Communication ID: 19135786

100% DESIGN – SPECIFICATIONS

FIRST QUALITY CYLINDERS
STATE SUPERFUND SITE
PROPOSED REMEDIAL ACTION PLAN

SAN ANTONIO, BEXAR COUNTY, TEXAS

TCEQ

Prepared for

Texas Commission on Environmental Quality
Austin, Texas

Project No: 41011805
April 2015

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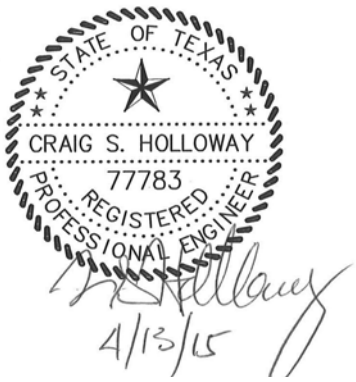


Division 1, 2, 3 and Specialized Specification

Division 16

END

SECTION 01010
SUMMARY OF WORK

1.0 PART I GENERAL

1.1 SECTION INCLUDES

A. Location of Work.
B. References.
C. Project Description.
D. Contract Description.
E. Bid Item Descriptions.
F. Work Sequence.

1.2 LOCATION OF WORK

A. The Work will be performed at the First Quality Cylinders Proposed State Superfund Site, located at 931 W. Laurel Street, San Antonio, Bexar County, Texas. The site occupies approximately 1.268 acres.

1.3 REFERENCES

A. Texas Commission on Environmental Quality (TCEQ). *Proposed Remedial Action Document (PRAD), First Quality Cylinders Proposed State Superfund Site, San Antonio, Bexar County, Texas, May 1, 2014*.

1.4 PROJECT DESCRIPTION:

A. Background

1. The site, which operated from 1982 to 1993, housed a aircraft cylinder rebuilding facility which used a chromium plating process. During its operation, several times the contaminated groundwater spilled onto the surrounding areas.

2. To control the offsite migration of contaminated groundwater, a containment system, consisting of a French Drain and a slurry wall surrounding the site. In addition, three extraction wells were installed on-site. Contaminated water extracted from the wells is disposed of in an off-site disposal facility.

3. TCEQ conducted a remedial investigation between February 2000 and January 2004. This investigation identified the source of contamination and also delineated the area of chromium contamination.

4. A removal action was conducted between June 18, 2012 and October 5, 2012. Scope of this removal action involved removal of the process building and excavation of the

contaminated soil. The excavated material was treated on-site prior to its disposal to an off-site disposal facility. The excavated area was restored by backfilling clean soil amended with 29% calcium polysulfide CPS solution. An amendment delivery system was also installed that aligned with the former trench that allowed sampling, extraction and/or treatment of groundwater.

5. A bench-scale and pilot-scale study was performed to evaluate the effect of in-situ chemical reduction (ISCR) treatment using CPS on the contaminated groundwater. The results of the bench-scale study indicated that the CPS is capable of lowering the concentration of hexavalent chromium to a pre-treatment standard that would allow the groundwater to be discharged to into the sanitary system. Following the bench-scale study, as part of the pilot-scale study, a total of 1,350 gallons of CPS solution was injected 7 to 12 feet below ground surface at 48 locations throughout the 4,400 square foot treatment area. Significant reduction in hexavalent chromium concentration was observed in the groundwater samples collected in the following 12 weeks post treatment.

B. Project Information

1. The remedial activities primarily consist of:

   a. Excavation, backfill, and grading of impacted soil areas in accordance with the drawings and 02400-Excavation to Sampled Limits, 02420-Excavation and Backfill for Utilities, and 02510-Backfill and Final Grading;

   b. Dispose of excavated impacted soils from the site in accordance with the drawings and 01650-Off-Site Transportation and Disposal;

   c. Installation of the treatment system in accordance with the drawings and Spec 11100-Groundwater Extraction and Treatment System

   d. Perform ISCR injections in accordance with the drawings and Spec 02600

2. The Engineer will acquire and analyze confirmation samples in the contaminated soil area for this work. In addition, URS will also collect samples for the waste classification. The Contractor will be responsible for all QC samples.

1.5 CONTRACT DESCRIPTION

A. The Work of this Contract includes planning and providing all necessary labor, equipment, and materials required to install and protect the Work in accordance with the Contract Documents and Drawings including, but not limited to, water treatment and local discharge, stabilization of sediment, and excavation of impacted soil.

1.6 BID ITEM DESCRIPTIONS

A. Bid items are described in Section 01025 – Measurement and Payment. This specification will be covered under the AIRS Contract for the CONTRACTOR.

1.7 WORK SEQUENCE

A. The work sequence shall be determined by the Contractor in order to complete the project most efficiently and without interruption. Neither Engineer nor Texas Commission on Environmental Quality (TCEQ) shall be responsible for delays due to poor construction sequencing.

END OF SECTION 01010

SECTION 01030
HEALTH AND SAFETY

PART I GENERAL

1.1 SECTION INCLUDES

A. This section specifies the minimum requirements for safety, health, and emergency response for the project. The Contractor shall develop and implement a written Site Health and Safety Plan (SHASP) which, at a minimum, meets the requirements of this section and complies with applicable federal, state, and local regulations. The Site Health and Safety Plan shall be submitted for approval to the TCEQ before any work covered in the specific procedures can be initiated. The approved SHASP, complete with all comments addressed, will be made a part of the Contract Documents.

1.2 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred in the text by basic designation number only.

CODE OF FEDERAL REGULATIONS (CFR)

29 CFR Part 1904 Recording and Reporting Occupational Injuries and Illnesses.

29 CFR Part 1910 Occupational Safety and Health Standards, especially Part 1910.120–Hazardous Waste Site Operations and Emergency Response.

29 CFR Part 1926 Safety and Health Regulations for Construction, especially Part 1926.65–Hazardous Waste Site Operations and Emergency Response.

49 CFR Part 171 General Information, Regulations, and Definitions.

49 CFR Part 172 Hazardous Materials Table, Special Provisions, Hazardous Materials Communications, Emergency Response Information, and Training Requirements.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY (EPA)

EPA-450/1-89-002a Air/Superfund National Technical Guidance Study Series, Volumes I-IV (Latest Revision).

Public Law 95-95	Clean Air Act Amendments of 1977 (1980).
No Publication No.	Standard Operating Safety Guides (1984).
EPA Order 1440.2	Health and Safety Requirements for Employees Engaged in Field Activities (1981).

AMERICAN CONFERENCE OF GOVERNMENTAL INDUSTRIAL HYGIENISTS (ACGIH)

ACGIH-13-5	Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices (Latest Revision).
ACGIH-14-3	Guide to Occupational Exposure Values (Latest Revision).
ACGIH-0460	Guidelines for the Selection of Chemical Protective Clothing (Latest Revision).

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z358.1	Emergency Eyewash and Shower Equipment (Latest Revision).
ANSI Z87.1	Occupational and Educational Eye and Face Protection (Latest Revision).
ANSI Z88.2	Respiratory Protection (Latest Revision).
ANSI Z41.1	Personal Protection for Protective Footwear (Latest Revision).
ANSI Z89.1	Protective Headgear for Industrial Workers (Latest Revision).

NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH (NIOSH)

NIOSH Pub No. 85-115	Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities (1985).
NIOSH Pub No. 84-100	NIOSH Manual of Analytical Methods (Latest Revision).

1.3 SITE BACKGROUND

The site, which operated from 1982 to 1993, housed an aircraft cylinder rebuilding facility which used a chromium plating process. During its operation, several times the contaminated groundwater spilled onto the surrounding areas.

To control the offsite migration of contaminated groundwater, a containment system, consisting of a French Drain and a slurry wall surrounding the site. In addition, three extraction wells were installed on-site. Contaminated water extracted from the wells is disposed of in an off-site disposal facility.

TCEQ conducted a remedial investigation between February 2000 and January 2004. This investigation identified the source of contamination and also delineated the area of chromium contamination.

A removal action was conducted between June 18, 2012 and October 5, 2012. Scope of this removal action involved removal of the process building and excavation of the contaminated soil. The excavated material was treated on-site prior to its disposal to an off-site disposal facility. The excavated area was restored by backfilling clean soil amended with 29% calcium polysulfide CPS solution. An amendment delivery system was also installed that aligned with the former trench that allowed sampling, extraction and/or treatment of groundwater.

A bench-scale and pilot-scale study was performed to evaluate the effect of in-situ chemical reduction (ISCR) treatment using CPS on the contaminated groundwater. The results of the bench-scale study indicated that the CPS is capable of lowering the concentration of hexavalent chromium to a pre-treatment standard that would allow the groundwater to be discharged to into the sanitary system. Following the bench-scale study, as part of the pilot-scale study, a total of 1,350 gallons of CPS solution was injected 7 to 12 feet below ground surface at 48 locations throughout the 4,400 square foot treatment area. Significant reduction in hexavalent chromium concentration was observed in the groundwater samples collected in the following 12 weeks post treatment.

1.4 REGULATORY REQUIREMENTS

A. Work performed under this contract shall comply with applicable federal, state, and local safety and occupational health laws and regulations. Where the requirements of this specification, applicable laws, criteria, ordinances, regulations, and referenced documents vary, the most stringent requirements shall apply.

1.5 HEALTH AND SAFETY PROGRAM

A. OSHA Standards 29 CFR Part 1910, Section 120 (b) and 29 CFR Part 1926, Section 65 (b) require employers to develop and implement a written Health and Safety Program for employees involved in hazardous waste operations. Also all Contractor Personnel working on site shall be active participants in a medical surveillance program in accordance with 29 CFR 1910.120 (f). The site-specific program requirements of the OSHA Standards shall be integrated into one site-specific document, the Site Health and Safety Plan (SHASP). The SHASP shall interface with the employer's overall Health and Safety Program. Any portions of the overall Health and Safety Program that are referenced in the SHASP shall be included as appendices to the SHASP.

1.6 CONTRACTOR'S HEALTH AND SAFETY PLAN

A. Preparation and Implementation

1. The Contractor shall prepare a Site Health and Safety Plan (SHASP). The Contractor's SHASP shall be submitted to the TCEQ in accordance with Section 01330. The SHASP shall establish, in detail, the protocols necessary for the anticipation, recognition, evaluation, and control of hazards associated with each task performed. The SHASP shall address site-specific health and safety requirements and procedures based upon site-specific conditions. The level of detail provided in the SHASP shall be tailored to the type of work, complexity of operations to be performed, and hazards anticipated. Details about some activities may not be available when the initial SHASP is prepared and submitted. Therefore, the SHASP shall address, in as much detail as possible, anticipated tasks, their related hazards, and anticipated control measures. Additional details shall be included in the activity hazard analyses as described in paragraph "Activity Hazard Analyses."

2. The Contractor's SHASP shall require the presence of a qualified, Site Health and Safety Officer (SHSO). The SHSO shall be responsible for implementing and monitoring the requirements and procedures contained in the SHASP.

B. Acceptance and Modifications

Prior to submittal, the SHASP shall be signed and dated by the Contractor's Health and Safety Manager and Site Superintendent. The SHASP shall be submitted for review at least seven (7) days prior to the Preconstruction Conference. Deficiencies in the SHASP will be discussed at the Preconstruction Safety Conference, and the SHASP shall be revised to correct the deficiencies and resubmitted for acceptance. Onsite

work shall not begin until the plan has been accepted. A copy of the written SHASP shall be maintained on site. As work proceeds, the SHASP shall be adapted to new situations and new conditions. Changes and modifications to the accepted SHASP shall be made with the knowledge and concurrence of the Health and Safety Manager, the Site Superintendent, and the Engineer. Should any unforeseen hazard become evident during the performance of the work, the SHSO shall bring such hazard to the attention of the Health and Safety Manager, the Site Superintendent, the Engineer, and the Owner both verbally and in writing, for resolution as soon as possible. In the interim, necessary actions shall be taken to re-establish and maintain safe working conditions in order to safeguard onsite personnel, visitors, the public, and the environment. Disregard for the provisions of this specification or the accepted SHASP shall be cause for stopping of work until the matter has been rectified.

C. Availability

The SHASP shall be made available in accordance with 29 CFR Part 1910, Section 120 (b)(1)(v) and 29 CFR Part 1926, Section 65 (b)(1)(v).

D. Elements

Topics required by 29 CFR Part 1910, Section 120 (b)(4), 29 CFR Part 1926, Section 65 (b)(4), and those described in this section shall be addressed in the SHASP. Where the use of a specific topic is not applicable to the project, the SHASP shall include a statement to justify its omission or reduced level of detail and establish that adequate consideration was given the topic.

1. Site Description and Contamination Characterization

   The SHASP shall include a site description and contamination characterization section that addresses the following elements:

   a. Description of site location, topography, size, and past use of the site.
   b. A list of contaminants which may present occupational health and safety hazards.

2. Hazard/Risk Analysis

   The SHASP shall include a health and safety hazard/risk analysis for each site task and operation to be performed. The hazard/risk analysis shall provide information necessary for determining health and safety procedures, equipment, and training to protect onsite personnel, the environment, and the public. The analysis shall

define the activities to be performed and identify the sequence of work, the specific hazards anticipated, and the control measures to be implemented to eliminate or reduce each hazard to an acceptable level. The activity hazard analyses shall be continuously reviewed and when appropriate, modified to address changing site conditions or operations, with the concurrence of the Health and Safety Manager, the Site Superintendent, and the Engineer. Available site information shall be reviewed when preparing the "Hazard/Risk Analysis" section of the SHASP. The following elements, at a minimum, shall be addressed.

a. Site Tasks and Operations:

The SHASP shall include a comprehensive section that addresses the tasks and objectives of the site operations and the logistics and resources required to reach those tasks and objectives. Based on the type of remediation required, the following is a list of anticipated major site tasks and operations to be performed.

- Mobilization/demobilization
- Excavation
- Backfill and Final Grading
- Site Restoration
- ISCR Treatment
- Well plug and abandon
- Installation of new well
- Installation of Treatment System

This is not a complete list of site tasks and operations, therefore, it shall be expanded and/or revised, during preparation of the SHASP, as necessary.

b. Hazards:

The following potential hazards may be encountered during site work. These are not complete lists, therefore, they shall be expanded and/or revised as necessary during preparation of the SHASP.

1) Safety Hazards

The following safety hazards that may be encountered during site work include, but are not limited to:

- slips, trips, and falls due to terrain, improperly stored equipment
- falling objects
- back strain due to lifting and carrying equipment
- crushing, pinching, and striking associated with working in and around heavy equipment and dangerous moving parts
- electrical hazards
- power tool injuries
- foot and hand injuries caused by falling objects, heavy equipment, or sharp objects
- engulfment from excavation activities
- encountering utilities/other buried hazards

2) Chemical Hazards

The Hazard/Risk Analysis section of the SHASP shall describe the chemical, physical, and toxicological properties of contaminants, sources and pathways of employee exposures, and regulatory (including federal, state, and local) or recommended protective exposure standards. The SHASP shall also address employee exposure to hazardous substances brought on site, and shall comply with the requirements of 29 CFR Part 1910, Section 1200 and 29 CFR Part 1926, Section 59, Hazard Communication.

3) Physical Agents

The following physical hazards that may be encountered during site work include:

- heat stress
- high noise levels from heavy equipment
- other heavy equipment related hazards
- severe weather-lightning, high winds

4) Biological Hazards

The following biological hazards that may be encountered during site work include:

- exposure to irritant and toxic plants such as poison ivy, causing allergic reaction to personnel
- animal bites
- insect bites

3. Staff Organization, Qualifications, and Responsibilities

An organizational structure shall be developed that sets forth lines of authority (chain of command), responsibilities, and communication procedures concerning site health, safety, and emergency response. This organization structure shall cover management, supervisors, and employees of the Contractor and subcontractors. The structure shall include the means for coordinating and controlling work activities of subcontractors and suppliers. The SHASP shall include a description of this organizational structure as well as qualifications and responsibilities of each of the following individuals. The Contractor shall obtain the Engineer's approval before replacing any member of the health and safety staff. Requests shall include the names, qualifications, duties, and responsibilities of each proposed replacement.

4. Personal Protective Equipment

a. General

In accordance with 29 CFR Part 1910 Section 120 (g) (5) and 29 CFR Part 1926 Section 65 (g) (5), a written Personal Protective Equipment (PPE) program which addresses the elements listed in that regulation, and which complies with respiratory protection program requirements of 29 CFR Part 1910 Section 134, is to be included in the employers Safety and Health Program. The Site Health and Safety Plan shall detail the minimum PPE ensembles and specific materials from which the PPE components are constructed for each site-specific task and operation to be performed, based upon the hazard/risk analysis.

b. Levels of Protection

The Health and Safety Manager shall establish appropriate levels of protection for each work activity based on review of historical site information, existing data, an evaluation of the potential for exposure (inhalation, dermal, ingestion, and injection) during each task, past air monitoring results, and a continuing health and safety monitoring program. The Health and Safety Manager shall also establish action levels for upgrade or downgrade in levels of PPE from the specified minimum levels of protection to be provided in the SHASP. Protocols and the communication network for changing the level of protection shall be described in the SHASP. The PPE reassessment protocol shall address air monitoring results, potential for exposure, changes in site conditions, work

phases, job tasks, weather, temperature extremes, individual medical considerations, etc.

1) Initial Minimum Levels of PPE by Task

Based on available information, the initial minimum recommended protective equipment requirements for each major task and operation shall be identified in the SHASP. Available site information shall be reviewed and the list of tasks and operations and these levels of protection shall be expanded and/or revised during preparation of the SHASP.

2) PPE For Owner/Regulatory Agency Personnel

Five clean sets of personal protective equipment and clothing (excluding air-purifying respirators and safety shoes, which must be provided by individual visitors), as required for entry into the Exclusion Zone and/or Contamination Reduction Zone, shall be available for use by the Owner or official visitors. The items shall be cleaned and maintained by the Contractor. The Contractor shall provide basic training in the use and limitations of the PPE provided, and institute administrative controls to check prerequisites prior to issuance. Such prerequisites include meeting minimum training requirements for the work tasks to be performed and medical clearance for site hazards and respirator use.

6. Medical Surveillance

The Health and Safety Manager, in conjunction with the Occupational Physician, shall detail, in the employer's Health and Safety Program and the SHASP, the medical surveillance program that includes scheduling of examinations, certification of fitness for duty, compliance with OSHA requirements, and information provided to the physician. Examinations shall be performed by or under the supervision of a licensed physician, preferably one knowledgeable in occupational medicine, and shall be provided without cost to the employee, without loss of pay, and at a reasonable time and place. Medical surveillance protocols and examination and test results shall be reviewed by the Occupational Physician. Personnel working in contaminated areas of the site shall have been examined as prescribed in 29 CFR Part 1910, Section 120, and 29 CFR Part 1926, Section 65, and determined medically fit to perform their duties.

7. Heat and Cold Stress Monitoring

The Health and Safety Manager shall develop a heat stress and cold stress monitoring program for onsite activities. Details of the monitoring program, including schedules for work and rest, and physiological monitoring requirements, shall be described in the SHASP.

8. Safety Procedures, Engineering Controls, and Work Practices

The SHASP shall describe the standard operating safety procedures, engineering controls, and safe work practices to be implemented for the work covered.

a) General Site Rules/Prohibitions:

The Contractor shall develop, implement, and enforce safe work practices and engineering safeguards for the work covered under these specifications.

9. Emergency Equipment and First Aid Requirements

The SHASP shall describe the emergency and first aid equipment to be available on site. The following items, as a minimum, shall be maintained on site and available for immediate use:

a) First aid equipment and supplies.

b) Emergency eye washes and showers (or alternative means of deluge wash) which comply with ANSI Z358.1.

c) Emergency-use respirators. For escape purposes, two 5- to 15-minute emergency escape masks shall be supplied. For rescue purposes, two positive pressure self-contained breathing apparatus (SCBA) shall be supplied. These shall be dedicated for emergency use by trained personnel only and maintained on site in the Contamination Reduction Zone.

d) A minimum of two people on site shall be designated to administer first aid as required. Such personnel shall be certified by the American Red Cross in first aid and CPR.

14. Certificate of Worker/visitor Acknowledgment

A copy of a Contractor-generated certificate of worker/visitor acknowledgment shall be completed and submitted for each visitor allowed to enter Contamination Reduction or Exclusion Zones, and for each employee, following the example certificate at the end of this section.

EXAMPLE CERTIFICATE OF WORKER/VISITOR ACKNOWLEDGMENT

CONTRACT NO.:

PROJECT NAME: _____

PROJECT ADDRESS:

CONTRACTORS NAME:

EMPLOYEES/VISITORS NAME:

The contract for the above project requires the following: that you be provided with and complete formal and site-specific training; that you be supplied with proper personal protective equipment including respirators; that you be trained in their use; and that you receive a medical examination to evaluate your physical capacity to perform your assigned work tasks, under the environmental conditions expected, while wearing the required personal protective equipment. These things are to be done at no cost to you. By signing this certification, you are acknowledging that your employer has met these obligations to you.

I HAVE READ, UNDERSTAND, AND AGREE TO FOLLOW THE SITE HEALTH AND SAFETY PLAN FOR THIS SITE.

Name Date

_____

FORMAL TRAINING: I have completed the following training courses that meet the OSHA "HAZWOPER" requirements.

Date Completed

40-Hour
8-Hour Supervisory
8-Hour Refresher

SITE-SPECIFIC TRAINING: I have been provided and have completed the site-specific training required by this contract. The Site Health and Safety Officer conducted the training.

RESPIRATORY PROTECTION: I have been trained in accordance with the criteria in the Contractor's/my employer's Respiratory Protection Program. I have been trained in the proper work procedures and use and limitations of the respirator(s) I will wear. I will abide by policies concerning eyeglasses, contact lenses, and facial hair.

RESPIRATOR FIT-TEST TRAINING: I have been trained in the proper selection, fit, use, care, cleaning, maintenance, and storage of the respirator(s) that I will wear. I have been fit-tested in accordance with the criteria in the Contractor's/my employer's Respiratory Protection Program and have received a satisfactory fit. I have been assigned my individual respirator. I have been taught how to properly perform positive and negative pressure fit-checks upon donning negative pressure respirators each time.

MEDICAL EXAMINATION: I have had a medical examination within the last twelve months which was paid for by my employer. The examination included: health history, pulmonary function tests, and may have included an evaluation of a chest x-ray. A physician made a determination regarding my physical capacity to perform work tasks on the project while wearing protective equipment including a respirator. I was personally provided a copy and informed of the results of that examination. My employer's industrial hygienist evaluated the medical certification provided by the physician and checked the appropriate blank below. The physician determined that there:

_____ were not limitations to performing the required work tasks;

_____ were identified physical limitations to performing the required work tasks.

Date medical exam completed

(Employee's) (Visitor's) Name_____Date

(Employee's) (Visitor's) Signature _____Date

Social Security Number

Contractor's Site Health
and Safety Officer's Signature _____Date

END OF SECTION 01030

SECTION 01230
ENVIRONMENTAL PROTECTION

PART 1 GENERAL

1.01 SUMMARY

A. CONTRACTOR is responsible to ensure that at all times and in all weather conditions there is no adverse environmental or human impact (including nuisance) associated with the Work outside of the limits of the site that is within the care and control of CONTRACTOR.

B. This Section and the Drawings establish minimum requirements for products, assemblies, criteria and procedures intended to facilitate environmental and offsite human protection when implemented in conjunction with an overall project plan which is attentive to environmental protection issues. CONTRACTOR is responsible to develop and implement, at no additional cost to TCEQ, all additional measures necessary to meet the environmental and human protection standards established in the Contract Documents.

C. CONTRACTOR shall continuously observe the effects of the Work and upon detecting that there is an actual or potential adverse (including nuisance) environmental or human impact, shall promptly:

1. Cease all activities which may be contributing to the impact; and,

2. Implement any actions required by the Health and Safety Plan in response to human impact; and,

3. Implement procedures to, when possible, contain any release impact within the site; and,

4. Mitigate and correct any adverse impacts; and,

5. Develop and implement corrective measures to prevent adverse environmental and human impact associated with the Work.

1.02 DEFINITIONS

A. Nuisance - Any sound, odor, artificial lighting or other environmental impact which unreasonably annoys, disturbs, injures, or endangers the peace, comfort, repose, health, or safety of a reasonable person of ordinary tastes and sensitivities.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

3.01 GENERAL

A. Institute procedures, sequences of Work and construction controls to ensure that the environment, the property of others, and the public are not damaged, endangered, harmed or subjected to Nuisance from noise, vibration, stormwater runoff, dust, odors, artificial lighting, or pollutants in any media as a result of the Work.

B. Promptly notify ENGINEER if any persons allege or otherwise indicates that activities at the site present a nuisance or hazard beyond the site limits. CONTRACTOR shall, at no additional cost to TCEQ, cooperate with ENGINEER and TCEQ to address the persons concerns.

C. Notify ENGINEER whenever a release of a hazardous substance or a petroleum substance such as oil, hydraulic fluid, transmission fluid, gasoline or diesel fuel occurs within 2 hours of initial awareness of a release. CONTRACTOR shall proceed to mitigate any such release immediately upon discovery.

D. Immediately notify the ENGINEER whenever noise, dust, odors, or air emissions appear to exceed applicable limits specified in this section. CONTRACTOR shall proceed to mitigate any such condition immediately upon discovery.

3.02 EROSION AND SEDIMENT CONTROL

A. GENERAL

1. The Drawings indicate the minimum erosion and sediment controls which shall be installed and which may provide effective sediment management. CONTRACTOR acknowledges that sediment generation and run-off can vary significantly depending upon the specific means, methods and sequences which it may choose to implement. CONTRACTOR shall, at no additional cost to TCEQ, implement the Work in a manner to, and install whatever sediment control devices are necessary to, ensure that run-off from the site is visibly clear and free of sediment. Sediment control shall be implemented as close as possible to the sediment source to help ensure that sediment control devices at the site perimeter are not overwhelmed.

2. Minimize areas of disturbance during the Work.

3. Install diversion berms upgradient from disturbed areas as shown on the Drawings and as appropriate based on CONTRACTOR's activities to minimize run-on which may increase surface water flow across disturbed areas. Care shall be taken to ensure that diverted water does not create a hazard or nuisance.

4. Install silt fence in accordance with Section 01232 - Silt Fence Construction and hay bales in accordance with Section 01234 - Hay Bale Barriers as shown on the Drawings. CONTRACTOR shall install additional silt fence and/or hay bale barriers as necessary to effectively filter sediment laden surface water run-off from disturbed areas or clean material stockpiles. Care shall be taken to arrange sediment filter devices such that sediment laden water does not 'end-run' these devices. If necessary, install multiple rows of sediment filter devices, separated by five to ten feet or more, to provide more effective filtering where appropriate. Installation and maintenance of grassy vegetation between rows of sediment filters may be used to increase effectiveness.

5. Install Rock Dams in accordance with Section 01236 - Rock Dams and as shown on the Drawings. Install additional rock dams as appropriate to provide settling ponds to help minimize sediment laden run-off.

6. Revegetate disturbed areas, not designated on the Drawings for pavement replacement, in accordance with Section 02932 - Hydromulch Seeding within 24 hours of completing backfill unless prevented by unfavorable weather conditions.

7. Remove and dispose of sediment that migrates off-site or accumulates in erosion and sedimentation control devices or structures in accordance with Section 01650 - Off-Site Transportation and Disposal.

8. Remove erosion and sedimentation control devices after a permanent vegetative cover has been established and all soil disturbing activities have been completed.

9. Dispose of silt fence and other materials in accordance with Section 01650 - Off-Site Transportation and Disposal.

10. Construct a Stabilized Construction Road in accordance with Section 01238 - Stabilized Construction Road as shown on the Drawings and

as necessary to ensure that no dirt or mud is tracked onto public or private roads at the exits from the site.

11. Stockpiles of clean granular and soil materials shall be covered and/or encircled with silt control devices at all times when rain may cause silty run-off from those stockpiles. Stockpiles of potentially contaminated material shall be tightly covered and encircled with silt control devices at all times. Stockpiles shall be set back from site boundaries to provide adequate room for silt control measures to be effective in preventing adverse impacts off-site.

B. INSPECTIONS

1. Inspect the site and adjacent off-site areas at the following frequencies to ensure that all erosion and sedimentation control devices and structures function effectively:

   a. At a minimum, once per work day;

   b. Promptly after short duration rainfall events; and

   c. During long duration and heavy rainfall events.

2. Inspect areas used for storage of materials exposed to precipitation for evidence of, or the potential for, pollutants entering the drainage system.

3. Inspect runoff and runoff conveyances along adjacent streets for visible silt, debris, or soil.

4. Inspect the site entrance for evidence of off-site sediment deposition and tracking.

5. Inspect vegetated areas for ponding and dead vegetation.

6. Inspect soils placed in backfill areas.

7. Include documentation of inspection activities in the Daily Progress Report as specified in Section 01320 - Scheduling and Progress Reporting.

C. MAINTENANCE

1. Maintain erosion and sedimentation control devices and structures in effective operating condition until a permanent vegetative cover has

been established and all soil disturbing activities have been completed.

2. If inspections indicate that an erosion and sedimentation control device or structure does not function effectively, promptly repair or replace the device or structure. If necessary to ensure adequate run-off water quality, develop and implement additional corrective devices or procedures.

3. Maintain vegetated areas in accordance with applicable requirements in Section 02932 - Hydromulch Seeding or Section 02935 - Sodding.

4. Maintain stabilized construction exit free of sediment for the duration of construction operations.

3.03 AIR QUALITY

A. Provide Dust Control in accordance with Section 01240 - Dust Control.

B. Open fires, excessive vehicle smoke, and excessive releases of organic vapors are prohibited during the work.

C. Stockpiles of clean granular and soil materials shall be covered at all times when rain or wind may cause blowing dust from those stockpiles. Potentially contaminated stockpiles shall be tightly covered at all times. Stockpiles shall be set back from site boundaries to provide adequate room for dust and odor control measures to be effective in preventing adverse impacts off-site.

C. If necessary, at no additional cost to TCEQ, alter Work procedures to ensure protection of air quality and prevent nuisance conditions.

3.04 NOISE CONTROL

A. Do not allow noise levels to create a nuisance.

B. Do not use hammer driven or vibratory sheet piles.

C. Do not allow excessive use of vehicle or equipment horns.

D. Do not allow noise generated by the Work to exceed 85 dBA off-site under any circumstances.

E. Where noise on-site exceeds 85 dBA, establish well-marked hearing protection zones and implement procedures to protect on-site personnel.

3.05. POLLUTION PREVENTION

A. FUEL STORAGE

1. Do not install underground storage tanks within the site. Store tanks and drums containing new and used petroleum products in an area with secondary containment. The secondary containment volume shall equal or exceed the total volume of all tanks and vessels therein.

2. Do not discharge storm water that accumulates within fuel and petroleum product storage area containment dikes into the storm water drainage system. Dispose of storm water that accumulates in containment dikes in accordance with Section 01650 - Off-Site Transportation and Disposal.

3. Maintain stores of sorbent pads to be used in case of petroleum product spills. Promptly remove visible sheens of fuel or petroleum products with sorbent pads. Dispose of sorbent pads in accordance with Section 01650 - Off-Site Transportation and Disposal at no additional cost to TCEQ.

4. Promptly excavate and dispose of soil contaminated by spills in accordance with Section 01650 - Off-Site Transportation and Disposal at no additional cost to TCEQ.

B. MATERIAL STORAGE

1. Maintain stores of chemicals, cements, solvents, paints or other potential water pollutants in containment areas so that they cannot contaminate runoff. Construct berms as necessary to divert run-on from material storage areas.

2. Store toxic chemicals in accordance with the manufacturer's guidelines. Use drip pans or plastic mats for secondary containment in areas where toxic liquids are used or stored.

3.06 PROTECTION OF VEGETATION

A. Preserve and protect existing trees and plants from foliage, branch, trunk, or root damage.

B. When trees, shrubs or other vegetation not designated for removal are destroyed or badly damaged by Work, remove and replace with the same size, species, and variety, up to 8 inches diameter.

C. Replace trees larger than 8 inches diameter with an 8-inch diameter tree of the same species and variety.

3.07 CONSTRUCTION DEBRIS AND TRASH

A. Construction debris and trash shall not be allowed to accumulate anywhere on site other than designated waste collection areas. Waste receptacles shall be covered and maintained in a neat and orderly manner. Wastes shall not be allowed to overflow containers.

B. Dispose of construction debris and trash in accordance with Section 01650 - Off-Site Transportation and Disposal.

END OF SECTION

SECTION 01232
SILT FENCE

PART 1 GENERAL

1.01 SUMMARY

A. This Section specifies requirements for construction and maintenance of reinforced silt fence.

B. Silt fence shall be installed at the locations shown on the Drawings, and, at no additional cost to TCEQ, at locations as are appropriate and necessary to control silt runoff from and within the site resulting from CONTRACTOR's activities.

1.02 SUBMITTALS

A. Data sufficient to determine that the following products or materials fully comply with the requirements of this specification:

1. Silt fence.

PART 2 PRODUCTS

2.01 SILT FENCE

A. Provide geotextile fabric composed of polypropylene, polyethylene, or polyamide that conforms to requirements in Table 01232-1.

B. Woven wire fence shall be galvanized steel with a minimum thickness of 14 gauge and a maximum mesh spacing of 6 inches.

TABLE 01232-1
SILT FENCE REQUIREMENTS

REQUIREMENTS	CRITERIA	METHOD
Grab Strength (min.)	100 lbs	ASTM D4632[1]
Mullet Burst Strength (min.)	200 psi	ASTM D3786[2]
Coefficient o Permeability (min.)	0.22 cm/sec	ASTM D4491[3]
Apparent Opening Size (min.)	40 percent	ASTM D4751[4]

TABLE 01232-1 SILT FENCE REQUIREMENTS		
REQUIREMENTS	**CRITERIA**	**METHOD**
Ultraviolet Stability (min.)	90 percent	ASTM D4355[5]

[1] ASTM D4632 - Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.

[2] ASTM D3786 - Standard Test Method for Hydraulic Bursting Strength for Knitted Goods and Non-woven Fabrics.

[3] ASTM D4491 - Standard Test Methods for Water Permeability of Geotexitiles by Permittivity.

[4] ASTM D4751 - Standard Test Method for Determining Apparent Opening Size of Geotextile.

[5] ASTM D4355 - Standard Test Method for Deterioration of Geotextiles from Exposure to Ultraviolet Light and Water.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install silt fences in accordance with the Drawings such that surface runoff percolates through the system as sheet flow. Remove obstructions that channel or otherwise hinder sheet flow through silt fences.

B. Purchase filter fabric in continuous rolls and cut it the same length as the fence, if possible, to avoid joints. When joints are necessary, splice the fabric together at support posts, as shown on the Drawings, and seal securely.

C. Use sandbags to support silt fence on asphalt or concrete surfaces. Do not excavate trenches through asphalt or concrete surfaces.

3.02 INSPECTIONS

A. Inspect silt fences for sagging or collapsed sections, sediment accumulations, and areas where runoff has eroded channels beneath the fence.

3.03 MAINTENANCE

A. Remove sediment deposits from silt fences when the sediment reaches a depth equal to one-third of the initial height measured from ground surface at time of installation.

B. Immediately replace damaged or sagging sections of silt fence.

END OF SECTION

SECTION 01234
HAY BALE BARRIER

PART 1 GENERAL

1.01 SUMMARY

A. This Section specifies requirements for installation of hay bale erosion control barriers.

B. Hay bale barriers shall be installed at the locations shown on the Drawings and, at no additional expense to TCEQ, at such other locations as my be appropriate to prevent silt runoff from or within the site resulting from CONTRACTOR's activities.

PART 2 PRODUCTS

2.01 HAY BALES

A. Hay bales shall consist of fresh, unweathered natural straw. Hay bales shall be tightly bound with baleing twine, wire, or other appropriate material.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install hay bales in accordance with the Drawings such that surface runoff percolates through the system as sheet flow. Remove obstructions that channel or otherwise hinder sheet flow through the hay bales.

3.02 INSPECTIONS

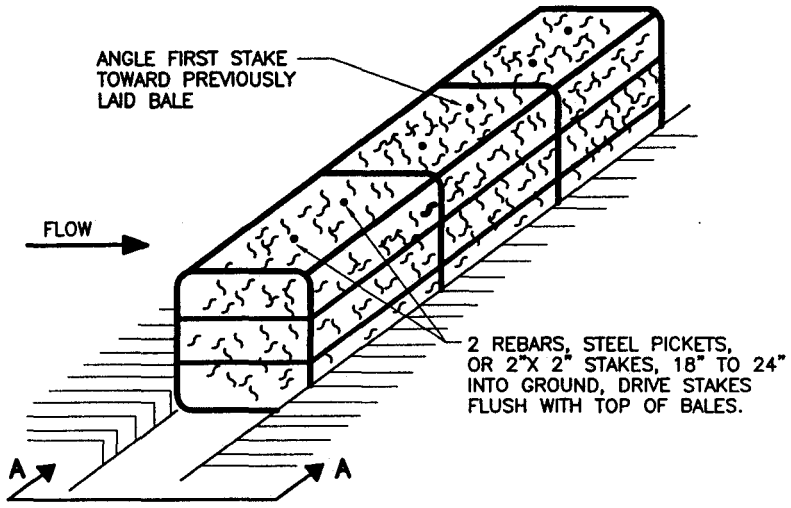
A. Inspect hay bales for sediment accumulations, and areas where runoff has eroded channels beneath the hay bales.

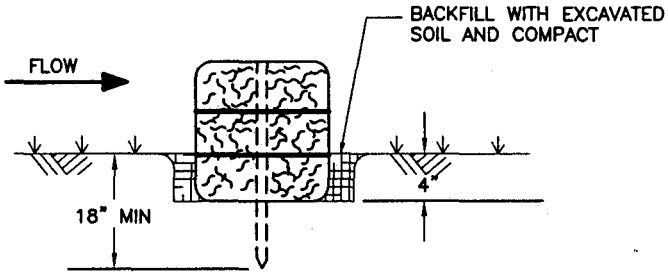
3.03 MAINTENANCE

A. Remove sediment deposits from the hay bale barriers when sediment reaches a depth equal to one-third of the initial height measured from ground surface at time of installation.

B. Immediately replace or repair damaged hay bale barriers.

END OF SECTION





SECTION A–A

TNRCC

FIGURE 01234–02

TEXAS NATURAL RESOURCE CONSERVATION COMMISSION

HAY BALE BARRIER

REVISION:	FILE:	SCALE:
11–30–99	01234–02	NTS

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SECTION 01236
ROCK DAMS

PART 1 GENERAL

1.01 SUMMARY

A. This Section specifies requirements for construction of rock dams.

B. Rock dams shall be constructed at the locations and to the dimensions shown on the Drawings.

1.02 SUBMITTALS

A. Data sufficient to determine that the following products and materials fully comply with the requirements of this specification:

1. Coarse aggregate.

2. Filter cloth.

PART 2 PRODUCTS

2.01 ROCK MATERIAL

A. Material shall be composed of hard, durable, angular, uncoated rock without harmful amounts of clay, silt, vegetation, or other deleterious substances.

B. Rock material shall be well-graded with a D_{50} of six inches (± 0.5 inches), a maximum particle size of 12 inches, and a minimum particle size of 3 inches.

2.02 FILTER CLOTH

A. Filter cloth shall consist of a minimum 8-oz/yd^2 nonwoven, needlepunched, polypropylene geotextile fabric.

2.03 COURSE AGGREGATE

A. Course aggregate shall be composed of hard, durable, angular, uncoated rock without vegetation or other deleterious substances.

B. Course aggregate shall meet size requirements in Table 01236-1.

TABLE 01236-1 COARSE AGGREGATE	
SIEVE SIZE	**PERCENT PASSING**
4 inch	100
3 ½ inch	90-100
2 ½ inch	25-60
1 ½ inch	0-15
3/4 inch	0-5

PART 3 EXECUTION

3.01 CONSTRUCTION

A. Construct rock dams as shown on the Drawings.

3.02 INSPECTIONS

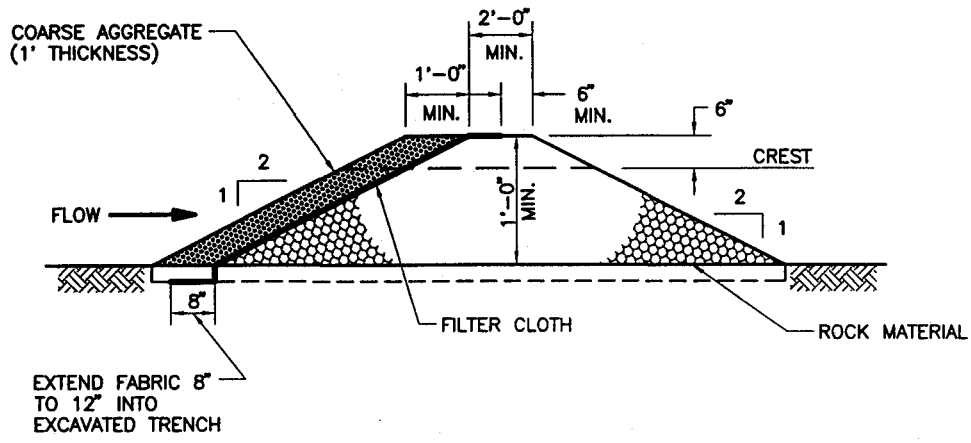
A. Inspect rock dams for damage and buildup of sediment.

3.03 MAINTENANCE

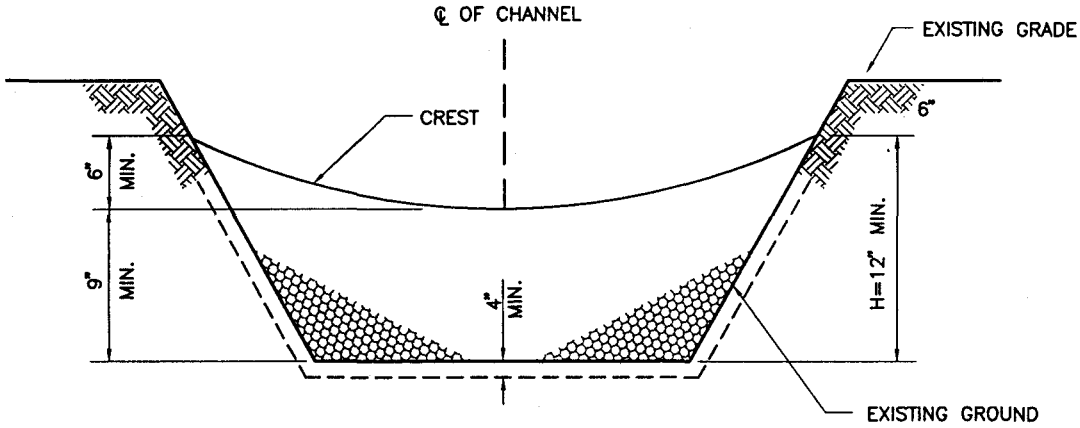
A. Remove sediment deposits from rock dams when the sediment reaches a depth equal to one-third of the initial height measured from ground surface at time of installation.

B. Immediately replace or repair damaged rock dams.

END OF SECTION



CROSS SECTION



PROFILE

NOTES:

1. EXTEND ROCK DAM FOR FULL WIDTH OF SWALE OR CHANNEL.

TNRCC

FIGURE 01236-01

TEXAS NATURAL RESOURCE CONSERVATION COMMISSION

ROCK DAM

REVISION:	FILE:	SCALE:
11-30-99	01236-01	NTS

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SECTION 01238
STABILIZED CONSTRUCTION ROAD

PART 1 GENERAL

1.01 SUMMARY

A. This Section specifies minimum requirements for the construction of stabilized construction roads. CONTRACTOR shall develop and implement, at no additional cost to TCEQ, construction road subgrade and final grade requirements necessary to support all construction traffic.

B. Stabilized construction roads shall be installed at the locations shown on the Drawings and, at no additional cost to TCEQ, such other locations as are necessary to support the CONTRACTOR's activities and traffic anticipated on the Site.

1.02 SUBMITTALS

A. Data sufficient to determine that the following materials fully comply with the requirements of this specification:

1. Coarse aggregate.

PART 2 PRODUCTS

2.01 COARSE AGGREGATE

A. Coarse aggregate shall be composed of hard, durable, angular, uncoated rock without vegetation or other deleterious substances.

B. Coarse aggregate shall meet size requirements in Table 01238-1.

PART 3 EXECUTION

3.01 CONSTRUCTION

A. Prepare subgrade to bear loads to be imposed by CONTRACTOR's equipment and traffic.

B. In areas designated on the Drawings, place coarse aggregate to achieve a minimum thickness of 8 inches.

3.02 MAINTENANCE

A. As the stabilized road becomes loaded with soil or mud such that material is tracked onto public or private roads off of the site, either add additional coarse aggregate to provide a clean surface or remove, and dispose offsite at CONTRACTOR's expense, the soiled material and replace with clean coarse aggregate.

3.03 DEMOBILIZATION

A. Except as specifically approved by TCEQ, existing roads shall be restored to their pre-construction condition upon completion of the work and all roads built specifically to support the construction shall be removed at CONTRACTOR's expense prior to completion of the Work.

TABLE 01238-1
COARSE AGGREGATE

SIEVE SIZE	PERCENT PASSING
4 inch	100
3 ½ inch	90-100
2 ½ inch	25-60
1 ½ inch	0-15
3/4 inch	0-5

END OF SECTION

SECTION 01240
DUST CONTROL

PART 1 GENERAL

1.01 SUMMARY

A. This Section specifies requirements for controlling dust generated on-site.

B. CONTRACTOR shall at all times conduct the Work to prevent nuisance conditions off-site.

1.02 DEFINITIONS

A. Nuisance - Any sound, odor, artificial lighting or other environmental impact which unreasonably annoys, disturbs, injures, or endangers the peace, comfort, repose, health, or safety of a reasonable person of ordinary tastes and sensitivities.

1.03 QUALITY ASSURANCE

A. ENGINEER will monitor air quality at locations shown on the Drawings for parameters listed in Section 01001 - Site Specific Environmental Parameters.

B. If any parameter exceeds the limit specified in Section 01001 - Site Specific Environmental Parameters, or if a nuisance condition exists off-site as a result of the Work, ENGINEER will notify the CONTRACTOR and will prepare a Nonconformance Report which shall be provided to CONTRACTOR.

C. Following notification of an exceedance or nuisance condition, CONTRACTOR shall immediately cease Site Operations. Site Operations shall not recommence until CONTRACTOR implements corrective measures specified in the Nonconformance Report.

D. Delays caused by exceedances of air emission limits or nuisance conditions off-site shall not serve as the basis for an increase in the Contract Price or Contract Times.

PART 2 PRODUCTS

2.01 COURSE AGGREGATE

A. Course Aggregate shall be composed of hard, durable, angular, uncoated rock without vegetation or other deleterious substances.

B. Course aggregate shall meet size requirements in Table 01240-1.

TABLE 01240-1
COARSE AGGREGATE

SIEVE SIZE	PERCENT PASSING
4 inch	100
3 ½ inch	90-100
2 ½ inch	25-60
1 ½ inch	0-15
3/4 inch	0-5

PART 3 EXECUTION

1.01 GENERAL

A. Control site operations in a manner that precludes off-site migration of air emissions at concentrations greater than specified limits in Section 01001 - Site Specific Environmental Parameters. Compliance will be measured by the ENGINEER at locations shown on the Drawings.

B. Do not allow visible dust on-site or off-site under any circumstances.

C. Spray potable water as necessary to prevent dust generation in general site work areas. Non-potable water shall not be used for dust control.

1. At a minimum, apply water daily during dry weather.

2. Apply sufficient water to dampen surface soils, without ponding or creating muddy conditions.

3. Apply water in a manner that precludes overspray or run-off.

4. Chemical treatment shall not be allowed for dust suppression.

D. Cover stockpiles during periods of inactivity as specified in Section 01230 - Environmental Protection.

E. Place coarse aggregate, as specified in Section 01238 - Stabilized Construction Road on construction areas as necessary to prevent dust and mud.

END OF SECTION

SECTION 01240SP DUST CONTROL

This Special Provision to Section 01240 serves to modify, add to, and/or delete from TCEQ Standard Specifications. Any item, paragraph, article, or work contained in the standard specification Section 01240, unless specifically modified, added to or deleted, shall remain unchanged.

