

Little Vince Bayou Greenway

LANDSCAPE DEVELOPMENT

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HARRIS COUNTY

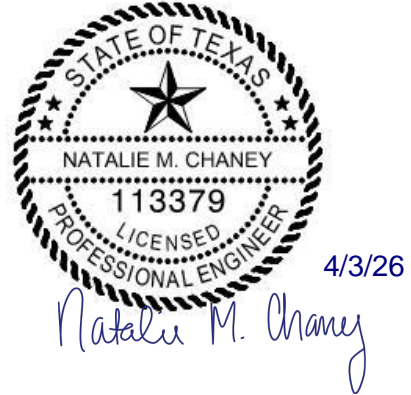
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SECTION 00107 – SEALS PAGE

SEALS PAGE Little Vince Bayou Greenway Design Professionals of Record	
Landscape Architect – Clark Condon	Civil Engineer – RPS



SECTION 01410

TPDES REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Documentation to be prepared and signed by Contractor/Operator before conducting construction operations, in accordance with the Texas Pollutant Discharge Elimination System (TPDES) Construction General Permit Number TXR150000 issued on February 8, 2018(the Construction General Permit).
- B. Implementation, maintenance inspection, and termination of storm water pollution prevention control measures including, but not limited to, erosion and sediment controls, storm water management plans, waste collection and disposal, off-site vehicle tracking, and other appropriate practices shown on the Drawings or specified elsewhere in the Contract.
- C. Review of the Storm Water Pollution Prevention Plan (SWP3) implementation in a meeting with Project Manager prior to start of construction.

1.02 DEFINITIONS

- A. Commencement of Construction Activities: The exposure of soil resulting from activities such as clearing, grading, and excavation activities, as well as other construction related activities (e.g., stock piling of fill material, demolition).
- B. Large Construction Activity: Project that:
 - 1. disturbs five acres or more, or
 - 2. disturbs less than five acres but is part of a larger common plan of development that will disturb five acres or more of land.
- C. Small Construction Activity: Project that:
 - 1. disturbs one or more acres but less than five acres, or
 - 2. are part of a larger common plan of development that will disturb at least 1 but less than 5 Ac
- D. TPDES Operator:
 - 1. Operator - The person or persons associated with a large or small construction activity that is either a primary or secondary as defined below:

2. Primary Operator - the person or persons associated with a large or small construction activity that meets either of the following two criteria:
 - a. the persons have operational control over construction plans and specifications, including the ability to make modifications to those plans and specifications or
 - b. the person or persons have day-to-day operational control of those activities at a construction site that are necessary to ensure compliance with a storm water pollution prevention plan (SWP3) for the site or other permit conditions (e.g., they are authorized to direct workers at a site to carry out activities required by the SWP3 or comply with other permit conditions).
3. Secondary Operator -The person or entity, often the property owner, whose operational control is limited to:
 - a. the employment of other operators, such as a general contractor, to perform or supervise construction activities, or
 - b. the ability to approve or disapprove changes to construction plans and specifications, but who does not have day-to-day on-site operational control over construction activities at the site.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 SITE SPECIFIC STORM WATER POLLUTION PREVENTION PLAN (SWP3)

- A. Prepare a SWP3 following Part III of the Construction General Permit and the Storm Water Management Handbook for Construction Activities issued under City Ordinance Section 47-695(b). If conflicts exist between the Construction General Permit and the handbook, the more stringent requirements will apply.
- B. Update or revise the SWP3 as needed during the construction following Part III, Section E of the Construction General Permit.
- C. Submit the SWP3 and any updates or revisions to Project Manager for review and address comments prior to commencing, or continuing, construction activities.

3.02 NOTICE OF INTENT FOR LARGE CONSTRUCTION ACTIVITY

- A. Fill out, sign, and date TCEQ Form 20022 (03/06/2018) Notice of Intent (NOI) for an Authorization for Stormwater Discharges Associated with Construction Activity under TPDES General Permit TXR150000, ATTACHMENT 1 of this Section 01410.

- B. Transmit the signed Contractor's copy of TCEQ Form 20022 (03/06/2018), along with a \$325.00 check, made out to Texas Commission on Environmental Quality, and the completed Payment Submittal Form to Project Manager.
- C. Project Manager will complete a separate TCEQ Form 20022 (03/06/2018) for City's Notice of Intent, and will submit both Notices, along with checks for application fees, to the TCEQ.
- D. Submission of the Notice of Intent form by both the City and Contractor to TCEQ if mailing is required a minimum of seven days before Commencement of Construction Activities.

3.03 CONSTRUCTION SITE NOTICE FOR SMALL CONSTRUCTION ACTIVITY

- A. Fill out, sign, and date the Construction Site Notice, Attachment 2 to TPDES General Permit TXR150000, "Small Construction Site Notice", ATTACHMENT 2 of this Section 01410.
- B. Transmit the signed Construction Site Notice to Project Manager at least seven days prior to Commencement of Construction Activity.

3.04 CERTIFICATION REQUIREMENTS

- A. Fill out TPDES Operator's Information form, ATTACHMENT 3 of this Section 01410, including Contractor's name, address, and telephone number, and the names of persons or firms responsible for maintenance and inspection of erosion and sediment control measures. Use multiple copies as required to document full information.
- B. Contractor and Subcontractors shall sign and date the Contractor's / Subcontractor's Certification for TPDES Permitting, ATTACHMENT 4 of this Section 01410. Include this certification with other Project certification forms.
- C. Submit properly completed certification forms to Project Manager for review before beginning construction operations.
- D. Conduct inspections in accordance with TCEQ requirements. Ensure persons or firms responsible for maintenance and inspection of erosion and sediment control measures read, fill out, sign, and date the Erosion Control Contractor's certification for Inspection and Maintenance. Use the City of Houston Storm Water Pollution Prevention Plan, Construction Site Inspection Report, ATTACHMENT 5 of this Section 01410 to record maintenance inspections and repairs.

3.05 RETENTION OF RECORDS

- A. Keep a copy of this document and the SWP3 in a readily accessible location at the construction site from Commencement of Construction Activity until submission of the Notice of Termination (NOT) for Storm Water Discharges Associated with Construction Activity under TPDES Construction General Permit (TXR150000). Contractors with day-to-day operational control over SWP3 implementation shall have a copy of the SWP3 available at a central location, on-site, for the use of all operators and those identified as having responsibilities under the SWP3. Upon submission of the NOT, submit all required forms and a copy of the SWP3 with all revisions to Project Manager.

3.06 REQUIRED NOTICES

- A. Post the following notices from effective date of the SWP3 until date of final site stabilization as defined in the Construction General Permit:
 - 1. Post the TPDES permit number for Large Construction Activity, with a signed TCEQ Construction Site Notice for large or Small Construction Activity. Signed copies of the City's and Contractor's NOI must also be posted.
 - 2. Post notices near the main entrance of the construction site in a prominent place where it is safely and readily available for viewing by General Public, Local, State, and Federal Authorities. Post name and telephone number of Contractor's local contact person, brief project description and location of the SWP3.
 - a. If posting near a main entrance is not feasible due to safety concerns, coordinate posting of notice with Project Manager to conform to requirements of the Construction General Permit.
 - b. If Project is a linear construction project (e.g.: road, utilities, etc.), post notice in a publicly accessible location near active construction. Move notice as necessary.
 - 3. Post a notice to equipment and vehicles operators, instructing them to stop, check, and clean tires of debris and mud before driving onto traffic lanes. Post at each stabilized construction access area.
 - 4. Post a notice of waste disposal procedures in a readily visible location on site.

3.07 ON-SITE WASTE MATERIAL STORAGE

- A. On-site waste material storage shall be self-contained and shall satisfy appropriate local, state, and federal rules and regulations.
- B. Prepare list of waste material to be stored on-site. Update list as necessary to include up-to-date information. Keep a copy of updated list with the SWP3.

- C. Prepare description of controls to reduce pollutants generated from on-site storage. Include storage practices necessary to minimize exposure of materials to storm water, and spill prevention and response measures consistent with best management practices. Keep a copy of the description with the SWP3.

3.08 NOTICE OF TERMINATION

- A. Submit a NOT, ATTACHMENT 6 of this Section 01410, to Project Manager within 30 days after:
 - 1. Final stabilization has been achieved on all portions of the site that are the responsibility of the Contractor or
 - 2. Another operator has assumed control over all areas of the site that have not been stabilized and
 - 3. All silt fences and other temporary erosion controls have either been removed, scheduled to be removed as defined in the SWP3, or transferred to a new operator if the new operator has sought permit coverage.
- B. Project Manager will complete City's NOT and submit Contractor and City's notices to the TCEQ and MS4 entities.

END OF SECTION

ATTACHMENT 1

TCEQ Office Use Only
Permit No:
CN:
RN:



**Notice of Intent (NOI) for an Authorization for
Stormwater Discharges Associated with
Construction Activity under
TPDES General Permit TXR150000**

IMPORTANT INFORMATION

Please read and use the General Information and Instructions prior to filling out each question in the NOI form.

Use the NOI Checklist to ensure all required information is completed correctly.
Incomplete applications delay approval or result in automatic denial.

Once processed your permit authorization can be viewed by entering the following link into your internet browser: http://www2.tceq.texas.gov/wq_dpa/index.cfm or you can contact TCEQ Stormwater Processing Center at 512-239-3700.

ePERMITS

Effective September 1, 2018, this paper form must be submitted to TCEQ with a completed electronic reporting waiver form (TCEQ-20754).

To submit an NOI electronically, enter the following web address into your internet browser and follow the instructions: <https://www3.tceq.texas.gov/steers/index.cfm>

APPLICATION FEE AND PAYMENT

The application fee for submitting a paper NOI is \$325. The application fee for electronic submittal of a NOI through the TCEQ ePermits system (STEERS) is \$225.

Payment of the application fee can be submitted by mail or through the TCEQ ePay system. The payment and the NOI must be mailed to separate addresses. To access the TCEQ ePay system enter the following web address into your internet browser: <http://www.tceq.texas.gov/epay>.

Provide your payment information for verification of payment:

- If payment was mailed to TCEQ, provide the following:
 - Check/Money Order Number: [REDACTED]
 - Name printed on Check: [REDACTED]
- If payment was made via ePay, provide the following:
 - Voucher Number: [REDACTED]
 - A copy of the payment voucher is attached to this paper NOI form.

RENEWAL (This portion of the NOI is not applicable after June 3, 2018)

Is this NOI for a renewal of an existing authorization? Yes No

If Yes, provide the authorization number here: TXR15 [REDACTED]

NOTE: If an authorization number is not provided, a new number will be assigned.

SECTION 1. OPERATOR (APPLICANT)

a) If the applicant is currently a customer with TCEQ, what is the Customer Number (CN) issued to this entity? CN [REDACTED]

(Refer to Section 1.a) of the Instructions)

b) What is the Legal Name of the entity (applicant) applying for this permit? (The legal name must be spelled exactly as filed with the Texas Secretary of State, County, or in the legal document forming the entity.)

[REDACTED]

c) What is the contact information for the Operator (Responsible Authority)?

Prefix (Mr. Ms. Miss): [REDACTED]

First and Last Name: [REDACTED] Suffix: [REDACTED]

Title: [REDACTED] Credentials: [REDACTED]

Phone Number: [REDACTED] Fax Number: [REDACTED]

E-mail: [REDACTED]

Mailing Address: [REDACTED]

City, State, and Zip Code: [REDACTED]

Mailing Information if outside USA:

Territory: [REDACTED]

Country Code: [REDACTED] Postal Code: [REDACTED]

d) Indicate the type of customer:

Individual

Federal Government

Limited Partnership

County Government

General Partnership

State Government

Trust

City Government

Sole Proprietorship (D.B.A.)

Other Government

Corporation

Other: [REDACTED]

Estate

e) Is the applicant an independent operator? Yes No

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(If a governmental entity, a subsidiary, or part of a larger corporation, check No.)

f) Number of Employees. Select the range applicable to your company.

0-20

251-500

21-100

501 or higher

101-250

g) Customer Business Tax and Filing Numbers: (**Required** for Corporations and Limited Partnerships. **Not Required** for Individuals, Government, or Sole Proprietors.)

State Franchise Tax ID Number:

Federal Tax ID:

Texas Secretary of State Charter (filing) Number:

DUNS Number (if known):

SECTION 2. APPLICATION CONTACT

Is the application contact the same as the applicant identified above?

Yes, go to Section 3

No, complete this section

Prefix (Mr. Ms. Miss):

First and Last Name: Suffix:

Title: Credential:

Organization Name:

Phone Number: Fax Number:

E-mail:

Mailing Address:

Internal Routing (Mail Code, Etc.):

City, State, and Zip Code:

Mailing information if outside USA:

Territory:

Country Code: Postal Code:

SECTION 3. REGULATED ENTITY (RE) INFORMATION ON PROJECT OR SITE

a) If this is an existing permitted site, what is the Regulated Entity Number (RN) issued to this site? RN

(Refer to Section 3.a) of the Instructions)

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b) Name of project or site (the name known by the community where it's located):

[REDACTED]

c) In your own words, briefly describe the type of construction occurring at the regulated site (residential, industrial, commercial, or other):

[REDACTED]

d) County or Counties (if located in more than one):

[REDACTED]

e) Latitude: Longitude:

[REDACTED] [REDACTED]

f) Site Address/Location

If the site has a physical address such as 12100 Park 35 Circle, Austin, TX 78753, complete *Section A*.

If the site does not have a physical address, provide a location description in *Section B*. Example: located on the north side of FM 123, 2 miles west of the intersection of FM 123 and Highway 1.

Section A:

Street Number and Name:

[REDACTED]

City, State, and Zip Code:

[REDACTED]

Section B:

Location Description:

[REDACTED]

City (or city nearest to) where the site is located:

[REDACTED]

Zip Code where the site is located:

[REDACTED]

SECTION 4. GENERAL CHARACTERISTICS

a) Is the project or site located on Indian Country Lands?

Yes, do not submit this form. You must obtain authorization through EPA Region 6.

No

b) Is your construction activity associated with a facility that, when completed, would be associated with the exploration, development, or production of oil or gas or geothermal resources?

Yes. Note: The construction stormwater runoff may be under jurisdiction of the Railroad Commission of Texas and may need to obtain authorization through EPA Region 6.

No

c) What is the Primary Standard Industrial Classification (SIC) Code that best describes the construction activity being conducted at the site?

[REDACTED]

d) What is the Secondary SIC Code(s), if applicable?

[REDACTED]

e) What is the total number of acres to be disturbed?

[REDACTED]

f) Is the project part of a larger common plan of development or sale?

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Yes

No. The total number of acres disturbed, provided in e) above, must be 5 or more. If the total number of acres disturbed is less than 5, do not submit this form. See the requirements in the general permit for small construction sites.

g) What is the estimated start date of the project? [REDACTED]

h) What is the estimated end date of the project? [REDACTED]

i) Will concrete truck washout be performed at the site? Yes No

j) What is the name of the first water body(ies) to receive the stormwater runoff or potential runoff from the site? [REDACTED]

k) What is the segment number(s) of the classified water body(ies) that the discharge will eventually reach? [REDACTED]

l) Is the discharge into a Municipal Separate Storm Sewer System (MS4)?

Yes No

If Yes, provide the name of the MS4 operator: [REDACTED]

Note: The general permit requires you to send a copy of this NOI form to the MS4 operator.

m) Is the discharge or potential discharge from the site within the Recharge Zone, Contributing Zone, or Contributing Zone within the Transition Zone of the Edwards Aquifer, as defined in 30 TAC Chapter 213?

Yes, complete the certification below.

No, go to Section 5

I certify that the copy of the TCEQ-approved Plan required by the Edwards Aquifer Rule (30 TAC Chapter 213) that is included or referenced in the Stormwater Pollution Prevention Plan will be implemented. Yes

SECTION 5. NOI CERTIFICATION

a) I certify that I have obtained a copy and understand the terms and conditions of the Construction General Permit (TXR150000). Yes

b) I certify that the full legal name of the entity applying for this permit has been provided and is legally authorized to do business in Texas. Yes

c) I understand that a Notice of Termination (NOT) must be submitted when this authorization is no longer needed. Yes

d) I certify that a Stormwater Pollution Prevention Plan has been developed, will be implemented prior to construction and to the best of my knowledge and belief is compliant with any applicable local sediment and erosion control plans, as required in the Construction General Permit (TXR150000). Yes

Note: For multiple operators who prepare a shared SWP3, the confirmation of an operator may be limited to its obligations under the SWP3, provided all obligations are confirmed by at least one operator.

SECTION 6. APPLICANT CERTIFICATION SIGNATURE

Operator Signatory Name:

Operator Signatory Title:

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

I further certify that I am authorized under 30 Texas Administrative Code §305.44 to sign and submit this document, and can provide documentation in proof of such authorization upon request.

Signature (use blue ink): _____ Date: _____

NOTICE OF INTENT CHECKLIST (TXR150000)

Did you complete everything? Use this checklist to be sure!

Are you ready to mail your form to TCEQ? Go to the General Information Section of the Instructions for mailing addresses.

Confirm each item (or applicable item) in this form is complete. This checklist is for use by the applicant to ensure a complete application is being submitted. **Missing information may result in denial of coverage under the general permit.** (See NOI process description in the General Information and Instructions.)

APPLICATION FEE

If paying by check:

- Check was mailed **separately** to the TCEQs Cashier's Office. (See Instructions for Cashier's address and Application address.)
- Check number and name on check is provided in this application.

If using ePay:

- The voucher number is provided in this application and a copy of the voucher is attached.

RENEWAL

- If this application is for renewal of an existing authorization, the authorization number is provided.

OPERATOR INFORMATION

- Customer Number (CN) issued by TCEQ Central Registry
- Legal name as filed to do business in Texas. (Call TX SOS 512-463-5555 to verify.)
- Name and title of responsible authority signing the application.
- Phone number and e-mail address
- Mailing address is complete & verifiable with USPS. www.usps.com
- Type of operator (entity type). Is applicant an independent operator?
- Number of employees.
- For corporations or limited partnerships - Tax ID and SOS filing numbers.
- Application contact and address is complete & verifiable with USPS. <http://www.usps.com>

REGULATED ENTITY (RE) INFORMATION ON PROJECT OR SITE

- Regulated Entity Number (RN) (if site is already regulated by TCEQ)
- Site/project name and construction activity description
- County
- Latitude and longitude <http://www.tceq.texas.gov/gis/sqmaview.html>

- Site Address/Location. Do not use a rural route or post office box.

GENERAL CHARACTERISTICS

- Indian Country Lands –the facility is not on Indian Country Lands.
- Construction activity related to facility associated to oil, gas, or geothermal resources
- Primary SIC Code that best describes the construction activity being conducted at the site. www.osha.gov/oshstats/sicser.html
- Estimated starting and ending dates of the project.
- Confirmation of concrete truck washout.
- Acres disturbed is provided and qualifies for coverage through a NOI.
- Common plan of development or sale.
- Receiving water body or waterbodies.
- Segment number or numbers.
- MS4 operator.
- Edwards Aquifer rule.

CERTIFICATION

- Certification statements have been checked indicating Yes.
- Signature meets 30 Texas Administrative Code (TAC) §305.44 and is original.

Instructions for Notice of Intent (NOI) for Stormwater Discharges Associated with Construction Activity under TPDES General Permit(TXR150000)

GENERAL INFORMATION

Where to Send the Notice of Intent (NOI):

By Regular Mail:

TCEQ

Stormwater Processing Center (MC228)

P.O. Box 13087

Austin, Texas 78711-3087

By Overnight or Express Mail:

TCEQ

Stormwater Processing Center (MC228)

12100 Park 35 Circle

Austin, TX

Application Fee:

The application fee of \$325 is required to be paid at the time the NOI is submitted. Failure to submit payment at the time the application is filed will cause delays in acknowledgment or denial of coverage under the general permit. Payment of the fee may be made by check or money order, payable to TCEQ, or through EPAY (electronic payment through the web).

Mailed Payments:

Use the attached General Permit Payment Submittal Form. The application fee is submitted to a different address than the NOI. Read the General Permit Payment Submittal Form for further instructions, including the address to send the payment.

ePAY Electronic Payment: <http://www.tceq.texas.gov/epay>

When making the payment you must select Water Quality, and then select the fee category “General Permit Construction Storm Water Discharge NOI Application”. You must include a copy of the payment voucher with your NOI. Your NOI will not be considered complete without the payment voucher.

TCEQ Contact List:

Application – status and form questions:

512-239-3700, swpermit@tceq.texas.gov

Technical questions:

512-239-4671, swgp@tceq.texas.gov

Environmental Law Division:

512-239-0600

Records Management - obtain copies of forms:

512-239-0900

Reports from databases(as available):

512-239-DATA (3282)

Cashier’s office:

512-239-0357 or 512-239-0187

Notice of Intent Process:

When your NOI is received by the program, the form will be processed as follows:

- **Administrative Review:** Each item on the form will be reviewed for a complete response. In addition, the operator’s legal name must be verified with Texas Secretary of State as valid and active (if applicable). The address(es) on the form must be verified with the US Postal service as receiving regular mail delivery. Do not give an overnight/express mailing address.

- **Notice of Deficiency:** If an item is incomplete or not verifiable as indicated above, a notice of deficiency (NOD) will be mailed to the operator. The operator will have 30 days to respond to the NOD. The response will be reviewed for completeness.
- **Acknowledgment of Coverage:** An Acknowledgment Certificate will be mailed to the operator. This certificate acknowledges coverage under the general permit.

or

Denial of Coverage: If the operator fails to respond to the NOD or the response is inadequate, coverage under the general permit may be denied. If coverage is denied, the operator will be notified.

General Permit (Your Permit)

For NOIs submitted **electronically** through ePermits, provisional coverage under the general permit begins immediately following confirmation of receipt of the NOI form by the TCEQ.

For **paper** NOIs, provisional coverage under the general permit begins **7 days after a completed NOI is postmarked for delivery** to the TCEQ.

You should have a copy of your general permit when submitting your application. You may view and print your permit for which you are seeking coverage, on the TCEQ web site <http://www.tceq.texas.gov>. Search using keyword TXR150000.

Change in Operator

An authorization under the general permit is not transferable. If the operator of the regulated project or site changes, the present permittee must submit a Notice of Termination and the new operator must submit a Notice of Intent. The NOT and NOI must be submitted no later than 10 days prior to the change in Operator status.