Part 1, Section 1.03 is modified as follows:

1.03.A. QUALITY ASSURANCE

Replace entire statement with “Engineer will monitor air quality.”

1.03.B. QUALITY ASSURANCE

Remove “specified in Section 01001 – Site Specific Environmental Parameters” from the statement.

Part 3, Section 1.01 is modified as follows:

1.01.A. GENERAL

Remove “in Section 01001 – Site Specific Environmental Parameters” from the statement.

1.01.D. GENERAL

Remove “as specified in Section 01230 – Stabilized Construction Road”.

END OF SECTION 01240SP

SECTION 01250
REMEDIAL OPERATIONS PLAN

PART 1 GENERAL

1.01 SUMMARY

A. CONTRACTOR shall prepare, submit as a written document, and orally present a Remedial Operations Plan (ROP) in accordance with this Section. The ROP shall describe the CONTRACTOR's approach for conducting all Work required by the Contract Documents.

B. TCEQ and CONTRACTOR recognize that in conducting remediation projects, failure to comply with the Contract Documents may cause irrevocable releases of potentially hazardous materials, nuisance conditions, needless time inefficiency or in other ways decrease the success of the completion of the project. The purpose of the ROP development and review process described in this Section is to help decrease the likelihood of such problems to the benefit of both the CONTRACTOR and TCEQ, and to facilitate efficient deployment of TCEQ and ENGINEER resources during the project.

C. The RPD development and review process described in this Section does not in any manner alter the rights, responsibilities or obligations of CONTRACTOR, TCEQ or ENGINEER as set forth in the Contract Documents.

D. CONTRACTOR shall not request, and TCEQ and ENGINEER shall not approve, any deviation from, or substitution for, any requirement of the Contract Documents through the ROP process. The ROP shall describe how the CONTRACTOR will prosecute the Work in strict compliance with the Contract Documents. The ROP may also include discussion of deviations from and substitutions to the Contract Documents that CONTRACTOR intends or is considering proposing for approval by TCEQ and ENGINEER, for the purpose of facilitating preliminary discussion of those deviations or substitutions, but a separate formal request and submittal in accordance with the General Conditions relating to substitutions shall be made by CONTRACTOR in order to gain approval for any deviation from the requirements of the Contract Documents.

1.02 SUBMITTALS

A. Draft ROP for Review purposes;

B. Final ROP for Record purposes; and

C. ROP Updates for Review and Record purposes.

1.03 ROP CONTENT

A. The ROP shall not restate the prescriptive requirements of the Contract Documents but shall describe the means, methods, procedures, techniques, sequences of Work, and human and equipment resources, that CONTRACTOR intends to utilize to conduct and complete the Work in strict accordance with the Contract Documents and the approved CONTRACTOR'S schedule.

B. The ROP shall be organized to describe the Work in the sequence that it is to be conducted, from Notice to Proceed through Final Acceptance. The ROP shall address the following activities, adding activities such as treatment processes that may be required by the Contract Documents or deleting activities which are not applicable to the Work under the Contract Documents for this project:

1. Site Preparation.

2. Environmental Protection.

3. Dewatering.

4. Excavation.

5. Onsite and Offsite Waste Management and Tracking.

6. Survey & Construction Controls.

7. Backfilling, Compacting, and Final Grading.

8. Off-site Transportation and Disposal.

9. Demolition.

10. Site Restoration.

C. The ROP shall describe how CONTRACTOR will respond to weather conditions such as rain and wind which may reasonably be anticipated to arise during the project and which, if not properly anticipated and responded to by CONTRACTOR, may result in delay or adverse environmental or human impact via water accumulation, water runoff, dispersal of dust or

vapors or fumes, and other similar conditions pertinent to the Work conducted for this specific project.

D. The ROP shall include copies of all figures, slides, overheads and other materials used in CONTRACTOR'S oral presentation.

1.04 ROP ORAL PRESENTATION

A. CONTRACTOR shall make an oral presentation of the ROP. The presentation shall be delivered by the CONTRACTOR'S site manager who will be the person responsible for the day-to-day management of the Work at the site.

B. The purpose of this presentation is to facilitate, in the most efficient manner possible, understanding by the attendees of the manner in which the CONTRACTOR intends to specifically fulfill the performance obligations under the Contract, and to help the CONTRACTOR understand the interests and concerns of the TCEQ and ENGINEER relating to the Work. Though not a structured "partnering" session, all attendees should enter into the process and participate in the spirit of partnering. The exchange of information and questions occurring at this meeting shall in no way alter the contractual relationship or the contract obligations of any participant or the organization that they represent. Failure of any party to question or point out any item which is not in accordance with the Contract Documents shall in no way constitute a waiver of any requirement of the Contract Documents or an acceptance of any substitution or deviation from the Contract Documents.

C. The meeting logistics shall be as follows:

1. Time: Meetings shall be scheduled to occur as soon as possible after the Notice to Proceed but no sooner than three working days after CONTRACTOR submittal of the Draft ROP. Attendees shall anticipate that the meeting will start at approximately 8:00 AM and will continue until 5:00 PM with one hour for lunch and other breaks as agreed.

2. Location: A central site, convenient for all parties, mutually agreed upon. The CONTRACTOR shall furnish all presentation equipment required, and shall advise the ENGINEER, at least two weeks prior to the presentation, of the number of attendees expected on behalf of the CONTRACTOR.

3. Attendance:

(a) TCEQ.
(b) ENGINEER.

(c) CONTRACTOR's Project Manager, Site Manager, Project Superintendent, and Site Health and Safety Officer.

(d) CONTRACTOR's Major Subcontractors.

(e) CONTRACTOR's Major suppliers and manufacturers.

(f) Governmental representatives as deemed appropriate by TCEQ.

(g) Others as appropriate and approved by TCEQ.

5. Agenda:

(a) CONTRACTOR's oral presentaion of the ROP - The presentation shall include projected or large scale display of figures and data from the ROP to facilitate effective explanation and discussion of the Plan. The presentation shall allow time for brief clarifying questions and answers after the presentation of each major section and shall be completed no later than 3:00 PM, leaving two hours for overall ROP discussion and question and answer.

(b) Discussion and question and answer period - CONTRACTOR presenter may be questioned by ENGINEER, TCEQ, and EPA representatives.

(c) Summary of discussed items and review of actions items identified and assigned.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION

SECTION 01250SP REMEDIAL ACTION WORK PLAN

This Special Provision to Section 01250 serves to modify, add to, and/or delete from TCEQ Standard Specifications. Any item, paragraph, article, or work contained in the standard specification Section 01250, unless specifically modified, added to or deleted, shall remain unchanged.

Section 1.01 is modified as follows:

1.01. SUMMARY

Replace 1.01.A. “Remedial Operations Plan (ROP)” with “Remedial Action Work Plan (RAWP)”.

Replace 1.01.C “RPD” with “RAWP”.

Replace 1.01.D “ROP” with “RAWP”.

Section 1.02 is modified as follows:

1.02. SUBMITTALS

Replace 1.02.A. “ROP” with “RAWP”.

Replace 1.02.B “RPD” with “RAWP”.

Replace 1.02.C “ROP” with “RAWP”.

Section 1.03 is modified as follows:

1.03. ROP CONTENT

Replace 1.03.A. “ROP” with “RAWP”.

Replace 1.03.B. “ROP” with “RAWP”.

Replace 1.03.B.3. “Dewatering” with “Plug and Abandon well TW-2”.

Replace 1.03.B.9 “Demolition” with “Installation of new well TW-2R”.

Insert “Installation of Groundwater Extraction and Treatment System” for 1.03.B.10 and renumber accordingly.

Insert “In-situ Chemical Reduction Treatment” for 1.03.B.11 and renumber accordingly.

Replace 1.03.C. “ROP” with “RAWP”.

Replace 1.03.D. “ROP” with “RAWP”.

Section 1.04 is modified as follows:

1.04. RWAP ORAL PRESENTATION

Replace 1.04.A. “ROP” with “RAWP”.

Replace 1.04.C.1 “ROP” with “RAWP”.

Replace 1.04.C.5.a “ROP” with “RAWP”.

END OF SECTION 01250SP

SECTION 01310
PROGRESS MEETINGS

PART 1 GENERAL

1.01 SUMMARY

A. This Section specifies the schedule and discussion topics for the Initial Preremediation Conference and periodic progress meetings.

B. This Section specifies the required attendees and their responsibilities.

1.02 ENGINEER'S ROLE

A. ENGINEER will schedule and administer the Initial Preremediation Conference and periodic progress meetings. In addition, the ENGINEER will:

1. Prepare an agenda for meetings.

2. Distribute written notice of each meeting at least 4 days in advance of meeting date.

3. Make physical arrangements for meetings.

4. Preside at meetings.

5. Record the minutes; include significant proceedings, decisions and action items.

6. Reproduce and distribute copies of minutes after each meeting to participants in the meeting.

1.03 AUTHORIZED REPRESENTATIVES

A. Representatives of CONTRACTOR, Subcontractor, and suppliers attending meetings shall be qualified and authorized to act on behalf of the entity each represents.

1.04 INITIAL PREREMEDIATION CONFERENCE

A. An Initial Preremediation Conference will be conducted in accordance with Section 00700 - General Conditions, Part 2.7.

B. Time and location of the meeting will be announced by the ENGINEER.

C. Attendance:

1. TNRCC.

2. ENGINEER.

3. CONTRACTOR's Project Manager and Project Superintendent.

4. Others as approved or requested by the TNRCC.

D. Agenda:

1. Construction Schedule and critical work sequencing.

2. Designation of responsible personnel.

3. Procedures and processing of:

a. Submittals.

b. Field orders.

c. Work change directives.

d. Change Orders.

e. Applications for Payment.

4. Distribution of Contract Documents.

5. Procedures for maintaining Project Record Documents.

6. Other/open discussion.

1.05 WEEKLY PROGRESS MEETINGS

A . Location of the meetings—Meetings shall be held at the project site unless otherwise directed by the ENGINEER.

B. Attendance:

1. TNRCC.

2. ENGINEER.

3. CONTRACTOR's Manager.

4. Others, as required by TNRCC.

C. Agenda:

1. Review, approval of minutes of previous meeting.

2. Review of previous progress.

3. Field observations, problems, conflicts.

4. Problems that impede Construction Schedule.

5. Corrective measures and procedures to regain projected schedule.

6. Planned work for next week.

7. Contract administration.

a. Change orders

b. Invoicing

8. Other business.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION

SECTION 01310SP PROGRESS MEETINGS

This Special Provision to Section 01310 serves to modify, add to, and/or delete from TCEQ Standard Specifications. Any item, paragraph, article, or work contained in the standard specification Section 01310, unless specifically modified, added to or deleted, shall remain unchanged.

Part 1, Section 1.04 is modified as follows:

1.04. INITIAL PREREMEDIATION CONFERENCE

Remove Section 1.04

Part 1, Section 1.05 is modified as follows:

1.05.B. WEEKLY PROGRESS MEETINGS

Replace “TNRCC” in entire section with “TCEQ.”

END OF SECTION 01310SP

SECTION 01320
SCHEDULES AND PROGRESS REPORTS

PART 1 GENERAL

1.01 SUMMARY

A. This Section establishes requirements for schedules and progress reports including:

1. Construction schedule.

3. Construction schedule updates.

2. Daily, weekly and monthly progress reports.

1.02 SUBMITTALS

A. Progress reports, as specified in this Section, for Record purposes. CONTRACTOR shall submit an example daily, weekly and monthly report forms to ENGINEER for approval prior to mobilization to the site.

B. Baseline project schedule.

C. As part of the weekly progress meeting, update and resubmit the construction schedule, for Record purposes, to reflect changed conditions in the Work or deviations from the original plan and schedule.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

3.01 DAILY PROGRESS REPORT

A. Daily progress reports shall include, at a minimum, the following information.

1. Date and day of week

2. Weather

3. CONTRACTOR Personnel on-site

4. Visitors on-site

5. Equipment on-site

6. Site activities appropriate to the project including an accounting of each location and type of activity within the site such as excavation, treatment, waste management, environmental protection, restoration and revegetation, etc.

7. Detailed accounting of quantities appropriate to the project including materials imported to the site, materials and wastes removed from the site, excavation quantities, treatment quantites, areal quantity of revegetation, etc.

8. Emergencies/accidents

9. Problems/complaints from public

10. The dated signatures of both the CONTRACTOR's Site Manager and Site Safety Officer.

11. CONTRACTOR may include a line labelled "Receipt Acknowleded By" for the dated signature of ENGINEER's senior onsite representative or designee and CONTRACTOR may make a copy of the report after such signature is affixed. ENGINEER's representative's signature shall not be construed as approval or acceptance of the report or activities or quantities contained therein.

B. Daily progress reports shall be neatly printed.

3.02 WEEKLY AND MONTHLY PROGRESS REPORTS

A. Weekly and monthly progress reports shall include a summary rollup of all data included in the daily reports for the period of concern.

3.02 BASELINE AND UPDATED PROGRESS SCHEDULE

A. The baseline project schedule and schedule updates shall be presented in bar chart format and shall contain, at a minimum, the following information, sorted by fields, for each activity in the schedule:

1. Identification and description

2. Estimated (Original) duration

3. Remaining duration

4. Actual duration

5. Early start date

6. Late start date

7. Early finish date

8. Late finish date

9. Free float

10. Total float

11. Activity codes

B. The baseline project schedule and schedule updates shall present critical path task completion.

c. Schedules for projects having an initial award value of $500,000 or greater shall be prepared using “Microsoft Project” (MS Project) scheduling software and shall be submitted in both paper hard copy format and in electronic format on “write-once” CD ROM in “MS Project 2000" format.

END OF SECTION

THIS SPECIFICATION SECTION IS AN EXAMPLE SHELL AND MUST BE MODIFIED BY THE ENGINEER TO FIT THE REQUIREMENTS OF THE SPECIFIC PROJECT

SECTION 01330
SUBMITTALS

PART 1 GENERAL

1.01 SUMMARY

A. This Section specifies requirements for preparing, processing, and submitting necessary data and information required by individual specification sections.

1.02 CONTRACTOR RESPONSIBILITIES

a. Transmit all submittals using the Submittal Transmittal Form provided in Section 00650 - Reference Forms.

1.03 SUBMITTAL LIST

ITEM	SECTION	DUE DATE	REVIEW TIME	NUMBER OF COPIES
Payroll Records	00650	Weekly	NA	3
Report of Differing Conditions	00700	Promptly	Promptly	3
Application for Payment	00700	See Article 14 of General Conditions	See Article 14	3
Preliminary Schedule of Shop Drawing and Sample Submittals	00700	See Article 14 of General Conditions	See Article 14	3
Contract Closeout Submittals	00700	See Article 14 of General Conditions	See Article 14	3
Health and Safety Plan	01210	Prior to Notice to Mobilize	NA	3

THIS SPECIFICATION SECTION IS AN EXAMPLE SHELL AND MUST BE MODIFIED BY THE ENGINEER TO FIT THE REQUIREMENTS OF THE SPECIFIC PROJECT

ITEM	SECTION	DUE DATE	REVIEW TIME	NUMBER OF COPIES
Air Quality Noncompliance Report	01230	Prior to Resuming Site Operations	3 Work Days	3
Inspection and Maintenance Report	01230	Daily	NA	3
Silt Fence Product Data	01231 1.02.A.1	Prior to Initial Use	3 Work Days	3
Draft Remedial Operations Plan	01250 1.02.A.1	20 Days After Notice to Proceed/ 3 Days Prior to Site Operations Narrative Presentation	3 Work Days	3
Final Remedial Operations Plan	01250 1.02.A.2	7 Days after Site Operations Oral Presentation or 7 days after receiving comments from ENGINEER	NA	3
Remedial Operations Plan Updates	01250 1.02.A.3	Prior to Any Changes Proposed to Site Operations	7 Days	3
Daily Progress Report	01320	Following Work Day	NA	3
Sample Bar Chart and Activity Listings	01320	2 Days Prior to Preremediation Conference	2 Work Days	3
Weekly Progress Report	01320	Monday of Following Week	NA	3

THIS SPECIFICATION SECTION IS AN EXAMPLE SHELL AND MUST BE MODIFIED BY THE ENGINEER TO FIT THE REQUIREMENTS OF THE SPECIFIC PROJECT

ITEM	SECTION	DUE DATE	REVIEW TIME	NUMBER OF COPIES
Construction Schedule	01320	Initial: 2 Days Prior to Preremediation Conference Update: Monthly	NA	3
Monthly Progress Report	01320	Third Day of Following Month	3 Working Days	3
As-Built Drawings	01380 1.02.A.1	Within 30 Days of Final Completion	7 Days	3
Proposed Off-Site Transportation Information	01650 1.03.A.1	Prior to Initial Use	NA	3
Proposed Storage, Processing, or Disposal Facility	01650 1.03.A.2	Prior to Initial Use	NA	3
Waste Manifests	01650 1.03.A.3	3 Working Days Following Off-site Shipment	NA	3
Certificate of Disposal and Load or Weight Ticket	01650 1.03.A.4	3 Work Days After Issuance of Certificate of Disposal	NA	3
Analytical Results and Waste Code Information	01650 1.03.A.5	3 Work Days Following Issuance of Waste Codes	3 Work Days	3
Testing Laboratory Qualifications	01714 1.03.A.1	Prior to Initial Use	3 Work Days	3
Laboratory QA/AC Manuals	01714 1.03.A.2	Prior to Initial Use	NA	3
Analytical/Testing Data Reports	01714 1.03.A.3	Project Specific	NA	3

THIS SPECIFICATION SECTION IS AN EXAMPLE SHELL AND MUST BE MODIFIED BY THE ENGINEER TO FIT THE REQUIREMENTS OF THE SPECIFIC PROJECT

ITEM	SECTION	DUE DATE	REVIEW TIME	NUMBER OF COPIES
Survey Files	01720	2 Days After Request by ENGINEER	NA	3
Field Notes	01720	2 Days After Request by ENGINEER	NA	3
Security Report	01715	Daily	NA	3
Well Casing, Well Screen, and Hardware Product Data Information	02360 1.03.A.1	Prior to Initial Use	NA	3
Monitoring Well Registration Information	02360 1.03.A.2	3 Work Days following Monitoring Well Registration	NA	3
Monitoring Well Decommission Report	02365 1.02.A	30 Days After Plugging	NA	3
Source Location Information and Borrow Source Samples	02510 1.04.A.1	Prior to Initial Use of Source	15 Work Days	3
Delivery Tickets	02510 1.04.A.2	Daily	NA	3
Field Quality Control	02510 1.04.A.3	Daily	1 Work Day	3
Chainlink Fence and Gate Shop Drawings	02831 1.02.A.1	Prior to Installation	3 Work Days	3
Chainlink Fence and Gate Product Data	02831 1.04.A.2	Prior to Installation	3 Work Days	3

THIS SPECIFICATION SECTION IS AN EXAMPLE SHELL AND MUST BE MODIFIED BY THE ENGINEER TO FIT THE REQUIREMENTS OF THE SPECIFIC PROJECT

ITEM	SECTION	DUE DATE	REVIEW TIME	NUMBER OF COPIES
Sod Product Data	02935 1.04.A.1	Prior to Use	3 Work Days	3
Fertilizer Product Data	02935 1.04.A.2	Prior to Use	3 Work Days	3
Reinforcement Fabrication Shop Drawings	03200 1.03.A.1	Prior to Installation	3 Work Days	3
Proposed Construction Joint Shop Drawings	03200 1.03.A.2	Prior to Installation	3 Work Days	3
Detail Shop Drawings	03200 1.03.A.3	Prior to Installation	3 Work Days	3
Material Test Results	02570 1.04.A.1	Prior to Use	3 Work Days	3

1.04 CONTRACTOR SUBMITTAL REGISTER

A. A sample copy of the CONTRACTOR submittal register is attached to this section as Figure 01330-01. ENGINEER and CONTRACTOR shall maintain this register. For all submittals, CONTRACTOR shall provide an up-to-date copy of this register.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

THIS SPECIFICATION SECTION IS AN EXAMPLE SHELL AND MUST BE MODIFIED BY THE ENGINEER TO FIT THE REQUIREMENTS OF THE SPECIFIC PROJECT

FIGURE 01330-1
SUBMITTAL REGISTER

Submittal Description	Date Received	Specification Section	Drawing No.	Revision No.	Action*	Date Approved

*Action
No Exception Taken (NET)
Revise and Resubmit (RR)
Exceptions as Noted (EN)
Rejected (R)

END OF SECTION

SECTION 01330SP SUBMITTALS

This Modification to Section 01330 serves to modify, add to, and/or delete from TCEQ Standard Specifications. Any item, paragraph, article, or work contained in the standard specification Section 01330, unless specifically modified, added to or deleted, shall remain unchanged.

Part 1, Section 1.03 is modified as follows:

1.03. SUBMITTALS LIST

Remove “Draft Remedial Operation Plan.”

Remove “Final Remedial Operations Plan.”

Remove “Survey Files”

Remove “Chainlink Fence and Gate Shop Drawings.”

Remove “Chainlink Fence and Gate Product Data.”

Remove “Sod Product Data”

Remove “Fertilizer Product Data”

Remove “Reinforcement Fabrication Shop Drawings.”

Remove “Proposed Construction Joint Shop Drawings.”

Remove “Detail Shop Drawings.”

Remove “Material Test Results”

Replace “TNRCC” in entire section with “TCEQ.”

END OF SECTION 01330SP – Modification

SECTION 01380
AS-BUILT DRAWINGS

PART 1 GENERAL

1.01 SUMMARY

A. This Section specifies the requirements for maintaining and preparing as-built drawings.

B. As-built drawings shall clearly and accurately depict the conditions at the site as they exist at the time of completion of the Work. Separate drawings shall be used to track the incremental progress of the work.

1.02 SUBMITTALS

A. Full size as-built drawings.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

3.01 MAINTENANCE OF AS-BUILT DRAWINGS

B. Maintain as-built drawings at the site during working hours and in a secure location at all times.

C. Maintain documents in a clean, dry, legible condition and good order. Do not use as-built drawings for construction purposes or to track the incremental progress of the Work.

D. Make documents and samples available at all times for inspection by TCEQ or ENGINEER.

E. Update one set of as-built drawings continuously as the Work progresses using red ink.

F. Label each document “AS-BUILT DRAWINGS.”

G. Record information concurrently with project progress.

H. Legibly mark the as-built drawings to record the following information:

1. Final extent, lines and grades of excavation and removal limits.

2. The horizontal and vertical location and alpha-numeric designation of all final confirmation samples such that laboratory analytical results can be associated with the location.

3. Horizontal and vertical locations of underground and underslab utilities and appurtenances, including those abandoned-in-place referenced to permanent surface improvements.

4. Horizontal and vertical locations of internal utilities and appurtenances concealed in the construction, referenced to visible and accessible features of the structure.

5. Field changes of dimensions or details.

6. Changes made by Field Order or Change Order.

7. Details not on the original Contract Drawings.

END OF SECTION

SECTION 01500
TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.01 SUMMARY

A. This Section specifies the requirements for providing and maintaining temporary office facilities, utilities, sanitary facilities, traffic control, air monitoring stations, decontamination facilities, and project signs.

B. All temporary facilities must meet latest edition of Uniform Building Code (UBC), National Electrical Code (NEC), and Standard Plumbing Code.

C. All temporary facilities including buried utilities, shall be removed before final completion.

D. Any facility which is specified to remain in place after the work of this contract is complete shall not be considered temporary.

PART 2 PRODUCTS

2.01 MATERIALS

A. Materials for temporary facilities may be new or used, but they shall be adequate for the required usage.

PART 3 EXECUTION

3.01 OFFICE FACILITIES

A. GENERAL

1. Provide and furnish a CONTRACTOR’s office and an ENGINEER’s office, which may be in the same structure, along with related parking areas as specified in this section.

2. Use allowable areas, shown on the Contract Drawings, for office facilities.

3. Erect structurally sound and weather-tight facilities in "like-new" condition. Provide “like-new” furniture.
4. At CONTRACTOR's option, a portable or mobile building may be used for an office facility. Mobile homes, when used, shall be modified for office use.

5. Provide mini-blinds or other means to control natural lighting for each window in the office facilities.

6. Office facilities shall be equipped with air conditioning and heating systems capable of maintaining 72 ˚F when cooling and 72 ˚F when heating.

7. Provide and maintain adequate lighting and ventilation for all office facilities.

8. Provide entrance doors equipped with substantial locks for all office facilities. ENGINEER's office shall have lock and separate key.

9. Provide each structure with at least one wall mounted first aid kit and one dry chemical, class ABC fire extinguisher. If local codes require more first aid kits or fire extinguishers, provide the required number.

10. Provide maintenance and daily janitorial service for all office facilities.

B. ENGINEER'S OFFICE

1. The ENGINEER's office shall consist of two rooms.

2. Room 1, the conference room, shall be adequate for eight people and shall include the following items:

a. Lockable doors.

b. [1] telephone(s) with speaker(s), voice mail, and an answering machine.

c. [1] grease board(s) (24-in. by 36-in. Minimum).

d. [1] tack board(s) (36-in. by 30 in.Minimum).

e. [8] arm chair(s)

f. [1] plan rack(s)

g. [1] plain paper fax machine(s) (XEROX telecopier 7033 or equal) with telephone.

h. [1] plain paper copying machine(s) (minimum rate of 50 copies per minute with automatic feed).

i. [1] filing cabinets.

3. Room 2, the office room, shall be at a minimum, [100] square feet in size, and shall be provided with the following items:

   a. Lockable doors.

   b. [1] telephone(s) with speaker(s), voice mail, and an answering machine.

   c. [1] grease boards(s) (24 inch by 36 inch minimum).

   d. [1] tack board(s) (36 inch by 30 inch minimum).

   e. [1] arm chair(s).

   f. [0] plan rack(s).

   g. [1] filing cabinets.

4. Provide and delineate at least [2] parking spaces for use by ENGINEER adjacent to ENGINEER's office.

3.02 DECONTAMINATION FACILITIES

A. Supply all equipment, materials, and personnel required to construct and operate all temporary vehicle, equipment, and personnel decontamination facilities. The facilities shall be capable of capturing all overspray (water, mist, dust) and collecting and transferring all decontamination fluids. Decontaminated water and sediment shall be collected and handled in accordance with Section 02090 - Decontamination.

B. Design and construct temporary decontamination facilities in such a manner that they can be readily moved to different locations on the site if warranted and can accommodate the entire staff.

C. Wash down decontamination facilities regularly to remove any buildup of sediments.

D. Design, construct, and operate the temporary decontamination facilities in a manner that prevents contamination of surrounding areas. If clean areas are contaminated by decontamination activities, as determined by sampling and analysis, those areas shall be remediated at the CONTRACTOR’s expense.

E. Provide hand washing facilities and an emergency eye wash station in the personnel decontamination facility.

F. Install backflow preventers or vacuum breakers if wash equipment connects directly to the potable water system.

G. Collect, store, and manage all decontamination waters as specified in Section 02300 - Waste Management.

3.03 AIR SAMPLING EQUIPMENT STANDS

A. Construct air sampling equipment stands as detailed on the Drawings. Install the stands at locations shown on the Drawings.

B. Provide electrical service for all air sampling equipment stands. Up to two air samplers will be operated from each stand. Electrical requirements for each sampler are 120 volts, 20 amps.

C. Provide two duplex electrical outlets with ground fault circuit interrupters for each stand; ground fault circuit interrupters shall be equipped with test and reset buttons. Electrical outlets shall be rated for outdoor service and equipped with waterproof covers.

D. Electrical outlets on air sampling equipment stands shall be on circuit(s) dedicated to that equipment only. CONTRACTOR shall not connect any CONTRACTOR equipment to the circuits or outlets dedicated to air sampling equipment.

E. Limit power routing for air sampler platforms to the site perimeter to avoid interferences with Site Operations.

3.04 ELECTRICITY

A. Determine actual power requirements and arrange for installation of wiring and electrical equipment including transformer(s) as necessary to perform the Work.

B. Arrange with local utilities to provide service required for electricity and lighting and pay all costs for services and electrical usage.

C. Provide adequate artificial lighting for all areas of the site when natural light is not adequate for the Work.

D. Design the electrical system for the office facility to handle the electrical load of all the equipment identified in this Section plus the following ENGINEER provided equipment:

1. [1] desktop/laptop computer(s) (110 volt, 5 amps);

2. [1] laser printer(s) (110 volt, 5 amps);

3. [1] health and safety instrument charger(s) (110 volt, 2 amps each);

4. [1] coffee maker(s) (110 volt, 2 amps).

5. [1] microwave oven (110 volt, 5 amps).

3.05 TELEPHONE

A. Pay all system installation, maintenance, and removal costs, service charges, and local telephone charges for ENGINEER's phone service. If "metro" telephone service is available to a nearby major metropolitan area, CONTRACTOR shall provide "metro" service. ENGINEER shall be responsible for all long distance charges.

B. Arrange with local utilities to disconnect telephone service after Final Completion.

C. Remove all above ground telephone equipment and appurtenances installed by CONTRACTOR.

3.06 WATER

A. Provide sufficient potable water for all Site Operations.

B. Provide bottled water and a dispenser for the ENGINEER's office facility.

3.07 TEMPORARY SANITARY FACILITIES

A. Provide and pay all costs for temporary sanitary facilities.

B. Enforce the use of sanitary facilities by all personnel at the job site. Such facilities shall be enclosed. Pit-type toilets will not be permitted. No discharge will be allowed from these facilities unless connected to local POTW. Collect and store sewage and waste so as not to cause nuisance or health problem; have sewer and waste hauled off-site and properly disposed in accordance with applicable regulations.

C. Service, clean, and maintain toilets on a regular basis throughout the course of the project.

D. Do not remove sanitary facilities until Substantial Completion.

3.08 TRAFFIC CONTROL

A. Ensure a smooth flow of vehicular traffic, particularly at the site entrance. Truck traffic flow and parking must comply with all Federal, State, and local requirements and the Contract Documents. Truck traffic shall not interfere with normal traffic on adjacent roads.

B. Furnish and install all traffic control devices required by State, county, or city regulations, and the Drawings. Comply with all requirements of the Texas Manual on Uniform Traffic Control Devices.

D. Obtain approval and permits from city, county, and/or other applicable authorities if the Work requires that public roads be temporarily impeded or closed. Coordinate activities with the city and/or county engineer's office.

3.09 PROJECT IDENTIFICATION SIGN

A. Project identification sign shall be:

1. Installed within 7 calendar days after the Notice to Mobilize.

2. Prepared by an experienced, professional sign painter. It shall present a fresh, new, and neat look.

3. Constructed of materials capable of withstanding weathering, fading, and chipping under site conditions for the duration of the work.

4. Made with 4-inch by 4-inch sign posts at least 11 feet long. For the sign, use 4-foot by 8-foot marine plywood at least 3/4-inch thick. Do not piece wood to fabricate a sign face. Paint sign material white on all sides and edges to resist weathering.

5. Painted with industrial grade, fast drying, white oil-based paint with gloss finish to prime surfaces. Paint all sign surfaces with this weather-protective paint prior to adding any sign paint or adhesive application.

6. Made with text as indicated on the Drawings.

7. Constructed with galvanized steel or brass fasteners and other hardware.

END OF SECTION

SECTION 01650
OFF-SITE TRANSPORTATION AND DISPOSAL

PART 1 GENERAL

1.01 SUMMARY

A. This Section specifies requirements for the following:

1. Transportation of hazardous and nonhazardous wastes to permitted storage, processing, or disposal facilities.

2. Off-site treatment, if necessary, and disposal of hazardous and nonhazardous wastes, removed from the site.

1.02 REFERENCES

A. *Code of Federal Regulations, Title 40, Part 261* (40 CFR § 261). U.S. Government Printing Office, Washington, DC.

B. *Code of Federal Regulations, Title 40, Part 761* (40 CFR § 761). U.S. Government Printing Office, Washington, DC.

C. RG-022 – Texas Commission on Environmental Quality. *Classifying and Coding of Industrial and Hazardous Waste*. Austin, TX.

D. SW-846 - U.S. Environmental Protection Agency. *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, Vol. I*. Washington, DC.

E. *Texas Administrative Code, Title 30, Chapter 305* (30 TAC § 305). Office of the Secretary of State, Austin, TX.

F. *Texas Administrative Code, Title 30, Chapter 330* (30 TAC § 330). Office of the Secretary of State, Austin, TX.

G. *Texas Administrative Code, Title 30, Chapter 335* (30 TAC § 335). Office of the Secretary of State, Austin, TX.

H. *Texas Administrative Code, Title 37, Chapter 16* (37 TAC § 16). Office of the Secretary of State, Austin, TX.

I. *Texas Administrative Code, Title 37, Chapter 21* (37 TAC § 21). Office of the Secretary of State, Austin, TX.

1.03 SUBMITTALS

A. The name, address, phone number, and U.S. Environmental Protection Agency (U.S. EPA) identification number for each proposed off-site transporter of hazardous waste or polychlorinated biphenyl (PCB) waste.

B. The name, address, phone number, and U.S. EPA identification number or State registration and/or permit number for each proposed storage, processing, or disposal facility.

C. Copies of the waste manifest, signed by the generator, transporter(s), and disposal facility, for each shipment of hazardous waste, PCB waste, or industrial, nonhazardous Class 1 waste.

D. Copies of the certificate of disposal and load or weight ticket for each hazardous waste, PCB waste, or nonhazardous waste shipment.

E. Analytical results and the resultant waste classification and TCEQ waste code for each waste shipment.

1.04 QUALIFICATIONS

A. Transport vehicle operators that enter an exclusion zone, defined in the site-specific Health and Safety Plan, shall be qualified to work with hazardous materials as specified in Section 01210 – Safety and Emergency Response.

B. Transport vehicle operators involved in off-site transportation shall possess commercial driver's licenses in accordance with applicable requirements in 37 TAC § 16.

C. Use analytical laboratories that conform to requirements in Section 01714 - Testing Laboratory Services for waste classification.

D. If the project is a Federal (National Priorities List or "CERCLA") Superfund Site, each disposal facility receiving hazardous or PCB wastes shall be approved by EPA to receive wastes from the site. CONTRACTOR shall secure confirmation from ENGINEER of disposal facility approval by EPA.

PART 2 PRODUCTS

2.01 TRUCK COVERS

A. Covers for open transport vehicles shall be constructed from water-resistant material with sufficient strength to withstand wind loads during transit.

B. Covers shall effectively prevent release of dust from the transport vehicle.

C. Covers shall have tie-downs or other restraint mechanisms necessary to securely fasten them to the transport vehicle.

PART 3 EXECUTION

3.01 GENERAL

A. Sample and analyze wastes upon generation in accordance with applicable requirements in SW-846 and 40 CFR § 761, Subpart D.

B. Promptly and properly classify wastes in accordance with 40 CFR § 261; 30 TAC § 335, Subchapter C and Subchapter R; and applicable regulatory policies and guidance documents including RG-022.

C. Complete waste manifests in conformance with applicable requirements in 30 TAC § 335, Subpart A; 40 CFR § 761, Subpart K; and Section 00700 - General Conditions.

D. Dispose of wastes at the lowest cost, permissible, waste classification for the material to be disposed.

E. If a disposal facility ceases to accept a waste, or if EPA withdraws its approval for a facility to receive wastes from a Federal Superfund Site, identify an alternate facility that complies with requirements in this section at no additional cost to the TCEQ. Such occurrences shall not provide a basis for adjustment to Contract Price or Contract Times.

F. Do not process liquid wastes into non-liquid form to circumvent treatment or disposal requirements.

G. If notification of receipt of any waste shipment has not been received within 30 days after departure from the site, notify the ENGINEER and contact the facility to determine the status of the waste shipment. Resolve any discrepancies with the facility, and notify the ENGINEER regarding resolution of the discrepancies.

3.02 OFF-SITE TRANSPORTATION

A. Provide transport vehicles that comply with applicable safety standards in 37 TAC § 21. Do not load any transport vehicle in excess of its gross vehicle weight rating.

B. Use only transporters with valid U.S. EPA identification numbers for off-site transportation of hazardous wastes and PCB wastes.

C. Comply with packaging, labeling, marking, placarding, and other applicable shipping requirements in 30 TAC § 335, Subchapter C.

D. Remediate waste spillage in transit in accordance with applicable requirements of 30 TAC § 335.93, § 330.34, and other applicable Federal, State, and local regulations at no additional cost to the TCEQ.

E. Comply with notification requirements for interstate transport of hazardous waste in 30 TAC § 335.75 if applicable.

F. Comply with applicable requirements for off-site transfer facilities in 30 TAC § 335.94.

G. Restrict transport vehicles to allowable site ingress and egress routes shown on the Drawings.

H. Control transport vehicles that enter or exit the site to avoid traffic disruptions as specified in Section 01500 - Temporary Facilities and Controls.

I. Do not allow transport vehicles to park on public roads in a manner that disrupts vehicular traffic.

J. Stage empty transport vehicles only within areas shown on the Drawings.

K. Inspect both interior and exterior surfaces of transport vehicles before they enter the site to ensure that they are visibly free of dirt and contaminants.

L. Do not stage loaded transport vehicles on-site. Loaded transport vehicles shall leave the site immediately.

M. Decontaminate transport vehicles as specified in Section 02090 - Decontamination before they exit the site.

N. Cover open transport vehicles before they exit the site in a manner that sheds rainwater.

O. Do not remove covers until transport vehicles arrive at their off-site destination.

P. Inspect transport vehicles before they exit the site.

1. Wheels and undercarriage of transport vehicles shall be inspected to ensure that no visible soil or waste adheres to any surface.

2. Tailgates shall be inspected to ensure that they are tightly sealed.

3. Covers shall be inspected to ensure that they are securely fastened and no holes are present.

4. Tank trucks shall be inspected to ensure that fittings are tightly sealed.

5. No drips or leaks of any size shall be allowed from any transport vehicle.

Q. Comply with local transportation regulations, ordinances, and restrictions.

3.03 OFF-SITE HAZARDOUS WASTE DISPOSAL

A. Treat hazardous wastes off-site, if necessary, in strict accordance with applicable requirements in 30 TAC § 335, Subchapter O.

B. Dispose of hazardous wastes, designated to be removed on the Drawings, including environmental media or debris that contain a listed waste or exhibit a hazardous characteristic, at an off-site facility in compliance with applicable requirements in 30 TAC § 335.

C. Dispose of construction debris and trash contaminated by hazardous wastes in accordance with hazardous waste disposal requirements at no additional cost to the TCEQ.

3.04 OFF-SITE PCB WASTE DISPOSAL

A. Comply with applicable PCB waste disposal requirements in 40 CFR § 761, Subpart D.

B. Comply with PCB waste disposal confirmation requirements in 40 CFR § 761.208.

C. Dispose of PPE and other wastes generated by cleanup of PCB contaminated materials in accordance with 40 CFR § 761.61 (a)(5)(v).

D. Treat, if necessary, and dispose of PCB contaminated liquids as specified in 40 CFR §§ 761.60 and 761.79(b).

E. Dewater PCB contaminated sediment or transport off-site in accordance with 40 CFR § 761.61(a)(5)(I)(B).

3.05 OFF-SITE NONHAZARDOUS WASTE DISPOSAL

A. Dispose of nonhazardous municipal solid waste and nonhazardous construction waste in accordance with applicable requirements of 30 TAC § 330.

B. Comply with applicable industrial solid waste disposal requirements in 30 TAC § 335, Subchapter A.

C. Dispose of nonhazardous, industrial solid waste, designated to be removed from the site, at a solid waste landfill in compliance with applicable requirements in 30 TAC § 330, Subchapter F.

D. Dispose of nonhazardous, liquid wastes at a facility in substantial compliance with applicable requirements of 30 TAC § 305.

END OF SECTION

SECTION 01650SP OFF-SITE TRANSPORTATION AND DISPOSAL

This Special Provision to Section 01650 serves to modify, add to, and/or delete from TCEQ Standard Specifications. Any item, paragraph, article, or work contained in the standard specification Section 01650, unless specifically modified, added to or deleted, shall remain unchanged.

The sections are modified as follows:

1.01.A.1 and 2 SUMMARY

Remove the words “hazardous and” from statements in Section 1.01.A.1. and 1.01.A.2.

1.03.A. SUBMITTALS

Remove Section 1.03.A.

1.03.C. SUBMITTALS

Add “URS is the generator and will sign waste manifests.” to the end of the statement.

1.04.A. QUALIFICATIONS

Remove “as specified in Section 01210 – Safety and Emergency Response” from the statement.

1.04.C. QUALIFICATIONS

Remove Section 1.04.C.

3.01.A and B GENERAL

Remove Sections 3.01.A and B.

3.03 OFF-SITE HAZARDOUS WASTE DISPOSAL

Remove Section 3.03.

3.04 OFF-SITE PCB WASTE DISPOSAL

Remove Section 3.04.

END OF SECTION 01650SP

SECTION 01720
SURVEYING

PART 1 GENERAL

1.01 SUMMARY

A. This Section specifies the requirements for performing surveying activities at the site.

B. Surveying required by other Sections shall also be in accordance with this Section.

1.02 SUBMITTALS

A. Name, address, and telephone number of the proposed Surveyor along with resume and data verifying Surveyor's qualifications.

B. Survey instrument calibration certificates.

C. Documentation verifying accuracy of surveying such as computer calculations or coordinates, closures on perimeter survey or areas and/or field notes for Record purposes.

D. Electronic files and hard copy printouts of all survey files for Record purposes.

E. Final Site Topographic Survey.

F. Final Site Metes and Bounds Survey.

G. Final Waste Cap or Cover Metes and Bounds Survey.

1.03 QUALIFICATIONS

A. The Surveyor shall be qualified and a Registered Public Land Surveyor licensed in the State of Texas. The Surveyor shall have a minimum of two years experience in construction surveying layout and with a record of performing horizontal and vertical control surveying and topographic mapping.

B. Survey equipment shall be state-of-the-art equipment and shall be calibrated prior to the start of the Work. Certificates shall be submitted to the ENGINEER prior to performing survey work confirming this calibration.

1.04 NOTIFICATIONS

A. Notify ENGINEER promptly of any discrepancies regarding locations or coordinates for survey monuments or control points.

B. Notify ENGINEER immediately of any loss, damage, destruction, or relocation of site reference points.

C. Site reference points may not be relocated without prior written notice to ENGINEER.

1.07 PROJECT RECORD DOCUMENTS

A. Maintain, on-site, a complete and accurate log of control and survey Work as it progresses, as specified in Section 01380 - Project Record Documents. This log shall include computer closures and area or volume computations applicable for Work functions and progress payments.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

3.01 GENERAL

A. Survey monuments and control points used to prepare the Contract Documents are described on the Drawings.

B. Use horizontal and vertical control points established by these datums for Work under this Contract:

1. All X, Y, and Z coordinates shall be referenced to the Texas State Planar Coordinate System.

C. Maintain benchmarks and excavation perimeter boundary points throughout the project. If benchmarks or boundary points are moved, lost, or destroyed the CONTRACTOR shall relocate at no additional cost to the TCEQ.

D. Protect survey monuments, control points, and site reference points prior to commencing any construction, soil management, or demolition activities.

E. All survey submittals shall bear the Seal and dated signature of the Surveyor.

3.02 PRE-REMEDIATION SURVEY

A. Verify locations and coordinates of survey monuments and control points prior to commencing Site Operations.

B. Verify lines, grades, and elevations shown on Drawings prior to commencing any construction, soil management, or demolition activities.

C. Survey all existing surface features and structures to document pre-excavation conditions.

D. Survey and mark the control points and perimeter boundaries of the excavation areas as shown on the Drawings prior to beginning excavation.

E. Survey and mark the location of erosion and sedimentation control structures, air sampler platforms, and construction facility areas.

3.03 SITE OPERATIONS SURVEY

A. Continuously delineate and identify grid boundaries shown on the Drawings, during excavation.

B. Survey the extent of excavations prior to verification sampling. Continue to excavate until the survey indicates that the excavation dimensions as shown on the Drawings have been reached.

3.04 FINAL SITE TOPOGRAPHIC SURVEY

A. Perform a final site topographic survey to verify final grading meets the lines and grades shown on the Drawings.

C. The final site topographic survey shall provide contours at one foot intervals over the entire site and to the nearest edge of pavement of any public streets adjacent to the site.

B. The final site topographic survey shall include spot elevations and coordinates at the intersection of tangents of the toe, top and crown of all waste containment caps and covers. The survey shall include spot elevations and coordinates at the grid intersections of a grid no larger than fifty by fifty feet (50' x 50') superimposed over the entire extent of all waste containment and groundwater protection caps and covers.

C. The final topographic survey shall include spot elevations and coordinates at no greater than fifty foot (50') intervals along the flow line of all drainage swales and ditches.

3.05 FINAL SITE METES AND BOUNDS SURVEY

A. CONTRACTOR shall submit a metes and bounds survey of each property tract upon which the site is situated for the purpose of recording same in the Real Property Records of the County in which the tract is located as an attachment to a lien instrument to be filed by TCEQ.

B. CONTRACTOR shall submit a title abstract showing all encumbrances against the tract and identifying the owner of record at the time that the survey is conducted.

3.06 FINAL WASTE CAP OR COVER METES AND BOUNDS SURVEY

A. CONTRACTOR shall submit a metes and bounds survey showing the extent and location of all waste caps or covers, the protective fences surrounding same, and all similar engineered controls remaining on the site at the completion of the Work, for the purpose of recording same in the Real Property Records of the County in which the tract is located as an attachment to a Deed Notice instrument to be filed by TCEQ.

END OF SECTION

SECTION 01740
TESTING LABORATORY SERVICES

THIS SECTION REQUIRES FURTHER COORDINATION WITH THE SUPERFUND PROGRAM QAPP.

PART 1 GENERAL

1.01 SUMMARY

A. This Section specifies the requirements for performing testing laboratory services for purposes of determining soil excavation limits, waste classification, tests for backfill materials, and other tests required by individual specification sections.

1.02 REFERENCES

A. ASTM D3740 - Standard Practice for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.

B. ASTM E329 - Standard Practice for Use in the Evaluation of Testing and Inspection Agencies for Concrete, Steel, and Bituminous Materials as Used in Construction.

C. SW-846 - U.S. Environmental Protection Agency. *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, Vol. I*. Washington, DC.

D. RG-022 - Texas Commission on Environmental Quality. *Classifying and Coding of Industrial and Hazardous Waste*. Austin, TX.

E. *Texas Administrative Code, Title 30, Chapters 1-351* (30 TAC 1-351). Office of the Secretary of State, Austin, TX.

F. ***INSERT REFERENCE TO SUPERFUND PROGRAM QAPP***

1.03 SUBMITTALS

A. Proposed testing laboratory qualifications that demonstrate compliance with the minimum requirements provided in Item 1.04, for Approval purposes.

B. Proposed testing laboratory's quality control/quality assurance manuals for Record purposes.

C. Certified copies of each analytical and/or testing data report for Record purposes. Submitted test results shall identify the measurement method, measured result, and whether the samples/specimens passed or failed the specified criteria.

1.04 QUALIFICATIONS

A. All tests and analysis requiring the services of a laboratory to determine compliance with Contract Documents shall be performed by an independent commercial testing laboratory identified and retained by the CONTRACTOR.

B. Analytical testing laboratories employed by the CONTRACTOR must have participated in a performance evaluation study within the last 6 months, must be subject to an independent/external audit on a yearly basis, and must perform complete internal annual audits and quarterly section/division/department audits.

1.05 QUALITY ASSURANCE

A. Coordinate all testing with the ENGINEER to allow the ENGINEER to be present for collection of samples and/or sample testing in the laboratory

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

3.01 CONDUCTING TESTING

A. Employ and pay for services of an independent testing laboratory to perform analysis and testing identified in the individual specification sections.

B. Laboratory analysis and testing shall conform to the test standards specified in the individual specification sections.

C. Employment of testing laboratory shall not relieve CONTRACTOR of obligation to perform work in accordance with requirements of Contract Documents.

3.02 SCHEDULES FOR TESTING

A. Determine the time required for the laboratory to perform tests and issue findings. Schedule and monitor testing as specified in the Contract Documents to avoid delay to the Project.

B. Promptly process and distribute copies of data reports to ensure adequate time is available for any required retesting and replacement of materials to avoid delay to the Project.

END OF SECTION

SECTION 01740SP TESTING LABORATORY SERVICES

This Special Provision to Section 01740 serves to modify, add to, and/or delete from TCEQ Standard Specifications. Any item, paragraph, article, or work contained in the standard specification Section 01740, unless specifically modified, added to or deleted, shall remain unchanged.

Remove statement “THIS SECTION REQUIRES FURTHER COORDINATION WITH THE SUPERFUND PROGRAM QAPP”

Section 1.02 is modified as follows:

1.02.F. REFERENCES

Delete Section 1.02.F

END OF SECTION 01740SP

SECTION 01750
SITE SECURITY

PART 1 GENERAL

1.01 SUMMARY

A. This Section specifies the security requirements for the site. It identifies the CONTRACTOR's responsibilities pertaining to the control of persons and vehicles entering the site and the maintenance of all security devices.

1.02 DEFINITIONS

A. Authorized Personnel – Employees of CONTRACTOR, its Subcontractors, TCEQ, and ENGINEER that routinely work on-site and visitors authorized by CONTRACTOR, TCEQ, or ENGINEER to enter the site for limited time period(s) on specific date(s).

1.03 SUBMITTALS

A. Daily security reports for Record purposes. Security reports shall include names of on-site security personnel, security patrol results, security breaches, the daily and after-hours entry/exit log. The entry/exit log shall include information specified in this Section.

1.04 MAINTENANCE

A. CONTRACTOR shall inspect, maintain, and repair all security devices including fences and gates for the duration of the work under the Contract Documents.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

3.01 GENERAL

A. CONTRACTOR shall assume full responsibility for protection of Products stored on the site.

3.02 PERIMETER FENCES AND GATES

A. Install fences and access gates around the perimeter of the site in accordance with the Contract Drawings and Section 02831 – Chain Link Fences and Gates.

B. Ensure that gates are closed and locked at the end of each work day.

C. Periodically inspect unattended gates to ensure that they are closed.

3.03 SECURITY PROCEDURES

A. Maintain a current list of authorized personnel. Only authorized personnel shall be permitted to enter the site.

B. CONTRACTOR shall compensate TNRCC or ENGINEER for acts of vandalism, stolen valuables, or any damage to the site by intruders or site personnel.

C. Have a security guard present at the site during all working hours through Substantial Completion. Security guard shall require authorized personnel to complete the entry/exit log each time they enter or leave the site.

D. A daily after-hours entry/exit log shall be posted at the site entrance during non-working hours. All authorized personnel shall complete the information required on the daily after-hours log each time they enter or exit the site.

E. The entry/exit logs shall have spaces for the following information:

1. Printed Name.

2. Title.

3. Employer's name.

4. Time of entry and exit (a.m./p.m.).

5. Signature.

END OF SECTION

SECTION 01750SP SITE SECURITY

This Special Provision to Section 01750 serves to modify, add to, and/or delete from TCEQ Standard Specifications. Any item, paragraph, article, or work contained in the standard specification Section 01750, unless specifically modified, added to or deleted, shall remain unchanged.

The sections are modified as follows:

3.03. B SECURITY PROCEDURES

Replace “TNRCC” with “TCEQ” in Section 3.03.B

3.03 SECURITY PROCEDURE

Add “3.03. F Maintain security on-site for 24 Hrs and seven days a week.”

END OF SECTION 01750SP

SECTION 02000
MOBILIZATION AND DEMOBILIZATION

PART 1 GENERAL

1.01 SUMMARY

A. This Section specifies the requirements for Mobilization and Demobilization to include:

1. Mobilizing labor, materials, equipment, structures, and temporary facilities, necessary to perform the work.

2. Installing project signs and utilities if required.

3. Demobilizing all labor, materials, equipment, structures, temporary facilities, utilities, project signs, and trash from the project site.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

3.01 MOBILIZATION

A. Obtain all required local, State, and Federal permits necessary for completion of this Work.

B. Obtain all required utility agency permits necessary for completion of this Work.

C. Prepare and submit a construction schedule in accordance with Section 01320 - Project Schedule and Progress Reporting and complete submittals required precedent to Notice to Mobilize in accordance with Section 01330 - Submittals.

D. Prepare, present and if necessary revise and resubmit the Remedial Operations Plan in accordance with Section 01250 - Remedial Operations Plan.

E. Complete all Work included in Section 02100 - Site Preparation.

F. Install personnel and equipment decontamination facilities.

G. Install sanitary facilities.

H. Mobilize to the site all equipment and personnel required to commence site operations (remedial activities) as described in CONTRACTOR's Remedial Operations Plan.

3.02 DEMOBILIZATION

A. Obtain Certificate of Substantial Completion in accordance with Section 00700 - General Conditions.

B. Remove all remaining equipment and temporary facilities from the site.

END OF SECTION

SECTION 02090
DECONTAMINATION

PART 1 GENERAL

1.01 SUMMARY

A. This Section specifies the requirements for the following decontamination activities:

1. Decontamination of vehicles, equipment, waste containers, roll-off boxes, tanks, and above ground piping to be removed.

2. Decontamination of slabs, sumps, drains, and underground piping to be abandoned.

3. Decontamination of materials to be recycled.

4. Decontamination of hazardous debris to be disposed as nonhazardous waste.

5. Operation of decontamination facilities.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

3.01 GENERAL

A. Construct decontamination facilities as specified in Section 01500 - Temporary Facilities and Controls.

B. Regularly clean decontamination facilities to remove sediment. Collect all over spray from decontamination facilities.

C. Manage liquid and solid wastes generated by decontamination activities in accordance with Section 02300 - Waste Management.

D. Dispose of liquid and solid wastes generated by decontamination activities in accordance with Section 01650 - Off-Site Transportation and Disposal.

E. Inspect decontaminated surfaces to ensure that applicable decontamination criteria have been achieved.

F. Remediate areas contaminated by decontamination activities at no additional cost to TCEQ.

G. Promptly repair any damage to decontamination facilities.

3.02 DECONTAMINATION CRITERIA

A. Hazardous debris may be decontaminated by an extraction or destruction technology in accordance with 40 CFR § 268.45 in lieu of disposal as a hazardous waste in accordance with Section 01650 - Off-Site Transportation and Disposal.

B. Decontaminate Recyclable Materials using any suitable method to achieve a Clean Debris Surface prior to removal from the site to dispose off-site as non-hazardous waste.

C. Decontaminate vehicles, equipment, waste containers, roll-off boxes, tanks, above ground piping, and other miscellaneous items until interior and exterior surfaces are visibly free of sediment, liquid, and wastes.

D. Decontaminate structures, sumps, drains, exposed slabs, electrical equipment, and mechanical equipment, designated to be abandoned on the Drawings, until interior and exterior surfaces are visibly free of sediment, liquid, and wastes.

E. Decontaminate underground piping by steam jetting until no visible solids or wastes are present in the waste stream. At a minimum, conduct three passes through each line segment with steam at a pressure of 1,500 psi.

END OF SECTION

SECTION 02090SP DECONTAMINATION

This Special Provision to Section 02090 serves to modify, add to, and/or delete from TCEQ Standard Specifications. Any item, paragraph, article, or work contained in the standard specification Section 02090, unless specifically modified, added to or deleted, shall remain unchanged.

Section 3.01 is modified as follows:

3.01.C. GENERAL

Replace statement with “In the event liquid and solid waste is generated due to decontamination activities that cannot be treated onsite, the waste will need to be collected and shipped for offsite disposal.”

END OF SECTION 02090SP

SECTION 02100
SITE PREPARATION

PART 1 GENERAL

1.01 SUMMARY

A. This Section specifies work required to be completed prior to performing primary work activities.

B. For the purposes of this Section, primary work activities include all on-site Work not specified in this Section.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

3.01 GENERAL

A. To the extent practicable, Work in this Section shall be conducted in the sequence presented below.

3.02 INITIAL ENVIRONMENTAL PROTECTION

A. Install initial environmental controls in accordance with Section 01230 - Environmental Protection.

B. Install initial environmental controls including:

1. Stabilized Construction Entrance.

2. All erosion and sediment control devices shown on the Drawings to be constructed around the perimeter of the workspace.

3. Erosion and sediment controls associated with run-on and run-off from installation of temporary electrical service and air sampling stands.

4. Erosion and sediment controls associated with run-on and run-off from internal site access and haul roads, temporary office areas and areas to be initially cleared or grubbed.

3.03 SECURITY

A. Establish Security measures in accordance with Section 01715 - Security.

B. Install site perimeter fences and gates in accordance with Section 02831 - Chain Link Fences and Gates.

3.04 AIR SAMPLING STANDS

A. Install air sampling equipment stands and energize electrical circuits to same in accordance with Section 01500 - Temporary Facilities and Controls.

3.05 INITIAL SURVEYING

A. Perform Surveying activities associated with documenting pre-remediation site conditions in accordance with Section 01720 - Surveying.

3.06 INITIAL CLEARING AND GRUBBING

A. Perform clearing and grubbing in accordance with Section 02100 - Clearing and Grubbing.

B. Do not clear or grub areas prior to placement of erosion and sediment control devices intended to control run-on and run-off from those areas.

C. Conduct initial clearing and grubbing only as necessary to conduct the Work in this Section.

3.07 INITIAL TEMPORARY FACILITIES

A. Install temporary facilities in accordance with Section 01500 - Temporary Facilities and Controls.

B. Construct access roads and parking areas associated with offices.

C. Install offices and associated electrical service, telephone service and sanitary facilities.

D. Install site sign.

END OF SECTION

SECTION 02100SP SITE PREPARATION

This Special Provision to Section 02100 serves to modify, add to, and/or delete from TCEQ Standard Specifications. Any item, paragraph, article, or work contained in the standard specification Section 02100, unless specifically modified, added to or deleted, shall remain unchanged.

The sections are modified as follows:

3.03.A Security

Replace text with “Establish Security measures in accordance with Section 01750 - Security and Section 01750SP – Special Provision for Site Security”.

3.03.B Security

Remove Section 3.03.B

3.05.A Initial Survey

Remove Section 3.05.A.

3.06 Initial Clearing and Grubbing

Remove Section 3.06.

END OF SECTION 02100SP

SECTION 02330
WASTE PILES

PART 1 GENERAL

1.01 SUMMARY

A. This Section specifies requirements for the following:

1. Construction of waste piles used for temporary on-site storage of Contaminated Soil or Debris.

2. Management of waste piles used for temporary on-site storage of Contaminated Soil or Debris.

1.02 REFERENCES

A. ASTM D638 – Standard Test Method for Tensile Properties of Plastics

B. ASTM D1004 - Standard Test Method for Initial Tear Resistance of Plastic Film and Sheeting

C. ASTM D1505 - Standard Test Method for Density of Plastics by the Density-Gradient Technique

D. ASTM D3895 - Standard Test Method for Oxidative-Induction Time of Polyolefins by Differential Scanning Calorimetry

1.03. SUBMITTALS

A. Product data required by Part 2 of this Section to ENGINEER for Approval.

PART 2 PRODUCTS

2.01 WASTE PILE LINER

A. Provide a bottom liner made from new, high density polyethylene (HDPE) resin. Resin shall not contain more than three percent by weight additives, fillers or extenders. Carbon black shall be added to the resin for ultra-violet resistance.

B. At a minimum, the bottom liner shall be 60-mils thick and satisfy the criteria in Table 02300-1. Liner material shall be free of holes, blisters, undisbursed raw materials, or any sign of contamination by foreign matter.

TABLE 02300-1 BOTTOM LINER SPECIFICATIONS		
PROPERTIES	**TEST METHOD**	**VALUE**
Minimum Density (grams/cubic centimeter)	ASTM D1505	0.94
Tensile Strength at Break (Pounds/inch width) Tensile Strength at Yield (Pounds/inch width) Elongation at Break (Percent) Elongation at Yield (Percent)	ASTM D638 (Type IV Dumb-bell at 2 inches/minute)	160 95 700 13
Tear Resistance Initiation (Pounds)	ASTM D1004 (Die C)	30
Thermal Stability Oxidative Induction Time (Minutes)	ASTM D3895 (130°C, 800 psi $O_{2)}$	2000

2.02 WASTE PILE COVER

A. Use string reinforced polyethylene or approved equal.

B. At a minimum, waste pile covers shall be 12-mils thick.

PART 3 EXECUTION

3.01 GENERAL

A. Construct and manage waste piles in a manner that precludes contamination of underlying or adjacent soils and other environmental media.

B. Place materials within the waste pile in a manner that does not damage the liner or cover. Use rubber-tired equipment within the waste pile enclosure.

C. Remediate environmental media contaminated by waste pile construction or management at no additional cost to TCEQ.

D. Cover any portion of a waste pile not actively being managed to minimize storm water ingress.

E. Anchor the cover with sandbags adequately spaced on and at the edges of the plastic, to prevent movement of the cover.

F. Promptly remove storm water from waste pile enclosures. Manage storm water removed from waste pile enclosures in accordance with Section 02300 - Waste Management.

G. Dispose of contaminated storm water in accordance with 01650 - Off-Site Transportation and Disposal.

3.02 WASTE PILE CONSTRUCTION

A. Remove Debris, rocks, and other materials larger than 2 inches in any dimension from the ground surface within the waste pile construction area.

B. Construct a one foot (1') high berm around the perimeter of the waste pile location.

C. Place HDPE bottom liner over the berm and extend it beyond the berm sufficiently far to allow sandbags to be placed on the HDPE weighting it in place.

D. Construct a ramp for ingress and egress to the waste pile.

3.03 DEMOBILIZATION

A. Following removal of all waste materials, remove liners and covers and dispose of them in accordance with Section 01650 - Off-Site Transportation and Disposal at no cost to TCEQ. Liner and cover materials contaminated with a hazardous waste may be decontaminated as specified in Section 02090-Decontamination in lieu of disposal at no cost to TCEQ.

B. Dispose of underlying soil or sand contaminated by waste materials in accordance with Section 01650-Off-Site Transportation and Disposal at no cost to TCEQ.

END OF SECTION

SECTION 02330SP WASTE PILES

This Special Provision to Section 02330 serves to modify, add to, and/or delete from TCEQ Standard Specifications. Any item, paragraph, article, or work contained in the standard specification Section 02330, unless specifically modified, added to or deleted, shall remain unchanged.

The sections are modified as follows:

2.01. B WASTE PILE LINER

Replace “60-mils” with “20-mils”.

Replace “TABLE 02300-1” with the following table:

TABLE 02300-1
BOTTOM LINER SPECIFICATION

PROPERTIES	TEST METHOD	VALUE
Minimum Density (grams/cubic centimeter)	ASTM D1505	0.94
Tensile Strength at Break (Pounds/inch width)	ASTM D638 (Type IV Dumb-bell at 2 inches/minute)	76
Tensile Strength at Yield (Pounds/inch width)		40
Elongation at Break (Percent)		700
Elongation at Yield (Percent)		12
Tear Resistance Initiation (Pounds)	ASTM D1004 (Die C)	13
Thermal Stability Oxidative Induction Time (Minutes)	ASTM D3895 (200°C, O_2, 1 atm)	>100

3.01. G GENERAL

Add “and 01650SP – Specialist Provision for Off-Site Transportation and Disposal” at end of the sentence.

END OF SECTION 02330SP

SECTION 02360
GROUNDWATER MONITOR WELLS

PART 1 GENERAL

1.01 SUMMARY

A. This Section specifies the requirements for installation and abandonment of groundwater monitor wells.

B. Monitor wells to be installed and abandoned are shown on the Drawings.

1.02 QUALIFICATIONS

A. The driller used for this work shall have a current water well driller's license in the State of Texas.

1.03 SUBMITTALS

A. Well casing, well screen, and hardware product data.

B. Monitoring well registration including boring log, well construction details diagram, and water level measurements for each installed monitoring well for Record purposes.

C. Monitoring well abandonment reports.

1.04 REFERENCES

A. Texas Commission on Environmental Quality, Superfund Cleanup Section. *Standard Operating Procedure No. 5.1 - Hollow Stem Borehole Advancement.* Current Revision. Austin, TX.

B. Texas Commission on Environmental Quality, Superfund Cleanup Section. *Standard Operating Procedure No. 5.5 - Monitoring Well Installation and Completion.* Current Revision. Austin, TX.

C. Texas Commission on Environmental Quality, Superfund Cleanup Section. *Standard Operating Procedure No. 5.6 - Monitoring Well Development and Abandonment.* Current Revision. Austin, TX.

D. Texas Commission on Environmental Quality, Superfund Cleanup Section. *Standard Operating Procedure No. 10.2 - Soil Sampling Using a Split Spoon.* Current Revision. Austin, TX.

1.05 GENERAL

A. Wells shall be installed and abandoned under the direct supervision of a geologist/engineer and in accordance with State of Texas Water Well Drillers Rules, this Section and the Drawings. The CONTRACTOR's geologist/engineer shall record the well construction details for Record purposes.

B. CONTRACTOR shall directly file all reports required by State of Texas Water Well Drillers Rules and shall provide a copy of same to ENGINEER.

PART 2 PRODUCTS

2.01 MATERIALS

A. Materials shall be as shown on the Drawings and as specified in applicable TCEQ Standard Operating Procedures referenced in Part 1.04 of this Section.

2.02 EQUIPMENT

A. Drilling activities shall be performed using a CME-75 or Mobile B61 drilling rig or approved equivalent that is capable of hollow stem auger drilling to the designated dimensions shown on the Drawings. All shims, pulleys, cables, and pumps shall be in good working condition prior to mobilization to the site.

B. Equipment shall be as specified in applicable TCEQ Standard Operating Procedures referenced in Part 1.04 of this Section.

C. All equipment shall be decontaminated prior to entering the site.

PART 3 EXECUTION

3.01 PREPARATION

A. Locate wells to be installed in accordance with Section 01720 - Surveying.

B. Perform a utilities check and note locations of underground utilities and overhead electrical wires.

C. Perform a visual check of the drill rig cables and verify the function of the drill rig emergency shutdown switch.

D. Safely align the drilling rig over the borehole location with proper vertical alignment once mast is raised.

E. Place plastic sheeting (15 ft. X 15 ft.) around the borehole location.

3.02 MONITOR WELL INSTALLATION

A. Advance the borehole, install and develop the well as specified in applicable TCEQ Standard Operating Procedures referenced in Part 1.04 of this Section.

B. Separately containerize drilling fluid, decontamination water, and borehole cuttings in drums and/or tanks for disposal in accordance with Section 01650 - Off-Site Transportation and Disposal.

C. Continuously sample the formation during drilling as specified in TCEQ Standard Operating Procedure No. 10.2 - Soil Sampling Using a Split Spoon. Conduct sampling such that a maximum extraction of sample is achieved in each sample interval. Provide the sample to the CONTRACTOR's geologist/engineer.

D. CONTRACTOR's geologist/engineer shall be responsible for visually examining and logging the sample and recording the physical characteristics of the formations in the sample in accordance with the Unified Soil Classification System (USCS).

E. During well construction and completion, use all reasonable measures to prevent the entrance of foreign matter into the well. The CONTRACTOR is responsible for removing any objectionable material that may fall into the well until completion and acceptance by the ENGINEER.

F. Wellhead completion shall be as shown on the Drawings.

3.03 WELL ABANDONMENT

A. Well abandonment shall be in accordance with State of Texas Water Well Drillers Rules and applicable TCEQ Standard Operating Procedures referenced in Part 1.04 of this Section.

3.04 SURVEYING

A. Surveying shall be in accordance with Section 01720 - Surveying.

B For each well installed CONTRACTOR shall include the surveyed location coordinates, ground surface elevation and top of casing elevation on all well installation reports, the as-built drawings submitted in accordance with Section 01380 - As Built Drawings, and the Final Site Topographic Survey and the Final Waste Cap or Cover Metes and Bounds Survey submitted in accordance with Section 01720 - Surveying.

C. For each well abandoned CONTRACTOR shall include the surveyed location coordinates and ground elevation on all well abandonment reports and the as-built drawings submitted in accordance with Section 01380 - As Built Drawings.

END OF SECTION

SECTION 02400
EXCAVATION TO SAMPLED LIMITS

PART 1 GENERAL

1.01 SUMMARY

A. This Section specifies requirements for the excavation of contaminated soil to final horizontal and vertical limits based on sampling of soil to determine that soil with contamination exceeding the action levels in Section 01001 - Site Specific Environmental Parameters has been removed.

B. The limits of excavation shown on the Drawings are not final and may be exceeded as provided by this Section.

1.02 SUBMITTALS

A. Excavation Confirmation Sample Analytical Results.

B. Excavation Quality Control Survey Log Sheets.

1.03 DEFINITIONS

A. Reused Safety Overexcavated Material - Soil identified in the CONTRACTOR's Remedial Operations Plan (submitted in accordance with Section 01250 - Remedial Operations Plan) for excavation beyond the designated excavation limits for the sole purpose of complying with excavation safety requirements during placement and compaction of backfill and which is suitable for reuse on the site in accordance with the Contract Documents.

B. Disposed Safety Overexcavated Material - Soil identified in the CONTRACTOR's Remedial Operations Plan (submitted in accordance with Section 01250 - Remedial Operations Plan) for excavation beyond the designated excavation limits for the sole purpose of complying with excavation safety requirements during placement and compaction of backfill and which is not suitable for reuse on the site in accordance with the Contract Documents.

1.04 QUALITY ASSURANCE

A. CONTRACTOR may be required to provide soil sample splits to ENGINEER who may perform independent laboratory analysis to verify CONTRACTOR generated analytical results.

B. ENGINEER may conduct surveys to verify CONTRACTOR generated Excavation Quality Control Surveys.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

3.01 GENERAL

A. Perform excavation operations in a manner that precludes the spread of contamination within the excavation area and in adjacent areas. Manage excavation backfill sequencing to prevent contact of backfill with adjacent unexcavated contaminated soil.

B. Excavation and backfill operations shall be sequenced and conducted to minimize the time that excavations remain open and subject to sloughing of sidewalls and exposure to stormwater.

C. Excavations shall be maintained in a dry condition in accordance with Section 02430 - Dewatering, until backfill has been placed.

D. Promptly remove storm water from active excavations. Manage stormwater that contacts Contaminated Soil in accordance with Section 02300 – Waste Management.

E. Notify the ENGINEER promptly whenever drums, barrels, or other containers are encountered in the subsurface.

3.02 PROTECTION OF UTILITIES

A. Locations and depths of underground structures, utilities and pipelines, shown on the Drawings, are based upon available information. Some underground structures, pipelines or utilities may not be shown on the Drawings.

B. Locate underground pipelines or utilities within designated excavation areas, shown on the Drawings, prior to commencement of excavation operations.

C. Comply with rules and regulations of authorities or companies with jurisdiction over utilities and pipelines.

D. Coordinate with authorities or companies with jurisdiction over utilities and pipelines regarding procedures for removal, relocation, protection, or extension of utilities or pipelines impacted by excavation operations.

E. Remove abandoned pipelines or utilities uncovered during excavations. Cap, plug, or seal abandoned pipelines or utilities, as specified in Section 02210 - Demolition, and identify at grade.

F. Accurately locate and record on the As Built Drawings any abandoned or active pipelines or utilities relocated or extended during Site Operations as specified in Section 01380 - As Built Drawings.

3.03 EXCAVATION OF CONTAMINATED SOIL

A. CONTRACTOR shall conduct excavation, dewatering, Excavation Quality Control Surveying, confirmation sample collection and all other Work except placement and compaction of backfill using sequences, equipment and techniques which do not require workers or equipment to be placed within the excavation or adjacent areas thereby causing the excavation to be subject to regulation under any federal, state or local excavation safety rule.

B. If CONTRACTOR elects to use overexcavation ("benching" or "layback") techniques to meet excavation safety requirements during placement and compaction of backfill, such approach shall be described in CONTRACTOR's Remedial Operations Plan submitted in accordance with Section 01250 - Remedial Operations Plan. Such overexcavated material shall be considered Safety Overexcavated Material and shall be managed in accordance with Section 02305 - Soils Management and as follows:

1. Safety Overexcavated Material shall be segregated from material designated for excavation.

2. Overexcavated material meeting backfill specification requirements may be segregated and stockpiled for reuse within the site as Reused Safety Overexcavated Material. Overexcavated material not meeting requirements for reuse within the site shall not be reused off-site but shall be classified and disposed off-site in an appropriately permitted waste disposal facility as Disposed Safety Overexcavated Material.

C. Conduct initial excavation to within ± 0.3 ft. of the lines and grades shown on the Drawings. Conduct further excavation, if any is directed by ENGINEER in accordance with this Section, to within ± 0.3 ft. of the lines and grades shown on the Revised Excavation Limit Drawing provided by ENGINEER in accordance with this Section. Material excavated beyond this tolerance, except material designated as Safety Overexcavated Material, shall be

managed in accordance with the Contract Documents at no expense to TCEQ.

D. CONTRACTOR shall provide equipment with operators (not including survey instruments and survey instrument operators) necessary to allow ENGINEER to conduct quality assurance verification surveys in the manner utilized by CONTRACTOR to conduct Excavation Quality Control Surveys without causing the excavation to be subject to regulation under any federal, state or local excavation safety rule.

F. Promptly upon excavating to the designated limits, cease excavation and conduct the Excavation Quality Control Survey in accordance with this Section and collect Excavation Confirmation Samples in accordance with Section 01001 - Site Specific Environmental Parameters. Cease excavation activities against designated limit lines and grades which are the subject of that survey and sampling until the ENGINEER completes its review of applicable Analytical Results. Excavation against edges which are not designated limits shown on the Drawings or applicable Revised Excavation Limit Drawing may proceed.

G. CONTRACTOR shall conduct Excavation Confirmation Sample Analyses in accordance with Section 01001 - Site Specific Environmental Parameters and submit Results to ENGINEER for review as follows:

1. Within 8 hours of receipt of CONTRACTOR's Excavation Confirmation Sample Analytical Results the ENGINEER shall provide CONTRACTOR with a written determination stating either that the excavation limits have been achieved (in which case backfill operations may proceed) or have not been achieved (in which case the ENGINEER's written determination shall include a Revised Excavation Limit Drawing indicating where additional excavation is required). Delivery to CONTRACTOR of the ENGINEER's written determination shall complete the ENGINEER's Excavation Confirmation Sample Analyses Results review.

2. ENGINEER's Excavation Confirmation Sample Analyses Results reviews that require 8 hours or less to complete shall not serve as the basis for an increase in the Contract Price or Contract Time.

H. Upon receipt of ENGINEER's written determination that the required excavation limits have been achieved, promptly proceed with backfill operations in accordance with Section 02510 – Backfill and Final Grading.

I. Upon receipt of ENGINEER's written determination that the designated limits of excavation have not been achieved, promptly continue excavation to the Revised Excavation Limit Drawing limits. CONTRACTOR may proceed with

backfill operations in those areas where the designated limits have been achieved insofar as those operations do not interfere with continuing excavation activities, do not cause contaminated soil to come in contact with clean material, and do not interfere with subsequent Excavation Quality Control Surveys and Excavation Confirmation Sample collection.

3.04 EXCAVATION QUALITY CONTROL SURVEY

A. Perform in accordance with Section 01720 - Surveying and this Section.

B. Excavation Quality Control Surveys shall include spot elevations and coordinates at all of the following locations:

1. All Excavation Confirmation Sample points.

1. The top and bottom corners of each excavation.

2. The intersection of any designated grade breaks.

3. Points no less than fifteen feet (15') and no greater than twenty-five feet (25') apart along plane intersections and in the field of flat planes comprising the sidewalls and bottoms of a grid.

C. As-built drawings submitted in accordance with Section 01380 - As Built Drawings, shall not show incremental excavation limits but shall depict the extent of final excavations.

END OF SECTION

SECTION 02400SP EXCAVATION TO SAMPLED LIMITS

This Special Provision to Section 02400 serves to modify, add to, and/or delete from TCEQ Standard Specifications. Any item, paragraph, article, or work contained in the standard specification Section 02400, unless specifically modified, added to or deleted, shall remain unchanged.

The sections are modified as follows:

3.01.C General

Replace text with “If groundwater is encountered during excavation, the groundwater will be fixed with CPS prior to backfill”.

3.01.D General

Remove Section 3.01.D

3.02.E Protection of Utilities

Remove “, as specified in Section 02210 – Demolition,.”

3.03.B Excavation of Contaminated Soil

Remove “in accordance with Section 02305 – Soils Management and”.

END OF SECTION 02400SP

SECTION 02420
EXCAVATION AND BACKFILL FOR UTILITIES

PART 1 GENERAL

1.01 SUMMARY

A. This Section specifies the requirements for excavating, trenching, embedment, and backfill of utilities including manholes and other miscellaneous structures which are to remain in place upon completion of the Work under this contract and which are not otherwise subject to the requirements of a utility owner.

B. Utilities and appurtenances are to be of the material, class, and types shown on the drawings.

C. Utilities shall be constructed to the locations, lines and grades shown on the Drawings.

1.02 REFERENCES

A. ASTM C31 - Standard Practice for Making and Curing Concrete Test Specimens in the Field.

B. ASTM C33 - Standard Specification for Concrete Aggregates (Fine Aggregate).

C. ASTM C40 - Standard Test Method for Organic Impurities in Fine Aggregates for Concrete.

D. ASTM C94 - Standard Specification for Ready-Mixed Concrete.

E. ASTM C123 - Standard Test Method for Lightweight Pieces in Aggregate.

F. ASTM C142 - Standard Test Method for Clay Lumps and Friable Particles in Aggregates.

G. ASTM C150 - Specification for Portland Cement.

H. ASTM D558 - Standard Test Methods for Moisture-Density Relations of Soil-Cement Mixtures.

I. ASTM D698 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures using 5.5-lb (249 kg) Rammer and 12-in. (304.8 mm) Drop.

J. ASTM D1556 - Test Method for Density in Place by the Sand-Cone Method.

K. ASTM D1632 - Standard Practice for Making and Curing Soil-Cement Compression and Flexure Test Specimen in the Laboratory.

L. ASTM D1633 - Standard Test Method for Compressive Strength of Molded Soil-Cement Cylinders.

M. ASTM D2487 - Standard Test Method for Classification of Soils for Engineering Purposes (Unified Soil Classification System).

N. ASTM D2488 - Standard Practice for Description and Identification of Soils (Visual-Manual Procedure).

O. ASTM D2922 - Test Method for Density of Soil and Soil Aggregate in Place by Nuclear Methods (Shallow Depth).

P. ASTM D3017 - Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

Q. ASTM D4318 - Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

R. TxDOT Tex-101-E - Preparation of Soil and Flexible Base Material for Testing.

S. TxDOT Tex-110-E - Determination of Particle Size Analysis of Soils.

1.03 DEFINITIONS

A. Backfill: Suitable material meeting specified quality requirements for the designated application as embedment or trench zone backfill.

B. Pipe Embedment: Material placed under controlled conditions within the embedment zone extending vertically upward from top of pipe foundation to an elevation 12 inches above top of pipe.

C. Trench Zone Backfill: Material meeting specified quality requirements and placed under controlled condition in the trench zone from top of pipe embedment to base course in paved areas or to the surface grading material in unpaved areas.

D. Pipe Foundation: Either suitable soil of the trench bottom, or material placed as backfill or over-excavation for removal and replacement of unsuitable or otherwise unstable soils.

E. Source: A source selected by CONTRACTOR for supply of pipe embedment or trench zone backfill material. A selected source may be the project excavation (if not designated for off-site disposal), off-site borrow pits, commercial borrow pits, or sand and aggregate production or manufacturing plants.

F. Unsuitable Trench Zone Backfill Material: Unsuitable soil material are the following:

1. Materials that are classified as ML, CL-ML, MH, PT, OH, or OL according to ASTM D2487.

2. Materials that cannot be compacted to required density due to either gradation, plasticity, or moisture content.

3. Material that contain large clods, aggregates, or stones greater than 4 inches in any dimension, debris, vegetation, waste, or any other deleterious materials.

4. Soil not meeting the requirements of Section 01001 - Site Specific Environmental Parameters.

G. Suitable Trench Zone Backfill: Suitable soil materials are those meeting specification requirements.

H. Stable Trench: Stable and substantially dry trench conditions exist in pipe embedment zone as a result of typically dry soils or by ground water control (dewatering or depressurization) for trenches extending below ground water level.

I. Unstable Trench: Unstable trench conditions exist in the pipe embedment zone if ground water inflow or high water content causes soil disturbances, such as sloughing, sliding, boiling, heaving, or loss of density.

J. Pipe Over-Excavation and Backfill: Excavation of subgrade soils with unsatisfactory bearing capacity or composed of otherwise unsuitable materials below top of foundation as shown on Drawings, and backfilled with pipe foundation backfill material.

K. Pipe Foundation Backfill Materials: Natural soil or manufactured aggregate of controlled gradation. Pipe Foundation backfill material is placed and compacted as backfill to provide stable support for bedding.

1.04 SUBMITTALS

A. Pipe embedment and trench zone backfill material sources and source qualification test results in accordance with this Section.

B. Pipe embedment and trench zone backfill material quality control data as specified in this Section.

C. For pipe embedment backfill material, submit material qualification and mix design tests to document compliance with the Design Requirements of this Section.

1.05 QUALITY ASSURANCE

A. Verification testing of pipe embedment and trench zone backfill material sources may be performed by ENGINEER. CONTRACTOR shall cooperate and provide assistance (if necessary) in collecting samples for verification testing.

B. Trench zone backfill material obtained from the project excavation will be inspected by ENGINEER to verify that the material is suitable (i.e. not unsuitable).

1.06 DESIGN REQUIREMENTS FOR PIPE EMBEDMENT MATERIAL

A. Design sand-cement mixture to produce a minimum unconfined compressive strength of 100 pounds per square inch in 48 hours when compacted to 95 percent in accordance with ASTM D558 and when cured in accordance with ASTM D1632, and tested in accordance with ASTM D1633. Mix shall contain a minimum of 1-1/2 sacks of cement per cubic yard. Compact mix with a moisture content on the dry side of optimum.

PART 2 PRODUCTS

2.01 PIPE EMBEDMENT BACKFILL MATERIAL

A. Cement: Type 1 Portland cement conforming to ASTM C150.

B. Sand: Clean, durable sand meeting grading requirements for fine aggregates of ASTM C33, and the following requirements:

1. Classified as SW, SP or SM by the United Soil Classification System of ASTM D2487.

2. Deleterious materials:

a. Clay lumps, ASTM C142; less than 0.5 percent.

b. Lightweight pieces, ASTM C123; less than 5.0 percent.

c. Organic impurities, ASTM C40; color no darker than the standard color.

3. Plasticity index of 4 or less when tested in accordance with ASTM D4318.

C. Water: Potable water, free of oils, acids, alkalies, organic matter or other deleterious substances, meeting requirements of ASTM C94.

2.02 TRENCH ZONE BACKFILL MATERIAL

A. Trench Zone Backfill Material shall be free of: stones greater than 6 inches, roots, debris, trash, natural organic matter, unstable material, and non-soil matter. The material shall conform to the following limits for deleterious materials:

1. Clay lumps: less than 0.5 percent for Class I, and less than 2.0 percent for Class II, when tested in accordance with ASTM C142.

2. Lightweight pieces: Less than 5 percent when tested in accordance with ASTM C123.

3. Natural organic impurities: No color darker than standard color when tested in accordance with ASTM C40.

B. Suitable Trench Zone Backfill Material shall meet one of the following class designations:

1. Class I: Well graded sands and gravels, gravel-sand mixtures, crushed well graded rock, little or no fines (GW, SW)

a. Plasticity Index: Nonplastic

b. Gradation: D_{60}/D_{10} - greater than 4 percent. Amount passing No. 200 Sieve - less than or equal to 5 percent

2. Class II: Poorly graded gravels and sands, silty sands and gravels, little to moderate fines (GM, GP, SP, SM)

a. Plasticity Index: Nonplastic to 4

b. Gradation (GP, SP): Amount passing No. 200 Sieve - less than 5 percent

c. Gradation (GM, SM): Amount passing No. 200 Sieve - between 12 percent and 50 percent

3. Class III: Clayey gravels and sands, poorly graded mixtures of sand, gravel, and clay (GC, SC)

a. Plasticity Index: greater than 7

b. Gradation: Amount passing No. 200 Sieve - between 12 and 50 percent

4. Class IV: Lean clays (CL)

a. Plasticity Index: greater than 7

b. Liquid Limit: less than 50

c. Gradation: Amount passing No. 200 Sieve - greater than 50 percent

d. Inorganic

5. Use soils with dual class designation according to ASTM D2487 according to the more restrictive class.

C. Soils classified as select fill in accordance with Section 02510 - Backfilling, compacting and Final Grading.

D. Soils classified as silt (ML), silty clay (CL - ML with PI of 4 to 7), elastic silt (MH), organic clay and organic silt (OL, OH), and organic matter (PT) are unsuitable trench zone backfill materials.

2.03 EQUIPMENT

A. Perform excavation with hydraulic excavator or other equipment suitable for achieving the requirements of this Section.

B. Use only hand-operated tamping equipment until a minimum cover of 12 inches is obtained over pipes, conduits, and ducts. Do not use heavy compacting equipment until adequate cover is attained to prevent damage to pipe.

C. Use trench shields or other Protective Systems or Shoring Systems that are designed and operated to achieve placement and compaction of backfill directly against undisturbed native soil.

2.04 SOURCE QUALITY CONTROL

A. Ensure that material selected or used for the Project meets this specification and is of sufficient uniform properties to allow practical construction and quality control. Responsibilities include:

1. Source Qualification. Perform testing, or obtain representative tests, for selection of material sources. Provide test results for a minimum of three samples for each source. Tests shall verify that the materials meet specification requirements. Repeat qualification test procedures each time the source characteristic changes or there is a planned change in source location or supplier. Qualification tests shall include, as applicable:

a. Gradation. Complete sieve analysis shall be reported regardless of the specified control sieves. The range of sieves shall be from the largest particle through the No. 200 sieve.

b. Plasticity

c. Los Angeles abrasion

d. Clay lumps

e. Light weight pieces

f. Organic impurities

2. Production Testing. Establish a program to provide assurance that backfill materials delivered from the sources and placed in the Work meet applicable specification requirements. Submit results to ENGINEER.

3. Notify ENGINEER when non-conforming material is detected.

PART 3 EXECUTION

3.01 PREPARATION

A. Immediately notify ENGINEER of any existing utility line which is damaged, broken, or disturbed.

B. Sawcut existing pavement as required to construct proposed utility.

C. Install and operate necessary dewatering systems in conformance with Section 02430 - Dewatering.

D. Install rigid pipe to conform with standard practice described in ASTM C12.

3.02 EXCAVATION

A. Except as otherwise specified or shown on the Contract Drawings, install underground utilities in open cut trenches with vertical sides.

B. Perform excavation work so that pipe can be installed to depths and alignments shown on the Contract Drawings. Avoid disturbing surrounding ground and existing facilities and improvements.

C. Determine trench excavation widths using the following schedule as related to pipe greatest outside diameter (O.D.):

Nominal Pipe Size, Inches	Trench Width, Inches		Trench Depth Below O.D., Inches	
	Min	Max	Min	Max
Less than 18	O.D. + 12	O.D. + 24	6	9
18 to 30	O.D. + 18	O.D. + 24	9	12

D. Upon discovery of unknown utilities, badly deteriorated utilities not designated for removal, or concealed conditions, discontinue work at that location and notify ENGINEER.

E. Use of Trench Shields. When a trench shield (trench box) is used as a worker safety device, the following requirements apply:

1. Make trench excavations of sufficient width to allow shield to be lifted or pulled freely, without damage to the trench sidewalls.

2. Move trench shields so that pipe, and backfill materials, after placement and compaction, are not damaged nor disturbed, nor the degree of compaction reduced.

3. When required, place, spread, and compact pipe foundation and bedding materials beneath the shield. For backfill above bedding, lift the shield as each layer of backfill is placed and spread. Place and compact backfill materials against undisturbed trench walls and foundation.

4. Maintain trench shield in position to allow sampling and testing to be performed in a safe manner.

F. Place material suitable for backfilling in stockpiles at a distance from the trench to prevent slides or cave-ins.

G. Excavate bottom of trench to uniform grade to achieve stable trench conditions and satisfactory compaction of pipe foundation.

3.03 PIPE EMBEDMENT PLACEMENT AND COMPACTION

A. Immediately prior to placement of embedment material, the bottoms and sidewalls of trenches shall be free of loose, sloughing, caving, or otherwise unsuitable soil.

B. Place pipe embedment to the limits shown on the Drawings.

C. Manually spread embedment materials around the pipe to provide uniform bearing and side support when compacted. Do not allow material to free-fall from heights greater than 24 inches above top of pipe. Perform placement and compaction directly against the undisturbed soils in the trench sidewalls.

D. Do not place trench shields within height of the embedment zone unless means to maintain the density of compacted embedment material are used. If movable supports are used in embedment zone, lift the supports incrementally to allow placement and compaction of the material against undisturbed soil.

E. Thoroughly mix sand, cement, and water in proportions of the mix design using a pugmill-type mixer. The plant shall be equipped with automatic weight controls to ensure correct mix proportions.

F. Stamp batch ticket at plant with time of loading directly after mixing. Material not placed and compacted within 4 hours after mixing shall be rejected.

G. Shovel pipe embedment material in place and compact it using pneumatic tampers in restricted areas, and vibratory-plate compactors or engine-powered jumping jacks in unrestricted areas. Compact each lift before proceeding with placement of the next lift.

H. Place sand-cement mixture in 6-inch-thick loose lifts and compact to 95 percent of ASTM D558, unless otherwise specified. The moisture content during compaction shall be on the dry side of optimum but sufficient for hydration. Perform and complete compaction of sand-cement mixture within 4 hours after addition of water to mix at the plant.

I. Do not place or compact sand-cement mixture in standing or free water.

3.04 TRENCH ZONE BACKFILL PLACEMENT AND COMPACTION

A. Utilities Installed in Paved Areas (Beneath Pavement)

1. Place trench zone backfill and restore surface as soon as practicable. Leave only the minimum length of trench open as necessary for construction.

2. Place trench zone backfill in lifts and compact by methods selected by CONTRACTOR. Fully compact each lift before placement of the next lift.

3. Maximum compacted lift thickness 8 inches.

4. Compaction by vibratory equipment to a minimum of 95 percent of the maximum dry density determined according to ASTM D558.

5. Moisture content on the dry side of optimum determined according to ASTM D5658 but sufficient for cement hydration.

B. Utilities Installed in Unpaved Areas

1. Maximum 9-inch compacted lift thickness for clayey soils and maximum 12-inch lift thickness for granular soils.

2. Compact to a minimum of 90 percent of the maximum dry density determined according to ASTM D698.

3. Moisture content as necessary to achieve density

C. Select fill

1. Maximum 6-inches compacted thickness.

2. Compaction by equipment providing tamping or kneading impact to a minimum of 95 percent of the maximum dry density determined according to ASTM D698.

3. Moisture content within 2 percent of optimum determined according to ASTM D698.

3.05 FIELD QUALITY CONTROL

A. Test for material source qualifications as defined in this Section and Section 02510 - Backfill and Final Grading.

B. Provide excavation and trench safety systems at locations and to depths required for testing and retesting during construction at no additional cost to TCEQ.

C. Tests will be performed on a minimum of three different samples of each material type for plasticity characteristics, in accordance with ASTM D 4318, and for gradation characteristics, in accordance with Tex-101-E and Tex-110-E. Additional classification tests will be performed whenever there is a noticeable change in material gradation or plasticity.

D. At least three tests for moisture-density relationships will be performed initially for trench zone backfill materials in accordance with ASTM D 698, and for cement- stabilized sand in accordance with ASTM D 558. Additional moisture-density relationship tests will be performed whenever there is a noticeable change in material gradation or plasticity.

E. In-place density tests of compacted pipe foundation, embedment, and trench zone backfill soil materials will be performed according to ASTM D 1556, or ASTM D 2922 and ASTM D 3017, and at the following frequencies and conditions:

1. A minimum of one test for every 20 cubic yards of compacted embedment and for every 50 cubic yards of compacted trench zone backfill material.

2. A minimum of three density tests for each full shift of Work.

3. Density tests will be distributed among the placement areas, pipe foundation and pipe embedment.

4. The number of tests will be increased if inspection determines that soil type or moisture content are not uniform or if compacting effort is variable and not considered sufficient to attain uniform density, as specified.

5. Two verification tests will be performed adjacent to in-place tests showing density less than the acceptance criteria. Placement will be rejected unless both verification tests show acceptable results.

6. Recompacted placement will be retested at the same frequency as the first test series, including verification tests.

F. Recondition, recompact, and retest at CONTRACTOR's expense if tests indicate Work not meeting specified compaction requirements. For hardened soil cement with nonconforming density, core and test for compressive strength at CONTRACTOR'S expense.

3.06 DISPOSAL OF EXCESS MATERIAL

A. Dispose of excess materials in accordance with requirements of Section 01650 - Off-Site Transportation and Disposal.

3.07 PROTECTION

A. Protect trees, shrubs, lawns, existing structures, and other permanent objects outside the allowable trench limits.

B. Protect and support above grade and below grade utilities which are to remain.

C. Restore damaged permanent facilities to pre-construction conditions unless replacement or abandonment of facilities is indicated on the Contract Drawings.

D. Take measures to minimize erosion of trenches. Do not allow water to pond in trenches. Areas where slides, washouts, settlements, loss of density, pavement failures, or potholes occur, repair, recompact, and pave those areas at no additional cost to TCEQ.

END OF SECTION

SECTION 02420SP EXCAVATION AND BACKFILL FOR UTILITIES

This Special Provision to Section 02420 serves to modify, add to, and/or delete from TCEQ Standard Specifications. Any item, paragraph, article, or work contained in the standard specification Section 02420, unless specifically modified, added to or deleted, shall remain unchanged.

The sections are modified as follows:

3.01.C Preparation

Remove Section 3.01.C

3.06 Disposal of Excess Material

Remove Section 3.06

END OF SECTION 02420SP

SECTION 02510
BACKFILL AND FINAL GRADING

PART 1 GENERAL

1.01 SUMMARY

A. This Section specifies the requirements for backfilling, compacting and grading the site following excavation activities.

B. All fill material shall be placed to the final lines, grades and thicknesses shown on the drawings

1.02 REFERENCES

A. ASTM C131 – Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.

B. ASTM D422 – Standard Test Method for Particle-Size Analysis of Soils.

C. ASTM D698 – Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3).

D. ASTM D2488 – Standard Practice for Description and Identification of Soils (Visual-Manual Procedure).

E. ASTM D2922 – Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

F. ASTM D3017 – Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

G. ASTM D4318 – Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

H. ASTM D4972 – Standard Test Method for pH of Soils.

I. SW-846 – U.S. Environmental Protection Agency. *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, Vol. I*. Washington, DC.

J. *Standard Specifications for Construction of Highways, Streets and Bridges*. Texas Department of Highways and Public Transportation

1.03 DEFINITIONS

A. Lift – Compacted layer of material.

B. Placement Area – A region of the site which is backfilled concurrently.

C. On-Site Soils – Excavated site soils that do not require off-site disposal.

1.04 SUBMITTALS

A. Locations of borrow sources and certified test results of all proposed borrow material. Soil sample collection, testing and results shall conform with the requirements of this Section.

B. Copies of delivery tickets for all delivered soil products to ENGINEER, for Record purposes, on a daily basis during backfilling and compacting operations.

C. Quality control data as specified in this Section to ENGINEER, for Review purposes, on a daily basis during backfilling and compacting operations.

1.05 QUALIFICATIONS

A. Geotechnical tests specified in this Section shall be conducted under the supervision of an independent, Registered Professional Engineer licensed in the State of Texas and qualified in construction materials engineering and geotechnical testing.

B. Geotechnical tests shall be performed by an independent laboratory in accordance with Section 01714 – Testing Laboratory Services.

PART 2 PRODUCTS

2.01 MATERIALS

A. SELECT FILL

1. Select fill shall be clayey gravel or clayey sand from a qualified, off-site borrow source with the following characteristics:

a. Liquid limit less than 40;

b. Plasticity index between 7 and 20; and

c. Maximum of 35 percent passing the No. 200 sieve.

2. Select fill shall be reasonably free of organic silt, peat, plants, roots, rocks greater than 3 inches in diameter, debris, trash, or waste materials.