TCEQ Central Registry Core Data Form

The Core Data Form has been incorporated into this form. Do not send a Core Data Form to TCEQ. After final acknowledgment of coverage under the general permit, the program will assign a Customer Number and Regulated Entity Number, if one has not already been assigned to this customer or site.

For existing customers and sites, you can find the Customer Number and Regulated Entity Number by entering the following web address into your internet browser: <http://www15.tceq.texas.gov/crpub/> or you can contact the TCEQ Stormwater Processing Center at 512-239-3700 for assistance. On the website, you can search by your permit number, the Regulated Entity (RN) number, or the Customer Number (CN). If you do not know these numbers, you can select “Advanced Search” to search by permittee name, site address, etc.

The Customer (Permittee) is responsible for providing consistent information to the TCEQ, and for updating all CN and RN data for all authorizations as changes occur. For this permit, a Notice of Change form must be submitted to the program area.

INSTRUCTIONS FOR FILLING OUT THE NOI FORM

Renewal of General Permit. Dischargers holding active authorizations under the expired General Permit are required to submit a NOI to continue coverage. The existing permit number is required. If the permit number is not provided or has been terminated, expired, or denied, a new permit number will be issued.

Section 1. OPERATOR (APPLICANT)

a) Customer Number (CN)

TCEQ's Central Registry will assign each customer a number that begins with CN, followed by nine digits. **This is not a permit number, registration number, or license number.**

If the applicant is an existing TCEQ customer, the Customer Number is available at the following website: <http://www15.tceq.texas.gov/crpub/>. If the applicant is not an existing TCEQ customer, leave the space for CN blank.

b) Legal Name of Applicant

Provide the current legal name of the applicant. The name must be provided exactly as filed with the Texas Secretary of State (SOS), or on other legal documents forming the entity, as filed in the county. You may contact the SOS at 512-463-5555, for more information related to filing in Texas. If filed in the county, provide a copy of the legal documents showing the legal name.

c) Contact Information for the Applicant (Responsible Authority)

Provide information for the person signing the application in the Certification section. This person is also referred to as the Responsible Authority.

Provide a complete mailing address for receiving mail from the TCEQ. The mailing address must be recognized by the US Postal Service. You may verify the address on the following website: <https://tools.usps.com/go/ZipLookupAction!input.action>.

The phone number should provide contact to the applicant.

The fax number and e-mail address are optional and should correspond to the applicant.

d) Type of Customer (Entity Type)

Check only one box that identifies the type of entity. Use the descriptions below to identify the appropriate entity type. Note that the selected entity type also indicates the name that must be provided as an applicant for an authorization.

Individual

An individual is a customer who has not established a business, but conducts an activity that needs to be regulated by the TCEQ.

Partnership

A customer that is established as a partnership as defined by the Texas Secretary of State Office (TX SOS). If the customer is a 'General Partnership' or 'Joint Venture' filed in the county (not filed with TX SOS), the legal name of each partner forming the 'General Partnership' or 'Joint Venture' must be provided. Each 'legal entity' must apply as a co-applicant.

Trust or Estate

A trust and an estate are fiduciary relationships governing the trustee/executor with respect to the trust/estate property.

Sole Proprietorship (DBA)

A sole proprietorship is a customer that is owned by only one person and has not been incorporated. This business may:

1. be under the person's name
2. have its own name (doing business as or DBA)
3. have any number of employees.

If the customer is a Sole Proprietorship or DBA, the 'legal name' of the individual business 'owner' must be provided. The DBA name is not recognized as the 'legal name' of the entity. The DBA name may be used for the site name (regulated entity).

Corporation

A customer that meets all of these conditions:

1. is a legally incorporated entity under the laws of any state or country
2. is recognized as a corporation by the Texas Secretary of State
3. has proper operating authority to operate in Texas

The corporation's 'legal name' as filed with the Texas Secretary of State must be provided as applicant. An 'assumed' name of a corporation is not recognized as the 'legal name' of the entity.

Government

Federal, state, county, or city government (as appropriate)

The customer is either an agency of one of these levels of government or the governmental body itself. The government agency's 'legal name' must be provided as the applicant. A department name or other description of the organization is not recognized as the 'legal name'.

Other

This may include a utility district, water district, tribal government, college district, council of governments, or river authority. Provide the specific type of government.

e) Independent Entity

Check No if this customer is a subsidiary, part of a larger company, or is a governmental entity. Otherwise, check Yes.

f) Number of Employees

Check one box to show the number of employees for this customer's entire company, at all locations. This is not necessarily the number of employees at the site named in the application.

g) Customer Business Tax and Filing Numbers

These are required for Corporations and Limited Partnerships. These are not required for Individuals, Government, and Sole Proprietors.

State Franchise Tax ID Number

Corporations and limited liability companies that operate in Texas are issued a franchise tax identification number. If this customer is a corporation or limited liability company, enter the Tax ID number.

Federal Tax ID

All businesses, except for some small sole proprietors, individuals, or general partnerships should have a federal taxpayer identification number (TIN). Enter this number here. Use no prefixes, dashes, or hyphens. Sole proprietors, individuals, or general partnerships do not need to provide a federal taxID.

TX SOS Charter (filing) Number

Corporations and Limited Partnerships required to register with the Texas Secretary of State are issued a charter or filing number. You may obtain further information by calling SOS at 512-463-5555.

DUNS Number

Most businesses have a DUNS (Data Universal Numbering System) number issued by Dun and Bradstreet Corp. If this customer has one, enter it here.

Section 2. APPLICATION CONTACT

Provide the name and contact information for the person that TCEQ can contact for additional information regarding this application.

Section 3. REGULATED ENTITY (RE) INFORMATION ON PROJECT OR SITE

a) Regulated Entity Number (RN)

The RN is issued by TCEQ's Central Registry to sites where an activity is regulated by TCEQ. This is not a permit number, registration number, or license number. Search TCEQ's Central Registry to see if the site has an assigned RN at <http://www15.tceq.texas.gov/crpub/>. If this regulated entity has not been assigned an RN, leave this space blank.

If the site of your business is part of a larger business site, an RN may already be assigned for the larger site. Use the RN assigned for the larger site.

If the site is found, provide the assigned RN and provide the information for the site to be authorized through this application. The site information for this authorization may vary from the larger site information.

An example is a chemical plant where a unit is owned or operated by a separate corporation that is accessible by the same physical address of your unit or facility. Other examples include industrial parks identified by one common address but different corporations have control of defined areas within the site. In both cases, an RN would be assigned for the physical address location and the permitted sites would be identified

separately under the same RN.

b) Name of the Project or Site

Provide the name of the site or project as known by the public in the area where the site is located. The name you provide on this application will be used in the TCEQ Central Registry as the Regulated Entity name.

c) Description of Activity Regulated

In your own words, briefly describe the primary business that you are doing that requires this authorization. Do not repeat the SIC Code description.

d) County

Provide the name of the county where the site or project is located. If the site or project is located in more than one county, provide the county names as secondary.

e) Latitude and Longitude

Enter the latitude and longitude of the site in degrees, minutes, and seconds or decimal form. For help obtaining the latitude and longitude, go to:
<http://www.tceq.texas.gov/gis/sqmaview.html>.

f) Site Address/Location

If a site has an address that includes a street number and street name, enter the complete address for the site in *Section A*. If the physical address is not recognized as a USPS delivery address, you may need to validate the address with your local police (911 service) or through an online map site used to locate a site. Please confirm this to be a complete and valid address. Do not use a rural route or post office box for a site location.

If a site does not have an address that includes a street number and street name, provide a complete written location description in *Section B*. For example: "The site is located on the north side of FM 123, 2 miles west of the intersection of FM 123 and Highway 1."

Provide the city (or nearest city) and zip code of the site location.

Section 4. GENERAL CHARACTERISTICS

a) Indian Country Lands

If your site is located on Indian Country Lands, the TCEQ does not have authority to process your application. You must obtain authorization through EPA Region 6, Dallas. Do not submit this form to TCEQ.

b) Construction activity associated with facility associated with exploration, development, or production of oil, gas, or geothermal resources

If your activity is associated with oil and gas exploration, development, or production, you may be under jurisdiction of the Railroad Commission of Texas (RRC) and may need to obtain authorization from EPA Region 6.

Construction activities associated with a facility related to oil, gas or geothermal resources may include the construction of a well site; treatment or storage facility; underground hydrocarbon or natural gas storage facility; reclamation plant; gas processing facility;

compressor station; terminal facility where crude oil is stored prior to refining and at which refined products are stored solely for use at the facility; a carbon dioxide geologic storage facility; and a gathering, transmission, or distribution pipeline that will transport crude oil or natural gas, including natural gas liquids, prior to refining of such oil or the use of the natural gas in any manufacturing process or as a residential or industrial fuel.

Where required by federal law, discharges of stormwater associated with construction activities under the RRC's jurisdiction must be authorized by the EPA and the RRC, as applicable. Activities under RRC jurisdiction include construction of a facility that, when completed, would be associated with the exploration, development, or production of oil or gas or geothermal resources, such as a well site; treatment or storage facility; underground hydrocarbon or natural gas storage facility; reclamation plant; gas processing facility; compressor station; terminal facility where crude oil is stored prior to refining and at which refined products are stored solely for use at the facility; a carbon dioxide geologic storage facility under the jurisdiction of the RRC; and a gathering, transmission, or distribution pipeline that will transport crude oil or natural gas, including natural gas liquids, prior to refining of such oil or the use of the natural gas in any manufacturing process or as a residential or industrial fuel. The RRC also has jurisdiction over stormwater from land disturbance associated with a site survey that is conducted prior to construction of a facility that would be regulated by the RRC. Under 33 U.S.C. §1342(1)(2) and §1362(24), EPA cannot require a permit for discharges of stormwater from field activities or operations associated with {oil and gas} exploration, production, processing, or treatment operations, or transmission facilities, including activities necessary to prepare a site for drilling and for the movement and placement of drilling equipment, whether or not such field activities or operations may be considered to be construction activities unless the discharge is contaminated by contact with any overburden, raw material, intermediate product, finished product, byproduct, or waste product located on the site of the facility. Under §3.8 of this title (relating to Water Protection), the RRC prohibits operators from causing or allowing pollution of surface or subsurface water. Operators are encouraged to implement and maintain best management practices (BMPs) to minimize discharges of pollutants, including sediment, in stormwater during construction activities to help ensure protection of surface water quality during storm events.

For more information about the jurisdictions of the RRC and the TCEQ, read the Memorandum of Understanding (MOU) between the RRC and TCEQ at 16 Texas Administrative Code, Part 1, Chapter 3, Rule 3.30, by entering the following link into an internet browser:

[http://texreg.sos.state.tx.us/public/readtac\\$ext.TacPage?sl=R&app=9&p_dir=&p_rloc=&p_tloc=&p_ploc=&pg=1&p_tac=&ti=16&pt=1&ch=3&rl=30](http://texreg.sos.state.tx.us/public/readtac$ext.TacPage?sl=R&app=9&p_dir=&p_rloc=&p_tloc=&p_ploc=&pg=1&p_tac=&ti=16&pt=1&ch=3&rl=30) or contact the TCEQ Stormwater Team at 512-239-4671 for additional information.

c) Primary Standard Industrial Classification (SIC) Code

Provide the SIC Code that best describes the construction activity being conducted at this site.

Common SIC Codes related to construction activities include:

- 1521 - Construction of Single Family Homes

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- 1522 - Construction of Residential Buildings Other than Single Family Homes
- 1541 - Construction of Industrial Buildings and Warehouses
- 1542 - Construction of Non-residential Buildings, other than Industrial Buildings and Warehouses
- 1611 - Highway and Street Construction, except Highway Construction
- 1622 - Bridge, Tunnel, and Elevated Highway Construction
- 1623 - Water, Sewer, Pipeline and Communications, and Power Line Construction

For help with SIC Codes, enter the following link into your internet browser:

<http://www.osha.gov/pls/imis/sicsearch.html> or you can contact the TCEQ Small Business and Local Government Assistance Section at 800-447-2827 for assistance.

d) Secondary SIC Code

Secondary SIC Code(s) may be provided. Leave this blank if not applicable. For help with SIC Codes, enter the following link into your internet browser:

<http://www.osha.gov/pls/imis/sicsearch.html> or you can contact the TCEQ Small Business and Environmental Assistance Section at 800-447-2827 for assistance.

e) Total Number of Acres Disturbed

Provide the approximate number of acres that the construction site will disturb.

Construction activities that disturb less than one acre, unless they are part of a larger common plan that disturbs more than one acre, do not require permit coverage.

Construction activities that disturb between one and five acres, unless they are part of a common plan that disturbs more than five acres, do not require submission of an NOI. Therefore, the estimated area of land disturbed should not be less than five, unless the project is part of a larger common plan that disturbs five or more acres. Disturbed means any clearing, grading, excavating, or other similar activities.

If you have any questions about this item, please contact the stormwater technical staff by phone at 512-239-4671 or by email at swgp@tceq.texas.gov.

f) Common Plan of Development

Construction activities that disturb less than five acres do not require submission of an NOI unless they are part of a common plan of development or for sale where the area disturbed is five or more acres. Therefore, the estimated area of land disturbed should not be less than five, unless the project is part of a larger common plan that disturbs five or more acres. Disturbed means any clearing, grading, excavating, or other similar activities.

For more information on what a common plan of development is, refer to the definition of “Common Plan of Development” in the Definitions section of the general permit or enter the following link into your internet browser:

www.tceq.texas.gov/permitting/stormwater/common_plan_of_development_steps.html

For further information, go to the TCEQ stormwater construction webpage enter the following link into your internet browser: www.tceq.texas.gov/goto/construction and search for “Additional Guidance and Quick Links”. If you have any further questions about the Common Plan of Development you can contact the TCEQ Stormwater Team at

512-239-4671 or the TCEQ Small Business and Environmental Assistance at 800-447-2827.

g) Estimated Start Date of the Project

This is the date that any construction activity or construction support activity is initiated at the site. If renewing the permit provide the original start date of when construction activity for this project began.

h) Estimated End Date of the Project

This is the date that any construction activity or construction support activity will end and final stabilization will be achieved at the site.

i) Will concrete truck washout be performed at the site?

Indicate if you expect that operators of concrete trucks will washout concrete trucks at the construction site.

j) Identify the water body(s) receiving stormwater runoff

The stormwater may be discharged directly to a receiving stream or through a MS4 from your site. It eventually reaches a receiving water body such as a local stream or lake, possibly via a drainage ditch. You must provide the name of the water body that receives the discharge from the site (a local stream or lake).

If your site has more than one outfall you need to include the name of the first water body for each outfall, if they are different.

k) Identify the segment number(s) of the classified water body(s)

Identify the classified segment number(s) receiving a discharge directly or indirectly. Enter the following link into your internet browser to find the segment number of the classified water body where stormwater will flow from the site: www.tceq.texas.gov/waterquality/monitoring/viewer.html or by contacting the TCEQ Water Quality Division at (512) 239-4671 for assistance.

You may also find the segment number in TCEQ publication GI-316 by entering the following link into your internet browser: www.tceq.texas.gov/publications/gi/gi-316 or by contacting the TCEQ Water Quality Division at (512) 239-4671 for assistance.

If the discharge is into an unclassified receiving water and then crosses state lines prior to entering a classified segment, select the appropriate watershed:

- 0100 (Canadian River Basin)
- 0200 (Red River Basin)
- 0300 (Sulfur River Basin)
- 0400 (Cypress Creek Basin)
- 0500 (Sabine River Basin)

Call the Water Quality Assessments section at 512-239-4671 for further assistance.

l) Discharge into MS4 – Identify the MS4 Operator

The discharge may initially be into a municipal separate storm sewer system (MS4). If the stormwater discharge is into an MS4, provide the name of the entity that operates the MS4 where the stormwater discharges. An MS4 operator is often a city, town, county, or utility district, but possibly can be another form of government. Please note that the Construction General Permit requires the Operator to supply the MS4 with a copy of the NOI submitted to TCEQ. For assistance, you may call the technical staff at 512-239-4671.

m) Discharges to the Edwards Aquifer Recharge Zone and Certification

The general permit requires the approved Contributing Zone Plan or Water Pollution Abatement Plan to be included or referenced as a part of the Stormwater Pollution Prevention Plan.

See maps on the TCEQ website to determine if the site is located within the Recharge Zone, Contributing Zone, or Contributing Zone within the Transition Zone of the Edwards Aquifer by entering the following link into an internet browser:

www.tceq.texas.gov/field/eapp/viewer.html or by contacting the TCEQ Water Quality Division at 512-239-4671 for assistance.

If the discharge or potential discharge is within the Recharge Zone, Contributing Zone, or Contributing Zone within the Transition Zone of the Edwards Aquifer, a site-specific authorization approved by the Executive Director under the Edwards Aquifer Protection Program (30 TAC Chapter 213) is required before construction can begin.

For questions regarding the Edwards Aquifer Protection Program, contact the appropriate TCEQ Regional Office. For projects in Hays, Travis and Williamson Counties: Austin Regional Office, 12100 Park 35 Circle, Austin, TX 78753, 512-339- 2929. For Projects in Bexar, Comal, Kinney, Medina and Uvalde Counties: TCEQ San Antonio Regional Office, 14250 Judson Rd., San Antonio, TX 78233-4480, 210-490- 3096.

Section 5. NOI CERTIFICATION

Note: Failure to indicate Yes to all of the certification items may result in denial of coverage under the general permit.

a) Certification of Understanding the Terms and Conditions of Construction General Permit (TXR150000)

Provisional coverage under the Construction General Permit (TXR150000) begins 7 days after the completed paper NOI is postmarked for delivery to the TCEQ. Electronic applications submitted through ePermits have immediate provisional coverage. You must obtain a copy and read the Construction General Permit before submitting your application. You may view and print the Construction General Permit for which you are seeking coverage at the TCEQ web site by entering the following link into an internet browser: www.tceq.texas.gov/goto/construction or you may contact the TCEQ Stormwater processing Center at 512-239-3700 for assistance.

b) Certification of Legal Name

The full legal name of the applicant as authorized to do business in Texas is required. The name must be provided exactly as filed with the Texas Secretary of State (SOS), or on

other legal documents forming the entity, that is filed in the county where doing business. You may contact the SOS at 512-463 5555, for more information related to filing in Texas.

c) Understanding of Notice of Termination

A permittee shall terminate coverage under the Construction General Permit through the submittal of a NOT when the operator of the facility changes, final stabilization has been reached, the discharge becomes authorized under an individual permit, or the construction activity never began at this site.

d) Certification of Stormwater Pollution Prevention Plan

The SWP3 identifies the areas and activities that could produce contaminated runoff at your site and then tells how you will ensure that this contamination is mitigated. For example, in describing your mitigation measures, your site's plan might identify the devices that collect and filter stormwater, tell how those devices are to be maintained, and tell how frequently that maintenance is to be carried out. You must develop this plan in accordance with the TCEQ general permit requirements. This plan must be developed and implemented before you complete this NOI. The SWP3 must be available for a TCEQ investigator to review on request.

Section 6. APPLICANT CERTIFICATION SIGNATURE

The certification must bear an original signature of a person meeting the signatory requirements specified under 30 Texas Administrative Code (TAC) §305.44.

If you are a corporation:

The regulation that controls who may sign an NOI or similar form is 30 Texas Administrative Code §305.44(a)(1) (see below). According to this code provision, any corporate representative may sign an NOI or similar form so long as the authority to sign such a document has been delegated to that person in accordance with corporate procedures. By signing the NOI or similar form, you are certifying that such authority has been delegated to you. The TCEQ may request documentation evidencing such authority.

If you are a municipality or other government entity:

The regulation that controls who may sign an NOI or similar form is 30 Texas Administrative Code §305.44(a)(3) (see below). According to this code provision, only a ranking elected official or principal executive officer may sign an NOI or similar form. Persons such as the City Mayor or County Commissioner will be considered ranking elected officials. In order to identify the principal executive officer of your government entity, it may be beneficial to consult your city charter, county or city ordinances, or the Texas statute(s) under which your government entity was formed. An NOI or similar document that is signed by a government official who is not a ranking elected official or principal executive officer does not conform to §305.44(a)(3). The signatory requirement may not be delegated to a government representative other than those identified in the regulation. By signing the NOI or similar form, you are certifying that you are either a ranking elected official or principal executive officer as required by the administrative code. Documentation demonstrating your position as a ranking elected official or principal executive officer may be requested by the TCEQ.

If you have any questions or need additional information concerning the signatory requirements discussed above, please contact the TCEQ's Environmental Law Division at 512-239-0600.

30 Texas Administrative Code

§305.44. Signatories to Applications

(a) All applications shall be signed as follows.

(1) For a corporation, the application shall be signed by a responsible corporate officer. For purposes of this paragraph, a responsible corporate officer means a president, secretary, treasurer, or vice-president of the corporation in charge of a principal business function, or any other person who performs similar policy or decision-making functions for the corporation; or the manager of one or more manufacturing, production, or operating facilities employing more than 250 persons or having gross annual sales or expenditures exceeding \$25 million (in second-quarter 1980 dollars), if authority to sign documents has been assigned or delegated to the manager in accordance with corporate procedures. Corporate procedures governing authority to sign permit or post-closure order applications may provide for assignment or delegation to applicable corporate positions rather than to specific individuals.

(2) For a partnership or sole proprietorship, the application shall be signed by a general partner or the proprietor, respectively.

(3) For a municipality, state, federal, or other public agency, the application shall be signed by either a principal executive officer or a ranking elected official. For purposes of this paragraph, a principal executive officer of a federal agency includes the chief executive officer of the agency, or a senior executive officer having responsibility for the overall operations of a principal geographic unit of the agency (e.g., regional administrator of the EPA).

Texas Commission on Environmental Quality General Permit Payment Submittal Form

Use this form to submit your Application Fee only if you are mailing your payment.

Instructions:

- Complete items 1 through 5 below:
- Staple your check in the space provided at the bottom of this document.
- *Do not mail this form with your NOI form.*
- *Do not mail this form to the same address as your NOI.*

Mail this form and your check to either of the following:

By Regular U.S. Mail

Texas Commission on Environmental
Quality Financial Administration
Division
Cashier's Office, MC-214
P.O. Box 13088
Austin, TX 78711-3088

By Overnight or Express Mail

Texas Commission on Environmental
Quality Financial Administration
Division
Cashier's Office,
MC-214 12100
Park 35 Circle
Austin, TX 78753

Fee Code: GPA General Permit: TXR150000

1. Check or Money Order No:
2. Amount of Check/Money Order:
3. Date of Check or Money Order:
4. Name on Check or Money Order:
5. NOI Information:

If the check is for more than one NOI, list each Project or Site (RE) Name and Physical Address exactly as provided on the NOI. **Do not submit a copy of the NOI with this form, as it could cause duplicate permit application entries!**

If there is not enough space on the form to list all of the projects or sites the authorization will cover, then attach a list of the additional sites.