3. On-site soils that meet the above requirements may be used as select fill.

B. TOPSOIL

1. Topsoil shall be fertile, friable, natural sandy loam surface soil from a qualified, off-site borrow source with the following characteristics:

a. pH value between 5.5 and 6.5;

b. Liquid limit less than 50;

c. Plasticity index less than 10;

d. Organic content between 5 and 20 percent;

e. Clay content between 5 and 20 percent; and

f. Maximum of 40 percent passing the No. 280 sieve.

2. Topsoil shall be free of deleterious material, subsoil, clay lumps, roots, stumps, stones larger than 2 inches in diameter, weeds, or waste materials.

3. Do not obtain topsoil from areas infected with noxious weeds.

2.02 SOURCE QUALITY CONTROLS

A. Source Qualification Requirements

1. At a minimum, collect one sample of each different soil product from each proposed borrow source and analyze the samples for the following geotechnical parameters.

a. Select Fill

(1) Liquid limit (ASTM D4318)

(2) Plasticity index (ASTM D4318)

(3) Grain size (ASTM D422)

(4) Maximum dry density and optimum moisture content (ASTM D698)

b. Topsoil

(1) pH value (ASTM D4972)

(2) Liquid limit (ASTM D4318)

(3) Plasticity index (ASTM D4318)

(4) Grain size (ASTM D422)

2. Collect one sample of each different soil product from each proposed borrow source in accordance with the requirements of this Section and provide to ENGINEER for chemical analysis. Samples will be analyzed for the analytes and criteria listed in Section 010001 - Site Specific Environmental Parameters. If soils from any proposed borrow source contain constituents of concern above the levels specified Section 010001 - Site Specific Environmental Parameters in, all materials from that source shall be rejected, and CONTRACTOR shall pay all analytical costs associated with those soils.

3. CONTRACTOR at his own expense shall repeat qualification test procedures whenever source characteristics change.

4. If quality control data specified in this Section indicate that soils from any source do not meet requirements in this Section, terminate further placement of that material and identify another borrow source at no additional cost to TCEQ.

5. Remove and dispose of all materials placed on the site that do not meet requirements in this Section and mitigate any damages caused by placement of that material at no additional cost to TCEQ.

6. Inspect On-Site Soils for unacceptable materials in accordance with ASTM D2488. On-Site Soils shall be exempt from source qualification requirements. Unacceptable materials shall be removed prior to use of On-Site Soils as backfill.

PART 3 EXECUTION

3.01 GENERAL

A. Do not place select fill or topsoil from any borrow source on the site without written authorization from ENGINEER.

B. Do not place any backfill if it becomes unsuitable for use, due to segregation, mixing with other materials, or contamination.

C. Control erosion and sedimentation; implement storm water pollution prevention procedures; avoid noise, dust, and odor generation; and protect air quality, as specified in Section 01230 – Environmental Protection, during all backfilling, compacting, and grading activities.

D. Place backfill and base materials in horizontal Lifts of uniform thickness, in a manner that avoids segregation, and compact each Lift to specified densities, if applicable, prior to placement of the next Lift. Slope Lifts only where necessary to drain water from placement surfaces or conform to final grades.

E. ENGINEER and TCEQ make no representations regarding the suitability of backfilled and compacted areas for CONTRACTOR's use.

3.02 PLACEMENT AND COMPACTION

A. Place and compact select fill in the following manner:

1. Maximum lift thickness of 6 to 8 inches; and

2. Uniform compaction to 95 percent Standard Proctor (ASTM D698) at a moisture content of one percent dry to three percent wet of the optimum moisture content defined by ASTM D698.

B. Place topsoil in the following manner:

1. Scarify surface soils to a depth of 4 inches. Remove vegetable material and foreign inorganic material;

2. Place topsoil on the loosened material in a maximum lift thickness of 6 to 8 inches and roll lightly to consolidate the topsoil;

3. Uniform compaction to 95 percent Standard Proctor (ASTM D698) at a moisture content of one percent dry to three percent wet of the optimum moisture content defined by ASTM D698; and

4. Place topsoil to achieve the minimum thickness shown on the Contract Drawings.

3.03 FINAL GRADING

A. Shape, trim, and finish backfilled and compacted areas to establish or maintain slopes and drainage as shown on Contract Drawings.

B. Shape, trim, and finish slopes of embankments and channels to conform with the lines, grades, and cross Sections shown on the Contract Drawings.

3.04 FIELD QUALITY CONTROL REQUIREMENTS

A. Notify ENGINEER immediately whenever noticeable changes occur in gradation or plasticity of imported materials or quality control data deviate from values specified in this Section.

B. During placement and compaction of backfill or base materials, measure in-place density and water content in accordance with ASTM 2922 and ASTM 3017, respectively, at the following frequencies:

1. In-place density and moisture content of select fill shall be measured one time per Lift per day per Placement Area with a minimum of one test per 500 cubic yards.

C. Personnel that conduct field quality control tests specified in this Section shall be certified in construction materials testing by the National Institute for Certification of Engineering Technologies (NICET).

D. Perform two verification tests adjacent to in-place tests that fail density criteria specified in this Section. Placement shall be rejected unless both verification tests show acceptable results.

E. If in-place density and water content tests indicate that compaction does not meet requirements in this Section, recondition, recompact, and retest backfill or base materials at no additional cost to TCEQ. Recompacted backfill or base materials shall be retested at the same frequency as the first test series including verification tests.

F. Samples collected for geotechnical testing, specified in this Section, shall be processed materials representative of soil products to be imported for use on the site.

END OF SECTION

SECTION 02510SP BACKFILL AND FINAL GRADING

This Special Provision to Section 02510 serves to modify, add to, and/or delete from TCEQ Standard Specifications. Any item, paragraph, article, or work contained in the standard specification Section 02510, unless specifically modified, added to or deleted, shall remain unchanged.

Section 1.05 is modified as follows:

1.05.B QUALIFICATIONS

Replace Section 1.05.B “Section 01714 – Testing Laboratory Services” with “Section 01740 – Testing Laboratory Services and Section 01740SP – Special Provision to Testing Laboratory Services”.

Section 3.02 is modified as follows:

3.02.A.2 PLACEMENT AND COMPACTION

Replace Section 3.02.A.2 with “Placement of the approved soils within the bottom five feet (ft) of the excavation will be in 2.5-ft lifts. 29% Calcium Polysulfide (CPS) will be added to each 2.5 ft lift of backfill soil at a dosage of one gallon of CPS per one cubic yard of soil. As each 2.5-ft lift of backfill soil has been placed in the excavation, the CPS solution will be applied uniformly, mixed thoroughly, leveled, and compacted prior to placement of the successive lift (the Contractor may dilute the CPS, if necessary, to facilitate distributing the solution uniformly). The remaining clean backfill soil will placed in 1-ft lifts to a depth of 1 ft below the top of the surrounding surface. All soil lifts will be leveled and compacted”.

END OF SECTION 02510SP

SECTION 02600
IN SITU CHEMICAL REDUCTION

PART 1 – GENERAL

1.01 SUMMARY

A. This Section covers the performance requirements for *in situ* chemical reduction (ISCR) of hexavalent chromium ([Cr(VI)] at the First Quality Cylinders Proposed State Superfund Site.

B. For boring locations placed in a close-packed array on 10-foot (ft) centers in the portion of the site identified in the URS Proposed Remedial Action Drawing Set, Sheet C-202, the CONTRACTOR will inject an aqueous solution of calcium polysulfide (CPS) over a 5-ft interval from 7 to 12 ft below ground surface (bgs).

C. The CONTRACTOR will minimize the backflow of injected liquids and will capture all liquids that are released onto the pavement or ground surface. The CONTRACTOR will be allowed to perform any means and methods necessary to achieve these objectives, as deemed reasonable by Texas Commission on Environmental Quality (TCEQ) or their representative.

D. Any changes or substitutions to the requirements herein shall be approved by the TCEQ in writing prior to construction.

E. Related Sections

1. Section 01010 – Summary of Work
2. Section 01030 – Health and Safety
3. Section 01230 – Environmental Protection
4. Section 01232 – Silt Fence
5. Section 01250 – Remedial Operations Plan
6. Section 01330 – Submittals
7. Section 01650 – Off-Site Transportation and Disposal
8. Section 01750 – Site Security
9. Section 02090 – Decontamination
10. Section 02100 – Site Preparation

11. Planned Remedial Action Plan Drawing Set

1.02 REFERENCES (USE LATEST EDITIONS ON ALL TEST METHODS)

A. TCEQ

1. *Addendum 1 to Field Sampling Plan for Treatability Study Activities, First Quality Cylinders Proposed State Superfund Site, San Antonio. Bexar County, Texas.* Contract No. 582-8-79656, Work Order No. 154-0016. Prepared by URS Corporation, December 23, 2008.

2. *Treatability Study Report, First Quality Cylinders Proposed State Superfund Site, San Antonio. Bexar County, Texas.* Contract No. 582-8-79656, Work Order No. 154-0001. Prepared by URS Corporation, July 31, 2009.

3. *TCEQ Class V Injection Well Inventory/Authorization Form, First Quality Cylinders Proposed State Superfund Site (SUP046), 931 West Laurel Street, San Antonio, Bexar County, Texas 78201***.** Prepared by URS Corporation. Submitted to Mr. Bryan Smith, TCEQ UIC Permits Team, Radioactive Materials Division, October 28, 2013.

4. *Pilot Treatability Study Work Plan, First Quality Cylinders Proposed State Superfund Site, San Antonio. Bexar County, Texas.* Contract No. 582-12-21804, Work Order No. 288-0021. Prepared by URS Corporation, November 11, 2013.

5. *Health and Safety Plan Addendum, First Quality Cylinders Proposed State Superfund Site, San Antonio. Bexar County, Texas*. Contract No. 582-12-21804, Work Order No. 288-0021. Prepared by URS Corporation, November 26, 2013.

6. *Authorization of Class V Injection Wells, TCEQ Authorization No. 5X2600700, CN600324081/RN100645977, SUP046, First Quality Cylinders, 931 West Laurel Street, San Antonio, Texas 78201*. Prepared by Bryan Smith, TCEQ UIC Permits Team, Radioactive Materials Division, December 2, 2013.

7. *Proposed Remedial Action Document, First Quality Cylinders Proposed State Superfund Site, San Antonio. Bexar County, Texas*. Prepared by Subhash C. Pal, Project Manager, TCEQ Superfund Section, Austin, TX, May 1, 2014.

8. *Pilot Treatability Study Report, First Quality Cylinders Proposed State Superfund Site, San Antonio. Bexar County, Texas*. Contract

No. 582-12-21804, Work Order No. 288-0021. Prepared by URS Corporation, August 29, 2014.

9. *Quality Assurance Project Plan for the Superfund Program Reports*.

1.03 SUBMITTALS

A. In accordance with Section 01250, the CONTRACTOR shall submit a Remedial Action Work Plan that must include, but is not limited to:

1. Backflow Liquid Management Plan (BLMP): The BLMP shall include a detailed description of the CONTRACTOR's proposed procedures, methods, and amendments for minimizing the generation of backflow liquids and managing the quantity of liquids that are generated.

2. Waste Management Plan: The CONTRACTOR shall prepare a Waste Management Plan that describes how waste generated during the remedial action, including backflow liquids, decontamination fluids, unused product, and other wastes obtained from site activities will be managed.

3. Mixing and Injection Equipment: The CONTRACTOR shall provide a list of major equipment by manufacturer, model number, type and capacity to be used on the project.

4. Decontamination Plan: A decontamination plan for equipment cleaning during site operations and prior to leaving the site must be provided.

B. INJECTION LOCATION MAPS

1. Locations of all injection points where CPS applications were attempted and/or completed shall be provided on a site map prepared at a scale acceptable to URS. The site map can be an edited version of the ISCR injection layout map provided in Proposed Remedial Action Drawing Set, Sheet C-202.

C. RECORDS

1. The CONTRACTOR shall maintain records for all quantities of materials injected, field tests, measurements, observations, and inspections. Site operation reports shall be submitted to the TCEQ or URS each day (or at the end of each shift) in a form acceptable to the TCEQ. These reports shall list all test results, measurements, and observations made and/or received by the CONTRACTOR for that day.

a. Injection logs shall be prepared each day that include the following information for each injection boring, at a minimum:

1. Boring ID;

2. Date, start time, end time;

3. Injection interval;

4. Initial and sustained pressures and average flow rate;

5. Fluid quantities (in gals), including total CPS solution injected, 29% CPS injected, mix water injected, flush water injected, and total solution quantities injected;

6. Totalizer readings for water obtained from a municipal water hydrant; and

7. Field observations and notes.

2. Product Documentation

a. Reagent composition, certificates of analysis, and Safety Data Sheet documentation for all chemicals must be available on site.

b. Copies of delivery tickets for all delivered reagents and water will be given to URS on a daily basis during site operations.

PART 2 – PRODUCTS

2.01 APPROVED REAGENTS

The following reagents (or equivalent, as approved by the TCEQ or their representative) shall be utilized.

A. Calcium polysulfide; synonyms include CAPS, calcium sulfide, lime sulfur, CaS_x

1. CaS_x content – 24 - 29% by weight

2. Water content – 71 - 76% by weight

B. Potable or nonpotable water

1. Clean water for chemical mixing, flushing, and decontamination activities may be obtained from the City of San Antonio municipal water system or other sources.

2.02 OTHER REAGENTS

A. The CONTRACTOR may propose other materials to the TCEQ or their representative for their approval;

B. Material shall not be generated by a facility which incorporates waste material or recyclable materials either into the manufacturing fuel sources or into the manufacturing feed materials;

C. The CONTRACTOR shall demonstrate by a laboratory testing program that the material is a cost-effective alternative;

D. The material exhibits no hazardous characteristics; and

E. The material contains no compounds which will adversely affect the long-term immobilization of Cr(VI).

PART 3 – EXECUTION

3.01 GENERAL

A. Implement storm water pollution prevention procedures; avoid the generation of noise, dust, and odor; and protect air quality as specified in Section 01230 – Environmental Protection during all chemical handling, injection, and waste management activities.

B. Maintain site security as specified in Section 01750 – Site Security and Section 01750SP – Special Provision for Site Security during all field operations.

C. Transport waste to an approved Solid Waste Landfill as specified in Section 01650 – Off-Site Transportation and Disposal, including the special provisions to that Section.

3.02 QUALITY CONTROL REQUIREMENTS

A. The CONTRACTOR shall ensure that all waste materials removed from the site comply with all applicable federal, state, county, and municipal regulations regarding off-site transportation and meet acceptance requirements established by the Solid Waste Landfill where the waste is to be disposed. The TCEQ or their representative may perform independent tests to confirm that the acceptance requirements have been achieved.

B. The CONTRACTOR shall provide a flow measuring device and a pressure gauge for each injection point that are capable of measuring injection flow rates and pressures with an accuracy of ± 10%.

3.03 CONSTRUCTION PROCEDURES

A. The CONTRACTOR shall mark the planned injection boring locations on 10-ft centers as shown on Sheet C-202. The planned methods and means for layout of the injection array must be approved by the TCEQ or their representative. Should it be impractical to place injection boring at the planned locations, alternative locations shall be proposed to the TCEQ or their representative.

B. The CONTRACTOR will use a Geoprobe® Series 66 or equivalent direct-push technology (DPT) rig capable of inserting open-screen injection tools that will distribute the CPS solution over the 5-ft target injection interval. Each injection location requires the injection of 2.8 gallons (gals) of 29% CPS product diluted in 11.2 gals of water followed by injection of 150-200 gals of water to enhance the distribution of the CPS solution in the saturated zone. Any proposed changes to these quantities must be approved by the TCEQ or their representative prior to injection.

C. The CONTRACTOR shall either perform injection borings individually or utilize a manifold system capable of pumping CPS solution to up to four injection borings simultaneously using a centrifugal, positive displacement, or progressive cavity pump. If a manifold system is used, each application line shall include an in-line flow measuring device and a pressure gauge.

3.05 COMPLETENESS AND REPROCESSING

A. The CONTRACTOR shall apply the total design quantity of 29% CPS product (308 gals). Should site conditions hinder the application of CPS solution at some locations, additional injection locations shall be selected by the CONTRACTOR in conjunction with TCEQ or their representative to apply the remaining CPS product.

B. Injected CPS products or quantities that do not meet the requirements established by this specification shall be replaced at the CONTRACTOR's expense until the requirements are satisfied.

END OF SECTION 02600

SECTION 02831
CHAINLINK FENCES AND GATES

PART 1 GENERAL

1.01 SUMMARY

A. This Section specifies the products and procedures for installation of galvanized chainlink fences and gates.

B. Fence and gates shall be installed at the locations shown on the Drawings.

1.02 SUBMITTALS

A. Shop Drawings that indicate plan layout, spacing of components, post foundation dimensions, hardware anchorage, and schedule of components.

B. Product Data on fabric, posts, accessories, fittings and hardware for Approval purposes.

PART 2 PRODUCTS

2.01 GALVANIZED FENCING

A. Fence Fabric - Zinc-coated steel chain-link fence fabric meeting the requirements of ASTM A-392 as follows:

1. Zinc-coated after weaving (GAW).

2. 2-Inch mesh.

3. 9 gage wire / 0.148-in. nominal diameter after coating.

4. Knuckled selvage top and bottom.

5. Class 2 coating, not less than 1.2 oz/ft^2.

6. Fabric height as specified on drawings.

B. Framework - Hot-dipped galvanized with a minimum coating of 2 ounces per square foot, or 1 ounce per square foot plus 30 micrograms per square inch chromate conversion coating.

C. Line Posts - Conform to ASTM A570 Grade 45 steel or ASTM A569, cold rolled steel 2 3/8-inch outside diameter, 3.65 pounds/foot pipe.

D. End Corner, Angle, and Pull Posts - Conform to ASTM A570 Grade 45 steel or ASTM A569 for steel pipe, 2/7/8-inch outside diameter, 5.79 pounds/foot pipe.

E. Top Rails - 1-5/8-inch outside diameter steel pipe, 2.27 pounds per foot.

F. Fabric Ties - Hog rings, galvanized steel wire not less than 9-gage with a zinc coating of not less than 1.2 ounces per square foot. Interlace a continuous 7-gage galvanized steel wire with the fabric along the extreme bottom of the fence.

G. Bolts and Nuts - Conform to ASTM A307; galvanized in accordance with AASHTO M232.

H. Horizontal Braces - Fabricated of 1-5/8-inch, 2.27-pound copper bearing steel pipe.

I. Extension Arms and Barbed Wire

1. Extension Arms - Project 45-degrees outward from the fenced area.

2. Barbed Wire - 3 strands per extension arm; each strand of double 12.5-gage with 14-gage, 4-point parts at 5 inches.

J. Gates - Provide either swing or slide as shown on the Drawings.

1. Swing Gates - Hinged to swing 90 degrees from closed to open or hinged to swing 180 degrees from close to open as shown on the Drawings.

2. Slide Gates—Roller type with guard and sealed bearings. Bearing housing shall be connected to shaft with a castle nut and cotter pin.

3. Swing Gate Leaves—Provide intermediate members and diagonal stress rods as required for rigid construction to eliminate sag or twist.

4. Slide Gate Leaves—Provide 2-inch outside diameter, 2.72 pounds/foot pipe diagonal bracing as required for rigid construction to eliminate sag or twist.

5. Barbed Wire Extension—Fit gates with vertical extension arms or extended frame end members to carry barbed wire.

6. Swing and Slide Gate Posts—4-inch outside diameter, 9.11 pounds/foot pipe.

7. Swing Gate Frames—2-inch outside diameter, castings.

8. Slide Gate Frames—2.5 inch outside diameter, 3.65 pounds/foot pipe.

9. Fabric—Same as for the fence.

10. Malleable Iron Fittings—Ball and socket hinges, catches and stops.

11. Padlocks—One for each gate. The lock shall have a hardened shackle and the body shall be made out of brass to withstand weathering with a resettable combination lock with at least four digits.

12. Posts for Single Swing Gates—Same as end posts.

2.02 CONCRETE

A. Concrete used for post anchorage shall have a strength of 2,500 psi at 28 days; and shall be Type II Portland cement with a 3-inch slump and maximum 1-inch size aggregates mixed with potable water.

B. For quantities less than 1 cubic yard, dry premixed concrete ("Sak-Crete" or equivalent) will be acceptable.

2.03 SOURCE QUALITY CONTROL

A. Furnish materials manufactured by a company that specializes in manufacturing the products specified in this Section.

PART 3 EXECUTION

3.01 LOCATION

A. Install chain link fencing and gates at locations shown on the Drawings.

3.02 INSTALLATION

A. Install chainlink fence in accordance with the directions of the Manufacturer and this Section.

B. Install fence posts at not more than 10-foot centers and at least 36 inches into the ground. Utilize concrete specified in this section to set all posts. Allow concrete to cure for at least 7 days before erecting remainder of fence. Fasten fabric to line posts with wire ties spaced about 14 inches apart and to top rail spaced about 24 inches apart.

C. Use standard chain link fence-stretching equipment to stretch the fabric before tying it to the rails and posts. Repeat the stretching and tying operations about every 100 feet.

D. Erect gates so they swing or slide in the appropriate direction. Provide gate stops as required. Secure hardware, adjust, and leave in perfect working order. Adjust hinges and diagonal bracing so that gates will hang level. Adjust rollers and guides of sliding gates so that gates are level.

E. At small natural swales or drainage ditches where it is not practical for fence to conform to the ground contour, span the opening below the fence with wire fastened to stakes of required length. Install the finished fence plumb, taut, true to line and ground contour. Stake down the chain link fence at several points between posts.

F. Where new fence joins an existing fence, set a corner post and brace post at the junction and brace. If the connection is made at other than the corner of the new fence, install a brace at the last span of the old fence.

END OF SECTION

SECTION 02932
HYDROMULCH SEEDING

PART 1 GENERAL

1.01 SUMMARY

A. This Section specifies required products and procedures for the application, growth and maintenance of hydromulch seeding on properly prepared topsoil. Certain requirements are based on planting dates and the geographic location of the site.

B. Hydromulch seeding shall be installed at the locations shown on the Drawings.

1.02 SUBMITTALS

A. Data sufficient to determine that the following products or materials fully comply with the requirements of this specification:

1. Seed.

2. Fertilizer.

3. Mulch.

4. Soil stabilizer.

5. Weed control agent.

B. CONTRACTOR shall include a record of overall condition, soil moisture, water application and other maintenance activities for placed hydromulch seeding in its daily reports of site activities for information of the ENGINEER.

PART 2 PRODUCTS

2.01 SEED

A. Seed shall conform to U.S. Department of Agriculture regulations pertaining to the Federal Seed Act and the Texas Seed Law. Select seed to be used based upon TCEQ region and planting date shown in Table 02932-1

B. Wet, moldy, or otherwise damaged seed shall not be acceptable. Seed shall be certified 90 percent pure, yield 80 percent germination.

C. Deliver seed in original, unopened containers labeled with weight, analysis, name of vender, and germination test results.

2.02 FERTILIZER

A. Use dry, free flowing, uniform, inorganic, water soluble commercial fertilizer. Deliver in unopened containers with the manufacturers guaranteed analysis. Caked, damaged, or otherwise unsuitable fertilizer shall not be acceptable.

B. Fertilizer shall contain minimum percentages of the following elements:

1. 15 percent nitrogen;

2. 5 percent phosphorous; and

3. 10 percent potassium.

2.03 MULCH

A. Use virgin wood cellulose fibers from whole wood chips having a minimum of 20 percent fibers 0.42 inches (10.7 millimeters) in length and 0.01 inches (0.27 millimeters) in diameter.

B. Mulch shall be dyed green for coverage verification purposes.

2.04 SOIL STABILIZER

A. Use "Terra Tack" 1 or approved equal.

2.05 WEED CONTROL AGENT

A. Use "Benefin" or approved equal as a pre-emergent herbicide.

2.06 WATER

A. Apply potable water from water trucks or other temporary sprinkler system suitable to evenly apply required amounts of water without creating erosion or runoff.

PART 3 EXECUTION

3.01 PREPARATION

A. Verify that backfill and topsoil placement, grading, compaction and scarification have been satisfactorily completed.

3.02 APPLICATION

A. Mix and apply products in accordance with hydromulching machine requirements to achieve the seed application rates shown in Table 02932-1

3.03 MAINTENANCE

A. Maintain hydromulched areas until a full and uniform stand of grass (i.e. not bare spots) has been established, and continue maintenance until final acceptance by TCEQ unless indicated otherwise in the Contract Documents.

B. Irrigate daily with, at a minimum, ½ inch of water for the first three weeks after installation. Apply water slowly so that soil surface does not puddle and crust.

C. After three weeks, irrigate twice per week with 3/4 inch of water unless a comparable amount of rain has fallen at the site since the area was irrigated previously.

D. Mow as necessary to maintain grass height less than 3 ½ inches and preserve a neat and healthy appearance.

1. Set mower blades at 2 ½ inches.

2. Do not remove more than one-half of the grass leaf surface.

3. Use a light-weight rotary type mower for areas that require mowing within one month after installation,.

4. Mow grass only when dry, not in a saturated or soft condition.

F. Spread fertilizer evenly at a rate of 40 pounds per 5000 square feet unless otherwise specified by the manufacturer. Fertilizer shall not be placed until two weeks after hydromulch application.

G. Treat areas of heavy weed and insect infestation and areas of fungus or other disease as necessary to promptly restore and maintain a healthy condition. Apply fungicide and insecticide in accordance with guidelines established by the Structural Pest Control Board of the State of Texas.

H. Repair areas damaged by erosion or disease by regrading, rolling and replanting at no additional cost to TCEQ.

TABLE 02932-1
GRASS SEED MIXTURE BY DATE AND REGION

TCEQ Region		Planting Dates	Grass Seed Mixture	
			Seed Type	lbs. (Live seed)/acre
1	Amarillo	Feb. 15 - Aug 15	Green Sprangletop	0.9
			Sideoats Gramm (El Reno)	2.8
			Blue Grama (Lovington)	0.8
			Buffalograss	8
		Aug. 15 - Feb 15	Tall Fescue	4
2	Lubbock	Feb 15 - Aug 15	Green Sprangletop	0.9
			Sideoats Grama (El Reno)	2.8
			Blue Gramm (Lovington)	0.8
			Buffalograss	8
		Aug 15 - Feb 15	Tall Fescue	4
3	Abiline	Feb 1 - Aug 15	Green Sprangletop	0.7
			Little Bluestem	1.4
			Sideoats Grama (Haskell)	2.8
			Buffalograss	6.4
			K-R Bluestem	0.8
		Aug 15 - Feb 1	Western Wheatgrass	
4	Arlington	Feb 1 - Aug 15	Green Sprangletop	0.7
			Bermudagrass	0.8
			Litrtle Bluestem	1.1
			Indiangrass	2
			Switchgrass	1.2
		Aug 15 - Feb 1	Tall Fescue	4
5	Tyler	Feb 1 - Sept 1	Green Sprangletop	0.7
			Bermudagrass	0.9
			Litrtle Bluestem	1.4
			Indianagrass (Lometa)	1.8
			Switchgrass (Alamo)	1.4

TCEQ Region		Planting Dates	Grass Seed Mixture	
			Seed Type	lbs. (Live seed)/acre
		Setp 1 - Feb 1	Tall Fescue	4
6	El Paso	Feb. 1 - Aug 15	Green Sprangletop	0.7
			Glack Grama	0.4
			Blue Grama (Hachita)	0.6
			Sideoats Grama (Tucson)	2.2
			Sand Dropseed	0.2
		Aug 15 - Feb 1	Western Wheatgrass	7.
7	Odessa	Feb 1 - Aug 15	Green Sprangletop	0.7
			Sideoats Grama (Premier or Tucson)	2.2
			Black Grama	0.4
			Blue Grama (Haciita)	0.6
			Little Bluestem	1.4
		Aug 15 - Feb 1	Western Wheatgrass	7.5
8	San Angelo	Feb 1 - Aug 15	Green Sprangletop	0.7
			Sideoats Grama (Haskell)	2.2
			Buffalograss	6.4
			Little bluestem	1.4
			K-R Bluestem	0.8
		Aug 15 - Feb 1	Western Wheatgrass	7.5
9	Waco	Feb 1 - Sept 15	Green Sprangletop	0.6
			Bermudagrass	0.8
			Litrtle Bluestem	1.1
			Indianagrass (Lomita)	1.5
			K-R Bluestem	0.7
			Switchgrass (Alamo)	1.2
		Sept 15 - Feb 1	Tall Fescue	4

TCEQ Region		Planting Dates	Grass Seed Mixture	
			Seed Type	lbs. (Live seed)/acre
10	Beaumont	Jan. 15 - Sept 1	Green Sprangletop	0.7
			Bermudagrass	0.9
			Little Bluestem	1.4
			Indianagrass (Lometa)	1.8
			Switchgrass (Alamo)	1.4
		Sept 15 - Jan 15	Oats	64
11	Austin	Feb 15 - Aug 15	Green Sprangletop	0.6
			Bermudagrass	0.8
			Little Bluestem	1.1
			Indianagrass (Lomita)	1.5
			Buffalograss	5.3
			Sideoats Gramm (Haskell & Uvalde)	1.8
		Aug 15 - Feb 1	Tall Fescue	4
12	Houston	Jan 15 - Sept 1	Green Sprangletop	0.7
			Bermudagrass	1
			Little Bluestem	0.4
			K-R Bluestem	0.7
			Switchgrass (Alamo)	1.2
		Sept 1 - Jan 15	Oats	64
13	San Antonio	Feb 1 - Sept 1	Green Sprangletop	0.6
			Sideoats Grama (Haskell or Uvalde)	1.8
			Litrtle Bluestem	1.1
			Bermudagrass	0.8
			Buffalograss	5.3
			K-R Bluestem	0.7
		Sept 1 - Feb 1	Oats	21

TCEQ Region		Planting Dates	Grass Seed Mixture	
			Seed Type	lbs. (Live seed)/acre
14	Corpus Christi	Jan 15 - Sept 1	Green Sprangletop	0.7
			Bermudagrass	0.9
			Sideoats Grama (Haaskell or Uvalde)	2.2
			Little Bluestem	1.4
			K-R Bluestem	0.8
		Sept 1 - Jan 15	Oats	64
15	Harlingen	Jan 15 - Sept 1	Green Sprangletop	0.7
			Rhodesgrass	0.4
			Plain Bristlegr	1.2
			Buffalograss	6.4
			K-R Bluestem	0.8
		Sept 1 - Jan 15	Oats	64

END OF SECTION

SECTION 03100
CONCRETE FORMWORK

PART 1 GENERAL

1.01 SUMMARY

A. This Section specifies the allowable products and procedures for installation of formwork for concrete which is incorporated in the Work and is to remain in place upon completion of the Work required by this Contract.

B. Formwork for concrete placed to restore, repair, replace or construct structures which are owned by municipalities, utilities or parties other than CONTRACTOR or TCEQ shall be in accordance with the specifications of the owning party. When the owning party does not have an appropriate specification for concrete formwork, this specification shall apply.

1.02 REFERENCES

A. ACI 117 B Standard Tolerances for Concrete Construction and Materials.

B. ACI 347 B Recommended Practice for Concrete Formwork.

C. U.S. Product Standard PS 1 Construction and Industrial Plywood.

D. U.S. Product Standard PS 20 American Softwood Lumber Standard.

1.03 SUBMITTALS

A. Trade or brand names of manufacturers and complete description of form-coating materials products for Approval purposes.

B. Form ties and related accessories for Approval purposes.

C. Form gaskets for Approval purposes

PART 2 PRODUCTS

2.01 MATERIAL

A. Smooth Forms: New plywood, metal, plastic, tempered concrete-form hardboard, dressed lumber faced with plywood or fiberboard lining, or metal-framed plywood-faced panel material, to provide continuous, straight, smooth surfaces. Form material shall be free of raised grain, torn surfaces, worn edges, patches, dents or other defects. Furnish material in largest practical

sizes to minimize number of joints and, when indicated on Drawings, conform to joint system indicated. Form material shall have sufficient strength and thickness to withstand pressure of newly placed concrete without bow or deflection.

B. Rough Forms: Plywood, metal, dressed or undressed lumber free of knots, splits or other defects, or other material acceptable to TCEQ and Engineer of sufficient strength and thickness to withstand pressure of newly placed concrete without bow or deflection.

C. Plywood: Conform to PS 1, Class 1.

D. Lumber: Conform to PS 20.

E. Edge Forms and Intermediate Screed Strips: Type and strength compatible with the screed equipment and methods used.

F. Earth Cuts for Forms:

1. Use earth cuts for forming unexposed sides of grade beams cast monolithically with slabs on grade.

2. Where sides of excavations are stable enough to prevent caving or sloughing, following surfaces may be cast against neat-cut excavations:

a. Sides of footings.

b. Inside face of perimeter grade beams not monolithic with slab on grade. When inside face is cast against earth, increase beam width indicated on Drawings by one inch.

c. Both faces of interior grade beams not monolithic with slab on grade. When grade beam is cast against earth, increase beam width indicated on Drawings by 2 inches.

G. Form Ties

1. Use commercially-manufactured ties, hangers and other accessories for embedding in concrete. Do not use wire not commercially fabricated for use as a form accessory.

2. Fabricate ties so ends or end fasteners can be removed without causing spalling of concrete faces. Depth from formed concrete face to the embedded portion: At least 1 inch, or twice the minimum dimension of tie, whichever is greater.

H. Form Coating: Commercial formulation of form oil or form-release agent having proven satisfactory performance. Coating shall not bond with, stain or otherwise adversely affect concrete surfaces, or impair their subsequent treatment, including application of bonding agents, curing compounds, paint, protective liners and membrane waterproofing.

I. Coating for Plastic Forms: Alkali-resistant gel-coat.

J. Chamfer Strips: Unless otherwise indicated on Drawings, provide 3/4-inch chamfer strips in corners of forms to produce beveled edges where required by Part 3, Execution.

K. Form Gaskets: Polyethylene rod, closed cell, one-inch diameter.

2.02 DESIGN OF FORMWORK

A. Conform to ACI 117, ACI 347 and Southern Uniform Building Code, unless more restrictive requirements are specified or shown on Drawings. Contractor shall design and engineer concrete formwork, including shoring and bracing. Design formwork for applicable gravity loads, lateral pressure, wind loads and allowable stresses. Camber formwork to compensate for anticipated deflection during placement of concrete when required to maintain specified tolerances. Design formwork to be readily removed without impact, shock or damage to concrete surfaces and adjacent materials.

PART 3 EXECUTION

3.01 PREPARATION

A. Clean surfaces of forms and embedded materials before placing concrete. Remove accumulated mortar, grout, rust and other other foreign matter.

B. Coat forms for exposed or painted concrete surfaces with form oil or form-release agent before placing reinforcement. Cover form surfaces with coating material in accordance with manufacturer's printed instructions. Do not allow excess coating material to accumulate in forms or to contact hardened concrete against which fresh concrete will be placed. Remove coating material from reinforcement before placing concrete.

C. Forms for unexposed surfaces, other than retained-in-place metal forms, may be wet with water immediately before concrete placement in lieu of coating. When possibility of freezing temperatures exists, however, the use of coating is mandatory.

3.02 INSTALLATION

A. Formwork Construction

1. Construct and maintain formwork so that it will maintain correct sizes of members, shape, alinement, elevation and position during concrete placement and until concrete has gained sufficient strength. Provide for required openings, offsets, sinkages, keyways, recesses, moldings, anchorages and inserts.

2. Construct forms for easy removal without damage to concrete surfaces.

3. Make formwork sufficiently tight to prevent leakage of cement paste during concrete placement. Solidly butt joints and provide backup material at joints as required to prevent leakage and fins. Provide gaskets for wall forms to prevent concrete paste leakage at their base.

4. Place chamfer strips in forms to bevel edges and corners permanently exposed to view, except top edges of walls, and slabs which are indicated on Drawings to be tooled. Do not bevel edges of formed joints and interior corners unless indicated on Drawings. Form beveled edges for vertical and horizontal corners of equipment bases. Unless otherwise indicated on Drawings, make bevels 3/4 inch wide.

5. Provide temporary openings at bases of column and wall forms and other points as required for observation and cleaning immediately before concrete is placed.

B. Forms for Surfaces Requiring Smooth Form Finish:

1. Drill forms to suit ties used and to prevent leakage of concrete mortar around tie holes. Uniformly space form ties and align in horizontal and vertical rows. Install taper ties, if used, with the large end on the wet face of the wall.

2. Provide sharp, clean corners at intersecting planes, without visible edges or offsets. Back up joints with extra studs or girts to maintain true, square intersections.

3. Form molding shapes, recesses and projections with smooth-finish materials and install in forms with sealed joints to prevent displacement.

4. Form exposed corners to produce square, smooth, solid, unbroken lines.

5. Provide exterior exposed edges with 3/4-inch chamfer or 3/4-inch radius.

C. Edge Forms and Screed Strips for Slabs: Set edge forms or bulkheads and intermediate screed strips for slabs to obtain required elevations and contours in finished slab surface. Provide and secure supports for types of screeds required.

D. Adjustment of Formwork:

1. Use wedges or jacks to provide positive adjustment of shores and struts. After final inspection and before concrete placement, fasten in position wedges used for final adjustment of forms.

2. Brace forms securely against lateral deflections. Prepare to compensate for settling during concrete placement.

3. For wall openings, construct wood forms that facilitate necessary loosening to counteract swelling of forms.

3.03 FIELD QUALITY CONTROL

A. Establish sufficient control points and bench marks as references for tolerance checks. Maintain these references in undisturbed condition until final completion and acceptance of the Work.

3.04 REMOVAL OF FORMS

A. Time Limits:

1. When repair of surface defects or finishing is required before concrete is aged, forms on vertical surfaces may be removed as soon as concrete has hardened sufficiently to resist damage from removal operations.
2. Remove top forms on sloping surfaces of concrete as soon as concrete has attained sufficient stiffness to prevent sagging. Formwork not supporting weight of concrete may be removed after 12 hours, provided concrete has hardened sufficiently to resist damage from removal operations, and provided removal of forms will not disturb members supporting weight of concrete.

3. Forms and shoring supporting weight of concrete or construction loads: Leave in place until concrete has reached minimum strength specified for removal of forms and shoring. Do not remove such forms in less than 4 days.

B. Removal Strength:

1. Control Tests: Suitable strength-control tests will be required as evidence that concrete has attained specified strength for removal of formwork or shoring supporting weight of concrete in beams, slabs and other structural members. Furnish test cylinders and data to verify strength for early form removal.

a. Field-cured Test Cylinders: When field-cured test cylinders reach specified removal strength, formwork or shoring may be removed from respective concrete placements.

b. Laboratory-cured Test Cylinders: When concrete has been cured as specified for structural concrete for same time period required by laboratory-cured cylinders to reach specified strength, formwork or shoring may be removed from respective concrete placements. Determine length of time that concrete has been cured by totaling the days or fractions of days, not necessarily consecutive, during which air temperature surrounding concrete is above 50 degrees F and concrete has been damp or thoroughly sealed against evaporation and loss of moisture.

2. Compressive Strengths: The minimum concrete compressive strength for removal of formwork supporting weight of concrete is 75 percent of specified minimum 28-day strength for class of concrete involved.

3.05 FORM REUSE

A. Do not reuse forms that are worn or damaged beyond repair. Thoroughly clean and recoat forms before reuse. For wood and plywood forms to be used for exposed smooth finish, sand or otherwise dress concrete contact surface to original condition or provide form liner facing material. For metal forms, straighten, remove dents and clean to return forms to original condition.

END OF SECTION

SECTION 03200
REINFORCING STEEL

PART 1 GENERAL

1.01 SUMMARY

A. This Section specifies the required products and procedures for structural concrete reinforcement and grouting of reinforcement dowel bars into hardened and existing concrete which is incorporated in the Work and is to remain in place upon completion of the Work required by this Contract.

B. Reinforcing steel placed to restore, repair, replace or construct structures which are owned by municipalities, utilities or parties other than CONTRACTOR or TCEQ shall be in accordance with the specifications of the owning party. When the owning party does not have an appropriate specification for reinforcing steel, this specification shall apply.

1.02 REFERENCES

A. ACI 315 – Details and Detailing of Concrete Reinforcement.

B. ACI 318 – Building Code Requirements for Reinforced Concrete.

C. ASTM A36 – Standard Specification for Structural Steel.

D. ASTM A82 – Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.

E. ASTM A185 – Standard Specification for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement.

F. ASTM A497 – Standard Specification for Steel Welded Wire Fabric, Deformed, for Concrete Reinforcement.

G. ASTM A615 – Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.

H. ASTM A675 – Standard Specification for Steel Bars, Carbon, Hot-Wrought, Special Quality, Mechanical Properties.

I. ASTM A775/A775M – Standard Specification for Epoxy-Coated Reinforcing Steel Bars.

J. ASTM C881 – Specification for Epoxy-Resin-Base Bonding Systems for Concrete.

K. AWS D1.4 – Structural Welding Code – Reinforcing Steel.

L. WRI – Manual of Standard Practice for Welded Wire Fabric.

M. CRSI MSP-1 – Manual of Standard Practice.

1.03 SUBMITTALS

A. Shop drawings detailing reinforcement fabrication, bar placement location, splices, spacing, bar designation, bar type, length, size, bending, number of bars, bar support type, and other pertinent information, including dimensions. Provide sufficient detail for placement of reinforcement without use of Contract Drawings. Information shall correspond directly to data listed on bill of materials.

B. Shop drawings showing location of proposed construction joints for Approval purposes.

C. Detail shop drawings in accordance with ACI 315, Figure 6.

D. Manufacturer's technical literature on mechanical bar splices including specifications and installation instructions for Approval purposes.

E. Manufacturer's technical literature on epoxy grout including recommended installation procedures for Approval purposes.

F. Steel Manufacture's certificates of mill tests giving properties of steel proposed for use at the site for Approval purposes. List Manufacturer's test number, heat number, chemical analysis, yield point, tensile strength, and percentage of elongation. Identify proposed location of steel in work.

G. Foreign-manufactured reinforcing bar test reports for Review purposes.

1.04 QUALITY ASSURANCE

A. Notify ENGINEER at least 48 hours before concrete placement so that reinforcement may be inspected, and errors corrected, without delaying Work.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Store steel reinforcement above ground on platforms, skids, or other supports. Protect reinforcing from mechanical injury, surface deterioration,

and formation of excessive, loose, or flaky rust caused by exposure to weather. Protect epoxy-coated reinforcing from formation of any amount of rust.

PART 2 PRODUCTS

2.01 MATERIAL

A. Reinforcing Bars: Deformed bars conforming to ASTM A615, grade as indicated on Drawings, except column spirals and those shown on Drawings to be smooth bars. Where grade is not shown on Drawings, use Grade 60.

B. Smooth Bars: Where indicated on Drawings, use smooth bars conforming to ASTM A36; ASTM A615, Grade 60; or ASTM A675, Grade 70.

C. Welded Wire Fabric:

1. Welded Smooth Wire Fabric: Conform to ASTM A185.

2. Welded Deformed Wire Fabric: Conform to ASTM A497.

3. Provide wire size, type, and spacing as shown. Where type is not shown on Drawings, use welded smooth wire fabric.

4. Furnish welded wire fabric in flat sheets only.

D. Tie Wire: 16-1/2 gage or heavier annealed steel wire. Use plastic-coated tie wire with epoxy-coated reinforcing steel.

E. Bar Supports: Provide chairs, riser bars, ties, and other accessories made of plastic or metal, except as otherwise specified. Use bar supports and accessories of sizes required to provide required concrete cover. Where concrete surfaces are exposed to weather, water, or wastewater, provide plastic accessories only; do not use galvanized or plastic-tipped metal in such locations. Provide metal bar supports and accessories rated Class 1 or 2 conforming to CRSI MSP-1 Manual of Standard Practice. Use epoxy-coated bar supports with epoxy-coated reinforcing bars.

F. Slabs on Grade: Provide chairs with sheet metal bases or provide precast concrete bar supports 3 inches wide, 6 inches long, and thick enough to allow required cover. Embed tie wires in 3-inch by 6-inch side.

G. Epoxy Grout: High-strength rigid epoxy adhesive, conforming to ASTM C881, Type IV, manufactured for purpose of anchoring dowels into hardened concrete at the moisture condition, application temperature and orientation of the hole to be filled. Unless otherwise shown, depth of embedment shall

be as required to develop the full tensile strength (125 percent of yield strength) of dowel, but not less than 12 diameters.

2.02 FABRICATION

A. Bending: Fabricate bars to shapes indicated on Drawings by cold bending. Bends shall conform to minimum bend diameters specified in ACI 318. Do not straighten or rebend bars. Fabricate epoxy-coated reinforcing steel to required shapes in a manner that will not damage epoxy coating. Repair any damaged epoxy coating with patching material conforming to Item 4.4 of ASTM A775/A775M.

B. Splices:

1. Locate splices as indicated on Drawings. Do not locate splices at other locations without ENGINEER approval. Use minimum number of splices located at points of minimum stress. Stagger splices in adjacent bars.

2. Length of lap splices: As shown on Drawings.

3. Prepare ends of bars at mechanical splices in accordance with splice manufacturer's requirements.

C. Construction Joints: Unless otherwise shown, continue reinforcing through construction joints.

D. Bar Fabrication Tolerances: Conform to tolerances listed in ACI 315, Figures 4 and 5.

E. Standard Hooks: Conform to the requirements of ACI 318.

F. Marking: Clearly mark bars with waterproof tags showing number of bars, size, mark, length, and yield strength. Mark steel with same designation as member in which it occurs.

2.03 SOURCE QUALITY CONTROL

A. Certificates: Foreign-manufactured reinforcing bars shall be tested for conformance to ASTM requirements by a certified independent testing laboratory located in United States. Certification from any other source is not acceptable. Submit test reports as described in Item 2.03.A. Do not begin fabrication of reinforcement until material has been Approved.

PART 3 EXECUTION

3.01 PREPARATION

A. Clean reinforcement of scale, loose, or flaky rust and other foreign material, including oil, mud, or coating that will reduce bond to concrete.

3.02 INSTALLATION

A. Placement Tolerances: Place reinforcement within tolerances of Table 03210A at the end of this Section. Bend tie wire away from forms to maintain the specified concrete coverage.

B. Interferences: Maintain 2-inch clearance from embedded items. Where reinforcing interferes with location of other reinforcing steel, conduit, or embedded items, bars may be moved within tolerances specified in Table 03210Aor one bar diameter, whichever is greater. Where greater movement of bars is required to avoid interference, notify TCEQ and ENGINEER. Do not cut reinforcement to install inserts, conduit, mechanical openings, or other items without approval of TCEQ and ENGINEER.

C. Concrete Cover: Provide clear cover measured from reinforcement to face of concrete as listed in Table 03210B at the end of this Section, unless otherwise indicated on Contract Drawings.

D. Placement in Forms: Use spacers, chairs, wire ties, and other accessory items necessary to assemble, space, and support reinforcing properly. Provide accessories of sufficient number, size, and strength to prevent deflection or displacement of reinforcement due to construction loads or concrete placement. Use appropriate accessories to position and support bolts, anchors, and other embedded items. Tie reinforcing bars at each intersection, and to accessories. Blocking reinforcement with concrete or masonry is prohibited.

E. Placement for Concrete on Ground: Support bar and wire reinforcement on chairs with sheet metal bases or precast concrete blocks spaced at approximately 3 feet on centers each way. Use minimum of one support for each 9 square feet. Tie supports to reinforcing bars and wires.

F. Splices:

1. Do not splice bars, except at locations indicated on Drawings or reviewed shop drawings.

2. Lap Splices: Unless otherwise shown or noted, Class B, conforming to ACI 318-89, Section 12.15.1. Tie securely with wire prior to concrete placement, to prevent displacement of splices during concrete placement.

G. Construction Joints: Place reinforcing continuously through construction joints, unless noted otherwise.

H. Welded Wire Fabric: Install wire fabric in as long lengths as practicable. Unless otherwise indicated on Drawings, lap adjoining pieces at least 6 inches or one full mesh plus 2 inches, whichever is larger. Lace splices with wire. Do not make end laps midway between supporting beams, or directly over beams of continuous structures. Offset end laps in adjacent widths to prevent continuous laps. Conform to WRI – Manual of Standard Practice for Welded Wire Fabric.

I. Field Bending: Shape reinforcing bent during construction operations to conform to Drawings. Bars shall be cold-bent; do not heat bars. Closely inspect reinforcing for breaks. When reinforcing is damaged, replace, Cadweld, or otherwise repair, as directed by ENGINEER. Do not bend reinforcement after it is embedded in concrete.

J. Field Cutting: Cut reinforcing bars by shearing or sawing. Do not cut bars with cutting torch.

K. Welding of reinforcing bars is prohibited, except where shown on Drawings.

3.03 GROUTING OF REINFORCING AND DOWEL BARS

A. Use epoxy grout for anchoring reinforcing and dowel steel to existing concrete in accordance with epoxy manufacturer's instructions. Drill hole not more than ¼ inch larger than steel bar diameter (including height of deformations for deformed bars) in existing concrete. Just before installation of steel, blow hole clean of all debris using compressed air. Partially fill hole with epoxy, using enough epoxy so when steel bar is inserted, epoxy grout will completely fill hole around bar. Dip end of steel bar in epoxy and twist bar while inserting into partially-filled hole.

TABLE 03210A
REINFORCEMENT PLACEMENT TOLERANCES

PLACEMENT	TOLERANCE IN INCHES
Clear Distance	
To formed soffit	-1/4
To other formed surfaces	±1/4
Minimum spacing between bars	-1/4
Clear distance from unformed surface to top reinforcement	
Members 8 inches deep or less	±1/4
Members more than 8 inches deep but less than 24 inches deep	-1/4, +1/2
Members 24 inches deep or greater	-1/4, +1
Uniform spacing of bars (but the required numbers of bars shall not be reduced)	±2
Uniform spacing of stirrups and ties (but the required number of strirups and ties shall not be reduced)	±1
Longitudinal locations of bends and ends of reinforment	
General	±2
Discontinuous ends of members	±½
Length of bar laps	-1-1/2
Embedded length	
For bar sizes No. 3 through 11	-1
For bar sizes No. 14 and 18	-2

TABLE 03210B
MINIMUM CONCRETE COVER FOR REINFORCEMENT

SURFACE	MINIMUM COVER IN INCHES
Slabs and Joists	
Top and bottom bars for dry conditions	
No. 11 bars and smaller	1
No. 14 and No. 18 bars	1-1/2
Formed concrete surfaces exposed to earth, water, or weather; and for bottoms bearing on work mat, or slabs supporting earth cover	
No. 5 bars and smaller	1-1/2
No. 6 through No. 18 bars	2
Footings and Base Slabs	
At formed surfaces and bottoms bearing on concrete work mat	2
At unformed surfaces and bottoms in contact with earth	3
Over top of piles	2
Top of footings	same as slabs

END OF SECTION

SECTION 03310
STRUCTURAL CONCRETE

PART 1 GENERAL

1.01 SUMMARY

A. This Section specifies the required products and procedures for placement of structural concrete which is incorporated in the Work and is to remain in place upon completion of the Work required by this Contract.

B. Structural concrete placed to restore, repair, replace or construct structures which are owned by municipalities, utilities or parties other than CONTRACTOR or TCEQ shall be in accordance with the specifications of the owning party. When the owning party does not have an appropriate specification for structural concrete, this specification shall apply.

1.02 REFERENCES

A. ACI 301 - Specifications for Structural Concrete for Buildings.

B. ACI 304.2R - Placing Concrete by Pumping Methods.

C. ACI 305R - Hot Weather Concreting.

D. ACI 306.2 - Standard Specification for Cold Weather Concreting.

E. ACI 308 - Standard Practice for Curing Concrete

F. ACI 309R - Guide for Consolidation of Concrete.

G. ACI318 - Building Code Requirements for Reinforced Concrete.

H. ACI 350R - Environmental Engineering Concrete Structures.

I. ASTM C31 - Standard Practice for Making and Curing Concrete Test Specimens in the Field

J. ASTM C33 - Standard Specification for Concrete Aggregates.

K. ASTM C39 - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.

L. ASTM C42 - Standard Method of Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.

M. ASTM C88 - Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate.

N. ASTM C94 - Standard Specifications fo Ready-Mixed Concrete.

O. ASTM C127 - Standard Test Method for Specific Gravity and Absorption of Coarse Aggregate.

P. ASTM C131 - Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.

Q. ASTM C136 - Sieve Analyses of Fine and Coarse Aggregates.

R. ASTM C150 - Standard Test Method for Slump of Hydraulic Cement Concrete.

S. ASTM C150 - Standard Specification for Portland cement.

T. ASTM C157 -Test Method for Length Change of hardened Hydraulic Cement Mortar and Concrete.

U. ASTM C171 - Standard Specifications for Sheet Materials for Curing Concrete.

V. ASTM C172 - Standard Practice for Sampling Freshly Mixed Concrete.

W. ASTM C173 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.

X. ASTM C192 - Method of Making and Curing Concrete Test Specimens in the Laboratory.

Y. ASTM C231 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.

Z. ASTM C260 - Standard Specification for Air-Entraining Admixtures for Concrete.

AA. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.

AB. ASTM C330 - Standard Specification for Lightweight Aggregates for Structural Concrete.

AC. ASTM C494 - Standard Specification for Chemical Admixtures for Concrete.

AD. ASTM C535 - Standard Test Method for Resistance to Degradation of Large-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine

AE. ASTM C881 - Specification for Epoxy-Resin-Base Bonding Systems for Concrete

AF. ASTM C1059 - Standard Specification for Latex agents for Bonding Fresh to Hardened Concrete.

AG. ASTM C1064 - Standard Test Method for Temperature of Freshly Mixed Portland Cement Concrete.

AH. Concrete Plant Manufacturer's Bureau (CPMB), Plant Mixer Manufacturers Division: Concrete Plant Mixer Standards.

AI. National Ready-Mixed concrete Association (NRMCA): Certification of Ready-Mixed Concrete Production Facilities (checklist with instructions).

AJ. John Wiley and Sons, Interscience Publishers Division, "Encyclopedia of Industrial Chemical Analysis," Vol. 15, Page 230 (alkalinity test procedure).

1.03 DEFINITIONS

A. Hot weather: Any combination of high air temperature, low relative humidity and wind velocity tending to impair the quality of fresh or hardened concrete or otherwise resulting in abnormal properties.

B. Cold Weather: Period when, for more than 2 successive days, mean daily temperature is below 40 degrees F.

1.04 SUBMITTALS

A. Design Mixes:

1. Submit test data on proposed design mixes for each type of concrete in the Work, including each class, and variations in type, source or quantity of material. Include type, brand and amount of cementitious materials; type, brand and amount of each admixture; slump; air content; aggregate sources, gradations, specific gravity and absorption; total water (including moisture in aggregate); water/cement ration; compressive strength test results for 7 and 28 days; and shrinkage tests for Class C and D concrete at 21 or 28 days of drying.

2. Submit abrasion loss and soundness test results for limestone aggregate for Review purposes.

3. Testing of aggregates, including sieve analysis, shall be performed by a certified independent testing laboratory in accordance with 01714 - Testing Laboratory Services. Tests shall have been performed no earlier than 3 months before Notice to Proceed.

4. Standard Deviation data for plant producing concrete for Review purposes. Data shall include copies of laboratory test results and standard deviation calculated in accordance with ACI 318, Item 5.3.1. laboratory tests shall have been performed within past 12 months. When standard deviation data is not available, comply with ACI 318, Table 5.3.2.2.

5. Admixtures: Submit manufacturer's technical information including following:

    a. Air-Entraining Admixture: Give requirements to control air content under all conditions, including temperature variations and presence of other admixtures.

    b. Chemical Admixtures: Give requirements for quantities and types to be used under various temperatures and job conditions to produce uniform, workable concrete mix. Submit evidence of compatibility with other admixtures and cementitious materials proposed for use in design mix.

6. Hot and Cold Weather Concreting: Submit, when applicable, proposed plans for hot and cold weather concreting. Review and acceptance of proposed procedure will not relieve Contractor of responsibility for quality of finished product

7. Delivery Batch Tickets: Submit all delivery batch tickets identifying date, class of concrete, mix design designation, volume of concrete delivered, etc.

1.05 QUALITY ASSURANCE

A. The ENGINEER may perform the following Quality Assurance Testing:

1. Checking of batching and mixing operations.

2. Review of manufacturer's report of each cement shipment and conducting laboratory tests of cement.

3. Molding and testing reserve 7-day cylinders or field cylinders.

4. Conducting additional field tests for slump, concrete temperature and ambient temperature.

5. Alkalinity Tests: For concrete used in sanitary structures, one test for each structure. Perform alkalinity tests on concrete covering reinforcing steel on the inside of the pipe or structure in accordance with "Encyclopedia of Industrial Chemical Analysis," Vol. 15, page 230.

6. Testing of deficient concrete in place:

    a. When averages of three consecutive strength test results fail to equal or exceed specified strength, or when any individual strength test result falls below specified strength by more than 500 psi, strength of concrete shall be considered potentially deficient and core testing, structural analysis or load testing may be required by ENGINEER.

    b. When concrete in place proves to be deficient, CONTRACTOR shall pay costs, including costs due to delays, incurred in providing additional testing and analysis services provided in accordance with 01714 - Testing Laboratory Services.

    c. Replace concrete work judged inadequate by core tests, structural analysis or load tests at no additional cost to TCEQ.

    d. Core Tests:

        (1) Obtain and test cores in accordance with ASTM C 42. Where concrete in structure will be dry under service conditions, air dry cores (temperature 60 to 80 degrees F, relative humidity less than 60 percent) for 7 days before test; test dry. Where concrete in structure will be more than superficially wet under service conditions, test cores after moisture conditioning in accordance with ASTM C 42.

        (2) Take at least three representative cores from each member or area of concrete in place that is considered potentially deficient. Location of cores shall be determined by ENGINEER so as to least impair strength of structure. When, before testing, one or more cores shows evidence of having been damaged during or after removal from structure, replace the damaged cores.

        (3) Concrete in area represented by core test will be considered adequate when average strength of cores is equal

to at least 85 percent of specified strength, and when no single core is less than 75 percent of specified strength.

(4) Patch core holes in accordance with this Section.

7. Structural Analysis: When core tests are inconclusive or impractical to obtain, ENGINEER may perform additional structural analysis at CONTRACTOR's expense to confirm safety of structure.

8. Load Tests: When core tests and structural analysis do not confirm safety of structure, load tests may be required, and their results evaluated, in accordance with ACI 318.

9. Testing by impact hammer, sonoscope, probe penetration tests (Windsor probe), or other nondestructive device may be permitted by ENGINEER to determine relative strengths at various locations in structure, to evaluate concrete strength in place, or for selecting areas to be cored. However, such tests, unless properly calibrated and correlated with other test data, shall not be used as basis for acceptance or rejection of structure's safety.

1.06 DELIVERY, STORAGE AND HANDLING

A. Cement: Store cement in weathertight buildings, bins or silos to provide protection from dampness and contamination and to minimize warehouse set. When there is any doubt as to expansive potential of shrinkage-compensating cements because of method or length of storage and exposure, laboratory test cement before use.

B. Aggregate: Arrange and use aggregate stockpiles to avoid excessive segregation or contamination with other materials or with other sizes of like aggregates. Build stockpiles in successive horizontal layers not exceeding 3 feet in thickness. Complete each layer before next is started.

C. Fine Aggregate: Before using, allow fine aggregate to drain until uniform moisture content is reached.

D. Admixtures: Store admixtures to avoid contamination, evaporation or damage. For those used in form of suspensions or nonstable solutions, provide suitable agitating equipment to assure uniform distribution of ingredients. Protect liquid admixtures from freezing and other temperature changes which would adversely affect their characteristics.

PART 2 PRODUCTS

2.01 MATERIALS

A. Cement:

1. Use same brand of cement used in concrete mix design. Use only one brand of each type in each structure, unless otherwise indicated on Drawings.

2. Portland Cement: ASTM C 150, Type I, gray in color.

B. Admixtures:

1. Do not use calcium chloride, thiocyanate or admixtures containing more than 0.05 percent chloride ions.

2. Air-Entraining Admixtures: ASTM C 260, compatible with other admixtures used.

3. Chemical Admixtures: Polymer type, nonstaininkg chloride-free admixtures conforming to ASTM C494, Type A, C, D or E.

C. Mixing Water: Use clean, potable water, free from harmful amounts of oils, acids, alkalis or other deleterious substances, meeting requirements of ASTM C 94.

D. Aggregates: Use coarse aggregate from only one source, and fine aggregate from only one source, for exposed concrete in any single structure.

1. Coarse Aggregate: Gravel, crushed grave,l or crushed limestone conforming to ASTM C 33.

2. Fine Aggregate: Natural sand complying with ASTM C 33.

3. Limestone aggregate shall conform to ASTM C 33 and the following additional requirements: Clean, hard, strong and durable particles free of chemicals and coatings of silt, clay, or other fine materials that may affect hydration and bond of cement paste. Select crushed limestone: High-calcium limestone (minimum 95 percent $CaCO_3$ and maximum 3.5 percent $MgCO_3$) with maximum Los Angeles Abrasion loss of 38 percent, when tested in accordance with ASTM C 131 or ASTM C 535. Test aggregate for soundness in accordance with ASTM C 88; maximum loss shall not exceed 18 percent after 5 cycles of magnesium sulfate test.

4. Maximum size of coarse aggregate:

a. Normal weight concrete, except as noted below: 1-1/2 inches.

b. Formed members 6 inches or less in least dimension: 1/5 least dimension.

c. Slabs: 1/3 depth of slab.

d. Drilled shafts: 1/3 clearance between reinforcing steel, but not greater than 3/4 inch.

e. Concrete fill, seal slabs and bonded concrete topping in clarifiers: 3/8 inch.

E. Calcium Chloride: Not permitted.

F. Evaporation Retardant: Masterbuilders “Confilm”, Euclid “Eucobar”, or equivalent.

G. Patching Mortar

1. Make patching mortar of same materials and of approximately same proportions as concrete, except omit coarse aggregate. Substitue while Portland cement for part of gray Portland cement on exposed concrete in order to match color of surrounding concrete. Determine color by making trial patch. Use minimum amount of mixing water required for handling and placing. Mix patching mortar in advance and allow to stand. Mix frequently with trowel until it has reached stiffest consistency that will permit placing. Do not add water.

2. Proprietary compounds for adhesion or specially formulated cementitious repair mortars may be used in lieu of or in addition to foregoing patching materials provided that properties of bond and compressive strength meet or exceed the foregoing and color of surrounding concrete can be matched where required. Use such compounds according to manufacturer’s recommendations. When used in liquid containing structures, material shall be suitable for use under continuously submerged conditions. Conformance and suitability certification by manufacturer is required.

H. Materials for Concrete Curing

1. Membrane-forming Curing compound: Conform to ASTM C309, Type 1D, and following requirements.

a. Minimum solids content: 30 percent.

b. Compound shall not permanently discolor concrete. When used for liquid-containing structures, curing compound shall be white-pigmented.

c. When used in areas that are to be coated, or that will receive topping or floor covering, material shall not reduce bond of coating, topping, or floor covering to concrete. Curing compound manufacturer's technical information shall state conditions under which compound will not prevent bond.

d. Conform to local, state and federal solvent emission requirements.

2. Clear Curing and Sealing Compound (VOC Compliant): Conform to ASTM C309, Type 1, Class B, and the following requirements: 30 percent solids content minimum; non-yellowing under ultraviolet light after 500-hour test in accordance with ASTM D4587. Sodium silicate compounds are not permitted. Conform to local, state and federal solvent emission requirements.

3. Sheet Material for Curing Concrete: ASTM C171; waterproof paper, polyethylene film or white burlap-polyethylene sheeting.

4. Curing Mats (for use in Curing Method 2): Heavy shag rugs or carpets, or cotton mats quilted at 4 inches on center; 12 ounce per square yard minimum weight when dry.

5. Water for curing: Clean and potable.

I. Miscellaneous Materials:

1. Bonding Agent: Two-component modified epoxy resin.

2. Vapor barrier: 6 mil clear polyethylene film of type recommended for below-grade aplication.

3. Non-shrink grout: premixed compound consisting of non-metallic aggregate, cement and water-reducing and plasticizing agents; capable of developing minimum compressive strength of 2,400 psi in 48 hours and 7,000 psi in 28 days.

2.02 EQUIPMENT

A. Equipment Selection: Select equipment of size and design to ensure continuous flow of concrete at delivery end. Conform to following equipment and operations requirements.

B. Truck mixers, agitators and manner of operation: Conform to ASTM C95. Use of non-agitating equipment for transporting concrete is not permitted.

C. Belt conveyors: Configure horizontally, or at a slope causing no segregation or loss. Use approved arrangement at discharge end to prevent separation. Discharge long runs without separation into hopper.

D. Chutes: Metal or metal-lined (other than aluminum). Arrange for vertical-to-horizontal slopes not more than 1 to 2 nor less than 1 to 3. Chutes longer than 20 feet or not meeting slope requirements may be used if concrete is discharged into hopper before distribution.

E. Concrete Conveyance: Do not use aluminum or aluminum-alloy pipe or chutes for conveying concrete.

2.03 CONCRETE MIX

A. Objective: Select proportions of ingredients to produce concrete having proper placability, durability, strength, appearance, and other specified properties.

B. Mix Design: Employ and pay an independent commercial testing laboratory to prepare and test mix designs for each type of concrete specified. Proportion mix design ingredients by weight

1. During the trial batches, aggregate proportions may be adjusted by the testing laboratory using two coarse aggregate size ranges to obtain the required properties. If one size range produces an acceptable mix, a second size range need not be used. Such adjustments shall be considered refinements to the mix design and shall not be the basis for extra compensation to CONTRACTOR. Concrete shall conform to the requirements of this Section, whether the aggregate proportions are from CONTRACTOR's preliminary mix design, or whether the proportions have been adjusted during the trial batch process. Prepare trial batches using the aggregates, cement and admixtures proposed for the project. Make trial batches large enough to obtain 6 compression test specimens from each batch.

2. Determine compressive strength by testing 6-inch diameter by 12-inch high cylinders, made, cured and tested in accordance with ASTM C 192 and ASTM C 39. Test 3 compression test cylinders at 7 days and 3 at 28 days. Average compressive strength for the 3 cylinders tested at 28 days for any given trial batch shall be not less than 125 percent of the specified compressive strength.

3. Perform sieve analysis of the combined aggregate for each trial batch according to of ASTM C 136. Report percentage passing each sieve.

4. Fine aggregate shall not exceed 41 percent of total aggregate by weight.

C. Selection Ingredient Proportions for Concrete:

1. Proportion concrete mix according to ACI 301, Chapter 3.

2. Establish concrete mix design by laboratory trial batches prepared by independent testing laboratory, or on basis of previous field experience in accordance with provisions of ACI 318, Item 5.3; however, minimum cement content for each class of concrete shall not be less than specified.

3. Concrete mix design data submitted for review shall have average 28-day compressive strength calculated in accordance with ACI 318, Item 5.3.2.1. When data is not available to determine standard deviation in accordance with ACI 318, Item 5.3.1, average 28-day strength of mix design shall conform to ACI 318, Table 5.3.2.2.

D. Water-Cement Ratios:

1. Maximum allowable water-cement ratios shall be as shown on Table 03310-1.

E. Adjustment of Mix Proportions: After sufficient data becomes available during construction, mix may be adjusted upon ENGINEER's Approval, in accordance with ACI 318, Item 5.5; however, minimum cement content for each class of concrete shall not be less than specified.

F. Entrained Air: Air-entrain all concrete except drilled shafts. Total air content in accordance with ASTM C 173: 4 to 6 percent.

G. Consistency, Workability, and Slump:

1. The quantity of water in a batch of concrete shall be just sufficient, with a normal mixing period, to produce concrete which can be worked properly into place without segregation, and which can be compacted by vibratory methods as specified, to give the desired strength, density, impermeability and smoothness of surface. Change the quantity of water as necessary, with variations in the nature or moisture content of the aggregates, to maintain uniform production of a desired consistency. Determine the consistency of the concrete in successive batches by slump tests in accordance with ASTM C 143. Slumps shall be not less than 2" and not in excess of 4".

2. Specified slump shall apply at time when concrete is discharged at job site. Perform slump tests to monitor uniformity and consistency of concrete delivered to job site; however, do not use as basis for mix design. Do not exceed water-cement ratios specified.

H. Admixtures: Proportion admixtures according to manufacturer's recommendations. Use of accelerator is permitted when air temperature is less than 40 degrees F. Use of retarder is permitted when temperature of placed concrete exceeds 65 degrees F.

I. Concrete Classification and Strength:

1. Strength: Conform to values for class of concrete indicated on Drawings and/or as shown in Table 03310.1 for each portion of Work. Requirements are based on 28-day compressive strength. If high early-strength concrete is allowed, requirements are based on 7-day compressive strength.

2. Maximum size aggregate for all other normal-weight concrete: 1-1/2 inches, except as specified in paragraph 2.01D.4.

3. When required strength is not obtained with minimum cement content as specified, add cement, lower water-cement ratio or provide other aggregates as necessary.

TABLE 03310-1
CONCRETE CLASSES

Class of Concrete	Intended Use	Min. 28-day compressive (f_e') strength (psi)	Min. 7-day Flexural strength (psi)	Max. water/rewet ratio
A	Reinforced concrete where not otherwise defined for liquid containing structures	4000	425	0.45
B	Reinforced concrete for liquid containing structures	3000	350	0.45
C	Unreinforced concrete fill for liquid containing	1500	–	0.45

Class of Concrete	Intended Use	Min. 28-day compressive (f_e') strength (psi)	Min. 7-day Flexural strength (psi)	Max. water/rewet ratio
AB	Reinforced concrete where not otherwise defined for buildings, slabs on grade, and miscellaneous structures not containing liquid	4000	425	0.55
BB	Duct Banks	3000	350	0.55
CB	Unreinforced concrete fill under structures not containing liquid	1500	–	0.55

2.04 MIXING NORMAL WEIGHT CONCRETE

A. Conform to ACI 301, Chapter 7.

B. Ready-Mixed Concrete:

1. Measure, batch, mix and transport ready-mixed concrete according to ASTM C94. Plant equipment and facilities shall conform to NRMCA Certification of Ready Mixed Concrete Production Facilities.

2. Provide batch tickets with information specified in ASTM C 94. Deliver batch ticket in accordance with 1.A Submittals.

C. Batch Mixing at Site:

1. Mix concrete in batch mixer conforming to requirements of CPMB "Concrete Plant Mixer Standards". Use mixer equipped with suitable charging hopper, water storage tank and water measuring device. Batch mixer shall be capable of mixing aggregates, cement and water into uniform mass within specified mixing time, and of discharging mix without segregation. Operate mixer according to rated capacity and recommended revolutions per minute printed on manufacturer's rating plate.

2. Charge batch into mixer so some water will enter before cement and aggregates. Keep water running until one-fourth of specified mixing time has elapsed. Provide controls to prevent discharging until required mixing time has elapsed. When concrete of normal weight is specified, provide controls to prevent addition of water during mixing. Discharge entire batch before mixer is recharged.

3. Mix each batch of 2 cubic yards or less for not less than 1 minute and 30 seconds. Increase minimum mixing time 15 seconds for each additional cubic yard or fraction of cubic yard.

4. Keep mixer clean. Replace pick-up and throw-over blades in drum when they have lost 10 percent of original depth.

D. Admixtures:

1. Charge air-entraining and chemical admixtures into mixer as solution using automatic dispenser or similar metering device. Measure admixture to accuracy within ±3 percent. Do not use admixtures in powdered form.

2. Two or more admixtures may be used in same concrete, provided that admixtures in combination retain full efficiency and have no deleterious effect on concrete or on properties of each other. Inject admixtures separately during batching sequence.

3. Add retarding admixtures as soon as practicable after addition of cement.

E. Temperature Control:

1. When ambient temperature falls below 40 degrees F, keep as-mixed temperature above 55 degrees F to maintain concrete above minimum placing temperature.

2. When water or aggregate has been heated, combine water with aggregate in mixer before cement is added. Do not add cement to mixtures of water and aggregate when temperature of mixture is greater than 100 degrees F.

3. In hot weather, maintain temperature of concrete below maximum placing temperature. When necessary, temperature may be lowered by cooling ingredients, cooling mixer drum by fog spray, using chilled water or well crushed ice in whole or part for added water, or arranging delivery sequence so that time of transport and placement does not generate unacceptable temperatures.

4. Submit hot weather and cold weather concreting plans for approval.

2.05 SOURCE QUALITY CONTROL

A. Provide necessary controls during evaluation of materials, mix designs, production and delivery of concrete, placement and compaction to assure that the Work will be accomplished in accordance with Contract Documents. Maintain records of concrete placement. Record dates, locations, quantities, air temperatures, and test samples taken.

B. Code Requirements: Concrete construction shall conform to ACI 318. Where this Specification conflicts with ACI 318, this Specification governs.

C. Testing and Other Quality Control Services:

1. Concrete testing required in this section, except concrete mix design, limestone aggregate test data, and testing of deficient concrete, will be performed by an independent commercial testing laboratory in accordance with 01714 - Testing Laboratory Services.

2. Provide material for and cooperate fully with testing laboratory technician in obtaining samples for required tests.

3. Standard Services: The following testing and quality control services shall be provided in accordance with Section 01714 - Testing Laboratory Services:

   a. Verification that plant equipment and facilities conform to NRMCA "Certification of Ready-Mix Concrete Production Facilities".

   b. Testing of proposed materials for compliance with this Specification.

   c. Review of proposed mix design submitted by CONTRACTOR.

   d. Obtaining production samples of materials at plants or stockpiles during work progress and testing for compliance with this Specification.

   e. Strength testing of concrete according to following procedures:

      (1) Obtain samples for field test cylinders from every 100 cubic yards and any portion less than 100 cubic yards for each mix design placed each day, according to ASTM C 172, with each sample obtained from a different bacth of concrete on a representative, random basis. Selecting test batches by an means other than random numbers chosen before concrete placement begins is not allowed.

      (2) Molding four specimens from each sample according to ASTM C 31, and curing under standard moisture and temperature conditions as specified in Sections 7(a) and (b) of ASTM C 31.

      (3) Test two specimens at 7 days and two specimens at 28 days according to ASTM C 39, reporting test results averaging strengths of two specimens. However, when one specimen evidences improper sampling, molding or testing, it will be discarded and remaining cylinder considered test result. When high-early-strength concrete is used, specimens will be tested at 3 and 7 days

   f. Air content: For each strength test, determination of air content of normal weight concrete according to ASTM C231,

g. Slump: For each strength test, and whenever consistency of concrete appears to vary, conduct slump test in accordance with ASTM C 43.

h. Temperature: For each strength test, check concrete temperature in accordance with ASTM C1064.

i. Monitor current and forecasted climatic conditions to determine when rate of evaporation, as determined by Figure 2.1.5 of ACI 305R, will produce loss of 0.2 pounds of water, or more, per square foot per hour. Testing lab representative will advise CONTRACTOR to use hot weather precautions when such conditions will exist during concrete placement, and note on concrete test reports when CONTRACTOR has been advised that hot weather conditions will exist.

PART 3 EXECUTION

3.01 SPECIAL CONSIDERATIONS

A. Concreting Under Water: Concreting Under Water: Not permitted except where shown otherwise on Drawings or approved by ENGINEER. When shown or permitted, deposit concrete under water by methods acceptable to ENGINEER so fresh concrete enters mass of previously-placed concrete from within, causing water to be displaced with minimum disturbance at surface of concrete.

B. Protection from Adverse Weather: Unless adequate protection is provided or ENGINEER's Approval is obtained, do not place concrete during rain, sleet, snow or freezing weather. Do not permit rainwater to increase mixing water or to damage surface finish. If rainfall occurs after placing operations begin, provide adequate covering to protect Work.

3.02 PREPARATION OF SURFACES FOR CONCRETING

A. Earth Surfaces;

1. Under interior slabs on grade, install vapor barrier. Lap joints at least 6 inches and seal watertight with tape, or sealant applied between overlapping edges and ends. Repair vapor barrier damaged during placement of reinforcing and inserts with vapor barrier material; lap over damaged areas at least 6 inches and seal watertight.

2. Other Earth Surfaces: Thoroughly wet by sprinkling prior to placing concrete, and keep moist by frequent sprinkling up to time of placing

concrete thereon. Remove standing water. Surfaces shall be free from standing water, mud, and debris at the time of placing concrete

B. Construction Joints:

1. Definition: Concrete surfaces upon or against which concrete is to be placed, where the placement of the concrete has been interrupted so that new concrete cannot be incorporated integrally with the previously placed concrete.

2 Interruptions: When placing of concrete is to be interrupted long enough for the concrete to take a set, use forms or other means to shape the working face to secure proper union with subsequent work.

3. Preparation: Give horizontal joint surfaces a compacted, roughened surface for good bond. Except where the Drawings call for joint surfaces to be coated, clean joint surfaces of laitance, loose or defective concrete and foreign material by hydroblasting or sandblasting (exposing aggregate), roughen surface to expose aggregate to a depth of at least 1/4 inch and wash thoroughly. Remove standing water from the construction joint surface before new concrete is placed.

4. After surfaces have been prepared cover horizontal construction joints with approximately a 3-inch lift of a grout mix consisting of Class A concrete batched without coarse aggregate; place and spread grout uniformly. Place wall concrete on the grout mix immediately thereafter.

C. Set and secure reinforcement, anchor bolts, sleeves, inserts and similar embedded items in the forms where indicated on Contract Drawings, shop drawings and as otherwise required. Obtain ENGINEER’s acceptance before concrete is placed. Accuracy of placement is the sole responsibility of CONTRACTOR.

D. Place no concrete until at least 4 hours after formwork, inserts, embedded items, reinforcement and surfce preparation have been completed and accepted by ENGINEER. Clean surfces o forms and embedded items that have become encrusted with grout or previously-placed concrete before placing adjacenet concrete.

E. Casting New Concrete Against Old**:** Where concrete is to be cast against old concrete (any concrete which is greater than 60 days of age), thoroughly clean and roughen the surface of the old concrete by hydro-blasting or sandblasting (exposing aggregate). Coat joint surface with epoxy bonding agent following manufacturer's written instructions, unless indicated

otherwise. Unless noted otherwise, this provision does not apply to vertical wall joints where waterstop is installed.

F. Protection from Water: Place no concrete in any structure until water entering the space to be filled with concrete has been properly cut off or diverted and carried out of the forms, clear of the work. Deposit no concrete underwater. Do not allow still water to rise on any concrete until concrete has attained its initial set. Do not allow water to flow over the surface of any concrete in a manner and at a velocity that will damage the surface finish of the concrete.

G. Corrosion Protection**:** Position and support pipe, conduit, dowels and other ferrous items to be embedded in concrete construction prior to placement of concrete so there is at least a 2 inch clearance between them and any part of the concrete reinforcement. Do not secure such items in position by wiring or welding them to the reinforcement.

H. Where practicable, provide for openings for pipes and setting of anchors during placing of concrete.

I. Accurately set anchor bolts and maintain in position with templates while they are being embedded in concrete.

J. Cleaning: Immediately before concrete is placed, thoroughly clean dirt, grease, grout, mortar, loose scale, rust and other foreign substances from surfaces of metalwork to be in contact with concrete.

3.03 HANDLING, TRANSPORTING AND PLACING CONCRETE

A. Conform to applicable requirements of Chapter 8 of ACI 301 and this Section. Use no aluminum materials in conveying concrete.

B. Unauthorized Placement: Place no concrete except in the presence of the ENGINEER. Notify ENGINEER in writing at least 24 hours before placement of concrete.

C. Conveyors and Chutes: Design and arrange ends of chutes, hopper gates and other points of concrete discharge in the conveying, hoisting and placing system so concrete passing from them will not fall separated into whatever receptacle immediately receives it. Conveyors, if used, shall be of a type acceptable to ENGINEER. Do not use chutes longer than 50 feet. Slope chutes so concrete of specified consistency will readily flow. If a conveyor is used, it shall be wiped clean by a device operated in such a manner that none of the mortar adhering to the belt will be wasted. All conveyors and chutes shall be covered.

D. Placement of Slabs: In hot or windy weather, conducive to plastic shrinkage cracks, apply evaporation retardant to slab after screeding in accordance with manufacturer's instructions and recommendations. Do not use evaporation retardant to increase water content of the surface cement paste. Place concrete for sloping slabs uniformly from the bottom of the slab to the top, for the full width of the placement. As work progresses, vibrate and carefully work concrete around slab reinforcement. Screed the slab surface in an up-slope direction.

E. Concrete Temperature: When placed, not more than 90 degrees F nor less than 55 degrees F for sections less than 12 inches thick, nor less than 50 degrees for all other sections. Do not heat concrete ingredients to a temperature higher than that necessary to keep the temperature of the mixed concrete, as placed, from falling below the specified minimum temperature. When concrete temperature is 85 degrees F or above, do not exceed 60 minutes between introduction of cement to the aggregates and discharge. When the weather is such that the concrete temperature would exceed 90 degrees F, employ effective means, such as pre-cooling of aggregates and mixing water, using ice or placing at night, as necessary to maintain concrete temperature, as placed, below 90 degrees F.

F. Cold Weather Placement: Conform to ACI 306.1 - Standard Specification for Cold Weather Concreting, and the following.

1. Remove snow, ice and frost from surfaces, including reinforcement, against which concrete is to be placed. Before beginning concrete placement, thaw the subgrade to a minimum depth of 6 inches. Warm reinforcement and embedded items to above 32 degrees F prior to concrete placement.

2. Maintain concrete temperature above 50 degrees F for at least 3 days after placement.

3.04 PUMPING OF CONCRETE

A. If pumped concrete does not produce satisfactory results, in the judgement of ENGINEER, discontinue pumping operations and proceed with the placing of concrete using conventional methods.

B. Pumping Equipment: Use a 2-cylinder pump designed to operate with only one cylinder if one is not functioning, or have a standby pump on site during pumping.

C. The minimum hose (conduit) diameter: Comply with ACI 304.2R.

D. Replace pumping equipment and hoses (conduits) that do not function properly.

E. Do not use aluminum conduits for conveying concrete.

F. Field Control**:** Take samples for slump, air content and test cylinders at the placement (discharge) end of the line.

3.05 CONCRETE PLACEMENT SEQUENCE

A. Place concrete in a sequence acceptable to ENGINEER. To minimize effects of shrinkage, place concrete in units bounded by construction joints shown. Place alternate units so each unit placed has cured at least 7 days for hydraulic structures, or 3 days for other structures, before contiguous unit or units are placed, except do not place corner sections of vertical walls until the 2 adjacent wall panels have cured at least 14 days for hydraulic structures and 7 days for other structures.

B. Level the concrete surface whenever a run of concrete is stopped. To ensure straight and level joints on the exposed surface of walls, tack a wood strip at least 3/4-inch thick to the forms on these surfaces. Carry concrete about 1/2 inch above the underside of the strip. About one hour after concrete is placed, remove the strip, level irregularities in the edge formed by the strip with a trowel and remove laitance.

3.06 TAMPING AND VIBRATING

A. Thoroughly settle and compact concrete throughout the entire depth of the layer being consolidated, into a dense, homogeneous mass; fill corners and angles, thoroughly embed reinforcement, eliminate rock pockets and bring only a slight excess of water to the exposed surface of concrete during placement. Use ACI 309R Group 3 immersion-type high-speed power vibrators (8,000 to 12,000 rpm) in sufficient number and with sufficient (at least one) standby units. Use Group 2 vibrators only when accepted by ENGINEER for specific locations.

B. Use care in placing concrete around waterstops. Carefully work concrete by rodding and vibrating to make sure air and rock pockets have been eliminated. Where flat-strip type waterstops are placed horizontally, work concrete under waterstops by hand, making sure air and rock pockets have been eliminated. Give concrete surrounding the waterstops additional vibration beyond that used for adjacent concrete placement to assure complete embedment of waterstops in concrete.

3.07 REPAIRING SURFACE DEFECTS AND FINISHING

A. Defective Areas: Repair immediately after removal of forms. Remove honeycombed and other defective concrete down to sound concrete but in no case to a depth less than 1 inch. Make edges of cuts perpendicular to concrete surface. Thoroughly work bonding grouth into the surface with a brush as that the entire surface is covered. Alternatively, a proprietary bonding agent may be used. Use bonding agent in accordance with manufacturer's instructions. While bonding coat is still tacky, apply premixed patching mortar. Thoroughly consolidate mortar into place and strike off to leave patch slightly higher than surrounding surface. To permit initial shrinkage, leave undisturbed for at least 1 hour before final finishing. Keep patched area damp for 7 days. Alternatively, a proprietary cementitious repair mortar may be used and placed in accordance with manufacturer's instructions. Do not use metal tools in finishing patches in formed walls which will be exposed.

B. Tie Holes: Patch holes immediately after removal of forms. After cleaning and roughening with a wire brush on a rotary drill, thoroughly dampen tie hole and fill solid with patching mortar. Taper tie holes shall have the plug, specified in Section 03100 - Concrete Formwork, driven into the hole to the center of the wall before grouting. Completely fill taper tie holes with patching mortar except that non-shrink grout shall be used for all walls in contact with soil or liquid. On wall faces exposed to view, fill the outer 2 inches of the taper tie hole with patching mortar blended to match adjacent concrete.

C. Cracks: Repair cracks in excess of 0.01 inch by pressure injection of moisture-insensitive expoxy-resin system. Submit proposed material and method of repair for approval prior to making repairs.

D. Structural Repair: When required, make structural repairs after prior approval of ENGINEER as to method and procedure, using specified epoxy adhesive or approved epoxy mortar.

3.08 CURING

A. Comply with ACI 308 and the requirements specified herein. Protect freshly-deposited concrete from premature drying and excessively hot or cold temperatures. Maintain minimal moisture loss and relatively constant temperature during time necessary for hydration of cement and proper hardening of concrete.

B. Unformed Surfaces: For concrete surfaces not in contact with forms, use one of the following procedures immediately after completion of placement and finishing.

1. Ponding or continuous sprinkling.

2. Absorptive mat or fasbric dept continuously wet.

3. Sand or other covering kept continuously wet.

4. Continuous steam bath (not exceeding 150 degrees F at surface of concrete).

5. Vapor mist bath.

6. Membrane-forming curing compound applied according to manufacturer's recommendations. After the curing compound has dried, wet slab surfaces and cover with waterproof paper, polyethylene film, or white burlap-polyethylene sheeting after the application of the curing compound. Tape sheet seams together and provide sufficient weights to keep the sheeting in place. Wet the slab surface again if the sheeting becomes dislodged, and replace the sheeting.

7. Other moisture-retaining coverings as approved by ENGINEER.

C. Restrictions on Use of Curing Compounds: Unless curing compound manufacturer certifies that curing compound will not prevent bond to cured surface, do not use curing compound on surfaces that will be rubbed or receive additional concrete, mortar, topping, terrazzo or other cementitious finishing materials, on slabs under resilient floors or built-up roofing, or on surfaces to be waterproofed, sealed, hardened or painted.

D. Curing and Sealing Compounds: At locations indicated, cure exposed interior slabs and troweled slabs receiving mastic-applied adhesives with specified clear curing and sealing compound in accordance with manufacturer's recommendations. Do not store materials directly on curing membranes. Use plywood to protect curing membrane from damage. Immediately repair membranes damaged by foot traffic or other operations.

E. Duration of Curing: Continue curing until cumulative number of days or fractions of days during which ambient temperature is above 50 degrees F has totaled 7. Continue curing of water-retaining structures for a total of 14 days. When high-early-strength concrete has been used, continue curing for total of 3 days. Prevent rapid drying at end of curing period.

F. Formed Surfaces: During the curing period keep steel forms heated by sun, and wood forms in contact with wet concrete. When forms are to be removed during curing period, employ curing materials or methods immediately. Continue such curing for remainder of curing period.

G. Temperature

1. Cold Weather: When mean daily temperature of atmosphere is less than 40 degrees F, maintain temperature of concrete between 50 and 70 degrees F for required curing period. When necessary, make arrangements for heating, covering, insulating or housing concrete work in advance of placement to maintain required temperature and moisture conditions. Prevent damage or injury due to concentration of heat. When combustion heaters are necessary in enclosed or protected area where concrete slabs are being placed, vent heaters.

2. Hot Weather: In advance of placement make arrangements for shading, fog spraying, sprinkling, ponding or installation of windbreaks or wet covering of light color. Take such protective measures as quickly as concrete hardening and finishing operations will allow.

3. Temperature Changes: Control so rate of change in temperature of concrete is as uniform as possible. Do not permit temperature change to exceed 5 degrees F in any one hour or 50 degrees F in any 24-hour period.

H. Protection from Mechanical Injury: During curing period, protect concrete from damaging mechanical disturbances, particularly load stresses, heavy shock, and excessive vibration. Protect finished concrete surfaces from damage caused by construction equipment, materials or methods, and by rain or running water. Do not load self-supporting structures in a way that over stresses concrete.

3.10 PROTECTION

A. Protect concrete against damage until final completion.

B. Protect fresh concrete from damage due to rain, hail, sleet or snow. Provide such protection while the concrete is still plastic and whenever such precipitation is imminent or occurring.

C. Do not backfill around concrete structures or subject them to design loadings until all components of the structure needed to resist the loading are complete and have reached the specified 28-day compressive strength, except as authorized otherwise by ENGINEER.

END OF SECTION

SECTION 11100 GROUNDWATER TREATMENT SYSTEM

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA 10084 (2005) Standard Methods for the Examination of Water and Wastewater

AWWA B100 (2009) Standard for Granular Filter Material

ASTM INTERNATIONAL (ASTM)

ASTM A36/A36M (2012) Standard Specification for Carbon Structural Steel

ASTM B124/B124M (2014) Standard Specification for Copper and Copper Alloy Forging Rod, Bar, and Shapes

ASTM D638 (2010) Tensile Properties of Plastics

ASTM D883 (2012) Standard Definitions of Terms Relating to Plastics

ASTM D1505 (2010) Density of Plastics by the Density-Gradient Technique

ASTM D1525 (2009) Test Method for Vicat SofteningTemperature of Plastics

ASTM D1693 (2013) Standard Test Method for Environmental Stress-Cracking of Ethylene Plastics

ASTM D1784 (2011) Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds

ASTM D1785 (2012) Standard Specification for Poly(Vinyl Chloride) (PVC), Plastic Pipe, Schedules 40, 80, and 120

ASTM D2035 (2013) Standard Practice for Coagulation-Flocculation Jar Test of Water

HYDRAULIC INSTITUTE (HI)

HI 7.1-7.5 (2006) Controlled Volume Metering Pumps

INTERNATIONAL SOCIETY OF AUTOMATION (ISA)

ANSI/ISA 5.1 (2009) Instrumentation Symbols and Identification

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

ISA 668 (2013) Series 1 Freight Containers Classification, Dimensions and Ratings

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA MG 1 (2011; Errata 2012) Motors and Generators NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)
NFPA 70 (2014; AMD 1 2013; Errata 1 2013; AMD 2 2013; Errata 2 2013; AMD 3 2014; Errata 3 2014) National Electrical Code

NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (NIST)

NIST SP 250 (1991) Calibration Services Users Guide

1.2 GROUNDWATER TREATMENT SYSTEM DESCRIPTION

The groundwater treatment system shall be a fully integrated water treatment plant which shall remove dissolved heavy metals and solids from groundwater. The system shall include equipment for groundwater extraction, flow equalization, wastewater conveyance, precipitation, clarification, and filtration required to meet the specified performance requirements. The groundwater treatment system shall be complete with required instruments, controls, and a local control panel. A portable building shall be provided to enclose, contain, and facilitate the overall control of the treatment plant. All parts shall be factory or shop preassembled to the maximum extent possible, compatible with transportation limitations and equipment protection considerations. Field assembly shall be minimized to the assembly of match-marked components. Submit installation instructions and framed, typed operating instructions for posting and explaining methods of checking the system for startup and normal safe operations, normal and emergency shutdown operations, and procedures for safely starting and stopping each piece of equipment within the system.

1.2.1 GROUNDWATER EXTRACTION UNIT

Groundwater extraction unit shall include one well pump with accessories, piping, valves, and instrumentation and controls to extract and convey accumulated

groundwater from existing well EW-2 to the equalization unit. All components of the unit shall be furnished as shown on the drawings.

1.2.2 EQUALIZATION UNIT

Equalization unit shall include one tank with accessories, piping, valves, pumps, and instrumentation and controls to provide a constant flow and contaminant concentration to the subsequent treatment equipment. All components of the unit shall be furnished as shown on the drawings.

1.2.3 PRECIPITATION UNIT

Precipitation unit shall include a static mixer, a chemical feed system for the precipitant addition, piping, valves, oxidation/reduction potential (ORP) controls, and other instrumentation and controls as indicated on the drawings.

1.2.4 CLARIFICATION UNIT

Clarification unit shall include a coned bottomed tank, a tank stand, a sludge removal system, piping, valve, and instrumentation and controls to separate sludge from decanted water. All components of the unit shall be furnished as indicated on the drawings.

1.2.5 FILTRATION UNIT

Filtration unit shall include a gravity sand filter, piping, valve, and instrumentation and controls to remove particulates from decanted water prior to discharge. All components of the unit shall be furnished as indicated on the drawings.

1.2.6 TEMPORARY EQUIPMENT

Work with Engineer and TCEQ to provide additional equipment that might be necessary to hold and transfer effluent during startup and initial operations. Although not included in current scope of work the Contractor should make provisions for temporary tankage, hoses, and pumps. See Section 3.4.4

1.3 PERFORMANCE REQUIREMENTS

Provide a groundwater treatment system which is capable of processing ground water at the conditions provided below:

Flow Rate	
Maximum	25 gal per minute
Minimum	1 gal per minute
Temperatures	
Maximum	90 degrees F
Minimum	33 degrees F
Influent/Effluent pH	
Maximum Influent	N/A
Minimum Influent	N/A
Maximum Effluent	6
Minimum Effluent	8
Liquid Properties	
Liquid Viscosity	1 centipoise
Liquid Density	1 gm/ml at 60 degrees F
Space Availability	
Maximum Area	10 feet by 10 feet
Maximum Height	8 feet

The groundwater treatment system shall be capable of meeting the maximum effluent metals and solids concentrations achieved in the previously conducted treatability testing (report appended to this specification), as listed below at the indicated maximum concentrations. Influent and effluent solids are as determined in accordance with Part 2000 Physical and Aggregate Properties, and metals as determined in accordance with Part 3000 METALS of AWWA 10084:

	Maximum Influent Concentration mg/L	Maximum Effluent Concentration mg/L
Hexavalent Chromium	5	0.1
TSS	90	5

Groundwater treatment system instrumentation and controls shall have the necessary accuracy and sensitivity to measure and control the operating ranges of the specified

equipment. Sampling and analysis shall be performed in accordance with Section 01 35 45.00 10 CHEMICAL DATA QUALITY CONTROL.

1.4 OTHER SUBMITTAL REQUIREMENTS

The following shall be submitted:

A. Detailed drawings of tanks showing the dimensions, nozzle orientation and elevations, interconnecting piping, equipment layout, hydraulic profile, and other details required to demonstrate that the unit has been coordinated and will properly function as part of the overall groundwater treatment system. Drawings shall show proposed layout, anchorage of equipment and accessories, installation/connection details, and equipment relationship to other parts of the work including clearances for installation, maintenance and operation. Submit manufacturer's descriptive data, specifications, technical literature, utility requirements, performance charts and curves, and catalog cuts for the clarifier.

B. Electrical one-line diagrams for instrumentation and controls, illustrating all electrical components (motor controls, disconnects, starters, selector switches, pushbuttons, pilot lights, conduit, wire, etc.), electrical load analyses, cable and conduit schedules (including conduit designation, materials of construction, descriptions for each conduit of the end points of each conduit segment in a run, wire count by number, type and size, wire length, etc.), and complete control ladder logic diagrams. All control ladder logic diagrams shall be fully coordinated between components and ladder rungs to illustrate component tag names for all relays, timers, selector switches, pushbuttons, pilot lights, etc. All wires and terminals shall be number tagged. Terminal designations shall distinguish between terminals contained within differing enclosures such as control panels, equipment enclosures, motor control centers, etc. All auxiliary relay contacts shall be illustrated and designated. All ladder rungs shall be numbered with cross referencing between all associated rungs. A narrative description shall be fully coordinated with the ladder logic diagrams so as to fully describe all control operations, sequences, interlocks, alarms, and shutdowns for the groundwater treatment system including, but not limited to, flow control systems, level control systems, ORP control systems, chemical addition control systems, pump/valve controls, alarm and shutdown schemes, PLC input/output points, and all component interlocking. Locations of all control panels, equipment enclosures, motor control centers, etc. shall be designated on an equipment layout drawing. Submit manufacturer's descriptive data, specifications, technical literature, utility requirements,

performance charts and curves, and catalog cuts for each instrument and control component supplied.