Project/Site (RE) Name:

Project/Site (RE) Physical Address:

Staple the check or money order to this form in this space.

ATTACHMENT 2



SMALL CONSTRUCTION SITE NOTICE

**FOR THE
Texas Commission on Environmental Quality (TCEQ)
Stormwater Program
TPDES GENERAL PERMIT TXR150000**

The following information is posted in compliance with **Part II.E.2.** of the TCEQ General Permit Number TXR150000 for discharges of stormwater runoff from small construction sites. Additional information regarding the TCEQ stormwater permit program may be found on the internet at:

http://www.tceq.state.tx.us/nav/permits/wq_construction.html

Operator Name:	
Contact Name and Phone Number:	
Project Description: <i>Physical address or description of the site's location, estimated start date and projected end date, or date that disturbed soils will be stabilized</i>	
Location of Stormwater Pollution Prevention Plan:	

For Small Construction Activities Authorized Under Part II.E.2. (Obtaining Authorization to Discharge) the following certification must be completed:

I _____ (Typed or Printed Name Person Completing This Certification) certify under penalty of law that I have read and understand the eligibility requirements for claiming an authorization under Part II.E.2. of TPDES General Permit TXR150000 and agree to comply with the terms of this permit. A stormwater pollution prevention plan has been developed and will be implemented prior to construction, according to permit requirements. A copy of this signed notice is supplied to the operator of the MS4 if discharges enter an MS4. I am aware there are significant penalties for providing false information or for conducting unauthorized discharges, including the possibility of fine and imprisonment for knowing violations.

Signature and Title _____ Date _____

_____ *Date Notice Removed*

_____ *MS4 operator notified per Part II.F.3.*

ATTACHMENT 3

TPDES OPERATOR'S INFORMATION

Owner's Name and Address: City of Houston

Mr.
(City Official)

(Department)
1002 Washington Ave, 2nd FL
Houston, TX 77002
(832) 394-9108

Contractors' Names and Addresses:

General Contractor: _____

Telephone: _____

Site Superintendent: _____

Telephone: _____

Erosion Control and
Maintenance Inspection: _____

Telephone: _____

Subcontractors' Names and Addresses:

Phone: _____

Phone: _____

Note: Insert name, address, and telephone number of person or firms

ATTACHMENT 4

**CONTRACTOR'S / SUBCONTRACTOR'S
CERTIFICATION FOR TPDES PERMITTING**

I certify under penalty of law that I understand the terms and conditions of TPDES General Permit No. TXR150000 and the Storm Water Pollution Prevention Plan for the construction site identified as part of this certification.

Signature:

Name: (printed or typed)

Title:

Company:

Address:

Date:

Signature:

Name: (printed or typed)

Title:

Company:

Address:

Date:

Signature:

Name: (printed or typed)

Title:

Company:

Address:

Date:

ATTACHMENT 5



City of Houston
Storm Water Quality
Construction Site Activities Inspection Report

TCEQ Stormwater Discharge Permit Number _____

COH Storm Water Quality Permit Number _____

COH Building Permit Login Number _____

NAME _____ DATE _____

ADDRESS _____

- No exceptions noted.
The following deficiencies have been noted:
- NOI / Construction Site Notice Improperly Posted
- Stormwater Pollution Prevention Plan Incomplete or requires updating
- Copy of NOI / CSN not on site
- Storm Water Pollution Prevention Plan not on site
- Erosion and sediment controls improperly installed
- Erosion and sediment control devices improperly maintained
- Fueling/washout/chemical storage areas not properly protected
- Portocan or other sanitary facilities not properly protected or leaking
- Self-inspection and maintenance records incomplete
- Sediment from site outside area of construction
- Other (see description below)

The deficiencies must be corrected:
 immediately; within 48 hours;
 prior to re-inspection

Should the noted deficiencies not be corrected in the time frame indicated, further enforcement remedies will be sought.

For questions concerning the above:
Please contact the Storm Water Quality Group at
1002 Washington Avenue, 2nd Floor, Houston TX 77002
832-394-9108

Inspector's Name

Operator's Signature

Inspector's Cell Phone

Operator's Name
 not present

Distribution: white – Stormwater Quality Engineer gold – operator

TCEQ Office Use Only

Permit No:

CN:

RN:

Region:



Notice of Termination (NOT) for Authorizations under TPDES General Permit TXR150000

IMPORTANT INFORMATION:

Please read and use the General Information and Instructions prior to filling out each question in the form.

Effective September 1, 2018, this paper form must be submitted to TCEQ with a completed electronic reporting waiver form (TCEQ-20754).

ePermits: This form is available on our online permitting system.

Sign up for online permitting at: <https://www3.tceq.texas.gov/steers/>

What is the permit number to be terminated?

TXR15

TXRCW

Section 1. OPERATOR (Permittee)

a) What is the Customer Number (CN) issued to this entity?

CN

b) What is the Legal Name of the current permittee?

c) Provide the contact information for the Operator (Responsible Authority).

Prefix (Mr. Ms. or Miss):

First and Last Name:

Suffix:

Title:

Credentials:

Phone Number:

Fax Number:

Email:

Mailing Address:

City, State, and Zip Code:

Country Mailing Information, if outside USA:

Section 2. APPLICATION CONTACT

This is the person TCEQ will contact if additional information is needed regarding this application.

Is the application contact the same as the permittee identified above?

Yes, go to Section 3.

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- No, complete section below

Prefix (Mr. Ms. or Miss):

First and Last Name: Suffix:

Title: Credentials:

Phone Number: Fax Number:

Email:

Mailing Address:

City, State, and Zip Code:

Country Mailing Information, if outside USA:

Section 3. REGULATED ENTITY (RE) INFORMATION ON PROJECT OR SITE

- TCEQ issued RE Reference Number(RN): RN
- Name of project or site as known by the local community:
- County, or counties if more than 1:
- Latitude: Longitude:
- Site Address/Location:

If the site has a physical address such as 12100 Park 35 Circle, Austin, TX 78753, complete Section 3A.

If the site does not have a physical address, provide a location description in Section 3B. Example: located on the north side of FM 123, 2 miles west of the intersection of FM 123 and Highway 1.

Section 3A: Physical Address of Project or Site:

Street Number and Name:

City, State, and Zip Code:

Section 3B: Site Location Description:

Location description:

City where the site is located or, if not in a city, what is the nearest city:

Zip Code where the site is located:

Section 4. REASON FOR TERMINATION

Check the reason for termination:

- Final stabilization has been achieved on all portions of the site that are the responsibility of the Operator and all silt fences and other temporary erosion controls have been removed, or scheduled for removal as defined in the SWP3.

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- Another permitted Operator has assumed control over all areas of the site that have not been finally stabilized, and temporary erosion controls that have been identified in the SWP3 have been transferred to the new Operator.
- The discharge is now authorized under an alternate TPDES permit.
- The activity never began at this site that is regulated under the general permit.

Section 5. CERTIFICATION

Signatory Name: _____

Signatory Title: _____

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

I further certify that I am authorized under 30 Texas Administrative Code §305.44 to sign and submit this document, and can provide documentation in proof of such authorization upon request.

Signature (use blue ink): _____ Date: _____

Instructions for Notice of Termination (NOT) for Authorizations under TPDES General Permit TXR150000

GENERAL INFORMATION

Where to Send the Notice of Termination (NOT):

BY REGULAR U.S. MAIL:

Texas Commission on Environmental Quality
Stormwater Processing Center (MC-228)
P.O. Box 13087
Austin, Texas 78711-3087

BY OVERNIGHT/EXPRESS MAIL:

Texas Commission on Environmental Quality
Stormwater Processing Center (MC-228)
12100 Park 35 Circle
Austin, TX 78753

TCEQ Contact List:

Application status and form questions:	512-239-3700, swpermit@tceq.texas.gov
Technical questions:	512-239-4671, swgp@tceq.texas.gov
Environmental Law Division:	512-239-0600
Records Management - obtain copies of forms:	512-239-0900
Reports from databases (as available):	512-239-DATA (3282)
Cashier's office:	512 239-0357 or 512-239-0187

Notice of Termination Process:

A Notice of Termination is **effective on the date postmarked for delivery to TCEQ.**

When your NOT is received by the program, the form will be processed as follows:

- 1) Administrative Review: The form will be reviewed to confirm the following:
 - the permit number is provided;
 - the permit is active and has been approved;
 - the entity terminating the permit is the current permittee;
 - the site information matches the original permit record; and
 - the form has the required original signature with title and date.
- 2) Notice of Deficiency: If an item is incomplete or not verifiable as indicated above, a phone call will be made to the applicant to clear the deficiency. A letter will not be sent to the permittee if unable to process the form.
- 3) Confirmation of Termination: A Notice of Termination Confirmation letter will be mailed to the operator.

Change in Operator:

An authorization under the general permit is not transferable. If the operator of the regulated entity changes, the present permittee must submit a Notice of Termination and the new operator must submit a Notice of Intent. The NOT and NOI must be submitted not later than 10 days prior to the change in Operator status.

INSTRUCTIONS FOR FILLING OUT THE FORM

The majority of permit information related to the current operator and regulated entity are available at the following website: http://www2.tceq.texas.gov/wq_dpa/index.cfm.

Section 1. Operator (Current Permittee):

a) Customer Number (CN)
TCEQ's Central Registry assigns each customer a number that begins with CN, followed by nine digits. This is not a permit number, registration number, or license number. The Customer Number, for the current permittee, is available at the following website:
http://www2.tceq.texas.gov/wq_dpa/index.cfm.

b) Legal Name of Operator
The operator must be the same entity as previously submitted on the original Notice of Intent for the permit number provided. The current operator name, as provided on the current authorization, is available at the following website:
http://www2.tceq.texas.gov/wq_dpa/index.cfm.

c) Contact Information for the Operator (Responsible Authority)
Provide information for person signing the NOT application in the Certification section. This person is also referred to as the Responsible Authority.

Provide a complete mailing address for receiving mail from the TCEQ. Update the address if different than previously submitted for the Notice of Intent or Notice of Change. The mailing address must be recognized by the US Postal Service. You may verify the address on the following website: <https://tools.usps.com/go/ZipLookupAction!input.action>.

The phone number should provide contact to the operator.

The fax number and e-mail address are optional and should correspond to the operator.

Section 2. Application Contact:

Provide the name, title and contact information of the person that TCEQ can contact for additional information regarding this application.

Section 3. Regulated Entity (RE) Information on Project or Site:

a) Regulated Entity Reference Number (RN)
A number issued by TCEQ's Central Registry to sites where an activity regulated by TCEQ. This is not a permit number, registration number, or license number. The Regulated Entity Reference Number is available at the following website:
http://www2.tceq.texas.gov/wq_dpa/index.cfm.

b) Name of the Project or Site
Provide the name of the site as known by the public in the area where the site is located.

c) County
Identify the county or counties in which the regulated entity is located.

d) Latitude and Longitude
Enter the latitude and longitude of the site in degrees, minutes, and seconds or decimal form. The latitude and longitude as provided on the current authorization is available at the following website: http://www2.tceq.texas.gov/wq_dpa/index.cfm.

e) Site/Project (RE) Physical Address/Location Information
The physical address/location information, as provided on the current authorization, is available at the following website: http://www2.tceq.texas.gov/wq_dpa/index.cfm.

LITTLE VINCE BAYOU GREENWAY

Section 3A. If a site has an address that includes a street number and street name, enter the complete address for the site. If the physical address is not recognized as a USPS delivery address, you may need to validate the address with your local police (911 service) or through an online map site used to locate the site. Please confirm this to be a complete and valid address. Do not use a rural route or post office box for a site location.

Section 3B. If a site does not have an address that includes a street number and street name, provide a complete written location description. For example: "The site is located on the north side of FM 123, 2 miles west of the intersection of FM 123 and Highway 1."

Provide the city (or nearest city) and Zip Code of the facility location.

Section 4. Reason for Termination:

The Notice of Termination form is only for use to terminate the authorization (permit). The Permittee must indicate the specific reason for terminating by checking one of the options. If the reason is not listed then provide an attachment that explains the reason for termination.

Please read your general permit carefully to determine when to terminate your permit. Permits will not be reactivated after submitting a termination form. The termination is effective on the date postmarked for delivery to TCEQ.

Section 5. Certification:

The certification must bear an original signature of a person meeting the signatory requirements specified under 30 Texas Administrative Code §305.44.

IF YOU ARE A CORPORATION:

The regulation that controls who may sign an application form is 30 Texas Administrative Code §305.44(a), which is provided below. According to this code provision, any corporate representative may sign an NOI or similar form so long as the authority to sign such a document has been delegated to that person in accordance with corporate procedures. By signing the NOI or similar form, you are certifying that such authority has been delegated to you. The TCEQ may request documentation evidencing such authority.

IF YOU ARE A MUNICIPALITY OR OTHER GOVERNMENT ENTITY:

The regulation that controls who may sign an NOI or similar form is 30 Texas Administrative Code §305.44(a), which is provided below. According to this code provision, only a ranking elected official or principal executive officer may sign an NOI or similar form. Persons such as the City Mayor or County Commissioner will be considered ranking elected officials. In order to identify the principal executive officer of your government entity, it may be beneficial to consult your city charter, county or city ordinances, or the Texas statutes under which your government entity was formed. An NOI or similar document that is signed by a government official who is not a ranking elected official or principal executive officer does not conform to §305.44(a) (3). The signatory requirement may not be delegated to a government representative other than those identified in the regulation. By signing the NOI or similar form, you are certifying that you are either a ranking elected official or principal executive officer as required by the administrative code. Documentation demonstrating your position as a ranking elected official or principal executive officer may be requested by the TCEQ.

If you have any questions or need additional information concerning the signatory requirements discussed above, please contact the Texas Commission on Environmental Quality's Environmental Law Division at 512-239-0600.

30 Texas Administrative Code §305.44. Signatories to Applications

(a) All applications shall be signed as follows.

(1) For a corporation, the application shall be signed by a responsible corporate officer. For purposes of this paragraph, a responsible corporate officer means a president, secretary, treasurer, or vice-president of the corporation in charge of a principal business function, or any other person who performs similar policy or decision-making functions for the corporation; or the manager of one or more manufacturing, production, or operating facilities employing more than 250 persons or having gross annual sales or expenditures exceeding \$25 million (in second-quarter 1980 dollars), if authority to sign documents has been assigned or delegated to the manager in accordance with corporate procedures. Corporate procedures governing authority to sign permit or post-closure order applications may provide for assignment or delegation to applicable corporate positions rather than to specific individuals.

(2) For a partnership or sole proprietorship, the application shall be signed by a general partner or the proprietor, respectively.

(3) For a municipality, state, federal, or other public agency, the application shall be signed by either a principal executive officer or a ranking elected official. For purposes of this paragraph, a principal executive officer of a federal agency includes the chief executive officer of the agency, or a senior executive officer having responsibility for the overall operations of a principal geographic unit of the agency (e.g., regional administrator of the EPA).

Section 3A. If a site has an address that includes a street number and street name, enter the complete address for the site. If the physical address is not recognized as a USPS delivery address, you may need to validate the address with your local police (911 service) or through an online map site used to locate the site. Please confirm this to be a complete and valid address. Do not use a rural route or post office box for a site location.

Section 3B. If a site does not have an address that includes a street number and street name, provide a complete written location description. For example: "The site is located on the north side of FM 123, 2 miles west of the intersection of FM 123 and Highway 1."

Provide the city (or nearest city) and Zip Code of the facility location.

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Please read your general permit carefully to determine when to terminate your permit. Permits will not be reactivated after submitting a termination form. The termination is effective on the date postmarked for delivery to TCEQ.

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IF YOU ARE A MUNICIPALITY OR OTHER GOVERNMENT ENTITY:

The regulation that controls who may sign an NOI or similar form is 30 Texas Administrative Code §305.44(a), which is provided below. According to this code provision, only a ranking elected official or principal executive officer may sign an NOI or similar form. Persons such as the City Mayor or County

SECTION 01555

TRAFFIC CONTROL AND REGULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Requirements for signs, signals, control devices, traffic barriers, flares, lights and traffic signals; construction parking control, designated haul routes, and bridging of trenches and excavations.
- B. Qualifications and requirements for use of flagmen.

1.02 RELATED SECTIONS

- A. Section 01110 - Summary of Work
- B. Section 01270 – Measurement and Payment
- C. Section 01330 – Submittal Procedures

1.03 MEASUREMENT AND PAYMENT

- A. Unit Price Contracts.
 - 1. Traffic control and regulation. Payment for traffic control and regulation is on a lump sum basis. Include preparation and submittal of traffic control plan if different than shown on Drawings, and provision of traffic control devices, equipment, and personnel necessary to protect the Work and public. Payment will be based on Contractor's Schedule of Values for traffic control and regulation.
 - 2. Payment for traffic control for wastewater or water line projects will be authorized by Project Manager in three (3) parts. Partial payment will be made according to following schedule:
 - a. Payment of 25 percent of traffic control amount will be authorized when permanent control devices and necessary temporary markings, sufficiently deployed along job site as required to maintain progress of work, are installed at job site and approved. This limiting percentage will be prorated based upon extent of Contractor's setup.
 - b. A payment of 50 percent of traffic control amount will be authorized when pavement replacement commences. This limiting percentage will be prorated based upon linear footage, as measured along centerline axis of wastewater or water line, of pavement replaced.

- c. A payment of 25 percent of traffic control amount will be authorized when permanent pavement markings are restored and all unnecessary permanent and temporary control devices removed. This limiting percentage will be prorated based upon the extent of restoration.
 3. Flagmen: Measurement is on a lump sum basis for flagmen as required for the project. The amount invoiced shall be determined based on the schedule of value submitted for flagmen.
 4. New Portable Concrete Low Profile Traffic Barrier or Water Filled Barrier Provided. Payment is on a unit price basis for each linear foot of low profile traffic barrier or water filled barrier provided, installed with hardware assemblies and connected together in accordance with the approved traffic control plan.
 5. Portable Concrete Low Profile Traffic Barrier or Water Filled Barrier picked up from City of Houston Stockpile. Payment is on a unit price basis for each linear foot of low profile traffic barrier or water filled barrier picked up from designated stockpile, moved onto the project, set at location and connected together.
 6. Portable Concrete Low Profile Traffic Barrier or Water Filled Barrier Installed. Payment is on a unit price basis for each linear foot of low profile traffic barrier or water filled barrier delivered to the project location, installed with hardware assemblies and connected together in accordance with the approved traffic control plan.
 7. Portable Concrete Low Profile Traffic Barrier or Water Filled Barrier Moved and Reset. Payment is on a unit price basis for each linear foot of low profile traffic barrier or water filled barrier disassembled, moved on the project, reset at the new locations and connected together. Include cost to repair roadway in the unit price.
 8. Portable Concrete Low Profile Traffic Barrier or Water Filled Barrier Removed. Payment is on a unit price basis for each linear foot of low profile traffic barrier or water filled barrier removed from the project, including hardware assemblies, and stockpiling at location listed in Section 01110 - Summary of Work. Include cost to repair roadway in the unit price.
 9. Refer to Section 01270 - Measurement and Payment for unit price procedures.
 - B. Stipulated Price Contracts. Include payment for work under this section in the total Stipulated Price.
- 1.04 REFERENCES
- A. Texas Manual on Uniform Traffic Control Devices (TMUTCD)

- B. Article 4413 (29bb), commonly referred to as Private Investigators and Private Security Agencies Act, and Article 2.12, Texas Code of Criminal Procedure.
- C. Code of Ordinances, City of Houston, Texas.
 - 1. Chapter 10 Buildings And Neighborhood Protection, Article X Cleanup After Demolition Or Removal Of Structures
 - 2. Chapter 40 Streets and Sidewalks, Article XVII Sidewalk and Roadway Obstructions and Impairments
- D. Institute of Transportation Engineers (ITE) Purchase Specification for Flashing and Steady Burn Warning Lights, current edition

1.05 SUBMITTALS

- A. Conform to requirements of Section 01330 - Submittal Procedures.
- B. Traffic control plan:
 - 1. If using traffic control plan contained in the Contract without modification, submit a letter confirming use of the plan.
 - 2. If using a different traffic control plan, submit the plan for approval. The plan must conform to TMUTCD requirements and be sealed by a Registered Texas Professional Engineer.
- C. Submit copies of approved lane closure permits issued by City Traffic Engineering Branch.
- D. Submit Schedules of Values for traffic control plan and flagmen within 30 days following Notice to Proceed.
- E. Submit records verifying qualifications of Uniformed Peace Officers and Certified Flagmen proposed for use on the Work.
- F. When working in the central business district, submit copies of approved Pedestrian Way permits issued by the City's Traffic Engineering Branch.

1.06 FLAGMEN

- A. Use Uniformed Peace Officers and Certified Flagmen to control movement of vehicular and pedestrian traffic when construction operations encroach on public traffic lanes. Unless otherwise approved by Project Manager, use Uniformed Peace Officer for work along major thoroughfares, schools, churches, hospitals and Work at signalized intersections.

- B. Uniformed Peace Officer: Individual employed full-time as a peace officer who receives separate compensation as a privately employed flagman. Private employment may be an employee-employer relationship or on an individual basis. Flagman may not be in the employ of another peace officer nor be a reserve peace officer.
1. Uniformed Peace Officers may be:
 - a. sheriffs and their deputies;
 - b. constables and deputy constables;
 - c. marshals or police officers of an incorporated city, town or village; or
 - d. as otherwise provided by Article 2.12, Code of Criminal Procedure.
 2. The Uniformed Peace Officer must be a full-time peace officer, must work a minimum average of 32 paid hours per week, and must be paid a rate not less than the prevailing minimum hourly wage rate set by the federal Wage and Hour Act. The individual must be entitled to vacation, holidays, and insurance and retirement benefits.
- C. Certified Flagman: Individual who receives compensation as a flagman and meets the following qualifications:
1. Formally trained and certified in traffic control procedures by the City's E. B. Cape Center or flagman trainings listed on TXDOT traffic control training list.
 2. Speaks English. Ability to speak Spanish is desirable but not required.
 3. Paid for flagman duty at an hourly rate not less than the wage rate set for Rough Carpenter under the City's Wage Scale for Engineering Construction.
- D. Certified Flagmen must wear a distinctive uniform, bright-colored vest, and be equipped with appropriate flagging and communication devices while at the Work site. They must also have in their possession while on duty, a proof of training identification card issued by the appropriate training institute.

PART 2 PRODUCTS

2.01 SIGNS, SIGNALS, AND DEVICES

- A. Comply with TMUTCD requirements.
- B. Traffic cones and drums, flares and lights: Conform to local jurisdictions' requirements.

1. Warning lights shall meet the requirements of TMUTCD section 6F.83 and the current ITE “Purchase Specification for Flashing and Steady Burn Warning Lights”.
 2. Warning lights shall be capable of being visible on a clear night from a distance of 3,000 feet.
- C. When working in the Central business district, provide pedestrian pathway signage approved by the City's Traffic Engineering Branch.

2.02 PORTABLE LOW PROFILE CONCRETE BARRIERS

- A. The low profile concrete barrier is a patented design. Information concerning this barrier may be obtained from Texas Transportation Institute, Texas A&M University System, College Station, Texas 77843-3135, (409) 845-1712.

2.03 WATER FILLED BARRIERS

- A. Provide barrier units that are capable of being lifted and moved when filled if draining is not possible.
- B. Provide water filled barrier that acts as its own free standing, non-redirective end treatment.
- C. When water filled barriers are used to channelize pedestrians, they must have a continuous detectable bottom for users of long canes and the top of the unit shall not be less than 32 inches in height.

PART 3 EXECUTION

3.01 PUBLIC ROADS

- A. Submit requests forms for lane closure and sidewalk closure to Office of City Engineer, Mobility Unit ten working days prior to need for blocking vehicular lanes or sidewalks. Do not block lanes or sidewalks without approved permits. Obtain application from the Office of City Engineer, Mobility Unit at 1002 Washington Ave, 2nd floor, Houston, TX 77002 or at the following internet address:
<https://www.houstonpermittingcenter.org/hpwmp1001#apply>
- B. Follow laws and regulations of governing jurisdictions when using public roads. Pay for and obtain permits from jurisdiction before impeding traffic or closing lanes. Coordinate activities with Project Manager.
- C. Give Project Manager one-week notice before implementing approved traffic control phases. Inform local businesses of impending traffic control activities.
- D. Notified police department, fire department, METRO, and local schools, churches, and businesses in writing a minimum of five business days prior to beginning work.

- E. Maintain 10-foot wide all-weather lanes adjacent to the Work for emergency vehicle use. Keep all-weather lanes free of construction equipment and debris.
- F. Do not obstruct normal flow of traffic from 7:00 a.m. to 9:00 a.m. and 4:00 p.m. to 6:00 p.m. on designated major arterials or as directed by Project Manager.
- G. Maintain local driveway access to residential and commercial properties adjacent to work areas at all times. Use all-weather materials approved by Project Manager to maintain temporary driveway access to commercial and residential driveways.
- H. Keep streets entering and leaving job site free of excavated material, debris, and foreign material resulting from construction operations in compliance with applicable ordinances.
- I. Remove existing signage and striping that conflict with construction activities or that may cause driver confusion.
- J. Provide safe access for pedestrians along major cross streets.
- K. Alternate closures of cross streets so that two adjacent cross streets are not closed simultaneously.
- L. Do not close more than two consecutive esplanade openings at a time without prior approval from Project Manager.

3.02 CONSTRUCTION PARKING CONTROL

- A. Control vehicular parking to prevent interference with public traffic and parking, access by emergency vehicles, and the City's operations.
- B. Monitor parking of construction personnel's vehicles in existing facilities. Maintain vehicular access to and through parking areas.
- C. Prevent parking on or adjacent to access roads or in non-designated areas.

3.03 FLARES AND LIGHTS

- A. Provide flares and lights during hours of low visibility to delineate traffic lanes and to guide traffic.
- B. When warning lights are used, they shall be mounted on signs or channelizing devices in a manner that if hit by an errant vehicle, they will not be likely to penetrate the windshield.

3.04 WATER FILLED BARRIERS

- A. Water filled barriers can be used as instructed by the Engineer and approved by City for projects where space is limited and heavy equipment to place concrete barriers is not feasible. Water filled barriers shall not be used on roadways with a posted speed limit more than 45 mph.
- B. Water filled barriers must be installed and maintained per the manufacturer's requirements and routinely inspected for defects.
- C. If water filled barrier is provided, use environmentally safe anti-freezing agent in the water when it is applicable per manufacturer specifications and recover agent when the barrier is drained.
- D. Dispose of water and agent properly. Do not drain water filled barrier into or across an existing travel lane.

3.05 HAUL ROUTES

- A. Utilize haul routes designated by authorities or shown on drawings for construction traffic.
- B. Confine construction traffic to designated haul routes.
- C. Provide traffic control at critical areas of haul routes to regulate traffic and minimize interference with public traffic.

3.06 TRAFFIC SIGNS AND SIGNALS

- A. Construct necessary traffic control devices for temporary signals required to complete the Work including loop detectors, traffic signal conduits, traffic signal wiring and crosswalk signals. Notify the City's Traffic Engineering Branch a minimum of 60 days in advance of need for control boxes and switchgear. The City will perform necessary service, programming or adjustments, to signal boxes and switchgear if required during construction.
- B. Install and operate traffic control signals to direct and maintain orderly traffic flow in areas under Contractor's control affected by Contractor's operations. Post notices, signs and traffic controls before moving into next phase of traffic control.
- C. Relocate traffic signs and signals as the Work progresses to maintain effective traffic control.
- D. Unless otherwise approved by Project Manager, provide driveway signs with name of business that can be accessed from each crossover. Use two signs for each crossover.
- E. Replace existing traffic control devices in Project area.
- F. Project Manager may direct Contractor to make minor adjustments to traffic control signage to eliminate driver confusion and maintain orderly traffic flow during construction at no additional cost to the City.

3.07 BRIDGING TRENCHES AND EXCAVATIONS

- A. When necessary, construct bridges over trenches and excavation to permit an unobstructed flow of traffic across construction areas and major drives. Use steel plates of sufficient thickness to support H-20 loading and install to operate with minimum noise.
- B. Shore trench or excavation to support bridge and traffic.
- C. Secure bridging against displacement with adjustable cleats, angles, bolts or other devices when:
 - 1. bridging is placed over existing bus routes,
 - 2. more than five percent of daily traffic is comprised of commercial or truck traffic,
 - 3. more than two separate plates are used for bridging, and
 - 4. when bridge is to be used for more than five consecutive days.
- D. Extend steel plates used for bridging a minimum of 1 foot beyond edges of trench or excavation. Use temporary paving materials such as premix to feather edges of plates to minimize wheel impact on secured bridging.

3.08 REMOVAL

- A. Remove equipment and devices when no longer required. All short-term duration closures within central business district (CBD) must have all their equipment picked up on a daily basis, this includes any and all construction equipment utilized, along with all traffic control, unless approved by the city mobility permits group.
- B. Repair damage caused by installation.
- C. Remove post settings to a depth of 2 feet.

3.09 TRAFFIC CONTROL, REGULATION AND DIRECTION

- A. Use Flagmen to control, regulate and direct an even flow and movement of vehicular and pedestrian traffic, for periods of time as may be required to provide for public safety and convenience, where:
 - 1. multi-lane vehicular traffic must be diverted into single lane vehicular traffic,
 - 2. vehicular traffic must change lanes abruptly,
 - 3. construction equipment must enter or cross vehicular traffic lanes and walks,
 - 4. construction equipment may intermittently encroach on vehicular traffic lanes and unprotected walks and crosswalk,

5. traffic regulation is needed due to rerouting of vehicular traffic around the Work site, and
 6. where construction activities might affect public safety and convenience.
- B. Use of Flagmen to assist in the regulation of traffic flow and movement does not relieve Contractor of responsibility to take other means necessary to protect the Work and public.

3.10 INSTALLATION STANDARDS

- A. Place temporary pavement for single lane closures, in accordance with TMUTCD.
- B. Reinstall temporary and permanent pavement markings as approved by Project Manager. When weather conditions do not allow application according to manufacturer's requirements, alternate markings may be considered. Submit proposed alternate to Project Manager for approval prior to installation. No additional payment will be made for use of alternate markings.

3.11 MAINTENANCE OF EQUIPMENT AND MATERIAL

- A. Submit name, address and telephone number of individual designated to be responsible for maintenance of traffic handling at construction site to Project Manager. Individual must be accessible at all times to immediately correct deficiencies in equipment and materials used to handle traffic including missing, damaged, or obscured signs, drums, barricades, or pavement markings.
- B. Inspect signs, barricades, drums, lamps and temporary pavement markings daily to verify that they are visible, in good working order, and conform with traffic handling plans as approved by Project Manager. Immediately repair, clean, relocate, realign, or replace equipment or materials that are not in compliance.
- C. Keep equipment and materials, signs and pavement markings, clean and free of dust, dirt, grime, oil, mud, or debris.
- D. Obtain approval of Project Manager to reuse damaged or vandalized signs, drums, and barricades.

END OF SECTION

SECTION 01570

STORM WATER POLLUTION PREVENTION CONTROL

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Implementation of Storm Water Pollution Prevention Plans (SWP3) described in Section 01410 - TPDES Requirement.
- B. Installation, maintenance and removal, of storm water pollution prevention structures: diversion dikes, interceptor dikes, diversion swales, interceptor swales, down spout extenders, pipe slope drains, paved flumes and level spreaders. Structures are used during construction and prior to final development of the site.
- C. Filter Fabric Barriers:
 - 1. Type 1: Temporary filter fabric barrier for erosion and sediment control in non-channelized flow areas.
 - 2. Type 2: Temporary reinforced filter fabric barrier for erosion and sediment control in channelized flow areas.
- D. Hay Bale Fence.
- E. Drop Inlet Basket
- F. Inlet Sediment Traps
- G. Brush Berm
- H. Sand Bag Barrier
- I. Bagged Gravel Barrier
- J. Sediment Basin
- K. Inlet Protection Barrier

1.02 RELATED SECTIONS

- A. Document 00410 – Bid Form
- B. Section 01270 – Measurement and Payment
- C. Section 01330 – Submittal Procedures
- D. Section 01410 – TPDES Requirements

- E. Section 01504 - Temporary Facilities and Controls
 - F. Section 01562 - Tree and Plant Protection
 - G. Section 01575 - Stabilized Construction Access
 - H. Section 01576 - Waste Material Disposal
 - I. Section 02233 - Clearing and Grubbing
 - J. Section 02315 - Roadway Excavation
 - K. Section 02317 - Excavation and Backfill for Utilities
 - L. Section 02320 - Utility Backfill Materials
 - M. Section 02505 - High Density Polyethylene (HDPE) Solid and Profile Wall Pipe
 - N. Section 02506 - Polyvinyl Chloride Pipe
 - O. Section 02510 – Polypropylene (PP) Corrugated Wall Pipe
 - P. Section 02642 - Corrugated Metal Pipe
 - Q. Section 03315 - Concrete for Utility Construction
- 1.03 MEASUREMENT AND PAYMENT
- A. UNIT PRICES
 - 1. Payment for filter fabric barrier is on a linear foot basis measured between limits of beginning and ending of stakes.
 - 2. Payment for reinforced filter fabric barrier is on a linear foot basis measured between limits of beginning and ending of stakes.
 - 3. Payment for drop inlet baskets is on a unit price basis for each drop inlet basket.
 - 4. Payment for storm inlet sediment traps is on a unit price basis for each storm inlet sediment trap.
 - 5. Payment for storm water pollution prevention structures is on a lump sum basis for the project. Earthen structures with outlet and piping include diversion dikes, interceptor dikes, diversion swales, interceptor swales, and excavated earth-outlet sediment trap, embankment earth-outlet sediment trap, down spout extenders, pipe slope drains, paved flumes, stone outlet sediment trap, and level spreaders.

6. Payment for hay bale barrier, if included in Document 00410 - Bid Form, is on a linear foot of accepted bale barriers, if not include in cost of storm water pollution prevention structures.
 7. Payment for brush berm, if included in Document 00410 - Bid Form, is on a linear foot of accepted brush berm, if not include in cost of storm water pollution prevention structures.
 8. Payment for sandbag barrier, if included in Document 00410 - Bid Form, is on a linear foot basis measured between limits of beginning and ending of sandbags, if not include in cost of storm water pollution prevention structures.
 9. Payment for bagged gravel barrier, if included in Document 00410 - Bid Form, is on a linear foot basis measured between limits of beginning and ending of bagged gravel barrier, if not include in cost of storm water pollution prevention controls.
 10. Payment for inlet protection barriers, if included in Document 00410 - Bid Form, is on a linear foot basis measured along outside face of inlet protection barrier, if not include in cost of storm water pollution prevention structures.
 11. Repair or replacement of any storm water pollution prevention component is incidental to the individual bid items, regardless of cause of damage.
 12. Refer to Section 01270 - Measurement and Payment for unit price procedures.
- B. Stipulated Price (Lump Sum) Contract. If Contract is Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

1.04 REFERENCE STANDARDS

- A. ASTM
1. A 36 - Standard Specification for Carbon Structural Steel.
 2. D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600kN-m/m³)).
 3. D3786 - Standard Test Method for Hydraulic Bursting Strength for knitted Goods and Nonwoven Fabrics.
 4. D 4355 - Standard Test Method for Deterioration of Geotextiles from Exposure to Ultraviolet Light and Water (Xenon-Arc Type Apparatus).
 5. D 4491 - Standard Test Methods for Water Permeability of Geotextiles by Permittivity.
 6. D 4632 - Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.

7. D 4833 - Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products.
 8. D 6382 - Standard Practice for Dynamic Mechanical Analysis and Thermogravimetry of Roofing and Waterproofing Membrane Material.
- B. Storm Water Management Handbook for Construction Activities prepared by City of Houston, Harris County and Harris County Flood Control District.

1.05 SYSTEM DESCRIPTIONS

- A. Filter Fabric Barrier Type 1 and Type 2: Install to allow surface or channel runoff percolation through fabric in sheet-flow manner and to retain and accumulate sediment. Maintain Filter Fabric Barriers to remain in proper position and configuration at all times.
- B. Hay Bale Fence: Install to allow surface runoff percolation through hay in sheet-flow manner and to retain and accumulate sediment. Maintain Hay Bale Fence to remain in proper position and configuration at all times.
- C. Interceptor Dikes and Swales: Construct to direct surface or channel runoff around the project area or runoff from project area into sediment traps.
- D. Drop Inlet Baskets: Install to allow runoff percolation through the basket and to retain and accumulate sediment. Clean accumulation of sediment to prevent clogging and backups.
- E. Sediment Traps: Construct to pool surface runoff from construction area to allow sediment to settle onto the bottom of trap.
- F. Sand Bags: Are used during construction activities in unstabilized minor swales, ditches, or streambeds when the contributing drainage area is no greater than 2 acres. It is also sediment barrier for stage one Inlet.
- G. Bagged Gravel Barrier: Are used during construction activities in unstabilized minor swales, ditches, or streambeds when the contributing drainage area is no greater than 2 acres. It is also sediment barrier for stage two Inlet.
- H. Drop Inlet Insert Basket: Is a temporary barrier placed within a storm drain inlet (Lower Portion of Stage I and Upper Portion of Stage II Inlets) consisting of a filter fabric supported by a metal framework to prevent sediment and other pollutants from entering convey system.
- I. Brush Berm: Brush Berm is constructed at the perimeter of a distribute site within the developing area.

1.06 SUBMITTALS

- A. Conform to requirements of Section 01330 - Submittal Procedures.

- B. Submit manufacturer's literature for product specifications and installation instructions.
- C. Submit manufacturer's catalog sheets and other product data for geotextile or filter fabrics, outlet pipe, perforated riser and connectors.
- D. Submit proposed methods, equipment, materials, and sequence of operations for storm water pollution prevention structures.
- E. Submit shop drawings for Drop Inlet Baskets.

PART 2 PRODUCTS

2.01 CONCRETE

- A. Concrete: Class B in accordance with Section 03315 - Concrete for Utility Construction or as shown on the Drawings.

2.02 AGREGATE MATERIALS

- A. Use poorly graded cobbles with diameter greater than 3 inches and less than 5 inches.
- B. Provide gravel lining in accordance with Section 2320 - Utility Backfill Materials or as shown on the drawings.
- C. Provide clean cobbles and gravel consisting of crushed concrete or stone. Use clean, hard crushed concrete or stone free from adherent coatings, salt, alkali, dirt, clay, loam, shale, soft or flaky materials, or organic matter.
- D. Sediment Pump Pit Aggregate: Use nominal 2-inch diameter river gravel.

2.03 PIPE

- A. High Density Polyethylene (HDPE) culvert pipe, Polypropylene (PP), or PVC sewer pipe in accordance with Section 02505 High Density Polyethylene (HDPE) Solid and Profile Wall Pipe and Section 02506 Polyvinyl Chloride Pipe or as shown on the Drawings.
- B. Inlet Pipes: Galvanized steel pipe in accordance with Section 02642 Corrugated Metal Pipe or as shown on the Drawings.
- C. Standpipe for Sediment Pump Pits: Galvanized round culvert pipe or round PVC pipe, minimum of 12-inch and a maximum of 24-inch diameter, perforate at 6 to 12 inch centers around circumference.

2.04 GEOTEXTILE FILTER FABRIC

- A. Woven or nonwoven geotextile filter fabric made of either polypropylene, polyethylene, ethylene, or polyamide material, in continuous rolls of longest practical length.
- B. Grab Strength: 100 psi in any principal direction (ASTM D-4632), Mullen burst strength >200 psi (ASTM D-3786), and equivalent opening size between 50 and 140.
- C. Furnish ultraviolet inhibitors and stabilizers for minimum 6 months of expected usable construction life at temperature range of 0 degrees F to 120 degrees F.
- D. Mirafi, Inc., Synthetic Industries, or equivalent.

2.05 BARRIER

- A. Wire Barrier: Woven galvanized steel wire, 14 gauge by 6-inch square mesh spacing, minimum 24-inch roll or sheet width of longest practical length.
- B. Barrier Stakes: Nominal 2-inch by 2-inch moisture-resistant treated wood or steel posts (min. of 1.25 lbs. per linear foot and Brinell Hardness greater than 140) with safety caps on top length as required for minimum 8 inch bury and full height of filter fabric.

2.06 SANDBAGS

- A. Provide woven material made of polypropylene, polyethylene, or polyamide material.
 - 1. Minimum unit weight of four ounces per square yard.
 - 2. Minimum grab strength of 100 lbs in any principal direction (ASTM D4632)
 - 3. Mullen burst strength exceeding 300 lbs (ASTM D4833).
 - 4. Ultraviolet stability exceeding 70 percent. After 500 hours of exposure (ASTM 4355).
 - 5. Size: Length: 18 to 24 inches. Width: 12 to 18 inches. Thickness: 6 to 8 inches. Weight: Approximately 40 to 50 pounds not to exceed 75 pounds.

2.07 BAGGED GRAVEL BARRIER

- A. Minimum unit weight of four ounces per square yard.
- B. Minimum grab strength of 100 lbs in any principal direction (ASTM D4632)
- C. Mullen burst strength exceeding 300 lbs (ASTM D4833).
- D. Ultraviolet stability exceeding 70 percent. After 500 hours of exposure (ASTM 4355).

- E. Size: Length: 18 to 24 inches. Width: 12 to 18 inches. Thickness: 6 to 8 inches. Weight: Approximately 40 to 50 pounds not to exceed 75 pounds.

2.08 DROP INLET BASKET

- A. Provide steel frame members in accordance with ASTM A36.
- B. Construct top frame of basket with two short sides of 2-inch by 2-inch and single long side of 1-inch by 1-inch, 1/8-inch angle iron. Construct basket hangers of 2 inch by 1/4-inch iron bars. Construct bottom frame of 1-inch by 1/4-inch iron bar or 1/4-inch plate with center 3 inches removed. Use minimum 1/4-inch diameter iron rods or equivalent for sides of inlet basket.
- C. Weld minimum of 14 rods in place between top frame/basket hanger and bottom frame. Exact dimensions for top frame and insert basket will be determined based on dimensions of type of inlet being protected.

2.09 HAY BALE

- A. Hay: Standard-baled agricultural hay bound by wire, nylon, or polypropylene rope. Do not use jute or cotton binding.
- B. Hay Bale Stakes (applicable where bales are on soil): No. 3 (3/8 diameter) reinforcing bars, deformed or smooth at Contractor's option, length as required for minimum 18 inch bury and full height bales.

PART 3 EXECUTION

3.01 PREPARATION, INSTALLATION AND MAINTENANCE

- A. Provide erosion and sediment control structures at locations shown on the Drawings.
- B. Do not clear, grub or rough cut until erosion and sediment control systems are in place unless approved by Project Manager to allow installation of erosion and sediment control systems, soil testing and surveying.
- C. Maintain existing erosion and sediment control systems located within project site until acceptance of Project or until directed by Project Manager to remove and discard existing system.
- D. Regularly inspect and repair or replace damaged components of erosion and sediment control structures. Unless otherwise directed, maintain erosion and sediment control structure until project area stabilization is accepted. Redress and replace granular fill at outlets as needed to replenish depleted granular fill. Remove erosion and sediment control structures promptly when directed by Project Manager. Dispose of materials in accordance with Section 01576 - Waste Material Disposal.

- E. Remove and dispose sediment deposits at the designated spoil site for the Project. If a project spoil site is not designated on Drawings, dispose of sediment off site at approved location in accordance with Section 01576 - Waste Material Disposal.
- F. Unless otherwise shown on the Drawings, compact embankments, excavations, and trenches in accordance with Section 02315 - Roadway Excavation or Section - 02317 Excavation and Backfill for Utilities.
- G. Prohibit equipment and vehicles from maneuvering on areas outside of dedicated right of way and easements for construction. Immediately repair damage caused by construction traffic to erosion and sediment control structures.
- H. Protect existing trees and plants in accordance with Section 01562 - Tree and Plant Protection.