C. A pre-startup test plan identifying the procedures and methods that will be used to verify the integrity, calibration, and operability of the equipment, piping, electrical wiring, and instruments and control systems. The plan shall specify acceptance criteria and tolerances to be achieved during the pre-startup testing.

D. A groundwater treatment performance test plan using contaminated water. The test plan shall describe the operating procedures to be followed during the test period including detailed descriptions of the measurements, record keeping, sampling and analyses to be performed to document that performance criteria has been achieved. The plan shall address full-scale operation of all equipment, piping, electrical wiring, and instruments and control systems included in the groundwater treatment system.

E. Manufacturer's certificates attesting that the equipment meets the specified requirements. The statement shall be dated after the award of the contract, shall state the Contractor's name and address, shall name the project and location, and shall list the specific requirements which are being certified. Certificate shall indicate the methods of testing used.

F. Three copies of operation and maintenance manuals for the groundwater treatment system containing the manufacturer's operating and maintenance instructions for each piece of equipment. Provide one complete set prior to the performance of the field test (see Paragraph Tests); submit the remaining sets prior to startup. Furnish each set in loose leaf three-hole ring binders. Inscribe the following identification on the covers: the words "OPERATING AND MAINTENANCE INSTRUCTIONS," name of equipment, name and location of the building, name of the Contractor, and contract number. Place cover sheets before instructions identifying each subject. Use standard letter size paper for instruction sheets, with larger sheets of drawings folding in to approximately the same size. Include, but do not limit the instructions to the following:

1. System layout detailing piping, valves, and controls.

2. Approved wiring and control ladder logic diagrams prepared in accordance with ANSI/ISA 5.1 including a drawing index, legend and symbols list, and abbreviation and identifiers.

3. A narrative control sequence describing startup, operation, and normal and emergency shutdown. This information shall include the detailed operational narrative described in Paragraph Control System.

4. Operating instructions for each equipment, instruments and control system including process monitoring requirements and recommendations for operations reporting to document the results of all process monitoring.

5. Maintenance instructions for each piece of equipment, including lubrication instructions and a troubleshooting guide to help the operator determine what steps shall be taken to correct anticipated problems that may occur in the system.

6. Manufacturer's bulletins, cut sheets and descriptive data of equipment; these shall be submitted after approval of detail drawings, and not later than 2 months prior to delivery of the system.

1.5 SUBMITTALS

Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Tanks
Mixers
Clarifiers
Instrumentation and Control
Portable Building
Secondary Containment

SD-03 Product Data

Tanks
Mixers
Clarifiers
Material Safety Data Sheets
Instrumentation and Control
Secondary Containment System
Spare Parts
Pre-startup Testing
Startup and Operation
Proof of Performance

SD-10 Operation and Maintenance Data

Operation and Maintenance Manual Updates

1.5.1 REGULATORY REQUIREMENTS

Obtain all permits, certifications, and/or meet the regulatory requirements necessary for the configuration, installation, startup, and operation of the treatment plant. Work shall meet or exceed applicable minimum requirements established by federal, state, and local laws and regulations. Submit permits, certifications, and/or substantive regulatory requirements before work starts plus copies of applications for permits and certifications not required until later, along with a schedule for obtaining them. Equipment, raw materials (including reagents/additives), contaminated materials, and treated materials shall be safely transported, stored, and handled in accordance with Sections 01650 OFFSITE TRANSPORTATION AND DISPOSAL and 01030 HEALTH AND SAFETY.

1.6 DELIVERY, STORAGE, AND HANDLING

Equipment delivered and placed in storage shall be stored with protection from the weather, excessive humidity and temperature variation, and dirt, dust or other contaminants.

1.7 SITE CONDITIONS

1.7.1 AMBIENT CONDITIONS

Groundwater treatment system shall be operated continuously during the winter when temperatures reach freezing or below. The system shall be installed indoors except for the equalization tank, feed pump, and well pump. The system shall be equipped with sufficient lighting as shown on the drawings for security purposes and for treatment plant operation during inadequate daylight or at night.

1.7.2 EXISTING CONDITIONS

The groundwater treatment system shall operate in an urban setting. Contractor shall become familiar with the existing site conditions, including site location, site configuration, topography, climate, site accessibility, and adjacent land use.

PART 2 PRODUCTS

2.1 STANDARD PRODUCTS

Provide materials and equipment which are the standard products of a manufacturer regularly engaged in the manufacture of such products and that essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening. Equipment shall be new and unused, except for test equipment. Where two or more pieces of equipment performing the same function are required, they shall be products of the same manufacturer. Equipment shall be supported by a service organization that is, in the opinion of the Engineer, capable of providing service, materials, and equipment in an expedient manner.

2.2 TANKS

Submit detailed drawings of each tank showing the dimensions, nozzle orientations and elevations, interconnecting piping, equipment layout, hydraulic profile, and any other detail required to demonstrate that the tank has been coordinated and will properly function as a part of the overall groundwater treatment system. Drawings shall show proposed layout, anchorage of equipment and accessories, installation/connection details, and equipment relationship to other parts of the work including clearances for installation, maintenance and operation. Submit manufacturer's descriptive data, specifications, technical literature, and catalog cuts for each tank supplied.

2.2.1 GENERAL REQUIREMENTS

Use manufacturer's standard size tanks whenever possible. Tank construction material and paints, coatings, or liners shall be compatible with the wastewater to be stored. Tank dimensions shall be selected to fit the available space as shown on the drawings. Unless noted otherwise on the drawings, each tank shall include flanged fittings for inlet, overflow, and drain. Hold down lugs shall be provided to anchor the tank to the base.

2.2.2 EQUALIZATION TANK

TK-1 shall be a rotationally-molded, high density cross-linked polyethylene, double wall, flat bottom tank with 7500 gallon capacity. High Density Cross-linked Polyethylene resin used in the tank manufacture shall contain an ultraviolet stabilizer as recommended by resin manufacturer. The assembly shall consist of one cylindrical, closed top inner primary tank and one cylindrical, open top containment outer tank. The tank shall be rotationally molded one-piece seamless constructed tank. The tank shall be designed for above-ground, vertical installation to store groundwater at atmospheric pressures. The assembly shall be designed to prevent rainwater and debris from entering the containment tank. The tank shall be adequately vented. The tank shall provide an access port in the top to install and retrieve submersible pump, P-2. The

tank will be provided with a port in the top for installation of a level transmitter as shown on the drawings.

2.2.3 CALCIUM POLYSULFIDE TOTE

The Contractor shall provide Calcium Polysulfide 29% solution in a vendor-provided 40-gallon tote tank (TK-2).

2.3 STATIC MIXER

The static mixer shall be designed to disperse the design flow, 0 to 2 gph of added chemicals in a process flow stream with flows ranging from 0 to 2 gpm. The minimum allowable pressure drop shall be 5 feet of water column. The maximum allowable pressure drop for the static mixer shall be 10 feet of water column in accordance with the requirements of the process stream pumping system. The diameter of the mixer housing shall be sized identical to the process piping. The length shall be in accordance with the number of mixing elements required. Housing materials shall be carbon steel, providing chemical resistance to both the chemical additives and process stream. End configurations shall be shall compatible with the piping system. Injection ports shall be of the same materials as the mixer housing with threaded connections compatible with the chemical feed piping system. The housing shall be supplied with a name plate which at a minimum provides the manufacturer's name and address, part model number, and direction of flow. Mixing elements shall be constructed of carbon steel providing resistance to both the chemical additives and process stream.

2.4 CLARIFIERS

Clarifier (TK-3) shall be a coned bottom settler with an effective surface overflow rate of 5 gpd/ft2 and the detention time shall be 2 hours at the design flow rate. Clarifier shall consist of, at a minimum, the following accessories: influent distribution system, sludge removal system, effluent collection flumes, associated piping, fittings, and sampling valves.

2.4.1 CLARIFIER VESSEL

The bottom and sides of the clarifier vessel shall be 1/4 inch minimum thickness carbon steel plate meeting or exceeding ASTM A36/A36M. Inlet, outlet, overflow, and drain connections shall be provided on the vessel. Structural steel framework shall be an integral part of the vessel to make it self-supporting.

2.4.2 INFLUENT DISTRIBUTION AND EFFLUENT COLLECTION SYSTEMS

Influent distribution system shall be supplied to dissipate the entrance energy and to equalize flow to the separator module. Weirs and baffles shall be included to control the local velocities and to eliminate short circuiting. Adjustable weirs shall

be supplied along each effluent collection flume to maintain uniform flow distribution.

2.4.3 SLUDGE COLLECTION/THICKENING DEVICES

Sludge holding compartment shall be equipped with hopper bottom having sides tapering downward at an angle not less than 55 degrees above horizontal for sludge collection. A flanged outlet shall be provided for the hopper which connects to a valve and quick connect fitting for sludge removal.

2.5 SAND FILTER UNIT

2.5.1 EQUIPMENT CAPACITY

The sand filter unit shall be a gravity downflow granular media filter, having a capacity to filter 5 gpm/ft2 of water at the design flowrate.

2.5.2 FILTER TANK

The filter tank shall be a cylindrical with the dimensions shown and shall be of carbon steel or HDPE construction, free from physical imperfections.

2.5.3 FILTER MEDIA

Filter media shall be silica sand. Total depth of filtration media shall be 4 feet. All media shall conform to the requirements of AWWA B100.

2.6 PIPING/VALVES

Provide piping materials and appurtenances as specified and as shown on the drawings, and suitable for the service intended. Pipe fittings shall be compatible with the applicable pipe materials.

2.6.1 PVC PIPE

PVC, ASTM D1784, minimum cell classification 12545-C, pipe shall be Schedule 40 conforming to ASTM D1785, so that the pressure rating of the pipe is consistent for all pipe sizes.

2.6.2 PVC JOINTS

The piping system shall be joined by socket-weld connections except where connecting to unions, valves, and equipment with threaded connections that may require future disassembly.

2.6.3 PVC FITTINGS

The schedule rating for the fittings shall not be less than that for the associated pipe. Fittings shall be ASTM D1784, PVC conforming to the requirements of ASTM D2466, socket type.

2.6.4 FLANGED FITTINGS

Flanges shall be complete with one-piece, molded PVC stub ends. Flanged connections shall have the same pressure rating as the pipe or greater. Bolting shall be stainless steel, ASTM A193/A193M, Grade B8 hex head bolts and ASTM A194/A194M, Grade 8 hex head nuts. Bolts shall be provided with washers of the same material as the bolts. Gaskets shall be full-faced, maximum 1/8 inch thick, fabricated from ethylene propylene rubber (EPR) in accordance with ASME B16.21. When the mating flange has a raised face, a flat ring gasket shall be used and a filler gasket shall be provided between outer diameter of the raised face and the flange outer diameter to protect the PVC flange from bolting moment.

2.6.5 PVC SOLVENT CEMENT

Socket connections shall be joined with PVC solvent cement conforming to ASTM D2564. Manufacture and viscosity shall be as recommended by the pipe and fitting manufacturer to assure compatibility. Joints shall be prepared with primers conforming to ASTM F656 prior to cementing and assembly.

2.6.6 POLYTETRAFLUOROETHYLENE (PTFE) TUBING

Tubing shall be flexible and clear with nominal size and wall thickness as shown on the drawings.

2.6.7 TUBING FITTINGS

Fittings shall be compression type comprised of forged brass alloy C37700, conforming to ASTM B124/B124M nuts, ferrules and bodies, with elastomeric O-ring seals rated to a minimum 150 psig with straight threads conforming to ASME B1.1.

2.6.8 VALVES

Thermoplastic ball valves, 6 inches and smaller, shall be rated for 150 psig, 120 degrees F, and have ASTM D1784 polyvinyl chloride (PVC) bodies, balls, and stems. Valves shall be end entry with solvent-weld socket ends connections, a ethylene propylene diene monomer (EPDM) O-ring stem seals. Valves shall have hand lever operators. Valves shall be the same size as adjoining pipe. Valve ends shall be compatible with adjacent piping system. An operator shall be sized to operate the associated valve for the full range of pressures and velocities. Valves will open by turning counterclockwise.

2.6.9 SAMPLE PORTS

Sample ports shall be provided as indicated in the process flow diagram to complete the piping systems for the use intended. The sample ports shall be located in easily accessible locations, and shall avoid potential stagnant points and/or areas where material could collect. Sampling ports shall be comprised of pipe fittings, pipe, and ball valves which comply with material, temperature, and pressure requirements of the associated piping system as specified elsewhere in this Section.

2.6.10 PIPE SUPPORTS

Provide auxiliary steel where the support of piping systems and equipment is required. Light gauge and structural steel shapes shall conform to the requirements of ASTM A36/A36M. The Contractor has the option to use pre-engineered support systems of electrogalvanized steel products.

2.7 PUMPS

Pumps shall conform to the following requirements. Pumps for specific services and accessories shall be as specified.

2.7.1 WELL PUMP

Pump P-1 shall be a submersible, electric well pump capable of extracting 20 gpm of groundwater at 25 feet total dynamic head (tdh). The pump shall be connected to the pump controls by a three-wire drop line. The pump shall operate on 208 volts, 60 Hz, single-phase power, and the motor shall be of sufficient size to operate the pump under the maximum operating conditions without exceeding its rating. Pump shall be equipped with necessary controls to provide automatic operation of the pump as shown on the drawings. The pump and motor unit shall fit inside the existing 12-inch recovery well, EW-2.

2.7.2 FEED PUMP

Pump P-2 shall be a simplex pump unit that includes a submersible pump with an integral diaphragm or float-switch automatic level-control mechanism. Provide pump capable of delivering 2 gpm at 25 feet total dynamic head (tdh). Ensure that pump seals, lubricant, and electrical insulation are suitable for service in liquids up to 140 degrees F. Provide permanently sealed, oil-filled, and watertight motor that is manufacturer's standard construction for the service. Provide single phase motors with automatic-reset thermal-overload protection. Provide waterproof, internally grounded, oil-resistant, Type SO chloroprene power cord, with three-prong plug of necessary length.

2.7.3 CHEMICAL METERING PUMP

Pump P-3 shall be a controlled volume pumps as defined by HI 7.1-7.5, capable of delivering calcium polysulfide 29% solution at any rate from the minimum flow rate to the maximum flow rate shown on the drawings, and shall be capable of continuous operation at rated capacity. Accuracy shall be plus or minus 2 percent over a 100 to 1 range from the required maximum capacity to the minimum pumping rate. Net positive suction head required shall not exceed 90 percent of the net positive suction head available, as installed. Construction shall be as simple as practicable to provide equipment isolation, bypass and reliable service and to be readily accessible for inspection, cleaning, adjustment, repairs, and replacements. Pump stands and platforms shall be adequate to support the pumping system

2.7.3.1 CALCIUM POLYSULFIDE FEED SYSTEM

A. Concentration: Minimum 26 percent; maximum 29 percent.

B. Number of pumps: 1.

C. Type of pump: Mechanically or hydraulically coupled diaphragm.

D. Configuration: Simplex.

E. Controls: Automatic rate adjustment.

F. Feed/flow rate: Minimum 1 gph; maximum 5 gph.

G. Back pressure at point of injection: 15 psig. Back pressure regulating valve shall be installed on the pump discharge and shall be factory adjusted to crack open at 15 psig. Regulators shall be of polyvinyl chloride construction with fluorocarbon resin diaphragms.

H. Suction valve cartridge: Single ball check.

I. Discharge valve cartridge: Single ball check.

J. Materials of construction allowed for wetted parts: Type 304L stainless steel, PVC or nylon.

2.7.3.2 CONTROLS

The chemical metering equipment shall be provided with the appurtenances and accessories, as required, for flow capacity adjustment. Manual range adjustment shall be provided on all systems. Automatic control shall have the capability to vary feed rate based on signals from an oxidation-reduction potential (ORP) meter or controller.

Oxidation-reduction potential probe shall be located where indicated on the drawings. Chemical feed rate shall be variable in response to the deviation from set point.

2.7.3.3 DRIVES FOR CONTROLLED VOLUME PUMPS

The metering pump shall be supplied with and driven by an alternating current electric motor drive. Electric motor shall be of sufficient capacity to operate the chemical metering equipment under all operating conditions without exceeding the rated nameplate current or power, or their specified temperature limits. The motors shall have starting characteristics and ruggedness necessary under the actual conditions of operations or clean-up procedures used in the areas where they will be located. Alternating current motors with power rating of 1/3 hp or less shall be 115 volts, single-phase, 60-Hz service.

2.8 ELECTRICAL WORK

Electrical equipment and wiring shall be in accordance with Section 16100 ELECTRICAL GENERAL PROVISIONS, 16200 GENERAL WIRING METHODS, 16289 SURGE PROTECTIVE DEVICES and 16550 GROUNDING.
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2.9 INSTRUMENTATION AND CONTROL

The instrumentation and control system shall be automatic with complete electrical power, control and instrumentation as specified or recommended by the equipment manufacturer for the safe operation and supervision of the groundwater treatment system. The instrumentation and control package for the groundwater treatment system shall be supplied as indicated on the drawings. Probes for oxidation reduction potential (ORP), measuring devices, and level sensors specified in the following four subparagraphs shall be of materials resistant to chemical attack over a pH range of 2 to 12, and suitable for a temperature range from 32 to 212 degrees F and for the liquid to be monitored. All enclosures for pH, flow, and level sensors and transmitters shall be rated NEMA 4X.

2.9.1 ORP MONITORING/CONTROL

An oxidation reduction potential (ORP) probe shall be provided where indicated on drawings for the purpose of ORP monitoring and control. Probe shall be easily removable without interrupting service. Probe materials shall be resistant to operating pressures of up to 50 psi. The probes shall be interconnected to associated transmitters/indicators that are located preferably in the control panel. Probe shall be connected to a microprocessor based pH analyzer having a 4 digit readout with 1-1/2 inch high letters and an isolated 4 - 20 mA DC output signal proportional to the ORP. The accuracy of the ORP unit shall be plus or minus 0.5 percent of full scale.

2.9.2 FLOW MONITORING

Flow measuring devices shall be provided on the effluent line for the purpose of flow monitoring. Measuring devices shall be easy to maintain without interrupting service. Measuring devices shall be resistant to operating pressures of up to 50 psi. The accuracy of the flow monitoring unit shall be plus or minus 0.5 percent of full scale. The type of flow meter selected shall be fully coordinated with the application involved as shown on the drawings to assure that the flow meter meets all installation and operational criteria (upstream and downstream distances from appurtenances, minimum and maximum flow velocities, degree of required accuracy, full pipe flow, etc.).

2.9.3 LEVEL MONITORING/CONTROL

All level (float) switches shall be mechanically actuated with Form C contacts. All electronic level sensing devices shall include a sending unit that transmits an analog or discrete signal, as required for the application, to an associated control panel or control device. Level monitoring/control sensors shall be provided where indicated on drawings. Sensors shall be easily removable without interrupting service. All analog level sensors shall be connected to a microprocessor based level indicator and/or controller as required by the application having a 4 digit readout with 1-1/2 inch high letters and an isolated 4 - 20 mA DC output signal proportional to the level to be measured.

2.9.4 CONTROL SYSTEM

Design the control system to operate as shown on the drawings and described in the operating and control procedures provided as an attachment. All alarms and/or shutdowns shall consist of visible alarm lights on the main control panel. The alarms and shutdowns shall function through a first-out-sequence annunciation. Alarms shall be provided for high levels, and high ORP values. Automatic shutdowns shall be provided for each system when a control value or an operational system ranges out of normal operational limits where personnel safety is a concern, where mechanical damage can occur to process equipment, or where the process excursion has the potential to violate discharge water quality criteria; such shutdowns can occur for both high and low conditions. Power failures and equipment failures shall initiate an alarm as well as an orderly and automatic shutdown of the treatment system. Auto-dialing to an indicated remote location shall be provided to report each alarm or shutdown that stops the movement of process water through the treatment system or stops chemical feed systems. The Contractor is responsible for providing the associated cellular telephone line for the auto-dialer system. Control power transformers, relays, adjustable timers, auxiliary contacts, switches, or additional equipment required to interconnect the treatment equipment to a monitoring/control system shall be provided. Conduit and wiring between control panels, treatment components, and all control devices shall be furnished.

2.9.5 CONTROL PANEL ENCLOSURES

All required control panels for the control system shall be rated NEMA 4X and shall be sized to assure that adequate internal space is available for all components specified and/or required with an allowance of no less than 30 percent spare space. To the greatest extent possible all instrument transmitters shall be installed in or adjacent to the control panel enclosure.

2.10 PORTABLE BUILDING

The portable building shall be a closed-van general purpose freight container, as defined in ISO 668. The building shall be constructed on a steel frame with bottom crossmembers, steel corrugated walls, steel corrugated roof, metal doors, and ISO corner fittings at all corners. The building shall be designed and constructed to be weatherproof with ports for power supply cables, influent and effluent piping, and data cable. The building shall be insulated, ventilated, and adequately lighted.

2.11 SECONDARY CONTAINMENT SYSTEM

The secondary containment system shall consist of a storage tank receiving water from a floor drain within a curbed area around the treatment building. See the construction plans for details.

PART 3 EXECUTION

3.1 EXAMINATION

After becoming familiar with all details of the work, verify all dimensions in the field, and advise the Engineer of any discrepancy before work begins. After equipment is delivered to the site and prior to installation, examine the treatment plant equipment for any damage, defect, or deterioration and verify that all construction equipment used at the site is of sufficient capacity and in good mechanical condition. Results of this pre-installation examination shall be documented and submitted to the Engineer for review. Based on the examination, the Engineer has the right to reject damaged, defective, or deteriorated equipment. Surface damage to equipment shall be corrected according to the manufacturer's requirements. Costs associated with the delay caused by the rejection shall be borne by the Contractor. All specified preconstruction submittals shall be provided to the Engineer.

3.2 INSTALLATION

Equipment shall be handled with extreme care to prevent damage during placement. Equipment shall be installed, except as otherwise specified, as indicated on the drawings, and in accordance with the manufacturer's written instructions. Installation shall include furnishing all materials required for initial operation. Equipment shall be properly leveled, aligned, and anchored in place in accordance with the

manufacturer's instructions. Supports shall be provided for equipment, appurtenances, and pipes as required. Piping runs shall be straight and evenly supported. Valves shall be installed with stems horizontal or above the pipe centerline. Flanges and unions shall be installed where valve and equipment maintenance may require disassembly. Groundwater treatment system shall be provided complete and ready for operation.

3.2.1 EXCAVATING, FILLING, AND GRADING

Excavating, filling, and grading shall conform to the applicable requirements of Section 31 00 00 EARTHWORK.

3.3 FIELD QUALITY CONTROL

3.3.1 INSPECTION

After the installation is complete, each component will be inspected by the Engineer to verify that the components of the system are properly installed according to drawings and specifications. Any discrepancies found shall be corrected and work affected by such deficiencies shall be at the Contractor's expense.

3.3.2 TESTS

Each piece of equipment shall be subject to an operational test, under the supervision of a factory representative and may be observed by the Engineer. Test shall demonstrate that the equipment is not defective and is in safe and satisfactory operating condition. Notify the Engineer 7 days prior to the dates and times for acceptance tests. Each unit shall be given a running field test in the presence of the Engineer for a minimum of 2 hours. If any deficiencies are revealed during the tests, such deficiencies shall be corrected by the manufacturer and the tests shall be repeated. Submit Test Reports in booklet form showing field tests performed to adjust each component and to prove compliance with the specified performance criteria upon completion and testing of the installed system. Test methods used shall be identified and test results shall be recorded. Each test report shall indicate the final set point of each control device. Test reports shall be provided for pre-startup testing and startup performance testing; also include test reports showing the results of factory tests performed.

3.4 STARTUP AND OPERATION

3.4.1 PRE-STARTUP CHECKOUT

Components subjected to the pre-startup checkout shall include the following items:

A. System shall be checked to verify that all equipment has been properly installed and connected;

B. Rotating equipment which requires lubrication shall be checked to ensure that manufacturer's procedures have been followed;

C. Equipment shall be level and checked for proper alignment, anchored, and static ground wires installed;

D. Piping, flange bolts, gaskets, and hoses shall be checked to ensure that connections are tight, and flushed clean;

E. Valves shall be checked for position and operability and flushed clean;

F. Electrical wiring and lighting shall be checked to verify that wiring has been completed correctly;

G. Continuity checks shall be performed on wiring loops;

H. High/Low liquid level alarms on tanks, as well as pump on/off level controls, shall be checked for proper installation and response;

I. Chemical feed systems shall be checked for proper installation;

J. Chemicals shall be checked for proper type, required quantity and mixing; tanks shall be filled;

K. Lockout devices and site security devices shall be checked for proper installation.

3.4.2 PRE-STARTUP TESTING

Each component of the system shall be subjected to the pre-startup testing as described below:

A. Piping and hoses transporting liquid shall be pressure tested on clean water for at least one hour, with no loss of pressure at 1.5 times the working pressure;

B. Electrical wiring shall be tested to verify that there is no wiring damage or deterioration that could cause injury to personnel or damage to equipment;

C. Power shall be turned on to test equipment and control systems only after the electrical systems are tested and certified ready for operation;

D. Lighting shall be tested and put in service to support work in all areas of the treatment system;

E. Rotating equipment such as pumps and blowers, if used, shall be tested for correct direction of rotation by bumping the starter manually;

F. Each pump shall be operated for a minimum of 4 continual hours at operating or test conditions. Tests shall assure that the units, controls and instrumentation have been installed correctly, and that there is no over-heating, vibration or excessive noise;

G. Depending on the complexity of the control system, testing can proceed from this point to verify that manual and automatic controls function properly. All tanks shall be filled and emptied to determine if high and low level alarms sound at the prescribed liquid level;

H. Safety shutdown sequences, controls/alarms and interlocks in the control system shall be tested to ensure that they are installed properly and functioning as intended;

I. Each emergency shutoff switch shall be clearly labeled and tested to determine that it works properly;

J. Electrical "lockout" devices with padlocks shall be tested to ensure that power has been disconnected;

K. Instrumentation shall be calibrated before systems are put into service. Pressure and temperature gauges shall be tested against standardized gauges. Where NIST SP 250 calibration standards exist, they shall be utilized.

3.4.3 STARTUP PERFORMANCE TESTING

Startup testing shall not be initiated until after each component of the system has been demonstrated to meet the requirements of the pre-startup testing and until written approval has been received from the Engineer. Once steady state operation is achieved, a functional performance test shall be performed as described in the following startup checklist:

A. Check flow rates, ORP, and contaminant levels of the wastewater feeding the reactor tank;

B. Check pump operating points to verify that the actual operating point matches the pump curve specification for flow and pressure;

C. Start/stop pumps from all control mechanisms;

D. Check that current draw and voltage balance match specifications for all phases;

E. Check the reagent feeding systems to verify that the actual chemical feed rate is within the specified accuracy range;

F. Check the ORP in the piping downstream of the static mixer to verify that operating values are within the design range;

G. Adjust the reagent feed rates, and the ORP control system as required to achieve maximum metal removals;

H. Monitor the composition of the effluent to verify that it meets the specified performance requirements.

I. Check the clarifier overflow rate to verify that it is within the design range;

J. Check the sludge collecting device to verify that it is operating properly;

K. Check the control system to verify that the system operates within set parameters; and

L. Check the monitoring systems and instruments to verify that they hold calibration.

M. A successful performance test shall include 48 hours of operation processing water from the design influent source at design capacity and meeting effluent requirements with less than 20 percent down time. Any deficiencies shall be corrected and performance checks successfully completed before the system will be accepted. Equipment not capable of performing as specified shall be replaced or upgraded at no additional cost. Submit Proof of Performance and Equipment Certificate of Conformance as specified. Submit a list of the proposed operating conditions for process parameters to be continuously monitored and recorded. Include detailed descriptions of the proof of performance schedule, operating conditions and parameters, influent sources, and required sampling and analyses.

3.4.4 STARTUP TREATMENT CONTINGENCIES

During the initial startup and initial operations additional equipment may be needed to store and transfer effluent prior to discharge. Although not included in current scope of work the Contractor should make provisions for temporary tankage, hoses, and pumps. Contractor shall coordinate these activities with the Engineer and TCEQ.

3.4.5 FIELD TRAINING

Upon completion of the installation and at a time designated by the Engineer, conduct a field training course for a representative of the Government in the operation and

maintenance of equipment furnished under the contract. These field instructions shall cover all the items contained in the operation and maintenance instructions. Training shall be provided for a total period of 8 hours per day for a period of 2 days of normal working time and shall start after the system is functionally complete but prior to final acceptance tests. Field instructions shall cover the items contained in the operating and maintenance instructions, as well as demonstrations of routine maintenance operations. A video tape of the field training course shall be prepared as a permanent record for future training use.

3.4.6 OPERATION AND MAINTENANCE MANUAL UPDATES

The O&M manual shall include the following:

A. General description of the treatment process;

B. A detailed description of equipment;

C. Process flow diagram;

D. Piping and instrumentation diagrams;

E. Certified drawings for equipment components and equipment layout;

F. Practical operating procedures including performance testing, influent, and effluent concentrations, and trend analysis of influent;

G. A complete set of fully updated and annotated piping and instrument diagrams, process flow diagrams, instrument indexes, control ladder logic diagrams, description of controls, alarms, interlocks, instrument interface, and maintenance procedures;

H. Specialty items such as type of oil and grease, desiccants, tools, analytical instruments, etc.;

I. Initial startup procedures;

J. Emergency and scheduled shutdown procedures;

K. Monitoring and quality control, spill controls;

L. Equipment specifications;

M. A list of modes of failure for each piece of equipment;

N. Fault/failure analysis, and troubleshooting guide;

O. List of spare parts;

P. Process safety and protective equipment requirements; and

Q. Record keeping (electronic or other) requirements.

In order to plan all the inspection and maintenance operations required for plant operation, a maintenance schedule shall be provided. The maintenance schedule shall include:

A. Scheduled maintenance procedure for each piece of equipment;

B. Sensor and measurement device calibration frequency;

C. Periodic reports regarding consumption of chemicals such as acid, caustic, polymer, and coagulants;

D. Electronic or other recording data;

E. Personnel training requirements;

F. The time required for each maintenance task;

G. Equipment shutdown and lock and tag requirements during maintenance/repair; and

H. Mothballing and preservation procedures for equipment layaway. The entire schedule and the results of each task shall be recorded for future analysis.

Other items shall be included as follows:

A. Spare parts list with suppliers and costs;

B. Plant utility requirements such as electrical, air, drinking water, service water, telephone, and sewer;

C. Detailed safety procedures for chemical handling; and

D. Name, address, and telephone number of technical personnel to contact in case of an emergency related to the treatment system.

Final acceptance of the GROUNDWATER TREATMENT system will not be given until these documents have been supplied, reviewed, and approved.

3.5 SPARE PARTS

Submit a list of spare parts with the manufacturer's part number, a current unit price and source of supply for each different material or equipment specified, after approval of the related submittals and not later than 2 months prior to the system startup. The list shall include: 1) parts recommended by the manufacturer to be replaced during the first 5 years of service, 2) a list of special tools recommended by the manufacturer for each type of equipment furnished including special tools necessary for adjustment, operation, maintenance, and disassembly and 3) spare parts data for each different item of equipment and materials specified.

END OF SECTION 11100

PART 1 GENERAL

1.01 WORK INCLUDED

A. The work includes, but is not limited to, the following principal systems and equipment:

1. 120/208-Volt System.
2. 480-System.
3. Motors.
4. Motor Control Centers.
5. Panelboards.
6. Conduit and Raceways.
7. Transformers.
8. Lighting fixtures and lamps.
9. Grounding and Lightning Protection.
10. Conductors.
11. Miscellaneous Controls and Equipment.

1.02 REFERENCE STANDARDS

A. Perform work, furnish and install materials and equipment in full accordance with the latest issue of the applicable rules, regulations, requirements, and specifications of the following:

1. Local laws and ordinances.
2. State and Federal Laws.
3. National Electrical Code (NEC).
4. State Fire Marshal.
5. Underwriters' Laboratories (UL).
6. National Electrical Safety Code (NESC).
7. American National Standards Institute (ANSI).
8. National Electrical Manufacturer's Association (NEMA).
9. National Electrical CONTRACTOR's Association (NECA) Standard of Installation.
10. Institute of Electrical and Electronics Engineers (IEEE).
11. Insulated Cable Engineers Association (ICEA).
12. Occupational Safety and Health Act (OSHA).
13. International Electrical Testing Association (NETA).
14. American Society for Testing and Materials (ASTM).
15. National Fire Protection Association (NFPA).
16. American Concrete Institute (ACI).
17. International Building Code (IBC).
18. Insulated Power Cable Engineers Association (IPCEA).
19. Association Edison Illuminating Company (AEIC).

B. Wherever the requirements of the Specifications or Drawings exceed those of the above items, the requirements of the Specifications or Drawings govern. Code compliance is mandatory.

C. Product Quality: All electrical items shall be new and unused. Items such as cables, transformers, motors, control centers, etc., shall be newly manufactured for this project. Proof of purchase documents shall be provided upon request. Utilize products of a single Manufacturer for each item.

1.03 CONTRACT DOCUMENTS

A. Intent:
1. The intent of the contract drawings or Plans is to establish the types of systems and functions, but not to set forth each item essential to the functioning of the system.
2. Electrical drawings are generally diagrammatic and show approximate location and extent of work.
3. Install the work complete, including minor details necessary to perform the function indicated.
4. In case of doubt as to work intended, or if amplification or clarification is needed, request instructions from the Engineer.
5. It is also the intent of these Contract Documents for the electrical and process system Contractor to coordinate with each other in order to provide a complete and workable system with all wiring, conduit and accessories required which may not be shown on the Plans.

B. Discrepancies:
1. Review pertinent drawings and adjust the work to conditions shown.
2. Where discrepancies occur between Plans, Specifications, and actual field conditions, immediately notify the Engineer for his interpretation.
3. Dimensions on electrical drawings shall be verified with structural, architectural and mechanical drawings.

C. Outlet and Equipment Locations:
1. Coordinate the actual locations of electrical outlets and equipment with building features and mechanical equipment as indicated on architectural, structural and mechanical drawings.
2. Review with the Engineer any proposed changes in outlet or equipment location.
3. Relocation of outlets before installation, up to 10 feet from the position indicated, may be directed by Owner without additional cost.
4. Remove and relocate outlets placed in an unsuitable location, when so requested by the Engineer.

1.04 REGULATIONS AND PERMITS

A. Regulations: Work, materials and equipment must comply with the latest rules and regulations of the following:
1. National Electrical Code (NEC).
2. National Electrical Safety Code (NESC).

3. National Fire Protection Association (NFPA70E)
4. Occupational Safety and Health Act (OSHA).
5. State and federal codes, ordinances and regulations.
6. Local Electrical Code.

B. Discrepancies:
1. The Plans and Specifications are intended to comply with listed codes, ordinances, regulations and standards.
2. Where discrepancies occur, immediately notify the Engineer in writing and ask for an interpretation.
3. Should installed materials or workmanship fail to comply, the Contractor is responsible for correcting the improper installation.
4. Additionally, where sizes, capacities, or other such features are required in excess of minimum code or standards requirement, provide those specified or shown.

C. Permits: Obtain certificates of inspection and other permits required as a part of the work.

1.05 CONTRACTOR QUALIFICATIONS

A. An acceptable Contractor for the work under this division must have personnel with experience, training, and skill to provide a practical working system. The Contractor shall have previous water and wastewater experience with at least 5 years in business.
1. The Contractor shall be required to furnish acceptable evidence of having installed not less than three systems of size and type comparable to this project.
2. The systems must have served satisfactorily for not less than 3 years.
3. The superintendent must have had experience in installing not less than three systems.
4. The Contractor shall submit qualifications of his firm and resumes of his personnel who will work on this project.
5. Contractor shall have performed a minimum of three projects with the Owner.

1.06 GENERAL REQUIREMENTS FOR WORKMANSHIP, EQUIPMENT AND MATERIALS

A. All electrical work shall be performed by workmen skilled in the electrical trade and licensed for the work by the local authority. (Licensed by the State of Texas)

B. A licensed Master Electrician will be required for the issuance of a building permit for constructing, installing, altering, maintaining, repairing, or replacing any electrical wiring, apparatus, or equipment on any voltage level. A licensed Master Electrician or a licensed Journeyman Electrician holding a current license in the State of Texas is required to be on the job site during the performance of any electrical work. Master Electrician shall spend minimum of 2 hrs per week at the job site reviewing work completed.

C. All cable splicing and termination methods and materials shall be of the type recommended by the splicing materials Manufacturer for the cable to be spliced, and shall be approved by the Engineer prior to installation.

D. All materials and equipment shall be installed in accordance with the approved recommendations of the Manufacturer, the best practices of the trade, and in

conformance with the Contract Documents. The Contractor shall promptly notify the Owner in writing of any conflict between any requirements of the Contract Documents and Manufacturer's directions, and shall obtain written instructions from the Owner before proceeding with the work. Should the Contractor perform any work that does not comply with the Manufacturer's directions or such written instructions from the Owner, he shall bear all costs arising in correcting deficiencies.

E. All equipment and materials shall be new, unless specifically noted otherwise, and shall bear the Manufacturer's name, trademark and ASME, UL, and/or other labels in every case where a standard has been established for the particular item. Equipment shall be the latest approved design of a standard product of a Manufacturer regularly engaged in the production of the required type of equipment, and shall be supported by a service organization that is, in the opinion of the Owner, reasonably convenient to the site.

F. It is the responsibility of the Contractor to insure that items furnished fit the space available with adequate room for proper operation and maintenance. He shall make measurements to ascertain space requirements, including those for connections, and shall furnish and install such sizes and shapes of equipment that, in the final inspection, will suit the true intent and meaning of the Plans, Specifications and Contract Documents.

G. The Contractor shall furnish and install all equipment, accessories, connections and incidental items necessary to complete the work, ready for use and operation by the Engineer/Owner.

H. When the Engineer/Owner has reviewed equipment submittals and given instructions to proceed with the installation of items of equipment that require arrangements or connections different from those shown on the drawings, it shall be the responsibility of the Contractor to install the equipment to operate properly and in accordance with the intent of the Plans and Specifications, and he shall provide any additional equipment and materials that may be required. The Contractor shall be responsible for the proper location of roughing-in and connections by other trades. All changes shall be made at no increase in the Contract Amount or additional costs to other trades.

I. The Contractor shall support the installation of all equipment, plumb, rigid and true to line. The Contractor shall determine how equipment, fixtures, conduit, etc., are to be installed, and shall provide foundations, bolts, inserts, stands, hangers, brackets and accessories for proper support whether or not shown on the drawings.

1.07 SHOP DRAWINGS AND PRODUCT DATA

A. Data Required:

1. Submit shop drawings, product data and all other required information as specified in Division 1. Submittals are required on all products and items to be installed on this project.
2. Submittal data must show Manufacturer's name, published ratings or capacity data, detailed equipment drawing for fabricated items, panel diagrams, wiring diagrams, installation instructions and other pertinent data.

3. Where literature is submitted covering a group or series of similar items, the applicable items must be clearly indicated. Mark through items not being provided and clearly identify all options being provided.
4. Do not combine submittal for multiple Specifications Sections.

B. Submittal Items: Submittals are required for all equipment and materials to be used on this project. Submittals shall be complete with all pertinent information and installation details. Assume all costs and liabilities which may result from the ordering of any material or equipment prior to the review of the shop drawings or submittals, and no work shall be done until the shop drawings or submittals have been reviewed. In case of correction or rejection, resubmit until such time as they are accepted by the Owner's Representative, and such procedures will not be cause for delay

C. Terminal Connection Diagrams:
1. Submit terminal connection diagrams for approval prior to any wire installation.
2. Submit finalized terminal connection diagrams at the end of the Contract.
3. All Manufacturers named are a basis as a standard of quality and substitutions of any equal product will be considered for acceptance. The judgment of equality of product substitution shall be made by the Engineer.

1.08 SYSTEM RESPONSIBILITY

A. The Contractor shall be responsible for:
1. Complete systems in accordance with the intent of these Contract Documents.
2. Coordinating the details of facility equipment and construction for all Specification Divisions which affect the work covered under Division 16, Electrical.
3. Furnishing and installing incidental items not actually shown or specified, but which are required by good practice to provide complete functional systems.
4. Coordinate the work with the instrumentation Contractor.
   a. The Instrument Contractor shall furnish and install the primary and secondary instruments.
   b. The conduit and wiring to and from the instruments shall be furnished and installed by the Electrical Contractor. Termination in the instrument shall be by the Instrument Contractor.
   c. All terminations in the control panel shall be by the Instrument Contractor.
   d. The Electrical Contractor shall provide termination drawings for the instrumentation Contractor.
   e. The equipment pad for the control panels, consoles and instrument panels shall be furnished by the Electrical Contractor.
   f. The Electrical Contractor shall coordinate the testing of the electrical system being furnished. He shall be responsible for the equipment he is supplying.
   g. The Electrical Contractor shall be present at the time of the instrument system testing and start-up. He shall be responsible to coordinate the testing of the facility with the Instrument Contractor, Engineer, and Owner.
   h. The Electrical Contractor shall coordinate the interface requirement between each starter and control panel furnished under this Contract with the Instrument Contractor.

B. Electrical plan drawings show only general locations of equipment, devices, and raceway, unless specifically dimensioned. The Contractor shall be responsible for the proper routing of raceway, subject to the approval of the Engineer.

C. Submit to the Engineer in writing details of any necessary, proposed departures from these Contract Documents, and the reasons therefore. Submit such request as soon as practicable, and within ten (10) days after award of the Contract. Make no such departures without written approval of the Engineer.

D. Dimensions on electrical drawings shall be verified with structural, architectural, and mechanical drawings.

E. Where the Contractor is submitting a packaged system, Contractor shall meet the requirements of electrical specifications (16000). This includes field cables, conductors, labeling, relays, terminal blocks, conduits, junction boxes, circuit breakers, combination starters, pushbuttons, pilot lights, and motors. Deviations shall not be accepted, unless approved in writing in advance. Control centers and special control cabinets wired to terminal blocks shall include the Manufacturer's standard quality, unless specifically mentioned to the contrary on the drawings or in the specifications.

F. Maintain continuity of electric service to functioning portions of the process or buildings during hours they are normally in use. Temporary outages will be permitted during cutover work at such times and places as can be prearranged with the Owner’s designated Representative. Give the owner a minimum of one weeks notice prior to any shutdowns. Such outages shall be kept to a minimum number and minimum length of time. Make no outages without prior written authorization of the Engineer. Include costs for temporary wiring and overtime work required in the Contract price. Remove temporary wiring at the completion of the work. The Contractor shall be responsible to provide and pay for temporary power to any facility during construction to facilitate the new construction. If generator is needed Contractor shall be responsible for all the cost associated with, including fuel.

G. Unless shown in detail, the drawings are diagrammatic and do not necessarily give exact details as to elevations and routing of raceways, nor do they show all offsets and fittings; nevertheless, install the raceway system to conform to the structural and mechanical conditions of the construction.

H. Cabling inside equipment shall be carefully routed, trained, and laced. Placing cables so that they obstruct equipment devices is not acceptable.

PART 2 PRODUCTS

2.01 PRODUCT REQUIREMENTS

A. Condition: Materials and equipment provided under these Specifications must be new products of Manufacturers regularly engaged in production of such equipment. Provide the Manufacturer’s latest standard design for the type of equipment specified.

B. NEC and UL: Products must conform to requirements of the National Electrical Code. Where Underwriters' Laboratories have set standards, listed products, and issued labels, products used must be listed and labeled by UL.

C. NEMA and IEC: Only NEMA rated equipment is acceptable. IEC or dual rated NEMA/IEC equipment are not acceptable.

D. Space Limitations: Equipment selected must conform to the buildings features and must be coordinated with them. Do not provide equipment that will not suit arrangement and space limitations.

E. Factory Finish: Equipment must be delivered with a hard surface, factory-applied finish so that no additional field painting is required.

F. Field Installation: All field installed equipment, conduit, etc., shall require Type 316 stainless steel nuts, bolts, washers, metal framing and supports, and other items as indicated on the Plans.

G. Seismic Design: All electrical equipment to be designed in accordance with/IBC-2006 & ASCE 7-05 code for Seismic Design.

PART 3 EXECUTION

3.01 PROTECTION OF EQUIPMENT

A. Moisture:
   1. During construction, provide heaters to protect switchgear, transformers, motors, control equipment, and other items from moisture absorption and corrosion.
   2. Apply protection immediately on receiving the products and provide continuous protection.
   3. Store all equipment indoors in dry, well ventilated and heated space.

B. Clean: Keep products clean by elevating above ground or floor and by using suitable coverings.

C. Damage: Take such precautions as are necessary to protect apparatus and materials from damage. Failure to protect materials is sufficient cause for rejection of the apparatus or material in question.

D. Finish: Protect factory finish from damage during construction operations and until final acceptance of the project.

E. Protect Equipment per the Manufacturer's requirements.

3.02 INSTALLATION

A. Cooperation with Other Trades:
   1. Cooperation with trades of adjacent, related or affected materials or operations, and of trades performing continuations of this work under subsequent contracts, is considered a part of this work in order to effect timely and accurate placing of work and to bring together, in proper and correct sequence, the work of such trades.
   2. Coordinate equipment layout in sufficient time to be coordinated with work of others, provide drawings and layout work showing exact size and location of sleeves, openings or inserts for electrical equipment in slabs, walls, partitions and chases.

B. Workmanship: Work must be performed by workmen skilled in their trade. The installation must be complete whether the work is concealed or exposed.

C. Concrete Equipment Pads:

1. Install minimal 4-inch-thick concrete housekeeping pads with chamfered edges for indoor and outdoor floor mounted equipment.
2. Pour pads on roughened floor slabs, sized so that outer edges extend a minimum of 3 inches beyond indoor equipment.
3. Exterior pads shall extend one foot beyond the equipment, including cooling fins.
4. Trowel pads smooth and chamfer edges to a 1-inch bevel.
5. Provide dowels in slab, and rebar between the dowels.
6. Pads must drain away from the equipment.
7. Secure equipment to pads as recommended by the Manufacturer.
8. Follow structural detail where applicable.

D. Setting of Equipment:
1. Equipment must be leveled and set plumb.
2. Stainless Steel 316 enclosures mounted against a wall must be separated from the wall not less than 1/2-inch by means of corrosion resistant 316 Stainless Steel spacers or by 3- inches of air for freestanding units. Mount on shallow 316 Stainless Steel unistrut.
3. Stainless Steel 316 bolts, nuts and washers to anchor the equipment.

E. Sealing of Equipment:
1. Permanently seal outdoor equipment at the base using concrete grout.
2. Seal or screen openings into equipment to prevent entrance of animals, birds and insects.
3. Use stainless steel mesh with openings not larger than 1/16-inch squares for screened openings.
4. Seal small cracks and openings from the inside with silicone sealing compound.

F. Concealed Work: Conceal electrical work in walls, floors, chases, under floors, underground and above ceilings except:
1. Where shown or specified to be exposed. Exposed is understood to mean open to view.
2. Where exposure is necessary to the proper function.
3. Where size of materials and equipment precludes concealment.

3.03 TESTING

A. Test Conditions:
1. Place circuits and equipment into service under normal conditions, collectively and separately, as may be necessary to determine satisfactory operation.
2. Perform specified tests in the presence of the Engineer, as specified in Division 1 - General Provisions and 16 - Electrical.
3. Furnish all instruments, wiring, equipment, and personnel required for conducting tests. Engage the services of an independent contractor if required. Test equipment shall be calibrated within the last 6 months.
4. Demonstrate that the equipment operates in accordance with requirements of the plans and specifications.

5. No process equipment is to be operated until any associated HVAC equipment and auxiliary equipment is operational.

B. Test Dates: Schedule final acceptance tests sufficiently in advance of the Contract completion date to permit completion of any necessary adjustment or alterations within the number of days allotted for completion of the Contract.