3.02 SEDIMENT TRAPS

- A. Install sediment traps so that surface runoff shall percolate through system in sheet flow fashion and allow retention and accumulation of sediment.
- B. Inspect sediment traps after each rainfall, daily during periods of prolonged rainfall, and at a minimum once each week. Repair or replace damaged sections immediately.
- C. Use fill material for embankment in accordance with Section 02320 - Utility Backfill Materials.
- D. Excavation length and height shall be as specified on Drawings. Use side slopes of 2:1 or flatter.
- E. Stone outlet sediment traps:
 - 1. Maintain minimum of 6 inches between top of core material and top of stone outlet, minimum of 4 inches between bottom of core material and existing ground and minimum of 1 foot between top of stone outlet and top of embankment.
 - 2. Embed cobbles minimum of 4 inches into existing ground for stone outlet. Core shall be minimum of 1 foot in height and in width and wrapped in triple layer of geotextile filter fabric.
- F. Sediment Basin with Pipe Outlet Construction Methods: Install outlet pipe and riser as shown on the Drawings.
- G. Remove sediment deposits when design basin volume is reduced by 1/3 or sediment level is 1 foot below principal spillway crest, whichever is less.

3.03 FILTER FABRIC BARRIER CONSTRUCTION METHODS

- A. Fence Type 1: Filter Fabric: Barrier

1. Install stakes 3 feet on center maximum and firmly embed minimum 8 inches in soil. If filter fabric is factory preassembled with support netting, then maximum support spacing is 8 feet. Install wood stakes at a slight angle toward the source of anticipated runoff.
 2. Trench in the toe of the fence lines so the downward face of the trenches is flat and perpendicular to direction of flow. V-trench configuration as shown on Drawings may also be used.
 3. Lay fabric along edges of trenches in longest practical continuous runs to minimize joints. Make joints only at a support post. Splice with minimum 6-inch overlap and seal securely.
 4. Staple filter fabric to stakes at maximum 3 inches on center. Extend fabric minimum 18 inches and maximum 36 inches above natural ground.
 5. Backfill and compact trench.
- B. Barrier Type 2: Reinforced Filter Fabric Barrier
1. Layout barrier same as for Type 1.
 2. Install stakes at 6 feet on center maximum and at each joint in wire fence, firmly embedded 1-foot minimum, and inclined it as for Type 1.
 3. Tie wire fence to stakes with wire at 6 inches on center maximum. Overlap joints minimum one bay of mesh.
 4. Install trench same as for Type 1.
 5. Fasten filter fabric wire fence with tie wires at 3 inches on center maximum.
 6. Layout fabric same as for Type 1. Fasten to wire fence with wire ties at 3 inches on center maximum and, if applicable, to stakes above top of wire fence it as for Type 1.
 7. Backfill and compact trench.
 8. Attach filter fabric to wooden fence stakes spaced a maximum of 6 feet apart or steel fence stakes spaced a maximum of 8 feet apart and embedded a minimum of 12 inches. Install stakes at a slight angle toward source of anticipated runoff.
 9. Trench in toe of filter fabric barrier with spade or mechanical trencher so that downward face of trench is flat and perpendicular to direction of flow. A V-trench configuration may also be used. Lay filter fabric along edges of trench. Backfill and compact trench upon completion of Construction.

10. Filter fabric fence shall have a minimum height of 18 inches and a maximum height of 36 inches above natural ground.
11. Cut length of fence to minimize use of joints. When joints are necessary, splice fabric together only at support post with minimum 6-inch overlap and seal securely.
12. When used in swales, ditches or diversions, elevation of barrier at top of filter fabric at flow line location in channel shall be lower than bottom elevation of filter fabric at ends of barrier or top of bank, whichever is less, in order to keep storm water discharge in channel from overtopping bank.

C. Triangular Filter Fabric Barrier Construction Methods

1. Attach filter fabric to wire fencing, 18 inches on each side. Provide a fabric cover and skirt with continuous wrapping of fabric. Skirt should form continuous extension of fabric on upstream side of fence.
2. Secure triangular fabric filter barrier in place using one of the following methods:
 - a. Toe-in skirt 6 inches with mechanically compacted material
 - b. Weight down skirt with continuous layer of 3-inch to 5-inch graded rock or
 - c. Trench-in entire structure 4 inches.
3. Anchor triangular fabric filter barrier structure and skirt securely in place using 6-inch wire staples on 2-foot centers on both edges and on skirt, or staked using 18-inch by 3/8-inch diameter re-bar with tee ends.
4. Lap fabric filter material by 6 inches to cover segment joints. Fasten joints with galvanized shoat rings.

3.04 DIKE AND SWALE

- A. Unless otherwise indicated, maintain minimum dike height of 18 inches, measured from cleared ground at up slope toe to top of dike. Maintain side slopes of 2:1 or flatter.
- B. Dike and Swale Stabilization: When shown on the Drawings, place gravel lining 3 inches thick and compacted into the soil or 6 inches thick if truck crossing is expected. Extend gravel lining across bottom and up both sides of swale minimum height of 8 inches vertically, above bottom. Gravel lining on dike side shall extend up the up slope side of dike a minimum height of 8 inches, measured vertically from interface of existing or graded ground and up slope toe of dike, as shown on Drawings.

- C. Divert flow from dikes and swales to sediment basins, stabilized outlets, or sediment trapping devices of types and at locations shown on Drawings. Grade dikes and swales as shown on Drawings, or, if not specified, provide positive drainage with maximum grade of 1 percent to outlet or basin.
- D. Clear in accordance with Section 2233 - Clearing and Grubbing Compact embankments in accordance with Section 2315 - Roadway Excavation.
- E. Carry out excavation for swale construction so that erosion and water pollution is minimal. Minimum depth shall be 1 foot, and bottom width shall be 4 feet, with level swale bottom. Excavation slopes shall be 2:1 or flatter. Clear, grub and strip excavation area of vegetation and root material.

3.05 DOWN SPOUT EXTENDER

- A. Down spout extender shall have slope of approximately 1 percent. Use pipe diameter of 4 inches or as shown on the Drawings. Place pipe in accordance with Section 02317 – Excavation and Backfill for Utilities.

3.06 PIPE SLOPE DRAIN

- A. Compact soil around and under drain entrance section to top of embankment in lifts appropriately sized for method of compaction utilized.
- B. Inlet pipe shall have slope of 1 percent or greater. Use pipe diameter as shown on the Drawings.
- C. Top of embankment over inlet pipe and embankments directing water to pipe shall be at least 1 foot higher at all points than top of inlet pipe.
- D. Pipe shall be secured with hold-down grommets spaced 10 feet on centers.
- E. Place riprap apron with a depth equal to pipe diameter with 2:1 side slopes.

3.07 PAVED FLUME

- A. Compact soil around and under the entrance section to top of the embankment in lifts appropriately sized for method of compaction utilized.
- B. Construct subgrade to required elevations. Remove and replace soft sections and unsuitable material. Compact subgrade thoroughly and shape to a smooth, uniform surface.
- C. Construct permanent paved flumes in accordance with Drawings.
- D. Remove sediment from riprap apron when sediment has accumulated to depth of one foot.

3.08 LEVEL SPREADER

- A. Construct level spreader on undisturbed soil and not on fill. Ensure that spreader lip is level for uniform spreading of storm runoff.
- B. Maintain at required depth, grade, and cross section as specified on Drawings. Remove sediment deposits as well as projections or other irregularities which will impede normal flow.

3.09 INLET PROTECTION BARRIER

- A. Place sandbags for Stage I, Bagged gravel for Stage II and filter fabric barriers at locations shown on the SWP3. Maintain to allow minimal inlet in flow restrictions/blockage during storm events.

3.10 DROP INLET BASKET CONSTRUCTION METHODS

- A. Fit inlet insert basket into inlet without gaps around insert at locations shown on the SWP3.
- B. Support for inlet insert basket shall consist of fabricated metal as shown on Drawings.
- C. Push down and form filter fabric to shape of basket. Use sheet of fabric large enough to be supported by basket frame when holding sediment and extend at least 6 inches past frame. Place inlet grates over basket/frame to serve as fabric anchor.
- D. Remove sediment deposit after each storm event and whenever accumulation exceeds 1-inch depth during weekly inspections.

3.11 HAY BALE FENCE CONSTRUCTION METHODS

- A. Place bales in row with ends tightly abutting adjacent bales. Place bales with bindings parallel to ground surface.
- B. Embed bale in soil a minimum of 4 inches.
- C. Securely anchor bales in place with Hay Bale Stakes driven through bales a minimum of 18-inches into ground. Angle first stake in each bale toward previously laid bale to force bales together.
- D. Fill gaps between bales with straw to prevent water from channeling between bales. Wedge carefully in order not to separate bales.
- E. Replace with new hay bale fence every two months or as required by Project Manager.

3.12 BRUSH BERM CONSTRUCTION METHODS

- A. Construct brush berm along contour lines by hand placing method. Do not use machine placement of brush berm.

- B. Use woody brush and branches having diameter less than 2-inches with 6- inches overlap. Avoid incorporation of annual weeds and soil into brush berm.
- C. Use minimum height of 18-inches measured from top of existing ground at upslope toe to top of berm. Top width shall be 24 inches minimum and side slopes shall be 2:1 or flatter.
- D. Embed brush berm into soil a minimum of 4-inches and anchor using wire, nylon or polypropylene rope across berm with a minimum tension of 50 pounds. Tie rope securely to 18-inch x 3/8-inch diameter rebar stakes driven into ground on 4-foot centers on both sides of berm.

3.13 STREET AND SIDEWALK CLEANING

- A. Keep areas clean of construction debris and mud carried by construction vehicles and equipment. If necessary, install stabilized construction exits at construction, staging, storage, and disposal areas, following Section 01575- Stabilized Construction Access.
- B. In lieu of or in addition to stabilized construction exits, shovel or sweep pavements as required to keep areas clean. Do not hose or sweep debris and mud off street into adjacent areas, except, hose sidewalks during off-peak hours, after sweeping.

3.14 WASTE COLLECTION AREAS

- A. Prevent water runoff from passing through waste collection areas, and prevent water runoff from waste collection areas migrating outside collection areas.

3.15 EQUIPMENT MAINTENANCE AND REPAIR

- A. Confine maintenance and repair of construction machinery and equipment to areas specifically designated for that purpose, so fuels, lubricants, solvents, and other potential pollutants are not washed directly into receiving streams or storm water conveyance systems. Provide these areas with adequate waste disposal receptacles for liquid and solid waste. Clean and inspect maintenance areas daily.
- B. Where designated equipment maintenance areas are not feasible, take precautions during each individual repair or maintenance operation to prevent potential pollutants from washing into streams or conveyance systems. Provide temporary waste disposal receptacles.

3.16 VEHICLE/ EQUIPMENT WASHING AREAS

- A. Install wash area (stabilized with coarse aggregate) adjacent to stabilized construction access, as required to prevent mud and dirt run-off. Release wash water into drainage swales or inlets protected by erosion and sediment controls. Build wash areas following Section 01575- Stabilized Construction Access. Install gravel or rock base beneath wash areas.

- B. Wash vehicles only at designated wash areas. Do not wash vehicles such as concrete delivery trucks or dump trucks and other construction equipment at locations where runoff flows directly into waterways or storm water conveyance systems.
- C. Locate wash areas to spread out and evaporate or infiltrate wash water directly into ground, or collect runoff in temporary holding or seepage basins.

3.17 WATER RUNOFF AND EROSION CONTROL

- A. Control surface water, runoff, subsurface water, and water from excavations and structures to prevent damage to the Work, the site, or adjoining properties. Follow environment requirements.
- B. Control fill, grading and ditching to direct water away from excavations, pits, tunnels, and other construction areas, and to direct drainage to proper runoff courses to prevent erosion, sedimentation or damage.
- C. Provide, operate, and maintain equipment and facilities of adequate size to control surface water.
- D. Retain existing drainage patterns external to the site by constructing temporary earth berms, sedimentation basins, retaining areas, and temporary ground cover as required to control conditions.
- E. Plan and execute construction and earth work to control surface drainage from cuts and fills, and from borrow and waste disposal areas, to prevent erosion and sedimentation.
 - 1. Hold area of bare soil exposed at one time to a minimum.
 - 2. Provide temporary controls such as berms, dikes, and drains.
- F. Construct fill and waste areas by selective placement to eliminate surface silts or clays which will erode.
- G. Inspect earthwork periodically to detect start of erosion. Immediately apply corrective measures as required to control erosion.
- H. Dispose of sediments offsite, not in or adjacent to waterways or floodplains, nor allow sediments to flush into streams or drainage ways. Assume responsibility for offsite disposal location.
- I. Unless otherwise indicated, compact embankments, excavations, and trenches by mechanically blading, tamping, and rolling soil in maximum of 8- inch layers. Provide compaction density at minimum 90 percent Standard Proctor ASTM D-698-78 density. Make at least 1 test per 500 cubic yards of embankment.

- J. Prohibit equipment and vehicles from maneuver on areas outside of dedicated rights-of-way and easements for construction. Immediately repair damage to erosion and sedimentation control systems caused by construction traffic.
- K. Do not damage existing trees intended to remain.

3.18 REMOVAL OF CONTROLS

- A. Remove erosion and sediment controls when the site is finally stabilized or as directed by Project Manager.
- B. Dispose of sediments and waste products following Section 01504 - Temporary Facilities and Controls.

END OF SECTION

SECTION 01578

CONTROL OF GROUND AND SURFACE WATER

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Dewatering, depressurizing, draining, and maintaining trenches, shaft excavations, structural excavations and foundation beds in stable condition, and controlling ground water conditions for tunnel excavations.
- B. Protecting work against surface runoff and rising floodwaters.
- C. Trapping suspended sediment in the discharge from the surface and ground water control systems.

1.02 RELATED SECTIONS

- A. Document 00410 – Bid Form
- B. Section 01270 – Measurement and Payment
- C. Section 01330 – Submittal Procedures
- D. Section 02260 – Trench Safety System

1.03 MEASUREMENT AND PAYMENT

A. UNIT PRICES

- 1. Measurement for control of ground water, if included in Document 00410 – Bid Form, will be on either a lump sum basis or a linear foot basis for continuous installations of wellpoints, eductor wells, or deep wells.
- 2. If not included in Document 00410 – Bid Form, include the cost to control ground water in unit price for work requiring such controls.
- 3. No separate payment will be made for control of surface water. Include cost to control surface water in unit price for work requiring controls.
- 4. Follow Section 01270 – Payment Procedures for unit price procedures.

- B. Stipulated Price (Lump Sum) Contract. If the Contract is a Stipulated Price Contract, include payment for work under this section in the total Stipulated Price.

1.04 REFERENCES

- A. ASTM D 698 - Standard Test Methods for Laboratory Compaction of Soils Using Standard Effort (12,400 ft-lbf/ft³ (600kN-m/m³))
- B. Federal Regulations, 29 CFR Part 1926, Standards-Excavation, Occupational Safety and Health Administration (OSHA)
- C. Storm Water Management Handbook for Construction Activities prepared by City of Houston, Harris County and Harris County Flood Control District.

1.05 DEFINITIONS

- A. Ground water control system: system used to dewater and depressurize water-bearing soil layers.
 - 1. Dewatering: lowering the water table and intercepting seepage that would otherwise emerge from slopes or bottoms of excavations, or into tunnels and shafts; and disposing of removed water. Intent of dewatering is to increase stability of tunnel excavations and excavated slopes, prevent dislocation of material from slopes or bottoms of excavations, reduce lateral loads on sheeting and bracing, improve excavating and hauling characteristics of excavated material, prevent failure or heaving of bottom of excavations, and to provide suitable conditions for placement of backfill materials and construction of structures and other installations.
 - 2. Depressurization: includes reduction in piezometric pressure within strata not controlled by dewatering alone, necessary to prevent failure or heaving of excavation bottom or instability of tunnel excavations.
- B. Excavation drainage: includes keeping excavations free of surface and seepage water.
- C. Surface drainage: includes use of temporary drainage ditches and dikes and installation of temporary culverts and sump pumps with discharge lines necessary to protect Work from any source of surface water.
- D. Monitoring facilities for ground water control system: includes piezometers, monitoring wells and flow meters for observing and recording flow rates.

1.06 PERFORMANCE REQUIREMENTS

- A. Conduct subsurface investigations to identify groundwater conditions and to provide parameters for design, installation, and operation of groundwater control systems. Submit proposed method and spacing of readings for review prior to obtaining water level readings.
- B. Design ground water control system, compatible with requirements of Federal Regulations 29 CFR Part 1926 and Section 02260 - Trench Safety Systems to produce following results:
 - 1. Effectively reduce hydrostatic pressure affecting:

- a. Excavations
 - b. Tunnel excavation, face stability or seepage into tunnels
 2. Develop substantially dry and stable subgrade for subsequent construction operations
 3. Preclude damage to adjacent properties, buildings, structures, utilities, installed facilities and other work
 4. Prevent loss of fines, seepage, boils, quick condition, or softening of foundation strata
 5. Maintain stability of sides and bottom of excavations
 - C. Provide ground water control systems that include single-stage or multiple-stage well point systems, eductor and ejector-type systems, deep wells, or combinations of these equipment types.
 - D. Provide drainage of seepage water and surface water, as well as water from other sources entering excavation. Excavation drainage may include placement of drainage materials, crushed stone and filter fabric, together with sump pumping.
 - E. Provide ditches, berms, pumps and other methods necessary to divert and drain surface water from excavation and other work areas.
 - F. Locate ground water control and drainage systems so as not to interfere with utilities, construction operations, adjacent properties, or adjacent water wells.
 - G. Assume sole responsibility for ground water control systems and for any loss or damage resulting from partial or complete failure of protective measures and settlement or resultant damage caused by ground water control operations. Modify ground water control systems or operations if they cause or threaten to cause damage to new construction, existing site improvements, adjacent property, adjacent water wells, or potentially contaminated areas. Repair damage caused by ground water control systems or resulting from failure of system to protect property as required.
 - H. Install an adequate number of piezometers installed at proper locations and depths, necessary to provide meaningful observations of conditions affecting excavation, adjacent structures and water wells.
 - I. Install environmental monitoring wells at proper locations and depths necessary to provide adequate observations of hydrostatic conditions and possible contaminant transport from contamination sources into work area or ground water control system.
- 1.07 SUBMITTALS
- A. Conform to requirements of Section 01330 - Submittals Procedures.

- B. Submit Ground Water and Surface Water Control Plan for review by Project Manager prior to start of excavation work. Include the following:
1. Results of subsurface investigations and description of extent and characteristics of water bearing layers subject to ground water control
 2. Names of equipment Suppliers and installation Subcontractors
 3. Description of proposed ground water control systems indicating arrangement, location, depth and capacities of system components, installation details and criteria and operation and maintenance procedures
 4. Description of proposed monitoring facilities indicating depths and locations of piezometers and monitoring wells, monitoring installation details and criteria, type of equipment and instrumentation with pertinent data and characteristics
 5. Description of proposed filters including types, sizes, capacities and manufacturer's application recommendations
 6. Design calculations demonstrating adequacy of proposed systems for intended applications. Define potential area of influence of ground water control operation near contaminated areas.
 7. Operating requirements, including piezometric control elevations for dewatering and depressurization
 8. Excavation drainage methods including typical drainage layers, sump pump application and other means
 9. Surface water control and drainage installations
 10. Proposed methods and locations for disposing of removed water
- C. Submit following records upon completion of initial installation:
1. Installation and development reports for well points, eductors, and deep wells
 2. Installation reports and baseline readings for piezometers and monitoring wells
 3. Baseline analytical test data of water from monitoring wells
 4. Initial flow rates
- D. Submit the following records weekly during control of ground and surface water operations:

1. Records of flow rates and piezometric elevations obtained during monitoring of dewatering and depressurization. Refer to Section 3.02, Requirements for Eductor, Well Points, or Deep Wells.
2. Maintenance records for ground water control installations, piezometers and monitoring wells

1.08 ENVIRONMENTAL REQUIREMENTS

- A. Comply with requirements of agencies having jurisdiction.
- B. Comply with Texas Commission on Environmental Quality regulations and Texas Water Well Drillers Association for development, drilling, and abandonment of wells used in dewatering system.
- C. Obtain necessary permits from agencies with jurisdiction over use of groundwater and matters affecting well installation, water discharge, and use of existing storm drains and natural water sources. Since review and permitting process may be lengthy, take early action to obtain required approvals.
- D. Monitor ground water discharge for contamination while performing pumping in vicinity of potentially contaminated sites.

PART 2 PRODUCTS

2.01 EQUIPMENT AND MATERIALS

- A. Select equipment and materials necessary to achieve desired results for dewatering. Selected equipment and materials are subject to review by Project Manager through submittals required in Section 1.07, Submittals.
- B. Use experienced contractors, regularly engaged in ground water control system design, installation, and operation, to furnish and install and operate educators, well points, or deep wells, when needed
- C. Maintain equipment in good repair and operating condition.
- D. Keep sufficient standby equipment and materials available to ensure continuous operation, where required.
- E. Portable Sediment Tank System: Standard 55-gallon steel or plastic drums, free of hazardous material contamination.
 1. Shop or field fabricate tanks in series with main inlet pipe, inter-tank pipes and discharge pipes, using quantities sufficient to collect sediments from discharge water.

PART 3 EXECUTION

3.01 GROUND WATER CONTROL

- A. Perform necessary subsurface investigation to identify water bearing layers, piezometric pressures and soil parameters for design and installation of ground water control systems. Perform pump tests, if necessary to determine draw down characteristics. Present results in the Ground Water and Surface Water Control Plan. submittal
- B. Provide labor, material, equipment, techniques and methods to lower, control and handle ground water in manner compatible with construction methods and site conditions. Monitor effectiveness of installed system and its effect on adjacent property.
- C. Install, operate, and maintain ground water control systems in accordance with the Ground Water and Surface Water Control Plan. Notify Project Manager in writing of changes made to accommodate field conditions and changes to Work. Provide revised drawings and calculations with notification.
- D. Provide continuous system operation, including nights, weekends, and holidays. Arrange appropriate backup if electrical power is primary energy source for dewatering system.
- E. Monitor operations to verify systems lower ground water piezometric levels at rate required to maintain dry excavation resulting in stable subgrade for subsequent construction operations.
- F. Depressurize zones where hydrostatic pressures in confined water bearing layers exist below excavations to eliminate risk of uplift or other instability of excavation or installed works. Define allowable piezometric elevations in the Ground Water and Surface Water Control Plan.
- G. Removal of ground water control installations.
 - 1. Remove pumping system components and piping when ground water control is no longer required.
 - 2. Remove piezometers, including piezometers installed during design phase investigations and left for Contractor's use, upon completion of testing, as required in accordance with Part 3 of applicable specification.
 - 3. Remove monitoring wells when directed by Project Manager.
 - 4. Grout abandoned well and piezometer holes. Fill piping that is not removed with cement-bentonite grout or cement-sand grout.

- H. During backfilling, maintain water level a minimum of 5 feet below prevailing level of backfill. Do not allow the water level to cause uplift pressures in excess of 80 percent of downward pressure produced by weight of structure or backfill in place. Do not allow water levels to rise into cement-stabilized sand until at least 48 hour after placement.
- I. Provide uniform pipe diameter for each pipe drain run constructed for dewatering. Remove pipe drains when no longer required. If pipe removal is impractical, grout connections at 50-foot intervals and fill pipe with cement- bentonite grout or cement-sand grout after removal from service.
- J. The extent of ground water control for structures with permanent perforated underground drainage systems may be reduced, for units designed to withstand hydrostatic uplift pressure. Provide a means to drain affected portions of underground systems, including standby equipment. Maintain drainage systems during construction operations.
- K. Remove systems upon completion of construction or when dewatering and control of surface or ground water is no longer required.
- L. Compact backfill to not less than 95 percent of maximum dry density in accordance with ASTM D 698.
- M. Foundation Slab: Maintain saturation line at least 3 feet below lowest elevations where concrete is to be placed. Drain foundations in areas where concrete is to be placed before placing reinforcing steel. Keep free from water for 3 days after concrete is placed.

3.02 REQUIREMENTS FOR EDUCTOR, WELL POINTS, OR DEEP WELLS

- A. For aboveground piping in ground water control system, include a 12-inch minimum length of clear, transparent piping between each eductor well or well point and discharge header to allow visual monitoring of discharge from each installation.
- B. Install sufficient piezometers or monitoring wells to show that trench or shaft excavations in water bearing materials are pre-drained prior to excavation. Provide separate piezometers for monitoring of dewatering and for monitoring of depressurization. Install piezometers and monitoring wells for tunneling as appropriate for selected method of work.
- C. Install piezometers or monitoring wells at least one week in advance of the start of associated excavation.
- D. Dewatering may be omitted for portions of under drains or other excavations, where auger borings and piezometers or monitoring wells show that soil is pre-drained by existing systems and that ground water control plan criteria are satisfied.
- E. Replace installations that produce noticeable amounts of sediments after development.

- F. Provide additional ground water control installations, or change method of control if, ground water control plan does not provide satisfactory results based on performance criteria defined by plan and by specifications. Submit revised plan according to Paragraph 1.07.B.

3.03 SEDIMENT TRAPS

- A. Install sediment tank as shown on approved plan.
- B. Inspect daily and clean out tank when one-third of sediment tank is filled with sediment.

3.04 SEDIMENT SUMP PIT

- A. Install sediment sump pits as shown on approved plan.
- B. Construct standpipe by perforating 12 inch to 24-inch diameter corrugated metal or PVC pipe.
- C. Extend standpipe 12 inches to 18 inches above lip of pit.
- D. Convey discharge of water pumped from standpipe to sediment trapping device.
- E. Fill sites of sump pits, compact to density of surrounding soil and stabilize surface when construction is complete.

3.05 EXCAVATION DRAINAGE

- A. Use excavation drainage methods if well-drained conditions can be achieved. Excavation drainage may consist of layers of crushed stone and filter fabric, and sump pumping, in combination with sufficient ground water control wells to maintain stable excavation and backfill conditions.

3.06 MAINTENANCE AND OBSERVATION

- A. Conduct daily maintenance and observation of piezometers or monitoring wells while ground water control installations or excavation drainage is operating at the site, or water is seeping into tunnels, and maintain systems in good operating condition.
- B. Replace damaged and destroyed piezometers or monitoring wells with new piezometers or wells as necessary to meet observation schedules.
- C. Cut off piezometers or monitoring wells in excavation areas where piping is exposed, only as necessary to perform observation as excavation proceeds. Continue to maintain and make specified observations
- D. Remove and grout piezometers inside or outside of excavation area when ground water control operations are complete. Remove and grout monitoring wells when directed by Project Manager.

3.07 MONITORING AND RECORDING

- A. Monitor and record average flow rate of operation for each deep well, or for each wellpoint or eductor header used in dewatering system. Also, monitor and record water level and ground water recovery. Record observations daily until steady conditions are achieved and twice weekly thereafter.
- B. Observe and record elevation of water level daily as long as ground water control system is in operation, and weekly thereafter until Work is completed or piezometers or wells are removed, except when Project Manager determines more frequent monitoring and recording are required. Comply with Project Manager's direction for increased monitoring and recording and take measures necessary to ensure effective dewatering for intended purpose.

3.08 SURFACE WATER CONTROL

- A. Intercept surface water and divert it away from excavations through use of dikes, ditches, curb walls, pipes, sumps or other approved means. Requirement includes temporary works required to protect adjoining properties from surface drainage caused by construction operations.
- B. Divert surface water and seepage water into sumps and pump it into drainage channels or storm drains, when approved by agencies having jurisdiction. Provide settling basins when required by agencies.

END OF SECTION

SECTION 02086

ADJUSTING MANHOLES, INLETS, AND VALVE BOXES TO GRADE

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Adjusting elevation of manholes, inlets, and valve boxes to new grades.

1.02 RELATED SECTIONS

- A. Section 01270 – Measurement and Payment
- B. Section 02081 – Cast-In-Place Concrete Manholes
- C. Section 02082 – Precast Concrete Manholes
- D. Section 02083 – Fiberglass Manholes
- E. Section 02090 – Frames, Grates, Rings, And Covers
- F. Section 02316 – Excavation and Backfill for Structures
- G. Section 02501 – Ductile Iron Pipe and Fittings
- H. Section 02528 – Polyethylene Encasement-Wrap
- I. Section 02632 – Cast-In-Pace Inlets, Headwalls, And Wingwalls
- J. Section 02633 – Precast Concrete Inlets, Headwalls, And Wingwalls
- K. Section 02911 – Topsoil
- L. Section 02921 – Hydro Mulch Seeding
- M. Section 02922 – Sodding
- N. Section 03315 – Concrete for Utility Construction
- O. Section 04061 – Mortar
- P. Section 04210 – Brick Masonry for Utility Construction

1.03 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No separate payment will be made for adjusting manhole frames and covers, inlets, valve boxes, and meter boxes to grade for new construction under this Section. Include payment in unit price for related item.
2. Payment for adjusting existing manholes, frames and covers, inlets, valve boxes, and meter boxes to a new grade is on a unit price basis for each.
3. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

PART 2 PRODUCTS

2.01 CONCRETE MATERIALS

- A. Provide concrete, conforming to requirements of Section 03315 - Concrete for Utility Construction.
- B. Provide precast concrete manhole sections and adjustment rings conforming to requirements of Section 02082 - Precast Concrete Manholes.
- C. Provide mortar conforming to requirements of Section 04061 - Mortar.

2.02 CAST-IRON MATERIALS

- A. Provide cast-iron materials conforming to requirements of Section 02090 - Frames, Grates, Rings, and Covers.

2.03 PIPING MATERIALS

- A. For riser pipes and fittings, refer to Sections 02501 - Ductile-Iron Pipe and Fittings through 02528 - Polyethylene Encasement Wrap.

2.04 MASONRY MATERIALS FOR STORM SEWER MANHOLES AND INLETS

- A. Provide brick masonry units conforming to the requirements of Section 04210 - Brick Masonry for Utility Construction.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine existing structure, valve box, frame and cover or inlet box, frame and cover or inlet, piping and connections for damage or defects affecting adjustment to grade. Report damage or defects to Project Manager.

3.02 ESTABLISHING GRADE

- A. Coordinate grade related items with existing grade and finished grade or paving, and relate to established benchmark or reference line.

3.03 ADJUSTING MANHOLES AND INLETS

- A. Rebuild adjustment portion of manhole or inlet by adding or removing Adjustments. Follow procedures for the type of structure being adjusted detailed in the following Sections:

1. Section 02081 - Cast-In-Place Concrete Manholes
2. Section 02082 - Precast Concrete Manholes
3. Section 02083 - Fiberglass Manholes
4. Section 02632 - Cast-In-Place Inlets, Headwalls and Wingwalls
5. Section 02633 - Precast Concrete Inlets, Headwalls and Wingwalls

- B. Salvage and reuse cast-iron frame and cover or grate.
- C. Protect or block off manhole or inlet bottom using wood forms shaped to fit so that no debris or soil falls to bottom during adjustment.
- D. Verify that manholes and inlets are free of visible leaks as result of reconstruction. Repair leaks in manner subject to Project Manger's approval.

3.04 ADJUSTING VALVE BOXES

- A. Salvage and reuse valve box and surrounding concrete block as approved by Project Manager. No separate pay.
- B. Remove and replace 6 inch ductile iron riser pipe with suitable length for depth of cover required to establish adjusted elevation to accommodate actual finish grade.
- C. Reinstall valve box and riser piping plumbed in vertical position. Provide minimum 6 inches telescoping freeboard space between riser pipe top butt end and interior contact flange of valve box for vertical movement damping.

- D. After valve box has been set, aligned, and adjusted so that top lid is level with final grade.

3.05 BACKFILL AND GRADING

- A. Backfill area of excavation surrounding each adjusted manhole, inlet, and valve box and compact according to requirements of Section 02316 - Excavation and Backfill for Structures.
- B. Grade ground surface to drain away from each manhole and valve box. Place earth fill around manholes to level of upper rim of manhole frame. Place earth fill around valve box concrete slab.
- C. In unpaved areas, grade surface at uniform slope of 1 to 5 from manhole frame to natural grade. Provide minimum of 4 inches of topsoil conforming to requirements of Section 02911 - Topsoil. Provide seeding in accordance with Section 02921 – Hydro Mulch Seeding, or if sodding in accordance with Section 02922 - Sodding.

END OF SECTION

SECTION 02100 - SITE PREPARATION

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Visit site to ascertain actual conditions and items related to the work of this section.
2. Provide necessary protection for persons, existing buildings, improvements, utilities and property including tree protection fencing.
3. Remove and grub all vegetation, noted on the Drawings.
4. Demolition and removal of above and below grade improvements as required for new work, including but not limited to existing paving walk, shell material, etc.
5. Mobilization of equipment at the site.
6. Providing requirements for personnel and facilities.
7. Securement of any temporary traffic channelizing devices required for the safe construction of this project.
8. Removing above- and below-grade site improvements.
9. Disconnecting and capping or sealing site utilities.

1.2 MATERIAL OWNERSHIP

- A. Except for stripped topsoil or other materials indicated to remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.3 PROJECT CONDITIONS

- A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.
1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
 2. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.
- B. Salvable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises where indicated.
- C. Utility Locator Service: Notify utility locator service for area where Project is located before site clearing.
- D. Do not commence site clearing operations until temporary erosion and sedimentation control measures are in place.
- E. Contractor shall provide access to utility owners, and others as designated, to the Work site at all times to relocate, service, and inspect their facilities. The Contractor shall cooperate with utility owners and others in facilitating such work so as not to delay the Work of this Contract.

1.4 CONTINUITY OF SERVICE

- A. Contractor shall ensure continuity of utility service and shall maintain, in a safe and satisfactory operating condition, all overhead, surface and subsurface utilities.

PART 2 - PRODUCTS - Not Applicable

PART 3 - EXECUTION

3.1 PREPARATION

- A. The Contractor is responsible for establishing, protecting, and maintaining benchmarks and survey control points from disturbance during construction.
- B. Locate and clearly flag trees and vegetation to remain or to be relocated.
- C. Protect existing site improvements to remain from damage during construction.
 - 1. Restore damaged improvements to their original condition, as acceptable to Owner.
- D. The location of staging areas and equipment shall be subject to the approval of the Owners Representative and Owner and shall be site close to that portion of the Work for which such items will be used.
- E. The Contractor may, at his discretion, erect a temporarily fenced area for securing equipment, materials, etc. as directed by the Owners Representative. Owner will not assume any responsibility for security of any materials, equipment, etc. during construction of the project.

3.2 TEMPORARY TRAFFIC

- A. Temporary traffic channelizing devices shall be installed in accordance with the requirements of Part VI of the TxDOT manual on Uniform Traffic Control Devices for Streets and Highways.
- B. Contractor shall submit his request and plan for temporarily channelizing traffic to Owners Representative and Owner for approval as appropriate.
- C. Devices shall be maintained as necessary during the course of the Work and shall be removed from the Site when no longer needed, or as otherwise directed by Owners Representative to Owner.

3.3 CONSTRUCTION VEHICULAR TRAFFIC

- A. Construction vehicular traffic shall be restricted to routes approved by Owners Representative and Owner.

3.4 PEDESTRIAN TRAFFIC

- A. Whenever pedestrian circulation is interrupted, flashing warning lights shall be employed to alert pedestrians.

3.5 UTILITIES

- A. Locate, identify, disconnect, and seal or cap off utilities indicated to be removed.
 - 1. Arrange with utility companies to shut off indicated utilities.
- B. 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 Landscape Architect not less than two days in advance of proposed utility interruptions.
 - 2. Do not proceed with utility interruptions without Landscape Architect's written permission.

3.6 SITE IMPROVEMENTS

- A. Remove existing above- and below-grade improvements as indicated and as necessary to facilitate new construction.

3.7 DISPOSAL

- A. Disposal: Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.
 - 1. Separate recyclable materials produced during site clearing from other nonrecyclable materials. Store or stockpile without intermixing with other materials and transport them to recycling facilities.

3.8 CLEANUP

- A. Clean up all debris caused by the work of this Section, keeping the premises clean and neat at all times.

END OF SECTION 02100

SECTION 02110 - SITE CLEARING; TREE REMOVAL & TREATMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
1. Removing existing trees and grass.
 2. Clearing and grubbing.
 3. Pruning and trimming of existing trees.

1.2 MATERIAL OWNERSHIP

- A. Except for stripped topsoil or other materials indicated to remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.3 PROJECT CONDITIONS

- A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.
1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
 2. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.
- B. Salvageable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises where indicated.
- C. Utility Locator Service: Notify utility locator service for area where Project is located before site clearing.
- D. Do not commence site clearing operations until temporary erosion and sedimentation control measures are in place.
- E. Drawings assume tree survey is accurate. Contractor shall notify the Owner's Representative if existing tree locations differ from locations represented on Drawings.
- F. Existing tree and vegetation conditions beyond tree protection fence shall remain undisturbed by Contractor.
- G. Contractor shall not allow any vehicular traffic, parking of vehicles or stockpiling of excavated material or construction material beyond the tree protection fence, or in any tree preservation areas as defined on the Drawings.

1.4 QUALITY ASSURANCE

- A. Retain and pay for services of qualified tree surgeon for tree pruning. Contractor shall not have less than 5 years experience in this field.

PART 2 - PRODUCTS - Not Applicable

PART 3 - EXECUTION

3.1 PREPARATION

- A. Contractor and all sub-contractors shall attend a preconstruction meeting given by the Owner's Representative to review tree preservation requirements for the construction process.
- B. Owner's Representative will review trees marked for demolition prior to clearing.
- C. Site preparation work shall not begin in any area where tree preservation measures have not been completed and approved as designated on the Drawings.
- D. Protect and maintain benchmarks and survey control points from disturbance during construction.
- E. Locate and clearly flag trees and vegetation to remain or to be relocated.
- F. Protect existing site improvements to remain from damage during construction.
 - 1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.2 UTILITIES

- 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 Landscape Architect not less than two days in advance of proposed utility interruptions.
 - 2. Do not proceed with utility interruptions without Landscape Architect's written permission.

3.3 TREE REMOVAL

- A. Proceed with tree removal in a systematic and safe manner. Protect adjacent trees from damage or scarring from felled trees. Protect existing improvements on site and adjacent sites. Remove all trash and debris created by tree removal from site. Dispose of properly.
- B. Because of limited construction zone, some trees to be removed may require topping in order to prevent damage to preservation trees and fencing. These trees shall be topped and felled to the ground in a safe manner.
- C. Remove stumps to a minimum of 2 foot below natural grade. "Pop" pine stumps to remove taproot to a minimum 3-foot depth.
- D. Backfill tree hole with approved topsoil, fine grade and hydromulch.

3.4 CLEAN-UP & TREATMENT

- A. Contractor shall chip and remove all cleared material from project site. On-site burning of material will not be allowed.

3.5 REPAIR AND REPLACEMENT OF TREES

- A. If any damage to preservation trees should occur beyond what is expected during the construction period, the Owner's Representative shall appraise the damage and order the repair by the Contractor or responsible party.

END OF SECTION 02110

SECTION 02221

REMOVING EXISTING PAVEMENTS, STRUCTURES, WOOD, AND DEMOLITION
DEBRIS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Removing concrete paving, asphaltic concrete pavement, brick pavement and base courses.
- B. Removing concrete curbs, concrete curbs and gutters, sidewalks and driveways.
- C. Removing pipe culverts, sewers, and sewer leads.
- D. Removing waterlines and water services lines including asbestos cement pipe per OSHA guidelines.
- E. Removing existing inlets and manholes.
- F. Removing and disposing of pre-stressed concrete beams and drill shafts.
- G. Removing miscellaneous structures of concrete or masonry.
- H. Removing existing bridge.
- I. Removing existing wood and demolition debris.

1.02 RELATED SECTIONS

- A. Section 01270 – Measurement and Payment
- B. Section 01576 – Waste Material Disposal
- C. Section 02316 – Excavation and Backfill for Structures
- D. Section 02960 – Milling Pavement

1.03 MEASUREMENT AND PAYMENT

- A. Unit Prices.
 - 1. Payment for removing and disposing of asphaltic surfacing with or without base, regardless of thickness encountered, is on square yard basis measured between lips of gutters.

2. Payment for removing and disposing of reinforced concrete pavement, with or without asphalt overlay, regardless of its thickness, is on square yard basis measured from back- to-back of curbs. Payment includes concrete pavement, esplanade curbs, curbs and gutters, and paving headers.
3. Payment for removing and disposing of curb or curb and gutter without removal of pavement is on a linear foot basis, if only curb or curb and gutter is being removed and disposed.
4. Payment for removing and disposing of cement stabilized shell base course, with or without asphaltic surfacing, is on square yard basis.
5. Payment for removing and disposing of concrete sidewalks and driveways is on square yard basis. Include removal and disposal of curb ramps in the cost for removal of sidewalks.
6. Payment for removing asphaltic pavement surface by milling shall be in accordance with Section 02960 – Milling Pavement.
7. Payment for removing and disposing of miscellaneous concrete and masonry is on cubic yard basis of structure in place.
8. Payment for removing and disposing of pipe culverts, sewers, and sewer leads, is on linear foot basis for each diameter and each material type of pipe removed.
9. Payment for removing and disposing of waterlines and water service lines including asbestos cement pipe is on linear foot basis for each diameter pipe and each material type of pipe removed.
10. Payment for removing and disposing of existing inlets is on unit price basis for each inlet removed.
11. Payment for removing and disposing of prestressed concrete piles and drill shafts is on linear foot basis.
12. Payment for removing and disposing of existing bridge, including piles and abutments to minimum of 4 feet below ground level, is on a lump sum basis.
13. Payment for removing existing pole foundations, including traffic signal pole foundations to minimum of 2 feet below grade, is on a unit price basis for each pole foundation removed.
14. Payment for removing and disposing of existing manholes is on unit price basis for each manhole removed.
15. Payment for removing and disposing of miscellaneous wood and demolition debris is on cubic yard basis.

16. Payment for removing and disposing of existing wheelchair ramps, except for concrete curb ramps, of any thickness is on square yard basis.
17. No payment for saw cutting of pavement, curbs, or curbs and gutters will be made under this section. Include cost of such work in unit prices for items listed in bid form requiring saw cutting.
18. No payment will be made for work outside maximum payment limits indicated on Drawings, or for pavements or structures removed for Contractor's convenience.
 - a. For utility installations: Match actual pavement replaced but no greater than maximum pavement replacement limits shown on Drawings. Limits of measurement will be as shown on Street Cut Pavement Replacement Rules.

19. Refer to Section 01270 - Measurement and Payment for unit price procedures

- B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.04 REFERENCES

- A. EPA 40 CFR 763 – Asbestos
- B. EPA 40 CFR 61, Subpart M – National Emission Standard for Asbestos
- C. OSHA 29 CFR 1926.1101 – Asbestos
- D. OSHA 29 CFR 1926.32 – General Safety and Health Provisions
- E. OSHA 29 CFR 1910.134 – Respiratory Protection
- F. National Institute of Occupational Safety and Health (NIOSH)

1.05 REGULATORY REQUIREMENTS

- A. Conform to applicable codes for disposal of debris.
- B. For removal of asbestos containing materials, or material that could potentially contain asbestos, comply with applicable provisions of OSHA 29 CFR 1926.1101 – Asbestos, OSHA 29 CFR 1926.32 – General Safety and Health Provisions, and EPA 40 CFR 61 Subpart M – National Emission Standard for Asbestos.

1.06 COORDINATION

- A. Coordinate removal work with utility companies.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PREPARATION

- A. Obtain advance approval from Project Manager for dimensions and limits of removal work.
- B. Identify known utilities below grade. Stake and flag locations.
- C. For removal of asbestos-containing materials, or materials that could potentially contain asbestos, comply with the following:
 - 1. Crew members must be trained in accordance with OSHA 29 CFR 1926.1101 – Asbestos.
 - 2. Conduct negative exposure assessment to demonstrate asbestos exposure below permissible exposure limit (PEL) in accordance with OSHA 29 CFR 1926.1101 – Asbestos and EPA 40 CFR 763 – Asbestos
 - 3. If negative exposure assessment not conducted, or if results are above PEL, provide respiratory protection in accordance with Paragraph 3.02 of this Section.
- D. Removal of existing pole foundations:
 - 1. Unless otherwise specified on Drawings, the tops of unused foundations shall be removed to a depth of two feet (minimum) below grade and backfilled according to specifications.

3.02 PROTECTION

- A. Protect following from damage or displacement:
 - 1. Adjacent public and private property.
 - 2. Trees, plants, and other landscape features designated to remain.
 - 3. Utilities designated to remain.
 - 4. Pavement and utility structures designated to remain.
 - 5. Bench marks, monuments, and existing structures designated to remain.
- B. When required, provide respiratory protection in accordance with OSHA 29 CFR 1910.134 – Respiratory Protection, and National Institute of Occupational Safety and Health (NIOSH).