C. Retests: Conduct retests as directed by the Engineer of such time duration as may be necessary to assure proper functioning of adjusted or altered parts or items of equipment. Any resultant delay as a result of such necessary retests does not relieve the Contractor of his responsibility under this contract. Provide notice to Engineer and Owner of testing 30-days prior to testing.

3.04 PROJECT RECORD DOCUMENTS

A. Preparation:

1. At the job site, maintain a set of white prints of the contract drawings.
2. At the job site, maintain a set of equipment terminal connection diagrams.
3. On the prints, record field changes and diagrams of those portions of work in which actual construction is at variance with the contract drawings.
4. Mark the drawings with a colored pencil. Record installed feeder conduits, dimensioning the exact location and elevation of the conduit.

B. Delivery: Deliver record drawings to the Engineer in the number and manner specified in Division 1 - General Requirements.

3.05 CUTTING AND PATCHING

A. Lay out work carefully in advance. Do not cut or notch any structural member or building surface without specific approval of the Engineer. Carefully carry out any cutting, channeling, chasing, or drilling of floors, walls, partitions, ceilings, paving, or other surfaces required for the installation, support, or anchorage of conduit, raceways, or other electrical materials and equipment. Following such work, restore surfaces neatly to original condition.

3.06 LOAD BALANCE

A. The Drawings and Specifications indicate circuiting to electrical loads and distribution equipment. Balance electrical load between phases as nearly as possible on switchboards, panelboards, motor control centers, etc.

3.07 MOTOR ROTATION

A. Before and after final service connections are made, check and correct as necessary the rotation of motors.

B. Coordinate rotation checks with the Engineer and the Contractor responsible for the driven equipment. Submit a written report to the Engineer for each motor verifying that rotation has been checked and corrected.

3.08 CLEANING AND TOUCH-UP PAINTING

A. Touch up scratches, scrapes, or chips in interior and exterior surfaces of devices and equipment with finishes matching as nearly as possible the type, color, consistency, and type of surface of the original finish. If extensive damage is done to equipment paint surfaces, refinish the entire equipment in a manner that provides finish equal to or better than the factory finish, and that meets the requirements of the Specifications and is acceptable to the Engineer.

B. Remove all temporary labels, dirt, paint, grease and stains from all exposed equipment. Upon completion of work, clean equipment and the entire installation so as to present a first class job suitable for occupancy. No loose parts or scraps of equipment shall be left on the premises.

C. All temporary wiring, wiring devices and associated equipment shall be removed upon completion of the project.

END OF SECTION

PART 1 GENERAL

1.01 SCOPE

A. This item of the specifications describes the wiring to be furnished and installed on the project. Contractor shall furnish and install all wiring required to make the electrical system completely and satisfactorily operable and shall comply with the National Electrical Code, all applicable federal, state, and local codes, regulations and ordinances.

1.02 REFERENCES

Code	*Title*
NFPA 70	National Electrical Code (NEC).

Standard	*Title*
UL 44	Thermoset – Insulated Wires and Cables.
NECA WC-70	Power Cables rated 2000V or less for distribution of electrical energy.
ASTM B8	Standard Specification for concentric-lay-stranded copper conductors hard, medium-hard and soft.
UL 510	Polyvinyl chloride, polyethylene, and rubber insulated tape.

1.03 SUBMITTALS

A. Submittals shall be made in accordance with the requirements of Specification SS-01300, “Submittals”.

B. Operations and Maintenance (O&M) Manuals shall be made in accordance with the requirements of Specification S01730.

1.04 APPLICABLE STANDARDS

1.05 CONDUCTOR COLOR CODING

– For power conductors, provide all single conductor power cables with integral insulation pigmentation of the designed colors, except conductors larger than No.6 may be provided with color coding by wrapping the conductor at each end and at all accessible locations with vinyl tape. Where this method of color-coding is used, wrap at least six full overlapping turns of tape around the conductor covering an area 1-1/2 to 2 inches wide at a visible location.

– phase A, B, and C implies the direction of positive phase rotation.

– use City of Austin standard wire color code:

The color of the wire shall be selected to conform in all instances to the following table:

VOLTAGE, 3 PHASE

PHASE	480/277	120/208	120/240
A	BROWN	RED	RED
B	YELLOW	BLACK	ORANGE (High Leg)
C	PURPLE	BLUE	BLACK
G	GREEN	GREEN	GREEN
N	GRAY	WHITE	WHITE

VOLTAGE, 1 PHASE

PHASE	120/240
A	RED
B	BLACK
G	GREEN
N	WHITE

DC CIRCUIT INSTALLED IN A RACEWAY

24 VDC	
+	Blue
-	Brown

CONTROL PANEL WIRING

AC Controls	Red
Annunciator Contacts	Yellow
DC Controls	Blue
DC (+) Power	Red
DC (-) Power	Black
AC Hot	Black
AC Neutral	White

PLC/RTU Contacts	Purple

NOTE: All wiring shall be color coded and tagged according to city wire tagging standard.

PART 2 PRODUCTS

2.01 GENERAL

A. Unless noted elsewhere in specifications all power and control wire shall be 98% conductivity copper, stranded, conductor THWN-2/THHN-2. All conductors, with the exception of grounding conductors shall be stranded copper.

B. Utilize only conductors meeting applicable requirements of UL 44, UL 1685 and NEMA WC70.

C. All control panel wiring shall be flexible 41 strand #14 AWG, 600 volt insulation type SIS tinned copper, color coded as outlined in this specification.

D. All wire on this project shall be new, unused, in good condition and shall be delivered in standard coils, packages or reels. If wire used is different than what is specified, samples of wire shall be submitted for the purpose of determining acceptability of the wire. Wire which has been rejected shall not be used again. Such rejected wire shall be removed from the Owner's premises. Decisions as to the quality of the wire furnished and the acceptance of such wire shall be made by the Owner or his representative.

E. No power conductors smaller than No. 12 wire shall be used except for control and alarm wiring where No. 14 wire shall be used as minimum size wire when protected by a 15 amp fu se/breaker.

F. The contractor may, if he deems it necessary or advisable, use larger sized conductors than those required. In no case shall there be a voltage drop greater than that allowed by the N.E.C.

G. Instrument wiring (4-20 milliamp signal wiring) shall be twisted pair, #16 AWG stranded copper conductor with PVC 600 volt insulation over each conductor, a tinned copper drain wire, an overall aluminum mylar shield and an outer overall PVC jacket (35 mils). Jacket shall be flame retardant and sunlight and oil resistant. Shield aluminum mylar shall be overlapped to provide a 100% coverage. Single pair instrumentation wiring shall be designed for noise rejection for process control, computer or data log applications. Cable shall be suitable for installation in cable tray, conduit or other approved raceways. Minimum cable temperature rating shall be 90° C dry locations, 75° C wet locations.

H. Single triad cable shall be #16 AWG stranded copper conductor with PVC 600 volt insulation over each conductor, a tinned copper drain wire, an overall aluminum mylar shield and an outer overall PVC jacket (35 mils). Jacket shall be flame retardant and sunlight and oil resistant. Shield aluminum mylar shall be overlapped to provide a 100% coverage. Single triad instrumentation wiring shall be designed for noise rejection for process control, computer or data log applications. Cable shall be suitable

for installation in cable tray, conduit or other approved raceways. Minimum cable temperature rating shall be 90° C dry locations, 75° C wet locations.

I. Multiconductors are not acceptable.

J. Splices are not acceptable on this project, except at light fixtures and receptacles.

PART 3 EXECUTION

3.01 INSTALLATION

A. Support all conductors in vertical conduits or raceways in the manner set forth in Item 300-19 of the latest revision of the National Electric Code. Do not use lighting fixtures for raceways or circuits other than parallel wiring of fixtures.

B. Do not make any splices or taps in any conductor except where absolutely required for 120 volt circuits feeding lights or receptacles. Such splicing may only take place in splice/junction boxes. Elapsed time meters are the only exception to not using a junction box.

C. Tag all power wiring in all pull boxes, wire ways, motor control center wire ways, panel board wiring gutters, light switch boxes, receptacles, disconnect switches etc. Use flame slip-on type tags, approved for this use, as manufactured by "Brady", or approved equal. See Section 16205, Wire and Cable Tagging Standard for additional requirements.

D. All devices (relays, terminal blocks, etc.) shall be labeled using phenolic labels.

E. All interconnect wiring going from one compartment to another, or between two separate pieces of equipment must terminate at a terminal block on each end, i.e. entering and leaving a compartment or piece of equipment.

F. All wiring passing between cabinets shall be protected by a rubber grommet or approved nipple with bushings.

G. All wire terminations shall be made with a mechanical compression type lug or terminal specifically designed to accept stranded wire. Do not terminate by wrapping the wire around the screw.

H. Number 8 AWG and larger wire shall utilize a crimper with a die set to install lugs to the wire.

I. No more than two wires/ lugs per terminal will be allowed unless ring type lugs are used. A maximum of three wires will be permitted if all wires are using ring lugs.

J. All current transformer loops shall utilize ring terminals and shorting terminal boards to avoid open circuiting the secondary of a CT.

K. All wiring run to the front door panel shall have a spiral wrap and ty wrapped to protect wires from being pinched between door and panel. A loop shall be provided to allow door to open freely.

L. All main panel wiring shall be run in a raceway such as Panduit. All wiring run from the Panduit to the devices shall be neatly run and ty wrapped. If Panduit is not practical, wires shall be neatly run and ty wrapped.

M. Equipment grounding wire run in conduit shall have an identifying green covering or green color coding at each end terminations and at junction box or pull box locations along its run length.

N. Where the capacity of a single feeder is so great as to require parallel conductors in more than 1 conduit, each conduit must contain the same number and length of conductors in all phases (legs) of the feeder, including any neutral conductors per the N.E.C.

O. Under no circumstance shall circuits above 600 volts and those below 600 volts be pulled in the same conduit.

P. Separate low level circuits (such as phone line) from noisy and power circuits by a minimum distance of 1 foot.

Q. Separate electrical buried electrical conduits from other buried utilities by a minimum distance of 1 foot to allow for maintenance of either the electrical or the other utility lines without disturbing the other.

R. Bolted connections for electrical conductors, without non-corrosive surfaces, shall be thoroughly cleaned and tinned or covered with a light film of commercial paste to prevent oxidation. Acceptable manufacturers are Noalox or approved equal.

S. Where mechanical assistance is used for pulling conductors, a wire pulling compound, Polywater, or equal, having inert qualities that do not harm the wire insulation or covering shall be free from grease, filings or foreign matter before conductors are pulled. Do not exceed cable Manufacturer's recommendations for maximum pulling tensions and minimum bending radii.

T. Wiring shall be tagged with Brady Wire Markers, or equal, at panel boards, and all termination points with numbers conforming to the City of Austin Wire and Cable Tagging Standard.

U. Lighting and receptacle wiring may use silicone filled spring type wire connectors in approved locations. This applies to lighting and receptacle circuits only.

V. In no case shall 24 volt DC circuits and AC circuits be pulled in the same conduit or raceway.

END OF SECTION

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes surge protective devices for low-voltage power, control, and communication equipment.

1.03 DEFINITIONS

A. ATS: Acceptance Testing Specifications.

B. SVR: Suppressed Voltage Rating.

C. SPD: Surge Protective Device

1.04 SUBMITTALS

A. Product Data: For each type of product indicated, include rated capacities, operating weights, operating characteristics, furnished specialties, and accessories.

B. Product Certificates: For surge protective devices, signed by product manufacturer certifying compliance with the following standards:
1. UL 1283 - Electromagnetic.
2. UL 1449 3rd Edition – UL Standard for Surge Protective Devices.

C. Qualification Data: For testing agency.

D. Field quality-control test reports, including the following:
1. Test procedures used.
2. Test results that comply with requirements.
3. Failed test results and corrective action taken to achieve requirements.

E. Operation and Maintenance Data: For transient voltage suppression devices to include in emergency, operation, and maintenance manuals.

F. Warranties: Special warranties specified in this Section.

1.05 QUALITY ASSURANCE

A. Source Limitations: Obtain surge protective devices and accessories through one source from a single manufacturer.

B. Product Options: Drawings indicate size, dimensional requirements, and electrical performance of suppressors and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. Comply with IEEE C62.41, "IEEE Guide for Surge Voltages in Low Voltage AC Power Circuits," and test devices according to IEEE C62.45, "IEEE Guide on Surge Testing for Equipment Connected to Low-Voltage (1000 Volts or less) AC Power Circuits."

E. Comply with NEMA LS 1, "Low Voltage Surge Protection Devices."

F. Comply with UL 1283, "Electromagnetic Interference Filters," and UL 1449, "Standard for Surge Protective Devices."

1.06 PROJECT CONDITIONS

A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
1. Notify Engineer not less than two days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Engineer's written permission.

B. Service Conditions: Rate surge protection devices for continuous operation under the following conditions, unless otherwise indicated:
1. Maximum Continuous Operating Voltage: Not less than 115 percent of nominal system operating voltage.
2. Operating Temperature: 30 to 120 deg F (0 to 50 deg C).
3. Humidity: 0 to 85 percent, non-condensing.
4. Altitude: Less than 20,000 feet (6090 m) above sea level.

1.07 COORDINATION

A. Coordinate location of field-mounted surge protective devices to allow adequate clearances for maintenance.

1.08 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of any surge suppressor that fails due to materials or workmanship within ten year from date of Project Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. General Electric Company.
2. Innovative Technology, Inc.
3. Square D/ Schneider Electric.
4. Eaton/Cutler Hammer.

2.02 480V SWITCHBOARD AND 480V MCC SUPPRESSORS

A. Surge Protective Devices with the following features and accessories:
   1. Fuses, rated at 200-kA interrupting capacity.
   2. Fabrication using bolted compression lugs for internal wiring.
   3. Integral disconnect switch.
   4. Redundant suppression circuits.
   5. Redundant or replaceable modules.
   6. Arrangement with copper bus bars and for bolted connections to phase buses, neutral bus, and ground bus.
   7. Arrangement with wire connections to phase buses, neutral bus, and ground bus.
   8. LED indicator lights for power and protection status.
   9. Audible alarm, with silencing switch, to indicate when protection has failed.
   10. One set of dry contacts rated at 5 A and 250Vac, for remote monitoring of protection status. Coordinate with building power monitoring and control system.
   11. Surge-event operations counter.

B. Surge suppressor shall be of type 2.

C. Peak Single-Impulse Surge Current Rating: 150kA/mode.

D. Connection Means: Permanently wired.

E. Protection modes and UL 1449 SVR for grounded wye circuits with voltages of 480Y/277, 3-phase, 4-wire circuits shall be as follows:
   1. Line to Neutral: 1500V
   2. Line to Ground: 1200V
   3. Neutral to Ground: 1200V

F. Protection modes and UL 1449 SVR for voltages of 480, 3-phase, 3-wire, delta circuits shall be as follows:
   1. Line to Line: 3000V
   2. Line to Ground: 1800V

2.03 PANELBOARD SUPPRESSORS

A. Surge Protective Device with the following features and accessories:
   1. Fuses, rated at 200-kA interrupting capacity.
   2. Fabrication using bolted compression lugs for internal wiring.
   3. Integral disconnect switch.
   4. Redundant suppression circuits.

5. Redundant replaceable modules.
6. Arrangement with wire connections to phase buses, neutral bus, and ground bus.
7. LED indicator lights for power and protection status.
8. Audible alarm, with silencing switch, to indicate when protection has failed.
9. One set of dry contacts rated at 5 A and 250Vac, for remote monitoring of protection status. Coordinate with building power monitoring and control system.
10. Surge-event operations counter.

B. Peak Single-Impulse Surge Current Rating: 120 kA / phase

C. Protection modes and UL 1449 SVR for grounded wye circuits with voltages of 480Y/277, 3-phase, 4-wire circuits shall be as follows:
1. Line to Neutral: 1200 V for 480Y/277.
2. Line to Ground: 1000 V for 480Y/277.
3. Neutral to Ground: 1000 V for 480Y/277.

D. Protection modes and UL 1449 SVR for grounded wye circuits with voltages of 208Y/120, 3-phase, 4-wire circuits shall be as follows:
1. Line to Neutral: 700V for 208Y/120.
2. Line to Ground: 600V for 208Y/120.
3. Neutral to Ground: 600V for 208Y/120.

2.04 ENCLOSURES

A. Install surge protective devices in the same cabinet as the MCC and 480V and 120/208V panelboards.

PART 3 EXECUTION

3.01 INSTALLATION OF SURGE PROTECTION DEVICES

A. Surge protective devices shall be installed by the MCC and panelboard manufacturer at the factory.

3.02 PLACING SYSTEM INTO SERVICE

A. Do not energize or connect service entrance equipment, panelboards, control terminals, data terminals to their sources until surge protection devices are installed and connected.

3.03 FIELD QUALITY CONTROL

A. Remove and replace malfunctioning units and retest.

3.04 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain transient voltage suppression devices.

END OF SECTION

PART 1 GENERAL

1.01 SCOPE

A. Provide grounding in accordance with the plans, these specifications and the N.E.C. Included within this specification are furnishing and installing all the wire, rods, connections, ground plates, etc., associated with the grounding system.

1.02 SUBMITTALS

A. Submittals shall be made in accordance with the requirements of Specification S01300, "Submittals" and shall include but not be restricted to the following:
   1. Grounding materials, equipment and processes,
   2. Product data: for each product supplied.

1.03 REFERENCES

A. The following standards shall apply as if written here in their entirety:

Code	*Title*
NFPA 70	National Electrical Code (NEC)

Standard	*Title*
ANSI 142	Recommended practice for grounding of Industrial and Commercial power systems
UL 467	Grounding and Bonding equipment

PART 2 PRODUCTS

A. Ground rods:
   1. Ground rods shall be ¾-inch diameter by 10'-0" long, copper clad steel by Copperweld, Teledyne Penn-Union, or equal.
   2. Listing: UL467.

B. Connectors shall be as follows:
   1. Below grade: Cadweld, Brundy Thermoweld, or equal thermite reaction welding system.
   2. Above grade: Burndy Type GAR, GB, GBM or GG as required or equal.

C. Wire shall be green insulated THW stranded copper. Use bare copper for grounding grids, loops, etc.

D. Ground rod boxes

1. Precast box with cast iron lid. Lid shall read “ground rod” on top. Brooks precast model “3-RT” or approved equal. Ground rod boxes located in driveway shall have AASHO H-20 rating.

E. Certification
1. Contractor shall receive proper training from the manufacturer prior to execution of the exothermic weld connection.

F. Grounding for instrumentation system
1. Ground loop for instrumentation system shall be connected at only one point to the building ground system.

G. Ground loop
1. All ground loop conductor shall be tin plated bare copper minimum wire size shall be #3/0 unless otherwise noted.

PART 3 EXECUTION

3.01 GROUND GRID

A. Install sufficient ground rods in addition to those shown or code required grounding so that resistance to ground as tested by standard methods meet the requirements of paragraph 3.2.I of this specification.

B. Use a fusion process, Burndy Thermoweld, Cadweld, or equal to make connections to ground rods; and, at any joint or connection which will be inaccessible after the construction. Do not cover until each connection has been inspected by the Owner.

C. One ground rod to be accessible for grid testing, connections, etc. Utilize a ground well with removable cover. Connections at this rod to be mechanical type so ground resistance can be tested.

D. Install additional grounding conductor to rebar in building slab and connect back to test well.

3.02 GENERAL EQUIPMENT GROUNDING

A. Ground all electrical equipment, lights, receptacles, etc., with a separate equipment ground wire installed in the conduit with the power conductors.

B. Provide equipment ground wire in all runs of conduit.

C. Install grounding system electrically and mechanically continuous throughout. Do not bond to the system neutral except at the service transformer or disconnect.

D. Install a bonding jumper from the grounding lug on each conduit to the ground bar or bus.

E. Where the equipment has no facility to attach an equipment ground wire, use a Burndy Quicklug or equal. Clean the metal surface under the lug to bright metal so that good contact can be made.

F. Provide a PVC sleeve where bare ground wire passes through concrete slab at or above ground level, where applicable.

G. Connect ground wires entering outlet boxes in such a manner that removal of the receptacle will not interrupt the continuity of the grounding circuit. A grounding screw attached to the box, and used for no other purpose, may be used to accomplish this.

H. Install a separate ground rod for lighting poles. Rod to be brought up through foundation into base of light fixture (See drawing detail).

I. Measure the ground grid resistance with the earth test megger and install additional ground rods and conductors as required until the resistance to ground is less than 2 ohms to ground for power and 1 ohm to ground for instrumentation.

J. Field test:

1. Testing shall be performed in accordance with section S16060 Acceptance Testing and Calibration.

END OF SECTION

ITEM NO. 854
SANITARY SEWER LATERALS

854.1 DESCRIPTION: This item shall govern sanitary sewer laterals installed in accordance with these specifications and as directed by the Engineer. This item shall also consist of the installation of a two-way sewer cleanout at the property line.

854.2 SUBMITTALS: Contractor shall submit manufacturer's product data, instructions, recommendations, shop drawings, and certifications.

854.3 MATERIALS: The materials for sanitary sewer laterals shall conform to the specification contained in Item No. 848, "Sanitary Sewers."

854.4 CONSTRUCTION:

1. Sanitary sewer laterals fittings and appurtenances shall conform to the material specifications and shall be installed by the Contractor as specified herein, or as directed by the Inspector or the Engineer and in accordance with the DD-854 Standard Drawing Series. When the lateral is within the Edwards Underground Recharge Zone, it shall be installed in accordance with Standard Drawing DD-854-ERZD.

2. Designation of Lateral: A sewer pipe located between the sanitary sewer main and the customer's premise, is designated as a "sanitary sewer lateral."

3. Lateral Installation: All lateral installations shall be performed in accordance with Item Nos. 848; "Sanitary Sewers" 804, "Excavation, Trenching and Backfill," and as described herein. For sanitary sewer mains that are 12 inch in diameter or smaller, all laterals shall be connected using the appropriate size tee/wye placed in line with the main line. For mains larger than 12 inch, insert-a-tee conforming to ASTM 3034-08, or approved or equal, shall be used. Where waterline crossings with sanitary sewer laterals are less than the regulated separation distances, all lateral piping shall be SDR-26 PVC pipe (ASTM D2241-09), with a pressure rating of 150 psi.

   Connection to the customer's end of the lateral shall be performed using a flexible coupling, or pre-approved equal. All flexible couplings shall be concrete-encased to prevent movement or breakage of the steel bands. All

cleanouts at job sites shall have installed an approved heavy duty sanitary sewer cap.

Cutting, excavation, and backfill shall be as specified herein and in accordance with applicable sections of Item No. 804, "Excavation, Trenching, Backfill."

854.5 **MEASUREMENT:** Sanitary sewer laterals shall be measured by the linear feet installed at the various diameter sizes. The measured dimension shall be taken from the centerline of the main to the connection at – or just inside – the customer's property line. Measurement will be continuous through any fittings in the main.

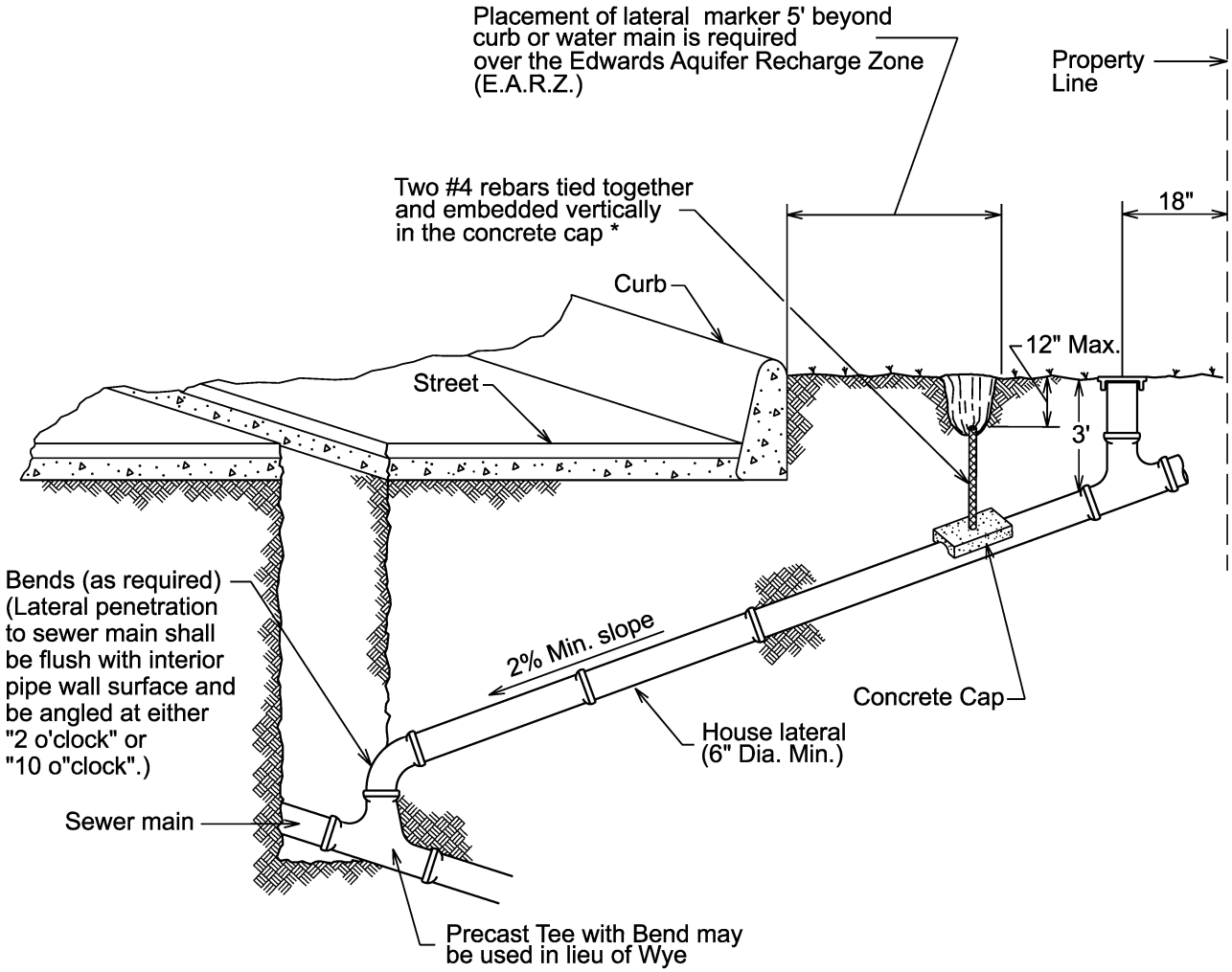
854.6 **PAYMENT:** Sanitary sewer laterals shall be paid for at the contract bid price per linear foot complete in place for the type, and size constructed. Price shall be full compensation for furnishing all materials, including pipe, pipe fittings (to include wyes, tees, bends), pumping, bedding, trenching or boring, trench protection, backfilling, tamping, cutting pavement and surface structures of whatever type encountered and replacement with whatever type specified and other incidentals required to complete the work.

When the minimum separation distances for any water and sewer piping facilities cannot be maintained per 30 TAC §217.53, contractor shall install SDR-26 PVC pipe (150 psi pressure rated). Payment for this higher pressure rated pipe shall be made at the contract bid price per linear foot complete in place for the type and size constructed.

Payment for the installation of the two-way cleanout shall be paid per each under the applicable line item. Only one-way cleanouts are required on the termination point of a dead-end main.

- End of Specification -

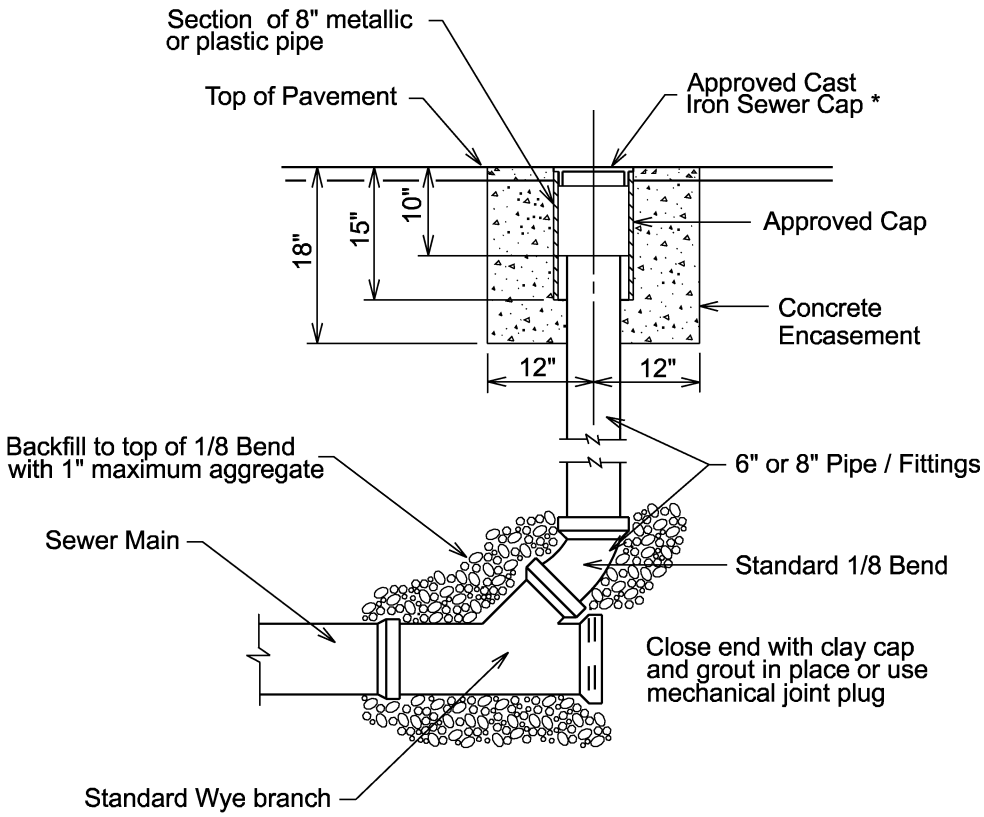
Depth and grade of service laterals as shown, are typical only. Actual depth, alignment and grade of service laterals shall be determined by the Engineer based on the elevations of the sewer main, street, natural ground and building to be serviced.

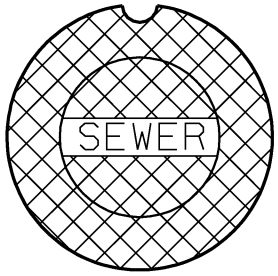


HOUSE LATERAL DETAIL

Note:
A minimum of 3' of cover to subgrade is necessary, otherwise concrete encasement will be required.

PROPERTY OF SAN ANTONIO WATER SYSTEM SAN ANTONIO, TEXAS	HOUSE LATERAL DETAIL (IN THE E.A.R.Z.)	APPROVED MARCH 2008	REVISED APRIL 2014
		DD-854-ERZD	SHEET 1 OF 1

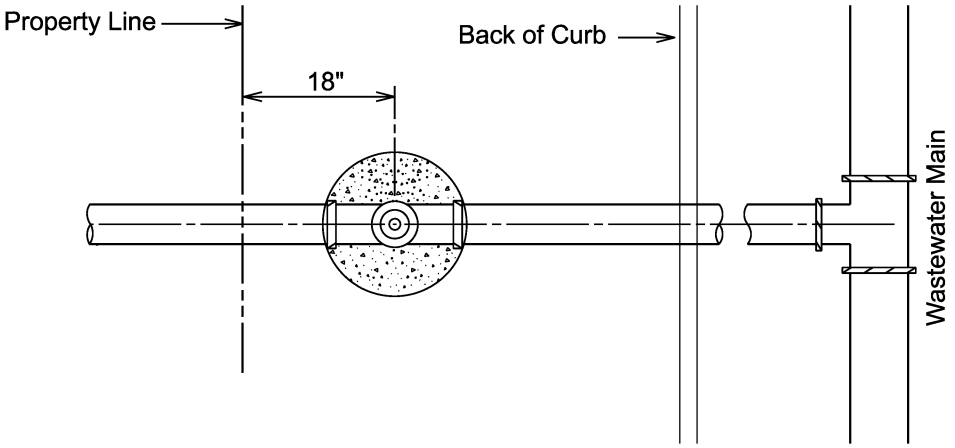




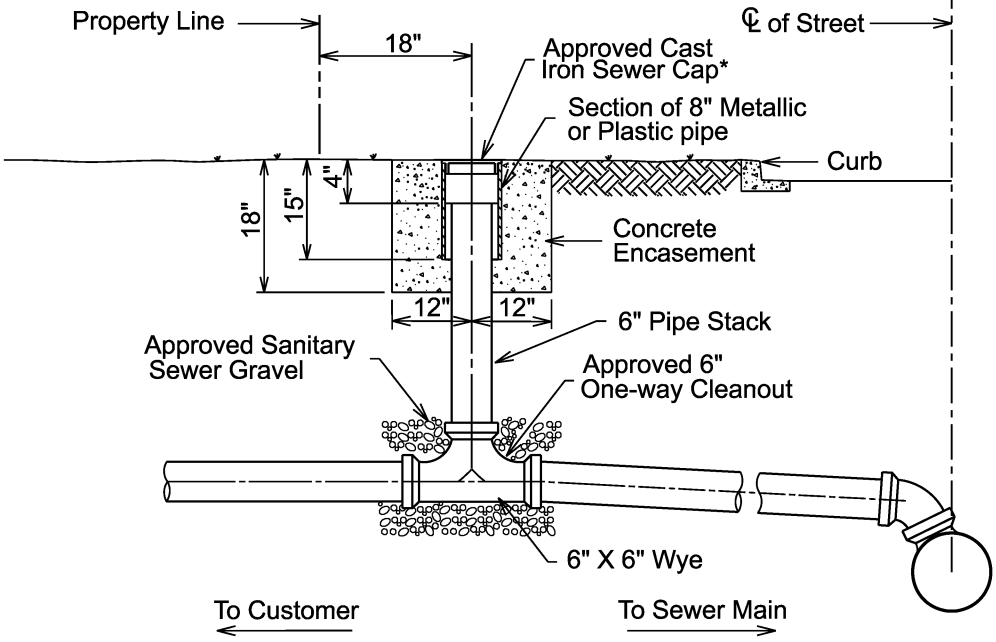
* Approved Gate Cap
(Heavy Duty)

Note: Depending upon the type of service that an 8 inch lateral (on a dead end main) is providing, A standard manhole in liev of is cleanout may be required. Consult with the SAWS Inspector.

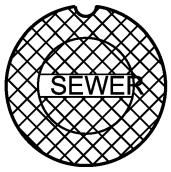
PROPERTY OF SAN ANTONIO WATER SYSTEM SAN ANTONIO, TEXAS	TYPICAL 6" OR 8" CLEANOUT DETAIL (ON DEAD-END MAIN)	APPROVED MARCH 2008	REVISED APRIL 2014
		DD-854-02	SHEET 1 OF 2



PLAN



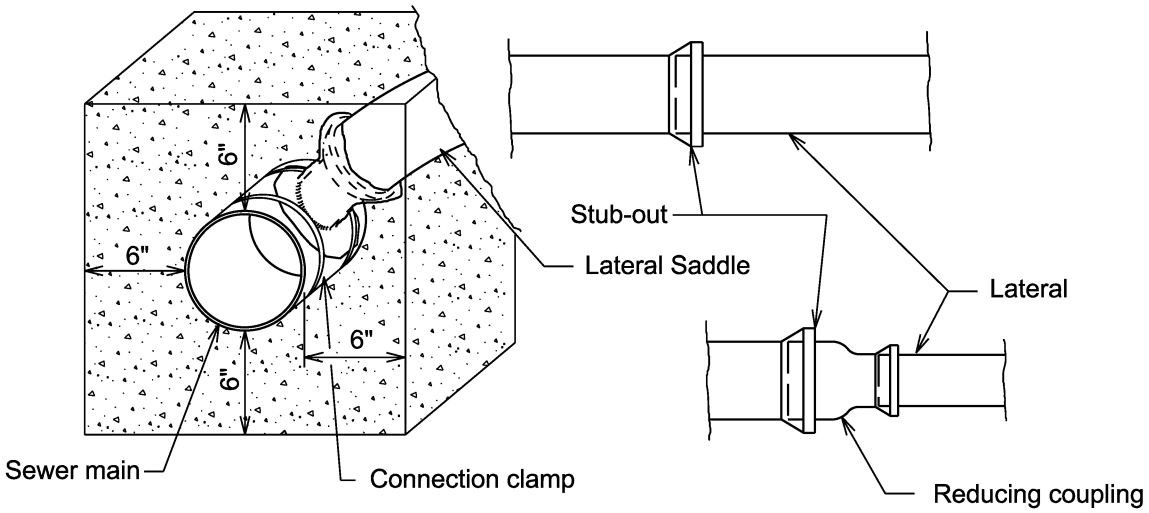
PROFILE



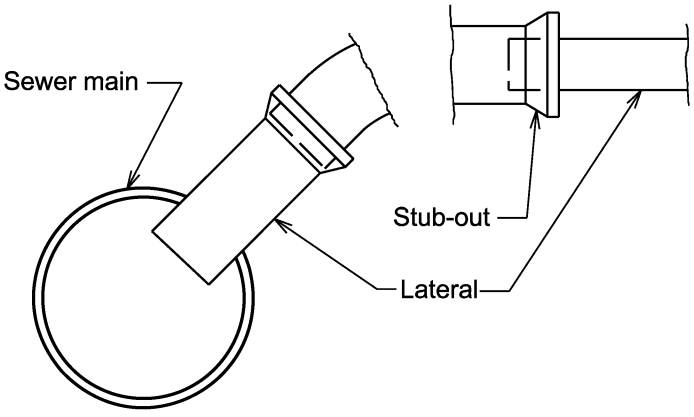
* Approved Sewer Cap
(Heavy Duty)

PROPERTY OF SAN ANTONIO WATER SYSTEM SAN ANTONIO, TEXAS	TYPICAL CLEANOUT DETAIL	APPROVED MARCH 2008	REVISED APRIL 2014
		DD-854-02	SHEET 2 OF 2

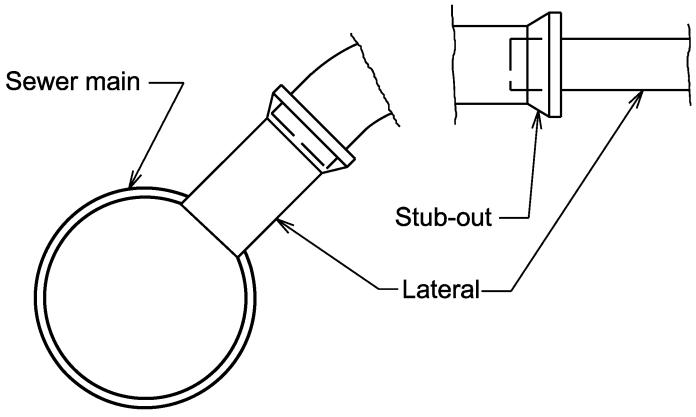
LATERAL CONNECTION TO EXISTING SEWER MAIN



ACCEPTABLE



UNACCEPTABLE



ACCEPTABLE

Note:
The saddle shall be permanently bonded to the existing main by the use of compounds or or clamps as recommended by the manufacturer.

PROPERTY OF SAN ANTONIO WATER SYSTEM SAN ANTONIO, TEXAS	LATERAL CONNECTION	APPROVED MARCH 2008	REVISED APRIL 2014
		DD-854-03	SHEET 1 OF 1

DIVISION 4. RATES AND CHARGES [9]

Sec. 34-226. Establishment of rates and schedules, rates schedules, and affordability discount analysis.

The schedule of sewer service rates and charges contained in schedule A for residential sewer service customers, the schedule of sewer service rates and charges contained in schedule B for general sewer service customers, and the sewer service rates and charges contained in schedule C for wholesale sewer service customers, as amended attached hereto, shall be effective for all billings on or about January 1, 2006, and shall be the lawful rates for sewer service to be charged by the system.

Rate schedules A, B and C relating to sewer service for residential, general and wholesale customers are hereby amended and shall hereinafter read as attached hereto and incorporated herein.

(Ord. No. 80330, § 1, 6-16-94; Ord. No. 99995, § 2(Att. I), 11-18-04; Ord. No. 101682, § 1(Att. I), 11-17-05)

Editor's note—

Rate Schedules referenced above are set out at length at the end of this chapter.

Sec. 34-226.1. Methods for establishing monthly residential charges.

(a) *Definitions.*

(1) *Entity.* A city, town, political or commercial subdivision, district, association, military installation or facility that establishes, operates and maintains a sewer collection system within its

jurisdictional boundaries, and contracts with the San Antonio Water System to connect that sewer collection system to the regional sewage transportation and treatment works in order that the San Antonio Water System can provide for the transportation and treatment of sewage discharged by the entity.

(2) *Winter averaging sewer charge period.* The period of water and sewer service during the three (3) complete consecutive billing periods commencing on or after November 15 of each year and terminating on or after the completion of three full billing cycles in March of each year. During the three (3) complete consecutive billing periods the system shall establish monthly sewer service charges for customers based upon their average monthly water consumption during the three (3) complete consecutive billing periods. The customer must receive sewer service at one location during the entire three (3) consecutive billing periods in order to establish a "winter average."

(3) *Interim averaging sewer charge period.* The period of water and sewer service during three (3) complete monthly billing periods during which the system establishes monthly sewer service charges for customers based upon their average monthly water consumption during that period. This interim averaging sewer charge period is to be used only in determining monthly sewer service charges when the customer has not yet established a winter average by the method outlined in (2) above.

(4) *Winter average charge.* The monthly sewer service charge established by the system during the winter averaging sewer charge period. This charge is the basis for monthly billings until completion of the next entire winter averaging sewer charge period.

(5) *Interim average charge.* The monthly sewer service charge established by the system during the interim averaging sewer charge period. This charge is the basis for monthly billings until completion of the next entire winter averaging sewer charge period and becomes the basis for subsequent monthly billings.

(b) *Final billings.* For all final billings, either the winter average charge, or the interim average charge, or the unaveraged residential charge or the unmetered residential charge, whichever is in effect at the termination of service for residential customers, will be prorated by dividing the applicable sewer service charge by thirty (30), and multiplying by the number of days that sewer service was actually received during the final month. However, final billings shall not be greater than the applicable sewer service charge and shall not be less than the minimum sewer service charge stated in Rate Schedules A and B, attached hereto and incorporated herein.

(c) *New customers who have not established monthly sewer service charge by previous residency within the service area during the preceding six months.* New customers who move into the service area after the first day of a billing period and before the last day of that billing period will be billed on a proration basis by dividing the applicable I.C.L. or O.C.L. unaveraged residential charge, stated in Rate Schedules A and B, attached hereto and incorporated herein by thirty (30), and multiplying by the number of days that sewer service was actually received. However, the initial bill for service received during the first partial billing period shall not be less than the minimum I.C.L. or O.C.L. sewer service charge stated in Rate Schedules A and B, attached hereto and incorporated herein.

New customers will pay the I.C.L. or O.C.L. unaveraged residential charge, stated in Rate Schedules A and B, attached hereto and incorporated herein, during the first three (3) complete billing periods while an interim average charge based upon water consumption is established. The interim average charges shall not be greater than the I.C.L. or O.C.L. unaveraged residential charge, stated in Rate Schedules A and B, attached hereto and incorporated herein, nor be less than the minimum monthly I.C.L. or O.C.L. sewer service charge stated in Rate Schedules A and B, attached hereto and incorporated herein.

Once the interim average charge is established, it shall be the monthly sewer service charge through the end of the next complete winter averaging sewer charge period. Once the winter average charge is established, the interim average charge shall no longer be the basis for the monthly service charge.

(d) *Initial billings for customers relocating within the service area.* Customers who relocate within the service area will receive an initial bill at their new residence based upon either the winter average charge, or the interim average charge, or the unaveraged residential charge or the unmetered residential charge, depending upon which charge has been the basis for monthly billings at the previous residence. The applicable charge will be prorated by dividing it by thirty (30), and multiplying by the number of days that sewer service is actually received during the first month at the new residence. However, initial billings shall not be greater than the applicable monthly sewer service charge and shall not be less than the minimum I.C.L. or O.C.L. sewer service charge stated in Rate Schedules A and B, attached hereto and incorporated herein. After this initial billing, the customers described above will continue to be billed monthly sewer service charges based upon the full monthly charge established at their previous residence. This applicable charge shall serve as the basis for monthly billings until the end of the next complete winter averaging sewer charge period.

(e) *Alternative methods.* The above definitions and methods (1-5) for established monthly residential sewer service charges shall apply to, and be implemented by, all water purveyors within the service area except those water purveyors that have submitted alternative definitions and methods which have been approved by the system.

(Ord. No. 80330, § 1, 6-16-94)

Editor's note—

Rate Schedules A and B referenced above are set out at length at the end of this chapter.

Sec. 34-226.2. Flat rate sewer program.

(a) The purpose of this program is to allow an alternate method of establishing a sewer charge for general accounts.

(b) Any general user who uses water in their daily activities which is not discharged into the sewer system, may submit a written request to customer service for a reduction in the volume of waste estimated to be discharged from the premise.

(c) In the event a customer requests to participate in the program, the system shall follow the flat rate sewer program procedure set out in Schedule 2 which is attached hereto for customer notification and convenience. In the event the system duly amends such procedure from time to time, an updated version of such procedure shall be supplied to the City of San Antonio City Clerk. Copies of the system's most current flat rate sewer program procedure shall also be available to all system customers upon request at the system's customer service locations.

(Ord. No. 80330, § 1, 6-16-94)

Editor's note—

Schedule 2 referenced above is set out at length at the end of this chapter.

Sec. 34-226.3. Industrial waste surcharges.

(a) Persons or owners discharging industrial wastes which exhibit none of the characteristics of wastes prohibited by Ordinance Number 77784, or as may be amended, other than excessive BOD or TSS, but having a concentration in excess of normal domestic sewage, that is, concentrations of BOD in excess of 250 mg/l and TSS in excess of 250 mg/l, shall pretreat the industrial waste to meet the concentrations of normal domestic sewage; however, such excessive BOD and TSS waste may be accepted for treatment if all the following requirements are met:

(1) Neither BOD nor TSS waste concentrations shall exceed 10,000 mg/l concentration.

(2) The wastes will not cause damage to the collection system.

(3) The wastes will not impair the system's treatment process.

(4) The wastes will not cause contamination of POTW sludges thus limiting sludge disposal options or practices.

(5) The person(s) or owners responsible for the wastes pays an industrial surcharge, in addition to the regular water and sewer charges, in accordance with the following cost factors and formula:

V	=	Volume of water use reported in millions of gallons (MG) per month
BOD	=	Biochemical oxygen demand analyzed in accordance with the procedures approved under 40 CFR Part 136, or the latest Environmental Protection Agency (EPA) approved method, and reported in units of milligrams per liter (mg/l).
TSS	=	Total suspended solids analyzed in accordance with the procedures approved under 40 CFR Part 136, or the latest Environmental Protection Agency (EPA) approved method, and reported in units of milligrams per liter (mg/l).

Cost factor BOD = $1.62

Cost factor TSS = $1.50

IWS = Industrial waste surcharge computed in dollars as follows: IWS = V [$1.62 × (BOD mg/l - 250 mg/l) + $1.50 × (TSS mg/l) - 250 mg/l].

(b) *Surcharge review.*

(1) Quality control shall review the basis for determining surcharges at least once every two (2) years, or more frequently as needed.

(2) The discharger may employ an independent registered professional engineer, at the discharger's cost, to perform additional sampling and analysis provided this activity is coordinated with quality control. Upon consideration of all available information, the system shall determine the final values and/or charges to be assessed.

(c) *Sample point.*

(1) Each sampling point shall be installed and maintained by the discharger so that any authorized representative of the system may readily and safely obtain samples of the flow at all times.

(2) Each sampling point shall be near the outlet of each sewer, drain, pipe, or channel which connects with the sewer or wastewater facility.

(3) Each sampling point shall be designed and constructed to prevent infiltration by ground and surface water and maintained so that any authorized representative of the system may readily and safely obtain samples of the flow at all times.

(4) Before beginning construction of a sampling point, a person shall submit plans to quality control for review and approval to insure compliance with these provisions. Plans must include the sewage metering device if one is to be installed.

(d) *Measurement of waste volumes.*

(1) The volume of wastes may be determined by the same methods used to calculate the general sewer service rate.