3.03 REMOVALS

- A. Remove pavements and structures by methods that will not damage underground utilities. Do not use drop hammer near existing underground utilities.
- B. Minimize amount of earth loaded during removal operations.
- C. Where existing pavement is to remain, make straight saw cuts in existing pavement to provide clean breaks prior to removal. Do not break concrete pavement or base with drop hammer unless concrete or base has been saw cut to minimum depth of 2 inches.
- D. When street and driveway saw cut location is greater than one-half of pavement lane width, remove pavement for full lane width or to nearest longitudinal joint as directed by Project Manager.
- E. Remove sidewalks and curbs to nearest existing dummy, expansion, or construction joint.
- F. Where existing end of pipe culvert or end of sewer is to remain, install 8-inch-thick masonry plug in pipe end prior to backfill in accordance with requirements of Section 02316 - Excavation and Backfill for Structures.
- G. Labeling of Asbestos Cement (AC) Pipe:
 1. Label leak-tight container with warning statement of hazardous asbestos content in accordance with OSHA 29 CFR 1926.1101 and as noted below.
 2. Label waste material with following warning:

DANGER
CONTAINS ASBESTOS FIBERS
MAY CAUSE CANCER
CAUSES DAMAGE TO LUNGS
DO NOT BREATHE DUST
AVOID CREATING DUST

3. Neatly print labels in letters of sufficient size and contrast so label is easily visible and legible.

3.04 BACKFILL

- A. Backfill of removal areas shall be in accordance with requirements of Section 02316 - Excavation and Backfill for Structures.

3.05 DISPOSALS

- A. Inlet frames, grates, and plates; and manhole frames and covers, may remain City property. Disposal shall be in accordance with requirements of Section 01576 - Waste Material Disposal.

- B. Remove from site, debris resulting from work under this section in accordance with requirements of Section 01576 - Waste Material Disposal.

- C. For asbestos-containing materials:
 - 1. Comply with 40 CFR Part 61 and 30 TAC Sections 330.137(b) for Industrial Class 1 waste.
 - 2. Inspect load to ensure correct packaging and labeling.
 - 3. Line vehicles with two layers of 6-mil polyethylene sheeting.
 - 4. Remove asbestos-containing waste from site daily.

END OF SECTION

SECTION 02233

CLEARING AND GRUBBING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Removing surface debris and rubbish.
- B. Clearing site of plant life and grass.
- C. Removing trees and shrubs.
- D. Removing root system of trees and shrubs.
- E. Fence removal.

1.02 RELATED SECTIONS

- A. Section 01270 – Measurement and Payment
- B. Section 01576 – Waste Material Disposal

1.03 MEASUREMENT AND PAYMENT

- A. Unit Prices.
 - 1. Payment for clearing and grubbing is on per acre basis.
 - 2. No separate payment will be made for clearing and grubbing of wastewater projects, include payment in unit prices for related items.
 - 3. Refer to Section 01270 - Measurement and Payment for unit price procedures.
- B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.04 REGULATORY REQUIREMENTS

- A. Conform to applicable codes for disposal of debris.
- B. Coordinate clearing work with utility companies.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PREPARATION

- A. Verify that existing plant life and features designated to remain are identified and tagged.

3.02 PROTECTION

- A. Protect following from damage or displacement:
 - 1. Living trees located 3 feet or more outside of intersection of side slopes and original ground line.
 - 2. Plants other than trees and landscape features designated to remain.
 - 3. Utilities designated to remain.
 - 4. Bench marks, monuments, and existing structures designated to remain.

3.03 CLEARING

- A. Remove stumps, main root ball, and root system to:
 - 1. Depth of 24 inches below finished subgrade elevation in area bounded by lines two feet behind back of curbs.
 - 2. Depth of 24 inches below finished surface of required cross section for other areas.
- B. Clear undergrowth and deadwood without disturbing subsoil.
- C. Remove vegetation from top soil scheduled for reuse.

3.04 REMOVAL

- A. Remove debris, rubbish, and extracted plant material life from site in accordance with requirements of Section 01576 - Waste Material Disposal.
- B. Remove on site fences. Materials generated from removal of fences become property of Contractor. Properly dispose of in accordance with applicable local, state and federal laws.

END OF SECTION

SECTION 02315

ROADWAY EXCAVATION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Excavation and compaction of materials for roadways and roadside ditches.

1.02 RELATED SECTIONS

- A. Section 01270 – Measurement and Payment
- B. Section 01454 – Testing Laboratory Services
- C. Section 01576 – Waste Material Disposal
- D. Section 01725 – Field Surveying
- E. Section 02330 – Embankment
- F. Section 02911 – Topsoil

1.03 MEASUREMENT AND PAYMENT

- A. Unit Prices.
 - 1. Payment for roadway excavation, with or without subgrade, is on cubic yard basis. Unless specified otherwise under the borrow (off-site) material or embankment fill work item, measurement for payment shall be based on the cut quantity shown on the drawing.
 - 2. No payment will be made for material excavated under the following conditions:
 - a. More than 2 feet outside of vertical planes behind back of curbs
 - b. For portion within limits of trench for utilities 24-inch and greater constructed by open-cut methods
 - c. As indicated otherwise on Drawings.
 - 3. Measurement for the bid item “Regrade Ditches” is on a linear foot basis. No separate payment will be made for reshaping and regrading roadway ditch shoulder slope and side slope adjacent to installed temporary pavement upon removal of temporary pavement.

4. If specified, off-site borrow material including placement and compaction will be paid by final in-place quantity on cubic yard basis.
 5. If specified and shown on the drawing, embankment fill including placement and compaction will be paid by final in-place quantity on cubic yard basis.
 6. Refer to Section 01270 - Measurement and Payment for unit price procedures.
- B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.04 REFERENCES

- A. ASTM D 698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400ft-lbf/ft³ (600 kN-m/m³)).
- B. ASTM D 2216 - Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass.
- C. ASTM D 4318 - Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
- D. ASTM D 6938 - Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

PART 2 PRODUCTS

2.01 MATERIALS

- A. Provide topsoil conforming to requirements of Section 02911 - Topsoil.
- B. Provide backfill which is excavated material, graded free of roots, lumps greater than 6 inches, rocks larger than 3 inches, organic material, and debris.
- C. Provide structural backfill which is select material meeting following requirements:
 1. Plasticity index: not less than 12 nor more than 20.
 2. Maximum liquid limit: 45

PART 3 EXECUTION

3.01 PREPARATION

- A. Identify required lines, levels, and datum. Coordinate with Section 01725 - Field Surveying.
- B. Identify and flag surface and aerial utilities.

- C. Notify utility companies to remove or relocate utilities.
- D. Identify, stake, and flag known utility locations below grade. Make temporary or permanent relocation of underground pipes, ducts, or utilities where indicated on Drawings.
- E. Upon discovery of unknown or badly deteriorated utilities, or concealed conditions, discontinue work. Notify Project Manager and obtain instructions before proceeding in such areas.
- F. Obtain approval of top soil quality before excavating and stockpiling.

3.02 PROTECTION

- A. Protect following from damage or displacement:
 - 1. Trees, shrubs, lawns, existing structures, and other features outside of grading limits.
 - 2. Utilities either above or below grade, which are to remain.

3.03 TOPSOIL REMOVAL

- A. Strip off topsoil from area to be excavated to minimum depth of 6 inches, unless indicated otherwise on Drawings.
- B. Stockpile topsoil in designated location for reuse. Stockpile topsoil to depth not

3.04 SOIL EXCAVATION

- A. Excavate to lines and grades shown on Drawings.
- B. Remove unsuitable material not meeting specifications. Backfill with embankment materials and compact to requirements of Section 02330 - Embankment.
- C. Record location and plug and fill inactive water and oil wells. Conform to Texas Department of Health, Texas Natural Resource Conservation Commission, and Texas Railroad Commission requirements. Notify Project Manager prior to plugging wells.
- D. At intersections, grade back at minimum slope of one inch per foot. Produce smooth riding junction with intersecting street. Maintain proper drainage.
- E. When area is inadvertently over excavated, fill area in accordance with requirements of Section 02330 - Embankment at no additional cost to City.
- F. Remove material not qualified for use and excess soil not being reused from site in accordance with requirements of Section 01576 - Waste Material Disposal.

3.05 COMPACTION

- A. Maintain optimum moisture content of subgrade to attain required density.
- B. Compact to following minimum densities at moisture content of optimum to 3 percent above optimum as determined by ASTM D 698, unless otherwise indicated on Drawings:
 - 1. Areas under future paving and shoulders: Minimum density of 95 percent of maximum dry density.
 - 2. Other areas: Minimum density of 90 percent of maximum dry density.

3.06 TOLERANCES

- A. Top of Compacted Surface: Plus or minus 1/2 inch in cross section, or in 16-foot length.

3.07 FIELD QUALITY CONTROL

- A. Testing will be performed under provisions of Section 01454 - Testing Laboratory Services.
- B. Test and analysis of soil materials will be performed in accordance with ASTM D 4318, ASTM D 2216, and ASTM D 698.
- C. Compaction testing will be performed in accordance with ASTM D 698 or ASTM D 6938.
- D. A minimum of three tests will be taken for each 1000 linear feet per lane of roadway.
- E. When tests indicate work does not meet specified compaction requirements, recondition, recompact, and retest at no additional cost to City.

3.08 PROTECTION

- A. Prevent erosion at all times. Maintain ditches and cut temporary swales to allow natural drainage in order to avoid damage to roadway. Do not allow water to pond.
- B. Distribute construction traffic evenly over compacted areas, where practical, to aid in obtaining uniform compaction. Protect exposed areas having high moisture content from wheel loads that cause rutting.
- C. Maintain excavation and embankment areas until start of subsequent work. Repair and recompact slides, washouts, settlements, or areas with loss of density.

END OF SECTION

SECTION 02316

EXCAVATION AND BACKFILL FOR STRUCTURES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Excavation, backfilling, and compaction of Backfill for structures.

1.02 RELATED SECTIONS

- A. Section 01270 – Measurement and Payment
- B. Section 01330 – Submittal Procedures
- C. Section 01454 – Testing Laboratory Services
- D. Section 01555 – Traffic Control and Regulation
- E. Section 01562 – Tree and Plant Protection
- F. Section 01576 – Waste Material Disposal
- G. Section 01578 – Control of Ground and Surface Water
- H. Section 01785 – Project Record Documents
- I. Section 02221 – Removing Existing Pavements, Structures, Wood, and Demolition Debris
- J. Section 02260 – Trench Safety System
- K. Section 02319 – Borrow
- L. Section 02320 – Utility Backfill Materials
- M. Section 02321 – Cement Stabilized Sand
- N. Section 02621 – Geotextile

1.03 MEASUREMENT AND PAYMENT

- A. Unit Prices.
 - 1. No payment will be made for structural excavation and Backfill under this Section. Include payment in unit price or lump sum for construction of structures.

2. Refer to Section 01270 - Measurement and Payment for unit price procedures.
- B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.04 DEFINITIONS

- A. Unsuitable Material: Unsuitable soil materials are the following:
1. Materials that are classified as ML, CL-ML, MH, PT, OH, and OL according to ASTM D 2487.
 2. Materials that cannot be compacted to required density due to gradation, plasticity, or moisture content.
 3. Materials that contain large clods, aggregates, stones greater than 4 inches in any dimension, debris, vegetation, waste or any other deleterious materials.
 4. Materials that are contaminated with hydrocarbons or other chemical contaminants.
- B. Suitable Material: Suitable soil materials are those meeting specification requirements. Unsuitable soils meeting specification requirements for suitable soils after treatment with lime or cement shall be considered suitable, unless otherwise indicated.
- C. Select Material: Material as defined in Section 02320 - Utility Backfill Materials.
- D. Backfill: Material meeting specified quality requirements, placed and compacted under controlled conditions around structures.
- E. Foundation Backfill Materials: Natural soil or manufactured aggregate meeting Class I requirements and geotextile filter fabrics as required, to control drainage and material separation. Foundation Backfill material is placed and compacted as Backfill where needed to provide stable support for structure Foundation Base. Foundation Backfill materials may include concrete fill and seal slabs.
- F. Foundation Base: For Foundation Base material, use crushed stone aggregate with filter fabric as required, cement stabilized sand, or concrete seal slab. Foundation Base provides smooth, level working surface for construction of concrete foundation.
- G. Foundation Subgrade: Foundation Subgrade is surface of natural soil which has been excavated and prepared to support Foundation Base or foundation Backfill, where needed.

- H. Ground Water Control Systems: Installations external to excavation such as well points, eductors, or deep wells. Ground water control includes dewatering to lower ground water, intercepting seepage which would otherwise emerge from side or bottom of excavation, and depressurization to prevent failure or heaving of excavation bottom. Refer to Section 01578 - Control of Ground and Surface Water.
- I. Surface Water Control: Diversion and drainage of surface water runoff and rain water away from excavation. Remove rain water and surface water which accidentally enters excavation as part of excavation drainage.
- J. Excavation Drainage: Removal of surface and seepage water in excavation by sump pumping and using French drains surrounding foundation to intercept water.
- K. Over-Excavation and Backfill: Excavation of subgrade soils with unsatisfactory bearing capacity or composed of otherwise Unsuitable Materials below foundation as shown on Drawings, and Backfilled with Foundation Backfill Material.
- L. Shoring System: Structure that supports sides of an excavation to maintain stable soil conditions and prevent cave-ins.

1.05 REFERENCES

- A. ASTM D 698 - Standard Test Methods for Laboratory Compaction of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600kN-m/m³)).
- B. ASTM D 1556 - Standard Test Method for Density and Unit weight of Soil in Place by Sand-Cone Method.
- C. ASTM D 2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).
- D. ASTM D 4318 - Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
- E. ASTM D 6938 - Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).
- F. TxDOT Tex-101-E - Preparing and Testing Soils and Base Materials.
- G. TxDOT Tex-110-E - Sieve Analysis of Soils and Base Materials.
- H. Excavation, Occupational Safety and Health Administration (OSHA).

1.06 SUBMITTALS

- A. Conform to requirements of Section 01330 - Submittal Procedures.

- B. Submit work plan for excavation and Backfill for each structure with complete written description which identifies details of proposed method of construction and sequence of operations for construction relative to excavation and Backfill activities. Use descriptions, with supporting illustrations, sufficiently detailed to demonstrate to Project Manager that procedures meet requirements of Specifications and Drawings.
- C. Submit excavation safety system plan.
 - 1. Submit excavation safety system plan in accordance with applicable OSHA requirements for excavations.
 - 2. Submit excavation safety system plan in accordance with requirements of Section 02260 - Trench Safety System, for excavations that fall under State and Federal trench safety laws.
- D. Submit ground and surface water control plan in accordance with requirements in this Section and Section 01578 - Control of Ground and Surface Water.
- E. Submit Backfill material sources and product quality information in accordance with requirements of Section 02320 - Utility Backfill Materials.
- F. Submit project record documents under provisions of Section 01785 - Project Record Documents. Record location of utilities, as installed, referenced to survey benchmarks. Include location of utilities encountered or rerouted. Give horizontal dimensions, elevations, inverts and gradients.

1.07 QUALITY ASSURANCE

- A. Testing and analysis of Backfill materials for soil classification and compaction during construction will be performed by an independent laboratory provided by City in accordance with requirements of Section 01454 - Testing Laboratory Services and as specified in this Section.
- B. Perform embedment and Backfill material source qualification testing in accordance with requirements of Section 02320 - Utility Backfill Materials.

PART 2 PRODUCTS

2.01 EQUIPMENT

- A. Perform excavation with equipment suitable for achieving requirements of this Specification.
- B. Use equipment which will produce degree of compaction specified. Compact Backfill within 3 feet of walls with hand operated equipment. Do not use equipment weighing more than 10,000 pounds closer to walls than a horizontal distance equal to depth of fill at that time. Use hand operated power compaction equipment where use of heavier equipment is impractical or restricted due to weight limitations.

2.02 MATERIAL CLASSIFICATIONS

- A. Use Backfill materials conforming to classifications and product descriptions of Section 02320 - Utility Backfill Materials. Use classification or product description for Backfill applications as shown on Drawings and as specified.

PART 3 EXECUTION

3.01 PREPARATION

- A. Conduct an inspection to determine condition of existing structures and other permanent installations.
- B. Set up necessary street detours and barricades in preparation for excavation if construction will affect traffic. Conform to requirements of Section 01555 - Traffic Control and Regulation. Maintain barricades and warning devices at all times for streets and intersections where work is in progress, or where construction work is considered hazardous to traffic movements.
- C. Perform work in accordance with OSHA standards. Employ an excavation safety system as specified in Section 02260 - Trench Safety Systems.
- D. Remove existing pavements and structures, including sidewalks and driveways, in accordance with requirements of Section 02221 - Removing Existing Pavements, Structures, Wood, and Demolition Debris.
- E. Install and operate necessary dewatering and surface water control measures in accordance with requirements of Section 01578 - Control of Ground and Surface Water.

3.02 PROTECTION

- A. Protect trees, shrubs, lawns, existing structures, and other permanent objects outside of grading limits and within grading limits as designated on Drawings, and in accordance with requirements of Section 01562 - Tree and Plant Protection.
- 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 Drawings.
- D. Prevent erosion of excavations and Backfill. Do not allow water to pond in excavations.
- E. Maintain excavation and Backfill areas until start of subsequent work. Repair and recompact slides, washouts, settlements, or areas with loss of density at no additional cost to City.

3.03 EXCAVATION

- A. Perform excavation work so that underground structure can be installed to depths and alignments shown on Drawings. Use caution during excavation work to avoid disturbing surrounding ground and existing facilities and improvements. Keep excavation to absolute minimum necessary. No additional payment will be made for excess excavation not authorized by Project Manager.
- B. Upon discovery of unknown utilities, badly deteriorated utilities not designated for removal, or concealed conditions, discontinue work at that location. Notify Project Manager and obtain instructions before proceeding in such areas.
- C. Immediately notify agency or company owning any line which is damaged, broken or disturbed. Obtain approval from Project Manager and agency for any repairs or relocations, either temporary or permanent.
- D. Avoid settlement of surrounding soil due to equipment operations, excavation procedures, vibration, dewatering, or other construction methods.
- E. Provide surface drainage during construction to protect work and to avoid nuisance to adjoining property. Where required, provide proper dewatering and piezometric pressure control during construction.
- F. Conduct hauling operations so that trucks and other vehicles do not create dirt nuisance in streets. Verify that truck beds are sufficiently tight and loaded in such a manner such that objectionable materials will not spill onto streets. Promptly clear away any dirt, mud, or other materials that spill onto streets or are deposited onto streets by vehicle tires.
- G. Maintain permanent benchmarks, monumentation, and other reference points. Unless otherwise directed, replace those which are damaged or destroyed by Work.
- H. Provide sheeting, shoring, and bracing where required to safely complete Work, to prevent excavation from extending beyond limits indicated on Drawings, and to protect Work and adjacent structures or improvements. Use sheeting, shoring, and bracing to protect workmen and public conforming to requirements of Section 02260 - Trench Safety Systems.
- I. Prevent voids from forming outside of sheeting. Immediately fill voids with grout, cement stabilized sand, or other material approved by Project Manager and compact to 95 percent standard density.
- J. After completion of structure, remove sheeting, shoring, and bracing unless shown on Drawings to remain in place or directed by Project Manager in writing that such temporary structures may remain. Remove sheeting, shoring and bracing in such a manner as to maintain safety during backfilling operations and to prevent damage to Work and adjacent structures or improvements.

- K. Immediately fill and compact voids left or caused by removal of sheeting with cement stabilized sand or other material approved by Project Manager and compact to 95 percent standard density.

3.04 HANDLING EXCAVATED MATERIALS

- A. Classify excavated materials. Place material which is suitable for use as Backfill in orderly piles at sufficient distance from excavation to prevent slides or cave-ins.
- B. Provide additional Backfill material in accordance with requirements of Section 02319 - Borrow, if adequate quantities of Suitable Material are not available from excavation and trenching operations at site.

3.05 DEWATERING

- A. Provide ground water control per Section 01578 - Control of Ground and Surface Water.
- B. Keep ground water surface elevation minimum of 2 feet below bottom of Foundation Base.
- C. Maintain ground water control as directed by Section 01578 - Control of Ground and Surface Water and until structure is sufficiently complete to provide required weight to resist hydrostatic uplift with minimum safety factor of 1.2.

3.06 FOUNDATION EXCAVATION

- A. Notify Project Manager at least 48 hours prior to planned completion of foundation excavations. Do not place Foundation Base until excavation is accepted by Project Manager.
- B. Excavate to elevations shown on Drawings, as needed to provide space for Foundation Base, forming level undisturbed surface, free of mud or soft material. Remove pockets of soft or otherwise unstable soils and replace with Foundation Backfill Material or material as directed by Project Manager. Prior to placing material over it, recompact subgrade where indicated on Drawings, scarifying as needed, to 95 percent of maximum Standard Dry Density according to ASTM D 698. If specified level of compaction cannot be achieved, moisture condition subgrade and recompact until 95 percent is achieved, over-excavate to provide minimum layer of 24 inches of Foundation Backfill Material, or other means acceptable to Project Manager.
- C. Fill unauthorized excessive excavation with Foundation Backfill Material or other material as directed by Project Manager.
- D. Protect open excavations from rainfall, runoff, freezing groundwater, or excessive drying so as to maintain Foundation Subgrade in satisfactory, undisturbed condition. Keep excavations free of standing water and completely free of water during concrete placement.

- E. Remove soils which become unsuitable due to inadequate dewatering or other causes, after initial excavation to required subgrade, and replace with Foundation Backfill Material, as directed by Project Manager, at no additional cost to City.
- F. Place Foundation Base, or Foundation Backfill Material where needed, over subgrade on same day that excavation is completed to final grade. Where base of excavations is left open for longer periods, protect it with seal slab or cement-stabilized sand.
- G. Use filter fabric as specified in Section 02621 - Geotextile to separate crushed aggregate, and other free draining Class I materials from native soils or Select Material Backfill. Overlap fabric minimum of 12 inches beyond where another material stops contact with soil.
- H. Place crushed aggregate, and other Class I materials, in uniform layers of 8-inch maximum thickness. Perform compaction by means of at least two passes of vibratory compactor.

3.07 FOUNDATION BASE.

- A. Place Foundation Base after subgrade is properly prepared, including placement of Foundation Backfill where needed. Use Foundation Base consisting of 12-inch layer of crushed stone aggregate or cement stabilized sand. Alternately, seal slab with minimum thickness of 4 inches may be placed. Extend Foundation Base minimum of 12 inches beyond edge of structure foundation, unless shown otherwise on Drawings.
- B. Where Foundation Base and Foundation Backfill are of same material, both can be placed in one operation.