(2) On premises where all or part of the water is obtained from a source other than the public water supply and no sewage metering device is installed, the owner shall provide and maintain a metering device of a type approved by the San Antonio Water System to measure sources of private water.

(e) *Sampling of wastes.*

(1) Quality control shall take samples of waste discharges from establishments as often as determined necessary to adequately monitor and control the discharges. If an owner desires additional samples, the owner shall pay the cost of the additional service.

(2) Samples collected by quality control may be either flow-proportional or time proportional composite samples as appropriate to achieve the most representative samples, or via the best available sampling method given the constraints and limitations present at the discharge point source.

(f) *Sampling and analysis fees.* A person discharging concentrations of BOD and/or TSS in excess of normal domestic sewage concentrations shall compensate the system for the cost of sample collection and analysis when an industrial surcharge is established.

(g) *Industrial surcharges for class groups.*

(1) Quality control shall assess an industrial surcharge rate for each class group based on waste strength determinations established by averaging grab or composite samples or both, taken from a representative number of establishments in each group, and shall apply this rate to the water consumption or metered wastewater of the establishment. If the establishment is within a larger facility for which water usage is determined from a master meter, customer service shall determine an estimated volume for the establishment on which the surcharge rate is applied. Customer service shall then add the appropriate industrial surcharge to billings for regular water and sewer service for each establishment classified into a class group.

(2) If an establishment contains operations from more than one of the class groups, and customer service determines that the surcharge rate for a particular class group would not adequately compensate the system for its cost of treatment, customer service shall add an appropriate industrial waste surcharge to adequately compensate the system for its cost of treatment.

(3) Quality control may, from time to time, revise surcharge class groups based on analysis of current samples.

(Ord. No. 80330, § 1, 6-16-94; Ord. No. 97395, 3-27-03)

Sec. 34-227. Determination in extenuating circumstances.

The president/chief executive officer of the system is hereby authorized to designate a committee comprised of representatives from quality control and customer service empowered to establish special monthly commercial rates in cases where extenuating circumstances exist, such as the use of water in a manufactured product, the use of water from a consumer's own supply where there is no meter, excessive irrigation, etc. The committee shall, upon review of the facts, make a determination as to sewer service charges in such instances.

Secs. 34-228—34-230. Reserved.

Sec. 34-231. Monthly charges to new, vacant, residential or commercial structures.

In the event that a newly constructed, vacant, residential structure is connected to a public sewer collection system, the unaveraged residential charge (I.C.L., O.C.L. or entity) shall be the basis for monthly sewer service billings to the owner of the newly constructed, vacant, residential structure after the expiration of six (6) months from the date that water service commences to said structure.

In the event that a newly constructed, vacant, commercial structure is connected to a public sewer collection system, the general service minimum charge on their contributed flow (I.C.L., O.C.L. or entity) shall be the basis for monthly sewer service billings to the owner of the newly constructed, vacant, commercial structure after the expiration of twelve (12) months from date that water service commences to said structure.

(Ord. No. 80330, § 1, 6-16-94)

Sec. 34-232. Reserved.

Sec. 34-233. Collection of charges.

The president/chief executive officer of the system or his designated representative shall negotiate with other water purveyors in order to make necessary arrangements for the collection of the sewer charges prescribed in this division by such water purveyors.

(Ord. No. 80330, § 1, 6-16-94)

Sec. 34-234. Reserved.

Sec. 34-235. Schedule of rates for stormwater drainage, services and programs; billing and collection.

(a) *Definitions.*

Benefitted property: Real property that is a parcel of property or lot within the corporate boundaries of the City of San Antonio to which stormwater drainage plans, programs, or services are made available and which receives water, wastewater, or electric utility service from the City of San Antonio. A parcel of property is a piece of land regardless of size under one (1) ownership, such ownership being further defined as the way in which property is legally described in duly recorded legal documents in the official public records of real property of the county in which the parcel of property is located. A lot is a designated property shown on a recorded plat duly recorded in the official public records of real property of the county in which the recorded plat is located.

Billing unit: A billing unit is benefitted property and is the smallest unit of real estate with a unique legal description according to the records of the Bexar Appraisal District.

Commercial/general stormwater customer: The owner or occupant of benefitted property not meeting the definitions of a residential, multifamily, or public stormwater customer as defined herein.

Multifamily stormwater customer: The owner or occupant of benefitted property containing a multiple family dwelling unit comprised of more than two (2) family units.

Public stormwater customer: The owner or occupant of benefitted property containing an improvement related to the provision of governmental services, public or private education, or religious activities and as so classified in records of the Bexar Appraisal District.

Residential stormwater customer: The owner or occupant of benefitted property containing a single or multiple family dwelling unit composed of two (2) or less family units.

(b) *Schedules of rates.* The following schedules of stormwater rates shall be effective with billings on or about October 1, 2007 and shall be applied to all billing units, except as provided by section 34-235(d), herein below. These rates may be included on other utility bills or may appear on a separate bill including only stormwater or drainage charges. Each billing unit ("unit") shall be assessed each month or fraction thereof in accordance with the following schedule:

Residential Stormwater Rate Schedule		
Tier	Billing Unit (SF)	Billing Unit Per Month Charge
1	0—4,999	$ 3.22
2	5,000 or more	4.25

Multifamily Stormwater Rate Schedule		
Tier	Billing Unit	Billing Unit Per Month

DIVISION 4. RATES AND CHARGES

	(SF)	Charge
1	0—21,999	$ 7.19
2	22,000—43,999	22.39
3	44,000—131,999	67.90
4	132,000 or more	323.09

Commercial/General Stormwater Rate Schedule		
Tier	Billing Unit (SF)	Billing Unit Per Month Charge
1	0—21,999	$ 18.32
2	22,000—43,999	50.12
3	44,000—86,999	89.82
4	87,000—131,999	154.81
5	132,000 or more	342.03

Public Stormwater Rate Schedule		
Tier	Billing Unit (SF)	Billing Unit Per Month Charge

1	0—21,999	$ 18.15
2	22,000—43,999	49.64
3	44,000—86,999	89.66
4	87,000 or more	151.57

Such rates are based on the following information: for private benefitted property, the imprint of improvements as depicted in the records of the Bexar Appraisal District; for public benefitted property, the imprint of improvements as depicted on forms supplied by a public entity to the San Antonio water system; in the event the San Antonio water system should request such forms from a public entity, and no forms are forthcoming, the tier four (4) charge shall be assessed.

(c) *Billing, collection, and management procedures.*

(1) Initially the San Antonio water system shall be the primary agency responsible for billing, collection, and management of other stormwater service matters relating to stormwater rates. Billing and collection procedures for stormwater rates shall be the same, insofar as practicable, as those utilized by the San Antonio water system in billing and collecting for water and wastewater service, all as set forth in City Ordinance No. 72742, approved and adopted December 6, 1990, or such successor ordinance, or those billing and collection procedures utilized by other water purveyors with whom the San Antonio water system contracts with to assist in billing and collecting stormwater rates, all with the exception that no advance deposit to secure payment of the customer's final bill for stormwater charges shall be collected.

(2) Billing and collection procedures shall include a process by which customers may appeal the validity of amounts billed in accordance with the written criteria established by San Antonio water system Customer Service Policies.

(d) *Exemptions.* The following real property, only, shall be exempt from the provisions of this section:

(1) Benefitted property owned by the City of San Antonio and dedicated to right-of-way for public streets and/or to provide drainage service;

(2) Benefitted property with proper construction and maintenance of a privately owned drainage or stormwater system wholly sufficient to provide all the drainage or stormwater service for that property;

(3) Benefitted property held and maintained in its natural state on which no improvements currently exist and until such time that the property is developed and all of the public infrastructure has been accepted by the City of San Antonio for maintenance; and

(4) Benefitted property before a structure has been built on the property or before the City of San Antonio has finally approved the use of the property in accordance with the Unified Development Code.

(e) *Relationship to San Antonio water system.*

(1) Initially the responsibility for the stormwater program for purposes of compliance with the EPA's rules and regulations shall be facilitated and coordinated by the board; however, such program shall not be deemed to be a part of the "system" as that term is defined in City Ordinance No. 75686, approved and adopted April 30, 1992. All revenues and expenses and other accounts related to the stormwater program shall be accounted for on a full cost of service basis separate and apart from all other funds for which the board has responsibility.

(2) No later than one (1) year prior to the expiration of the initial permit issued by the EPA, city council shall reevaluate this section and determine whether such utility shall become a part of the "system" as that term is defined in City Ordinance No. 75686.

(f) *Repayment of stormwater expenses.* Funds advanced by the wastewater system for stormwater or drainage plans, programs, and services in an approximate amount of five million dollars ($5,000,000.00) to support the stormwater program shall be repaid from revenues generated by stormwater rates over a period not to exceed five (5) years from the effective date of this section. Once the specific amount of dollars expended by the wastewater system for stormwater or drainage plans, programs, and services has been finally determined, such specific amount is hereby authorized to be substituted for the approximate amount of five million dollars ($5,000,000.00) set out herein.

(Ord. No. 77949, §§ 1—6, 5-13-93; Ord. No. 90499, § 1, 9-16-99; Ord. No. 96515, § 1, 10-3-02; Ord. No. 98635, § 1, 12-18-03; Ord. No. 100066, § 1, 12-9-04; Ord. No. 2007-09-20-0988, § 1, 9-20-07)

Editor's note—

Ord. No. 77949, §§ 1—6, adopted May 13, 1993 has been included herein at the discretion of the editor as § 34-235

Sec. 34-236. Lift station maintenance fee.

A customer-developer wishing to install a lift station as an element of an off-site wastewater collection system to serve a specific area must meet all SAWS regulatory requirements as they relate to lift stations and, in addition, pay to SAWS a one-time lift station maintenance fee of eighty-seven thousand four hundred ten dollars ($87,410.00) that will be used to offset annual lift station maintenance expenses over a ten-year period.

(Ord. No. 2007-12-13-1345, § 2(Att. B), 12-13-07)

Secs. 34-237—34-270. Reserved.

FOOTNOTE(S):

DIVISION 4. RATES AND CHARGES

Editor's note— Ord. No. 80330, § 1, adopted June 16, 1994, amended the provisions of former §§ 34-226—34-234, relative to sewage disposal rates and charges, in their entirety to read as herein set out. The provisions of these former sections derived from Code 1959, §§ 33A-61—33A-65, 33A-67—33A-69; Ord. No. 56173, 11-24-82; Ord. No. 57792, 10-27-83; Ord. No. 58526, 3-29-84; Ord. No. 60600, 4-25-85; Ord. No. 63544, 8-28-86; Ord. No. 65694, 9-10-87; Ord. No. 65767, 9-24-87; Ord. No. 67918, 9-15-88. (Back)

SECTION 02 51 13 Groundwater Treatment System

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA 10084 (2005) Standard Methods for the Examination of Water and Wastewater

AWWA B100 (2009) Standard for Granular Filter Material

ASTM INTERNATIONAL (ASTM)

ASTM A36/A36M (2012) Standard Specification for Carbon Structural Steel

ASTM B124/B124M (2014) Standard Specification for Copper and Copper Alloy Forging Rod, Bar, and Shapes

ASTM D638 (2010) Tensile Properties of Plastics

ASTM D883 (2012) Standard Definitions of Terms Relating to Plastics

ASTM D1505 (2010) Density of Plastics by the Density-Gradient Technique

ASTM D1525 (2009) Test Method for Vicat Softening Temperature of Plastics

ASTM D1693 (2013) Standard Test Method for Environmental Stress-Cracking of Ethylene Plastics

ASTM D1784 (2011) Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds

ASTM D1785 (2012) Standard Specification for Poly(Vinyl Chloride) (PVC), Plastic Pipe, Schedules 40, 80, and 120

ASTM D2035 (2013) Standard Practice for Coagulation-Flocculation Jar Test of Water

HYDRAULIC INSTITUTE (HI)

HI 7.1-7.5 (2006) Controlled Volume Metering Pumps

INTERNATIONAL SOCIETY OF AUTOMATION (ISA)

ANSI/ISA 5.1 (2009) Instrumentation Symbols and Identification

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

ISA 668	(2013) Series 1 Freight Containers Classification, Dimensions and Ratings

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA MG 1	(2011; Errata 2012) Motors and Generators

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2014; AMD 1 2013; Errata 1 2013; AMD 2 2013; Errata 2 2013; AMD 3 2014; Errata 3 2014) National Electrical Code

NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (NIST)

NIST SP 250	(1991) Calibration Services Users Guide

1.2 GROUNDWATER TREATMENT SYSTEM DESCRIPTION

The groundwater treatment system shall be a fully integrated water treatment plant which shall remove dissolved heavy metals and solids from groundwater. The system shall include equipment for groundwater extraction, flow equalization, wastewater conveyance, precipitation, clarification, and filtration required to meet the specified performance requirements. The groundwater treatment system shall be complete with required instruments, controls, and a local control panel. A portable building shall be provided to enclose, contain, and facilitate the overall control of the treatment plant. All parts shall be factory or shop preassembled to the maximum extent possible, compatible with transportation limitations and equipment protection considerations. Field assembly shall be minimized to the assembly of match-marked components. Submit installation instructions and framed, typed operating instructions for posting and explaining methods of checking the system for startup and normal safe operations, normal and emergency shutdown operations, and procedures for safely starting and stopping each piece of equipment within the system.

1.2.1 Groundwater Extraction Unit

Groundwater extraction unit shall include one well pump with accessories, piping, valves, and instrumentation and controls to extract and convey accumulated groundwater from existing well EW-2 to the equalization unit. All components of the unit shall be furnished as shown on the drawings.

1.2.2 Equalization Unit

Equalization unit shall include one tank with accessories, piping, valves, pumps, and instrumentation and controls to provide a constant flow and contaminant concentration to the subsequent treatment equipment. All components of the unit shall be furnished as shown on the drawings.

1.2.3 Precipitation Unit

Precipitation unit shall include a static mixer, a chemical feed system for the precipitant addition, piping, valves, oxidation/reduction potential (ORP) controls, and other instrumentation and controls as indicated on the drawings.

1.2.4 Clarification Unit

Clarification unit shall include a coned bottomed tank, a tank stand, a sludge removal system, piping, valve, and instrumentation and controls to separate sludge from decanted water. All components of the unit shall be furnished as indicated on the drawings.

1.2.5 Filtration Unit

Filtration unit shall include a gravity sand filter, piping, valve, and instrumentation and controls to remove particulates from decanted water prior to discharge. All components of the unit shall be furnished as indicated on the drawings.

1.4 PERFORMANCE REQUIREMENTS

Provide a groundwater treatment system which is capable of processing ground water at the conditions provided below:

Flow Rate	
Maximum	25 gal per minute
Minimum	1 gal per minute
Temperatures	
Maximum	90 degrees F
Minimum	33 degrees F
Influent/Effluent pH	
Maximum Influent	[_____]
Minimum Influent	[_____]
Maximum Effluent	6
Minimum Effluent	8
Liquid Properties	
Liquid Viscosity	1 centipoise
Liquid Density	1 gm/ml at 60 degrees F
Space Availability	
Maximum Area	10 feet by 10 feet
Maximum Height	8 feet

The groundwater treatment system shall be capable of meeting the maximum effluent metals and solids concentrations achieved in the previously conducted treatability testing (report appended to this specification), as listed below at the indicated maximum concentrations. Influent and effluent solids are as determined in accordance with Part 2000 Physical and Aggregate Properties, and metals as determined in accordance with Part 3000 METALS of AWWA 10084:

	Maximum Influent Concentration mg/L	Maximum Effluent Concentration mg/L
Hexavalent Chromium	5	0.1
TSS	90	5

Groundwater treatment system instrumentation and controls shall have the necessary accuracy and sensitivity to measure and control the operating ranges of the specified equipment. Sampling and analysis shall be performed in accordance with Section 01 35 45.00 10 CHEMICAL DATA QUALITY CONTROL.

1.5 OTHER SUBMITTAL REQUIREMENTS

The following shall be submitted:

a. Detailed drawings of tanks showing the dimensions, nozzle orientation and elevations, interconnecting piping, equipment layout, hydraulic profile, and other details required to demonstrate that the unit has been coordinated and will properly function as part of the overall groundwater treatment system. Drawings shall show proposed layout, anchorage of equipment and accessories, installation/connection details, and equipment relationship to other parts of the work including clearances for installation, maintenance and operation. Submit manufacturer's descriptive data, specifications, technical literature, utility requirements, performance charts and curves, and catalog cuts for the clarifier.

b. Electrical one-line diagrams for instrumentation and controls, illustrating all electrical components (motor controls, disconnects, starters, selector switches, pushbuttons, pilot lights, conduit, wire, etc.), electrical load analyses, cable and conduit schedules (including conduit designation, materials of construction, descriptions for each conduit of the end points of each conduit segment in a run, wire count by number, type and size, wire length, etc.), and complete control ladder logic diagrams. All control ladder logic diagrams shall be fully coordinated between components and ladder rungs to illustrate component tag names for all relays, timers, selector switches, pushbuttons, pilot lights, etc. All wires and terminals shall be number tagged. Terminal designations shall distinguish between terminals contained within differing enclosures such as control panels, equipment enclosures, motor control centers, etc. All auxiliary relay contacts shall be illustrated and designated. All ladder rungs shall be numbered with cross referencing between all associated rungs. A narrative description shall be fully coordinated with the ladder logic diagrams so as to fully describe all control operations, sequences, interlocks, alarms, and shutdowns for the groundwater treatment system including, but not limited to, flow control systems, level control systems, ORP control systems, chemical addition control systems, pump/valve controls, alarm and shutdown schemes, PLC input/output points, and all component interlocking. Locations of all control panels, equipment enclosures, motor control centers, etc. shall be designated on an equipment layout drawing. Submit manufacturer's descriptive data, specifications, technical literature, utility requirements, performance charts and curves, and catalog cuts for each instrument and control component supplied.

c. A pre-startup test plan identifying the procedures and methods that will be used to verify the integrity, calibration, and operability of the

equipment, piping, electrical wiring, and instruments and control systems. The plan shall specify acceptance criteria and tolerances to be achieved during the pre-startup testing.

d. A groundwater treatment performance test plan using contaminated water. The test plan shall describe the operating procedures to be followed during the test period including detailed descriptions of the measurements, record keeping, sampling and analyses to be performed to document that performance criteria has been achieved. The plan shall address full-scale operation of all equipment, piping, electrical wiring, and instruments and control systems included in the groundwater treatment system.

e. Manufacturer's certificates attesting that the equipment meets the specified requirements. The statement shall be dated after the award of the contract, shall state the Contractor's name and address, shall name the project and location, and shall list the specific requirements which are being certified. Certificate shall indicate the methods of testing used.

f. Three copies of operation and maintenance manuals for the groundwater treatment system containing the manufacturer's operating and maintenance instructions for each piece of equipment.Provide one complete set prior to the performance of the field test (see Paragraph Tests); submit the remaining sets prior to startup. Furnish each set in loose leaf three-hole ring binders. Inscribe the following identification on the covers: the words "OPERATING AND MAINTENANCE INSTRUCTIONS," name of equipment, name and location of the building, name of the Contractor, and contract number. Place cover sheets before instructions identifying each subject. Use standard letter size paper for instruction sheets, with larger sheets of drawings folding in to approximately the same size. Include, but do not limit the instructions to the following:

(1) System layout detailing piping, valves, and controls.

(2) Approved wiring and control ladder logic diagrams prepared in accordance with ANSI/ISA 5.1 including a drawing index, legend and symbols list, and abbreviation and identifiers.

(3) A narrative control sequence describing startup, operation, and normal and emergency shutdown. This information shall include the detailed operational narrative described in Paragraph Control System.

(4) Operating instructions for each equipment, instruments and control system including process monitoring requirements and recommendations for operations reporting to document the results of all process monitoring.

(5) Maintenance instructions for each piece of equipment, including lubrication instructions and a troubleshooting guide to help the operator determine what steps shall be taken to correct anticipated problems that may occur in the system.

(6) Manufacturer's bulletins, cut sheets and descriptive data of equipment; these shall be submitted after approval of detail drawings, and not later than 2 months prior to delivery of the system.

1.6 SUBMITTALS

Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Tanks
Mixers
Clarifiers
Instrumentation and Control
Portable Building
Secondary Containment

SD-03 Product Data

Tanks
Mixers
Clarifiers
Material Safety Data Sheets
Instrumentation and Control
Secondary Containment System
Spare Parts
Pre-startup Testing
Startup and Operation
Proof of Performance

SD-10 Operation and Maintenance Data

Operation and Maintenance Manual Updates

1.9.1 Regulatory Requirements

Obtain all permits, certifications, and/or meet the regulatory requirements necessary for the configuration, installation, startup, and operation of the treatment plant. Work shall meet or exceed applicable minimum requirements established by federal, state, and local laws and regulations. Submit permits, certifications, and/or substantive regulatory requirements before work starts plus copies of applications for permits and certifications not required until later, along with a schedule for obtaining them. Equipment, raw materials (including reagents/additives), contaminated materials, and treated materials shall be safely transported, stored, and handled in accordance with Sections 02 81 00 TRANSPORTATION AND DISPOSAL OF HAZARDOUS MATERIALS and 01 35 29.13 HEALTH, SAFETY, AND EMERGENCY RESPONSE PROCEDURES FOR CONTAMINATED SITES.

1.10 DELIVERY, STORAGE, AND HANDLING

Equipment delivered and placed in storage shall be stored with protection from the weather, excessive humidity and temperature variation, and dirt, dust or other contaminants.

1.11 SITE CONDITIONS

1.11.1 Ambient Conditions

Groundwater treatment system shall be operated continuously during the winter when temperatures reach freezing or below. The system shall be installed indoors except for the equalization tank, feed pump, and well pump. The system shall be equipped with sufficient lighting as shown on the drawings for security purposes and for treatment plant operation during inadequate daylight or at night.

1.11.2 Existing Conditions

The groundwater treatment system shall operate in an urban setting. Contractor shall become familiar with the existing site conditions, including site location, site configuration, topography, climate, site accessibility, and adjacent land use.

PART 2 PRODUCTS

2.1 STANDARD PRODUCTS

Provide materials and equipment which are the standard products of a manufacturer regularly engaged in the manufacture of such products and that essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening. Equipment shall be new and unused, except for test equipment. Where two or more pieces of equipment performing the same function are required, they shall be products of the same manufacturer. Equipment shall be supported by a service organization that is, in the opinion of the Engineer, capable of providing service, materials, and equipment in an expedient manner.

2.2 TANKS

Submit detailed drawings of each tank showing the dimensions, nozzle orientations and elevations, interconnecting piping, equipment layout, hydraulic profile, and any other detail required to demonstrate that the tank has been coordinated and will properly function as a part of the overall groundwater treatment system. Drawings shall show proposed layout, anchorage of equipment and accessories, installation/connection details, and equipment relationship to other parts of the work including clearances for installation, maintenance and operation. Submit manufacturer's descriptive data, specifications, technical literature, and catalog cuts for each tank supplied.

2.2.1 General Requirements

Use manufacturer's standard size tanks whenever possible. Tank construction material and paints, coatings, or liners shall be compatible with the wastewater to be stored. Tank dimensions shall be selected to fit the available space as shown on the drawings. Unless noted otherwise on the drawings, each tank shall include flanged fittings for inlet, overflow, and drain. Hold down lugs shall be provided to anchor the tank to the base.

2.2.2 Equalization Tank

TK-1 shall be a rotationally-molded, high density cross-linked polyethylene, double wall, flat bottom tank with 7500 gallon capacity. High Density Cross-linked Polyethylene resin used in the tank manufacture shall contain an ultraviolet stabilizer as recommended by resin manufacturer. The assembly shall consist of one cylindrical, closed top inner primary tank and one cylindrical, open top containment outer tank. The tank shall be rotationally molded one-piece seamless constructed tank. The tank shall be designed for above-ground, vertical installation to store groundwater at atmospheric pressures. The assembly shall be designed to prevent rainwater and debris from entering the containment tank. The tank shall be adequately vented. The tank shall provide an access port in the top to install and retrieve submersible pump, P-2. The tank will be provided with a port in the top for installation of a level transmitter as shown on the drawings.

2.2.3 Calcium Polysulfide Tote

The Contractor shall provide Calcium Polysulfide 29% solution in a vendor-provided 40-gallon tote tank (TK-2).

2.3 STATIC MIXER

The static mixer shall be designed to disperse the design flow, 0 to 2 gph of added chemicals in a process flow stream with flows ranging from 0 to 2 gpm. The minimum allowable pressure drop shall be 5 feet of water column. The maximum allowable pressure drop for the static mixer shall be 10 feet of water column in accordance with the requirements of the process stream pumping system. The diameter of the mixer housing shall be sized identical to the process piping. The length shall be in accordance with the number of mixing elements required. Housing materials shall be carbon steel, providing chemical resistance to both the chemical additives and process stream. End configurations shall be shall compatible with the piping system. Injection ports shall be of the same materials as the mixer housing with threaded connections compatible with the chemical feed piping system. The housing shall be supplied with a name plate which at a minimum provides the manufacturer's name and address, part model number, and direction of flow. Mixing elements shall be constructed of carbon steel providing resistance to both the chemical additives and process stream.

2.5 CLARIFIERS

Clarifier (TK-3) shall be a coned bottom settler with an effective surface overflow rate of 5 gpd/ft2 and the detention time shall be 2 hours at the design flow rate. Clarifier shall consist of, at a minimum, the following accessories: influent distribution system, sludge removal system, effluent collection flumes, associated piping, fittings, and sampling valves.

2.5.1 Clarifier Vessel

The bottom and sides of the clarifier vessel shall be 1/4 inch minimum thickness carbon steel plate meeting or exceeding ASTM A36/A36M. Inlet, outlet, overflow, and drain connections shall be provided on the vessel. Structural steel framework shall be an integral part of the vessel to make it self-supporting.

2.5.2 Influent Distribution and Effluent Collection Systems

Influent distribution system shall be supplied to dissipate the entrance energy and to equalize flow to the separator module. Weirs and baffles shall be included to control the local velocities and to eliminate short circuiting. Adjustable weirs shall be supplied along each effluent collection flume to maintain uniform flow distribution.

2.5.3 Sludge Collection/Thickening Devices

Sludge holding compartment shall be equipped with hopper bottom having sides tapering downward at an angle not less than 55 degrees above horizontal for sludge collection. A flanged outlet shall be provided for the hopper which connects to a valve and quick connect fitting for sludge removal.

2.6 SAND FILTER UNIT

2.6.1 Equipment Capacity

The sand filter unit shall be a gravity downflow granular media filter, having a capacity to filter 5 gpm/ft2 of water at the design flowrate.

2.6.2 Filter Tank

The filter tank shall be a cylindrical with the dimensions shown and

shall be of carbon steel or HDPE construction, free from physical imperfections.

2.6.3 Filter Media

Filter media shall be silica sand. Total depth of filtration media shall be 4 feet. All media shall conform to the requirements of AWWA B100.

2.7 PIPING/VALVES

Provide piping materials and appurtenances as specified and as shown on the drawings, and suitable for the service intended. Pipe fittings shall be compatible with the applicable pipe materials.

2.7.1 PVC Pipe

PVC, ASTM D1784, minimum cell classification 12545-C, pipe shall be Schedule 40 conforming to ASTM D1785, so that the pressure rating of the pipe is consistent for all pipe sizes.

2.7.2 PVC Joints

The piping system shall be joined by socket-weld connections except where connecting to unions, valves, and equipment with threaded connections that may require future disassembly.

2.7.3 PVC Fittings

The schedule rating for the fittings shall not be less than that for the associated pipe. Fittings shall be ASTM D1784, PVC conforming to the requirements of ASTM D2466, socket type.

2.7.4 Flanged Fittings

Flanges shall be complete with one-piece, molded PVC stub ends. Flanged connections shall have the same pressure rating as the pipe or greater. Bolting shall be stainless steel, ASTM A193/A193M, Grade B8 hex head bolts and ASTM A194/A194M, Grade 8 hex head nuts. Bolts shall be provided with washers of the same material as the bolts. Gaskets shall be full-faced, maximum 1/8 inch thick, fabricated from ethylene propylene rubber (EPR)in accordance with ASME B16.21. When the mating flange has a raised face, a flat ring gasket shall be used and a filler gasket shall be provided between outer diameter of the raised face and the flange outer diameter to protect the PVC flange from bolting moment.

2.7.5 PVC Solvent Cement

Socket connections shall be joined with PVC solvent cement conforming to ASTM D2564. Manufacture and viscosity shall be as recommended by the pipe and fitting manufacturer to assure compatibility. Joints shall be prepared with primers conforming to ASTM F656 prior to cementing and assembly.

2.7.6 Polytetrafluoroethylene (PTFE) Tubing

Tubing shall be flexible and clear with nominal size and wall thickness as shown on the drawings.

2.7.7 Tubing Fittings

Fittings shall be compression type comprised of forged brass alloy C37700, conforming to ASTM B124/B124M nuts, ferrules and bodies, with elastomeric O-ring seals rated to a minimum 150 psig with straight threads conforming

to ASME B1.1.

2.7.8 Valves

Thermoplastic ball valves, 6 inch and smaller, shall be rated for 150 psig, 120 degrees F, and have ASTM D1784 polyvinyl chloride (PVC) bodies, balls, and stems. Valves shall be end entry with solvent-weld socket ends connections, a ethylene propylene diene monomer (EPDM) O-ring stem seals. Valves shall have hand lever operators. Valves shall be the same size as adjoining pipe. Valve ends shall be compatible with adjacent piping system. An operator shall be sized to operate the associated valve for the full range of pressures and velocities. Valves will open by turning counterclockwise.

2.7.9 Sample Ports

Sample ports shall be provided as indicated in the process flow diagram to complete the piping systems for the use intended. The sample ports shall be located in easily accessible locations, and shall avoid potential stagnant points and/or areas where material could collect. Sampling ports shall be comprised of pipe fittings, pipe, and ball valves which comply with material, temperature, and pressure requirements of the associated piping system as specified elsewhere in this Section.

2.7.10 Pipe Supports

Provide auxiliary steel where the support of piping systems and equipment is required. Light gauge and structural steel shapes shall conform to the requirements of ASTM A36/A36M. The Contractor has the option to use pre-engineered support systems of electrogalvanized steel products.

2.8 PUMPS

Pumps shall conform to the following requirements. Pumps for specific services and accessories shall be as specified.

2.8.1 Well Pump

Pump P-1 shall be a submersible, electric well pump capable of extracting 20 gpm of groundwater at 25 feet total dynamic head (tdh). The pump shall be connected to the pump controls by a three-wire drop line. The pump shall operate on 208 volts, 60 hz, single-phase power, and the motor shall be of sufficient size to operate the pump under the maximum operating conditions without exceeding its rating. Pump shall be equipped with necessary controls to provide automatic operation of the pump as shown on the drawings. The pump and motor unit shall fit inside the existing 12-inch recovery well, EW-2.

2.8.2 Feed Pump

Pump P-2 shall be a simplex pump unit that includes a submersible pump with an integral diaphragm or float-switch automatic level-control mechanism. Provide pump capable of delivering 2 gpm at 25 feet total dynamic head (tdh). Ensure that pump seals, lubricant, and electrical insulation are suitable for service in liquids up to 140 degrees F. Provide permanently sealed, oil-filled, and watertight motor that is manufacturer’s standard construction for the service. Provide single phase motors with automatic-reset thermal-overload protection. Provide waterproof, internally grounded, oil-resistant, Type SO chloroprene power cord, with three-prong plug of necessary length.

2.8.3 Chemical Metering Pump

Pump P-3 shall be a controlled volume pumps as defined by HI 7.1-7.5, capable of delivering calcium polysulfide 29% solution at any rate from the minimum flow rate to the maximum flow rate shown on the drawings, and shall be capable of continuous operation at rated capacity. Accuracy shall be plus or minus 2 percent over a 100 to 1 range from the required maximum capacity to the minimum pumping rate. Net positive suction head required shall not exceed 90 percent of the net positive suction head available, as installed. Construction shall be as simple as practicable to provide equipment isolation, bypass and reliable service and to be readily accessible for inspection, cleaning, adjustment, repairs, and replacements. Pump stands and platforms shall be adequate to support the pumping system

2.7.2.1 Calcium Polysulfide Feed System

a. Concentration: Minimum 26 percent; maximum 29 percent.

b. Number of pumps: 1.

c. Type of pump: Mechanically or hydraulically coupled diaphragm.

d. Configuration: Simplex.

e. Controls: Automatic rate adjustment.

f. Feed/flow rate: Minimum 1 gph; maximum 5 gph.

g. Back pressure at point of injection: 15 psig. Back pressure regulating valve shall be installed on the pump discharge and shall be factory adjusted to crack open at 15 psig. Regulators shall be of polyvinyl chloride construction with fluorocarbon resin diaphragms.

h. Suction valve cartridge: Single ball check.

i. Discharge valve cartridge: Single ball check.

j. Materials of construction allowed for wetted parts: Type 304L stainless steel, PVC or nylon.

2.7.2.2 Controls

The chemical metering equipment shall be provided with the appurtenances and accessories, as required, for flow capacity adjustment. Manual range adjustment shall be provided on all systems. Automatic control shall have the capability to vary feed rate based on signals from a oxidation-reduction potential (ORP) meter or controller. Oxidation-reduction potential probe shall be located where indicated on the drawings. Chemical feed rate shall be variable in response to the deviation from set point.

2.7.2.3 Drives for Controlled Volume Pumps

The metering pump shall be supplied with and driven by an alternating current electric motor drive. Electric motor shall be of sufficient capacity to operate the chemical metering equipment under all operating conditions without exceeding the rated nameplate current or power, or their specified temperature limits. The motors shall have starting characteristics and ruggedness necessary under the actual conditions of operations or clean-up procedures used in the areas where they will be located. Alternating current motors with power rating of 1/3 hp or less shall be 115 volts, single-phase, 60-Hz service.

2.8 ELECTRICAL WORK

Electrical equipment and wiring shall be in accordance with Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM and shall conform to NFPA 70. Circuit installation shall be in accordance with Sections 33 71 01 OVERHEAD TRANSMISSION AND DISTRIBUTION and 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION.

2.9 INSTRUMENTATION AND CONTROL

The instrumentation and control system shall be automatic with complete electrical power, control and instrumentation as specified or recommended by the equipment manufacturer for the safe operation and supervision of the groundwater treatment system. The instrumentation and control package for the groundwater treatment system shall be supplied as indicated on the drawings. Probes for oxidation reduction potential (ORP), measuring devices, and level sensors specified in the following four subparagraphs shall be of materials resistant to chemical attack over a pH range of 2 to 12, and suitable for a temperature range from 32 to 212 degrees F and for the liquid to be monitored. All enclosures for pH, flow, and level sensors and transmitters shall be rated NEMA 4X.

2.9.1 ORP Monitoring/Control

An oxidation reduction potential (ORP) probe shall be provided where indicated on drawings for the purpose of ORP monitoring and control. Probe shall be easily removable without interrupting service. Probe materials shall be resistant to operating pressures of up to 50 psi. The probes shall be interconnected to associated transmitters/indicators that are located preferably in the control panel. Probe shall be connected to a microprocessor based pH analyzer having a 4 digit readout with 1-1/2 inch high letters and an isolated 4 - 20 mA DC output signal proportional to the ORP. The accuracy of the ORP unit shall be plus or minus 0.5 percent of full scale.

2.9.2 Flow Monitoring

Flow measuring devices shall be provided on the effluent line for the purpose of flow monitoring. Measuring devices shall be easy to maintain without interrupting service. Measuring devices shall be resistant to operating pressures of up to 50 psi. The accuracy of the flow monitoring unit shall be plus or minus 0.5 percent of full scale. The type of flow meter selected shall be fully coordinated with the application involved as shown on the drawings to assure that the flow meter meets all installation and operational criteria (upstream and downstream distances from appurtenances, minimum and maximum flow velocities, degree of required accuracy, full pipe flow, etc.).

2.9.3 Level Monitoring/Control

All level (float) switches shall be mechanically actuated with Form C contacts. All electronic level sensing devices shall include a sending unit that transmits an analog or discrete signal, as required for the application, to an associated control panel or control device. Level monitoring/control sensors shall be provided where indicated on drawings. Sensors shall be easily removable without interrupting service. All analog level sensors shall be connected to a microprocessor based level indicator and/or controller as required by the application having a 4 digit readout with 1-1/2 inch high letters and an isolated 4 - 20 mA DC output signal proportional to the level to be measured.

2.9.4 Control System

Design the control system to operate as shown on the drawings and

described in the operating and control procedures provided as an attachment. All alarms and/or shutdowns shall consist of visible alarm lights on the main control panel. The alarms and shutdowns shall function through a first-out-sequence annunciation. Alarms shall be provided for high levels, and high ORP values. Automatic shutdowns shall be provided for each system when a control value or an operational system ranges out of normal operational limits where personnel safety is a concern, where mechanical damage can occur to process equipment, or where the process excursion has the potential to violate discharge water quality criteria; such shutdowns can occur for both high and low conditions. Power failures and equipment failures shall initiate an alarm as well as an orderly and automatic shutdown of the treatment system. Auto-dialing to an indicated remote location shall be provided to report each alarm or shutdown that stops the movement of process water through the treatment system or stops chemical feed systems. The Contractor is responsible for providing the associated cellular telephone line for the auto-dialer system. Control power transformers, relays, adjustable timers, auxiliary contacts, switches, or additional equipment required to interconnect the treatment equipment to a monitoring/control system shall be provided. Conduit and wiring between control panels, treatment components, and all control devices shall be furnished.

2.9.5 Control Panel Enclosures

All required control panels for the control system shall be rated NEMA 4X and shall be sized to assure that adequate internal space is available for all components specified and/or required with an allowance of no less than 30 percent spare space. To the greatest extent possible all instrument transmitters shall be installed in or adjacent to the control panel enclosure.

2.10 PORTABLE BUILDING

The portable building shall be a closed-van general purpose freight container, as defined in ISO 668. The building shall be constructed on a steel frame with bottom crossmembers, steel corrugated walls, steel corrugated roof, metal doors, and ISO corner fittings at all corners. The building shall be designed and constructed to be weatherproof with ports for power supply cables, influent and effluent piping, and data cable. The building shall be insulated, ventilated, and adequately lighted.

2.11 SECONDARY CONTAINMENT SYSTEM

The secondary containment system shall consist of a 6-mil thick HDPE liner secured to a modular plastic or fiberglass wall and corner sections. The containment system shall be sized to accommodate the portable building with full access to the doors. The wall height shall provide sufficient containment volume to hold 100% of the largest volume tank inside the building plus the 25 year, 24 hour storm event.

PART 3 EXECUTION

3.1 EXAMINATION

After becoming familiar with all details of the work, verify all dimensions in the field, and advise the Engineer of any discrepancy before work begins. After equipment is delivered to the site and prior to installation, examine the treatment plant equipment for any damage, defect, or deterioration and verify that all construction equipment used at the site is of sufficient capacity and in good mechanical condition. Results of this pre-installation examination shall be documented and submitted to the Engineer for review. Based on the examination, the

Engineer has the right to reject damaged, defective, or deteriorated equipment. Surface damage to equipment shall be corrected according to the manufacturer's requirements. Costs associated with the delay caused by the rejection shall be borne by the Contractor. All specified preconstruction submittals shall be provided to the Engineer.

3.2 INSTALLATION

Equipment shall be handled with extreme care to prevent damage during placement. Equipment shall be installed, except as otherwise specified, as indicated on the drawings, and in accordance with the manufacturer's written instructions. Installation shall include furnishing all materials required for initial operation. Equipment shall be properly leveled, aligned, and anchored in place in accordance with the manufacturer's instructions. Supports shall be provided for equipment, appurtenances, and pipes as required. Piping runs shall be straight and evenly supported. Valves shall be installed with stems horizontal or above the pipe centerline. Flanges and unions shall be installed where valve and equipment maintenance may require disassembly. Groundwater treatment system shall be provided complete and ready for operation.

3.2.1 Excavating, Filling, and Grading

Excavating, filling, and grading shall conform to the applicable requirements of Section 31 00 00 EARTHWORK.

3.3 FIELD QUALITY CONTROL

3.3.1 Inspection

After the installation is complete, each component will be inspected by the Engineer to verify that the components of the system are properly installed according to drawings and specifications. Any discrepancies found shall be corrected and work affected by such deficiencies shall be at the Contractor's expense.

3.3.2 Tests

Each piece of equipment shall be subject to an operational test, under the supervision of a factory representative and may be observed by the Engineer. Test shall demonstrate that the equipment is not defective and is in safe and satisfactory operating condition. Notify the Engineer 7 days prior to the dates and times for acceptance tests. Each unit shall be given a running field test in the presence of the Engineer for a minimum of 2 hours. If any deficiencies are revealed during the tests, such deficiencies shall be corrected by the manufacturer and the tests shall be repeated. Submit Test Reports in booklet form showing field tests performed to adjust each component and to prove compliance with the specified performance criteria upon completion and testing of the installed system. Test methods used shall be identified and test results shall be recorded. Each test report shall indicate the final set point of each control device. Test reports shall be provided for pre-startup testing and startup performance testing; also include test reports showing the results of factory tests performed.

3.4 STARTUP AND OPERATION

3.4.1 Pre-startup Checkout

Components subjected to the pre-startup checkout shall include the following items:

a. System shall be checked to verify that all equipment has been properly installed and connected;

b. Rotating equipment which requires lubrication shall be checked to ensure that manufacturer's procedures have been followed;

c. Equipment shall be level and checked for proper alignment, anchored, and static ground wires installed;

d. Piping, flange bolts, gaskets, and hoses shall be checked to ensure that connections are tight, and flushed clean;

e. Valves shall be checked for position and operability and flushed clean;

f. Electrical wiring and lighting shall be checked to verify that wiring has been completed correctly;

g. Continuity checks shall be performed on wiring loops;

h. High/Low liquid level alarms on tanks, as well as pump on/off level controls, shall be checked for proper installation and response;

i. Chemical feed systems shall be checked for proper installation;

j. Chemicals shall be checked for proper type, required quantity and mixing; tanks shall be filled;

k. Lockout devices and site security devices shall be checked for proper installation.

3.4.2 Pre-startup Testing

Each component of the system shall be subjected to the pre-startup testing as described below:

a. Piping and hoses transporting liquid shall be pressure tested on clean water for at least one hour, with no loss of pressure at 1.5 times the working pressure;

b. Electrical wiring shall be tested to verify that there is no wiring damage or deterioration that could cause injury to personnel or damage to equipment;

c. Power shall be turned on to test equipment and control systems only after the electrical systems are tested and certified ready for operation;

d. Lighting shall be tested and put in service to support work in all areas of the treatment system;

e. Rotating equipment such as pumps and blowers, if used, shall be tested for correct direction of rotation by bumping the starter manually;

f. Each pump shall be operated for a minimum of 4 continual hours at operating or test conditions. Tests shall assure that the units, controls and instrumentation have been installed correctly, and that there is no over-heating, vibration or excessive noise;

g. Depending on the complexity of the control system, testing can proceed from this point to verify that manual and automatic controls function properly. All tanks shall be filled and emptied to determine

if high and low level alarms sound at the prescribed liquid level;

h. Safety shutdown sequences, controls/alarms and interlocks in the control system shall be tested to ensure that they are installed properly and functioning as intended;

i. Each emergency shutoff switch shall be clearly labeled and tested to determine that it works properly;

j. Electrical "lockout" devices with padlocks shall be tested to ensure that power has been disconnected;

k. Instrumentation shall be calibrated before systems are put into service. Pressure and temperature gauges shall be tested against standardized gauges. Where NIST SP 250 calibration standards exist, they shall be utilized.

3.4.3 Startup Performance Testing

Startup testing shall not be initiated until after each component of the system has been demonstrated to meet the requirements of the pre-startup testing and until written approval has been received from the Engineer. Once steady state operation is achieved, a functional performance test shall be performed as described in the following startup checklist:

a. Check flow rates, ORP, and contaminant levels of the wastewater feeding the reactor tank;

b. Check pump operating points to verify that the actual operating point matches the pump curve specification for flow and pressure;

c. Start/stop pumps from all control mechanisms;

d. Check that current draw and voltage balance match specifications for all phases;

e. Check the reagent feeding systems to verify that the actual chemical feed rate is within the specified accuracy range;

f. Check the ORP in the piping downstream of the static mixer to verify that operating values are within the design range;

g. Adjust the reagent feed rates, and the ORP control system as required to achieve maximum metal removals;

h. Monitor the composition of the effluent to verify that it meets the specified performance requirements.

i. Check the clarifier overflow rate to verify that it is within the design range;

j. Check the sludge collecting device to verify that it is operating properly;

k. Check the control system to verify that the system operates within set parameters; and

l. Check the monitoring systems and instruments to verify that they hold calibration.

m. A successful performance test shall include 48 hours of operation processing water from the design influent source at design capacity

and meeting effluent requirements with less than 20 percent down time. Any deficiencies shall be corrected and performance checks successfully completed before the system will be accepted. Equipment not capable of performing as specified shall be replaced or upgraded at no additional cost. Submit Proof of Performance and Equipment Certificate of Conformance as specified. Submit a list of the proposed operating conditions for process parameters to be continuously monitored and recorded. Include detailed descriptions of the proof of performance schedule, operating conditions and parameters, influent sources, and required sampling and analyses.

3.4.4 Field Training

Upon completion of the installation and at a time designated by the Engineer, conduct a field training course for a representative of the Government in the operation and maintenance of equipment furnished under the contract. These field instructions shall cover all the items contained in the operation and maintenance instructions. Training shall be provided for a total period of 8 hours per day for a period of 2 days of normal working time and shall start after the system is functionally complete but prior to final acceptance tests. Field instructions shall cover the items contained in the operating and maintenance instructions, as well as demonstrations of routine maintenance operations. A video tape of the field training course shall be prepared as a permanent record for future training use.

3.4.5 Operation and Maintenance Manual Updates

The O&M manual shall include the following:

a. General description of the treatment process;

b. A detailed description of equipment;

c. Process flow diagram;

d. Piping and instrumentation diagrams;

e. Certified drawings for equipment components and equipment layout;

f. Practical operating procedures including performance testing, influent, and effluent concentrations, and trend analysis of influent;

g. A complete set of fully updated and annotated piping and instrument diagrams, process flow diagrams, instrument indexes, control ladder logic diagrams, description of controls, alarms, interlocks, instrument interface, and maintenance procedures;

h. Specialty items such as type of oil and grease, desiccants, tools, analytical instruments, etc.;

i. Initial startup procedures;

j. Emergency and scheduled shutdown procedures;

k. Monitoring and quality control, spill controls;

l. Equipment specifications;

m. A list of modes of failure for each piece of equipment;

n. Fault/failure analysis, and troubleshooting guide;

o. List of spare parts;

p. Process safety and protective equipment requirements; and

q. Record keeping (electronic or other) requirements.

In order to plan all the inspection and maintenance operations required for plant operation, a maintenance schedule shall be provided. The maintenance schedule shall include:

a. Scheduled maintenance procedure for each piece of equipment;

b. Sensor and measurement device calibration frequency;

c. Periodic reports regarding consumption of chemicals such as acid, caustic, polymer, and coagulants;

d. Electronic or other recording data;

e. Personnel training requirements;

f. The time required for each maintenance task;

g. Equipment shutdown and lock and tag requirements during maintenance/repair; and

h. Mothballing and preservation procedures for equipment layaway. The

entire schedule and the results of each task shall be recorded for Future analysis. Other items shall be included as follows:

a. Spare parts list with suppliers and costs;

b. Plant utility requirements such as electrical, air, drinking water, service water, telephone, and sewer;

c. Detailed safety procedures for chemical handling; and

d. Name, address, and telephone number of technical personnel to contact in case of an emergency related to the treatment system.

Final acceptance of the GROUNDWATER TREATMENT system will not be given until these documents have been supplied, reviewed, and approved.

3.5 SPARE PARTS

Submit a list of spare parts with the manufacturer's part number, a current unit price and source of supply for each different material or equipment specified, after approval of the related submittals and not later than 2 months prior to the system startup. The list shall include: 1) parts recommended by the manufacturer to be replaced during the first 5 years of service, 2) a list of special tools recommended by the manufacturer for each type of equipment furnished including special tools necessary for adjustment, operation, maintenance, and disassembly and 3) spare parts data for each different item of equipment and materials specified.

-- End of Section --