3.08 BACKFILL

- A. Complete Backfill to surface of natural ground or to lines and grades shown on Drawings. Remove forms, lumber, trash and debris from structures. Deposit Backfill in uniform layers and compact each layer as specified.
 - 1. Unless otherwise shown on Drawings, for structures under pavement or within one foot back of curb, use cement stabilized sand up to the top of the proposed structure. Use suitable on-site material (random Backfill) up to 12 inches below pavement base or subgrade. Place minimum of 12 inches of select Backfill below pavement base or subgrade.
 - 2. Unless otherwise shown on Drawings, for structures not under pavement, use random Backfill of Suitable Material up to the surface.
- B. Do not place Backfill against concrete walls or similar structures until laboratory test breaks indicate that concrete has reached minimum of 85 percent of specified compressive strength. Where walls are supported by slabs or intermediate walls, do not begin Backfill operations until slab or intermediate walls have been placed and concrete has attained sufficient strength.

- C. Remove concrete forms before starting Backfill and remove shoring and bracing as work progresses.
- D. Maintain Backfill material at no less than 2 percent below nor more than 2 percent above optimum moisture content, unless otherwise approved by Project Manager. Place fill material in uniform 8-inch maximum loose layers. Compact fill to at least 95 percent of maximum Standard Proctor Density according to ASTM D 698 below paved areas. Compact fill to at least 90 percent around structures below unpaved areas.
- E. Where Backfill is placed against sloped excavation surface, run compaction equipment across boundary of cut slope and Backfill to form compacted slope surface for placement of next layer of Backfill.
- F. Place Backfill using cement stabilized sand in accordance with Section 02321 - Cement Stabilized Sand.

3.09 FIELD QUALITY CONTROL

- A. Testing will be performed under provisions of Section 01454 - Testing Laboratory Services.
- B. Tests will be performed initially on minimum of one different sample 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 noticeable change in material gradation or plasticity.
- C. In-place density tests of compacted subgrade and Backfill will be performed according to ASTM D 1556, or ASTM D 6938, and at following frequencies and conditions:
 - 1. Minimum of one test for every 50 to 100 cubic yards of compacted Backfill material as directed by Project Manager.
 - 2. A minimum of three density tests for each full work shift.
 - 3. Density tests will be performed in all placement areas.
 - 4. Number of tests will be increased when inspection determines that soil types or moisture contents are not uniform or when compacting effort is variable and not considered sufficient to attain uniform density.
 - 5. Identify elevation of test with respect to natural ground.
 - 6. Record approximate depth of lift tested.

- D. At least one test for moisture-density relationships will be initially performed for each type of Backfill material in accordance with ASTM D 698. Perform additional moisture-density relationship test once a month or whenever there is noticeable change in material gradation or plasticity.
- E. When tests indicate work does not meet specified compaction requirements, recondition, recompact, and retest at Contractor's expense.

3.10 DISPOSAL OF EXCESS MATERIAL

- A. Dispose of excess materials in accordance with requirements of Section 01576 - Waste Material Disposal.

END OF SECTION

SECTION 02317

EXCAVATION AND BACKFILL FOR UTILITIES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Excavation, trenching, foundation, embedment, and Backfill for installation of utilities, including manholes and other pipeline structures.

1.02 RELATED SECTIONS

- A. Section 01270 – Measurement and Payment
- B. Section 01330 – Submittal Procedures
- C. Section 01454 – Testing Laboratory Services
- D. Section 01504 – Temporary Facilities and Controls
- E. Section 01555 – Traffic Control and Regulation
- F. Section 01562 – Tree and Plant Protection
- G. Section 01576 – Waste Material Disposal
- H. Section 01578 – Control of Ground and Surface Water
- I. Section 01725 – Field Surveying
- J. Section 02221 – Removing Existing Pavements, Structures, Wood, and Demolition Debris
- K. Section 02260 – Trench Safety System
- L. Section 02320 – Utility Backfill Materials
- M. Section 02321 – Cement Stabilized Sand
- N. Section 02322 – Flowable Fill
- O. Section 02621 – Geotextile
- P. Section 03315 – Concrete for Utility Construction

1.03 MEASUREMENT AND PAYMENT

- A. Unit Prices

1. No additional payment will be made for trench excavation, embedment and Backfill under this Section. Include cost in unit price for installed underground piping, sewer, conduit, or duct work.
 2. When Project Manager directs Contractor to over excavate trench bottom, Contractor will be paid by unit price bid per linear foot under bid item -6-inches Over Excavation of Trench Bottom.
 - a. No payment will be paid if Project Manager does not direct Contractor to over excavate trench bottom.
 - b. No over excavation will be measured or paid when unsuitable conditions result from dewatering system not in conformance with Section 01578 - Control of Ground and Surface Water.
 3. No additional payment will be made for performing Critical Location exploratory excavation. Include cost in unit price for installed underground piping, sewer, conduit, or duct work.
 4. Refer to Section 01270 - Measurement and Payment for unit price procedures.
- B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

1.04 DEFINITIONS

- A. Pipe Foundation: Suitable and stable native soils that are exposed at trench subgrade after excavation to depth of bottom of bedding as shown on Drawings, or foundation Backfill material placed and compacted in over-excavations.
- B. Pipe Bedding: Portion of trench Backfill that extends vertically from top of foundation up to level line at bottom of pipe, and horizontally from one trench sidewall to opposite sidewall.
- C. Haunching: Material placed on either side of pipe from top of bedding up to springline of pipe and horizontally from one trench sidewall to opposite sidewall.
- D. Initial Backfill: Portion of trench Backfill that extends vertically from springline of pipe (top of Haunching) up to level line 12-inches above top of pipe, and horizontally from one trench sidewall to opposite sidewall.
- E. Pipe Embedment: Portion of trench Backfill that consists of bedding, Haunching and Initial Backfill.
- F. Trench Zone: Portion of trench Backfill that extends vertically from top of Pipe Embedment up to pavement subgrade or up to final grade when not beneath pavement.
- G. Unsuitable Material: Unsuitable soil materials are the following:

1. Materials that are classified as ML, CL-ML, MH, PT, OH, and OL according to ASTM D 2487.
 2. Materials that cannot be compacted to required density due to gradation, plasticity, or moisture content.
 3. Materials that contain large clods, aggregates, stones greater than 4-inches in any dimension, debris, vegetation, waste or any other deleterious materials.
 4. Materials that are contaminated with hydrocarbons or other chemical contaminants.
- H. Suitable Material: Suitable soil materials are those meeting specification requirements. Materials mixed with lime, fly ash, or cement that can be compacted to required density and meeting requirements for Suitable Materials may be considered Suitable Materials, unless otherwise indicated.
- I. Backfill: Suitable material meeting specified quality requirements placed and compacted under controlled conditions.
- J. Ground Water Control Systems: Installations external to trench, such as well points, eductors, or deep wells. Ground water control includes dewatering to lower ground water, intercepting seepage which would otherwise emerge from side or bottom of trench excavation, and depressurization to prevent failure or heaving of excavation bottom. Refer to Section 01578 - Control of Ground Water and Surface Water.
- K. Surface Water Control: Diversion and drainage of surface water runoff and rain water away from trench excavation. Rain water and surface water accidentally entering trench shall be controlled and removed as part of Excavation Drainage.
- L. Excavation Drainage: Removal of surface and seepage water in trench by sump pumping and using drainage layer, as defined in ASTM D 2321, placed on foundation beneath Pipe Bedding or thickened bedding layer of Class I material.
- M. Trench Conditions are defined with regard to stability of trench bottom and trench walls of Pipe Embedment zone. Maintain trench conditions that provide for effective placement and compaction of embedment material directly on or against undisturbed soils or foundation Backfill, except where structural trench support is necessary.
1. Dry Stable Trench: Stable and substantially dry trench conditions exist in Pipe Embedment zone as result of typically dry soils or achieved by ground water control (dewatering or depressurization) for trenches extending below ground water level.
 2. Stable Trench with Seepage: Stable trench in which ground water seepage is controlled by Excavation Drainage.

- a. Stable Trench with Seepage in Clayey Soils: Excavation Drainage is provided in lieu of or to supplement Ground Water Control Systems to control seepage and provide stable trench subgrade in predominately clayey soils prior to bedding placement.
 - b. Stable Wet Trench in Sandy Soils: Excavation Drainage is provided in embedment zone in combination with ground water control in predominately sandy or silty soils.
3. Unstable Trench: Unstable trench conditions exist in Pipe Embedment zone if ground water inflow or high water content causes soil disturbances, such as sloughing, sliding, boiling, heaving or loss of density.
- N. Sub-trench: Sub-trench is special case of benched excavation. Sub-trench excavation below Trench Shields or shoring installations may be used to allow placement and compaction of foundation or embedment materials directly against undisturbed soils. Depth of sub-trench depends upon trench stability and safety as determined by Contractor.
- O. Trench Dam: Placement of low permeability material in Pipe Embedment zone or foundation to prohibit ground water flow along trench.
- P. 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 foundation bedding.
- Q. Foundation Bedding: Natural soil or manufactured aggregate of controlled gradation, and geotextile filter fabrics as required, to control drainage and material separation. Foundation Bedding is placed and compacted as Backfill to provide stable support for bedding. Foundation Bedding materials may include concrete seal slabs.
- R. Trench Safety Systems include both protective systems and Shoring Systems as defined in Section 02260 - Trench Safety Systems.
- S. Trench Shield (Trench Box): Portable worker safety structure moved along trench as work proceeds, used as protective system and designed to withstand forces imposed on it by cave in, thereby protecting persons within trench. Trench Shields may be stacked if so designed or placed in series depending on depth and length of excavation to be protected.
- T. Shoring System: Structure that supports sides of an excavation to maintain stable soil conditions and prevent cave-ins, or to prevent movement of ground affecting adjacent installations or improvements.
- U. Special Shoring: Shoring System meeting Special Shoring as specified in Paragraph 1.09, Special Shoring Design Requirements, for locations identified on Drawings.

V. Vacuum Excavation: An excavation technique performed by an experienced subcontractor in which water or air jetting is used to slough off and vacuum away soil.

W. Large Diameter Water Line (LDWL): Water line that is 24-inches in diameter or larger. X. Emergency Action Plan (EAP): The EAP document should include a discussion of procedures for timely and reliable detection, classification (level of emergency) and response procedure to a potential emergency condition associated with a Large Diameter Water Line.

X. Subsurface Utility Exploration (SUE): Non-destructive excavation, unless otherwise approved by Project Manager.

1.05 REFERENCES

A. ASTM D 558 - Standard Test Methods for Moisture-Density (Unit Weight) Relations of Soil-Cement Mixtures.

B. ASTM D 698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lb/ft³ (600 kN-m/m³)).

C. ASTM D 1556 - Standard Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method.

D. ASTM D 2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity Flow Applications.

E. ASTM D 2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classifications System).

F. ASTM D 4318 - Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

G. ASTM D 6938 - Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

H. TxDOT Tex-101-E - Preparing and Testing Soils and Base Materials.

I. TxDOT Tex-110-E - Sieve Analysis of Soils and Base Materials.

J. .

1.06 SCHEDULING

A. Schedule work so that Pipe Embedment can be completed on same day that acceptable foundation has been achieved for each section of pipe installation, manhole, or other structures.

B. For proposed utility adjacent to or across existing LDWL:

1. Conduct a meeting between Contractor, Drinking Water Operations and Utility Maintenance Branch prior to beginning excavation to coordinate the EAP in the event a water line shut down becomes necessary.
2. Notify Drinking Water Operations a minimum of 1 week prior to beginning construction activities.
3. Notify Drinking Water Operations a minimum of 48 hours prior to beginning SUE work near LDWL.
4. Unless otherwise approved by City Engineer, perform construction activities between 7 AM and 7 PM, Monday through Friday. No work permitted around a LDWL on weekends or City Holiday.
5. A City Inspector must be present during SUE or construction activities occurring within four feet or one diameter of the LDWL, whichever is greater, from a LDWL or appurtenance.

1.07 SUBMITTALS

- A. Conform to requirements of Section 01330 - Submittal Procedures.
- B. Submit planned typical method of excavation, backfill placement and compaction including:
 1. Trench widths.
 2. Procedures for foundation and pipe zone bedding placement, and trench Backfill compaction.
 3. Procedures for assuring compaction against undisturbed soil when pre-manufactured trench safety systems are proposed.
- C. Submit Backfill material sources and product quality information in accordance with requirements of Section 02320 - Utility Backfill Materials.
- D. Submit trench excavation safety program in accordance with requirements of Section 02260 - Trench Safety System. Include designs for Special Shoring meeting requirements defined in Paragraph 1.08, Special Shoring Design Requirements contained herein.
- E. Submit record of location of utilities as installed, referenced to survey control points. Include locations of utilities encountered or rerouted. Give stations, horizontal dimensions, elevations, inverts, and gradients.
- F. Submit 11-inch by 17-inch or 12-inch by 18-inch copy of Drawing with plotted utility or obstruction location titled "Critical Location Report" to Project Manager.

- G. For installation of proposed utility adjacent to or across existing LDWL, prepare and submit the following to Drinking Water Operations prior to beginning construction activities. Obtain approval from Drinking Water Operations prior to commencing prelocate or utility work near LDWL.
1. Trench details, Shoring System designs, installation sequences, and flowable fill mix designs.
 2. Emergency Action Plan (EAP) to address contingency plans in the event of damage to or failure of LDWL. Include the following:
 - a. Contact personnel and agencies including primary and secondary telephone numbers.
 - b. Contractor's hierarchy of responsible personnel.
 - c. Traffic control measures
 - d. Identification of resources to be available on or near Project site in event of damage to or failure of LDWL.

1.08 QUALITY ASSURANCE

- A. Testing and analysis of Backfill materials for soil classification and compaction during construction will be performed by an independent laboratory provided by City in accordance with requirements of Section 01454 - Testing Laboratory Services and as specified in this Section.
- B. Perform Backfill material source qualification testing in accordance with requirements of Section 02320 - Utility Backfill Materials.

1.09 SPECIAL SHORING DESIGN REQUIREMENTS

- A. Have Special Shoring designed or selected by Contractor's Professional Engineer to provide support for sides of excavations, including soils and hydrostatic ground water pressures as applicable, and to prevent ground movements affecting adjacent installations or improvements such as structures, pavements and utilities. Special Shoring may be a premanufactured system selected by Contractor's Professional Engineer to meet project site requirements based on manufacturer's standard design.

PART 2 PRODUCTS

2.01 EQUIPMENT

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

- B. Use only hand-operated tamping equipment until 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 pipes, conduits, or ducts.
- C. Use Trench Shields or other protective systems or Shoring Systems which are designed and operated to achieve placement and compaction of Backfill directly against undisturbed native soil.
- D. Use special Shoring Systems where required which may consist of braced sheeting, braced soldier piles and lagging, slide rail systems, or other systems meeting requirements as specified in Paragraph 1.08, Special Shoring Design Requirements.

2.02 MATERIAL CLASSIFICATIONS

- A. Embedment and Trench Zone Backfill Materials: Conform to classifications and product descriptions of Section 02320 - Utility Backfill Materials and Section 02321 – Cement Stabilized Sand.
- B. Concrete Backfill: Conform to requirements for Class B concrete as specified in Section 03315 - Concrete for Utility Construction.
- C. Geotextile (Filter Fabric): Conform to requirements of Section 02621 - Geotextile.
- D. Concrete for Trench Dams: Concrete Backfill or 3 sack premixed (bag) concrete.

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

- A. In addition to requirements found in this Section, conform to requirements found in the applicable Sections for utility material/type. Where an apparent conflict occurs between the Sections, this Section governs.

3.02 PREPARATION

- A. Establish traffic control to conform to requirements of Section 01555 - Traffic Control and Regulation. Maintain barricades and warning lights for streets and intersections affected by Work, and are considered hazardous to traffic movements.
- B. Perform work to conform to applicable safety standards and regulations. Employ trench safety system as specified in Section 02260 - Trench Safety Systems.
- C. Immediately notify agency or company owning any existing utility line which is damaged, broken, or disturbed. Obtain approval from Project Manager and agency for any repairs or relocations, either temporary or permanent.

- D. Remove existing pavements and structures, including sidewalks and driveways, to conform to requirements of Section 02221 - Removing Existing Pavements, Structures, Wood and Demolition Debris, as applicable.
- E. Install and operate necessary dewatering and surface-water control measures to conform to Section 01578 - Control of Ground and Surface Water. Provide stable trench to allow installation in accordance with Specifications.
- F. Maintain permanent benchmarks, monumentation, and other reference points. Unless otherwise directed in writing, replace those which are damaged or destroyed in accordance with Section 01725 - Field Surveying.

3.03 CRITICAL LOCATION INVESTIGATION

- A. Horizontal and vertical location of various underground lines shown on Drawings, including but not limited to water lines, gas lines, storm sewers, sanitary sewers, telecommunication lines, electric lines or power ducts, pipelines, concrete and debris, are based on best information available but are only approximate locations. Unless otherwise approved by Project Manager, at Critical Locations shown on Drawings, perform Vacuum Excavation to field verify horizontal and vertical locations of such lines within a zone 2 feet vertically and 4 feet horizontally of proposed work exclude water jetting at PCCP water line.
 - 1. Verify location of existing utilities minimum of 7 working days in advance of pipe laying activities based on daily pipe laying rate or prior to beginning installation of auger pit or tunnel shaft. Use extreme caution and care when uncovering utilities designated by Critical Locate.
 - 2. Notify Project Manager in writing immediately upon identification of obstruction. In event of failure to identify obstruction in minimum of 7 days, Contractor will not be entitled to extra cost for downtime including, but not limited to, payroll, equipment, overhead, demobilization and remobilization, until 7 days has passed from time Project Manager was notified of obstruction.
- B. Notify involved utility companies of date and time that investigation excavation will occur and request that their respective utility lines be marked in field. Comply with utility or pipeline company requirements that their representative be present during excavation. Provide Project Manager with 48-hours notice prior to field excavation or related work.
- C. Survey vertical and horizontal locations of obstructions relative to project baseline and datum and plot on 12-inch by 18-inch copy of Drawings. For Large diameter Water Lines, submit to Project Manager for approval, horizontal and vertical alignment dimensions for connections to existing lines, tied into Project baseline, signed and sealed by R.P.L.S.
- D. LDWL Prelocate Requirements:

1. Field-locate LDWL, appurtenances and laterals connected directly to LDWL through use of non-probing method such as a vacuum truck (non-water jetting method) at no greater than 50-foot intervals. Locate upstream and downstream of proposed work or utility installation.
2. Record crown and side of LDWL adjacent to proposed work or utility installation. Record LDWL locations horizontally and vertically using same coordinate system employed on proposed utility drawings.
3. Tie horizontal and vertical coordinates into project baseline. Submit recordings performed by R.P.L.S to City a minimum of 14 days prior to mobilizing to site.

3.04 PROTECTION

- A. Protect trees, shrubs, lawns, existing structures, and other permanent objects outside of grading limits and within grading limits as designated on Drawings, and in accordance with requirements of Section 01562 - Tree and Plant Protection.
- 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 Drawings.
- D. Take measures to minimize erosion of trenches. Do not allow water to pond in trenches. Where slides, washouts, settlements, or areas with loss of density or pavement failures or potholes occur, repair, re-compact, and pave those areas at no additional cost to City.
- E. Contingency plans for proposed work or utility installation adjacent to or across a LDWL:
 1. Conduct on-site emergency drill prior to commencing proposed utility installation, and at three-month intervals to assure EAP is current.
 2. In the event a LDWL shut down becomes necessary, secure site and provide assistance to City personnel to access pipe and isolation valves as needed.

3.05 EXCAVATION

- A. Except as otherwise specified or shown on Drawings, install underground utilities in open cut trenches with vertical sides.
- B. Perform excavation work so that pipe, conduit, and ducts can be installed to depths and alignments shown on Drawings. Avoid disturbing surrounding ground and existing facilities and improvements.
- C. Determine trench excavation widths using following schedule as related to pipe outside diameter (O.D.). Excavate trench so that pipe is centered in trench.

Nominal Pipe Size, Inches	Minimum Trench Width, Inches
30 or less	O.D. + 24
36 to 42	O.D. + 36
Greater than 42	O.D. + 48

- D. Do not obstruct sight distance for vehicles utilizing roadway or detours with stockpiled materials.
- E. Use sufficient trench width or benches above embedment zone for installation of well point headers or manifolds and pumps where depth of trench makes it uneconomical or impractical to pump from surface elevation. Provide sufficient space between shoring cross braces to permit equipment operations and handling of forms, pipe, embedment and Backfill, and other materials.
- F. Upon discovery of unknown utilities, badly deteriorated utilities not designated for removal, or concealed conditions, discontinue work at that location. Notify Project Manager and obtain instructions before proceeding.
- G. Shoring of Trench Walls.
1. Install Special Shoring in advance of trench excavation or simultaneously with trench excavation, so that soils within full height of trench excavation walls will remain laterally supported at all times.
 2. For all types of shoring, support trench walls in Pipe Embedment zone throughout installation. Provide trench wall supports sufficiently tight to prevent washing trench wall soil out from behind trench wall support.
 3. Leave sheeting driven into or below Pipe Embedment zone in place to preclude loss of support of foundation and embedment materials, unless otherwise directed by Project Manager. Leave rangers, walers, and braces in place as long as required to support sheeting, which has been cut off, and trench wall in vicinity of pipe zone.
 4. Employ special methods for maintaining integrity of embedment or foundation material. Before moving supports, place and compact embedment to sufficient depths to provide protection of pipe and stability of trench walls. As supports are moved, finish placing and compacting embedment.
 5. If sheeting or other shoring is used below top of Pipe Embedment zone, do not disturb Pipe Foundation and embedment materials by subsequent removal. Maximum thickness of removable sheeting extending into embedment zone shall be equivalent of 1-inch-thick steel plate. As sheeting is removed, fill in voids left with grouting material.
- H. Use of Trench Shields. When Trench Shield (Trench Box) is used as 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 trench sidewalls.
 2. Move Trench Shields so that pipe, and Backfill materials, after placement and compaction, are not damaged nor disturbed, nor degree of compaction reduced. Re-compact after shield is moved if soil is disturbed.
 3. When required, place, spread, and compact Pipe Foundation and bedding materials beneath shield. For backfill above bedding, lift 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 safe manner.
 5. Conform to applicable Government regulations.
- I. Voids under paving area outside shield caused by Contractor's work will require removal of pavement, consolidation and replacement of pavement in accordance with Contract Documents. Repair damage resulting from failure to provide adequate supports.
- J. Place sand or soil behind shoring or Trench Shield to prevent soil outside shoring from collapsing and causing voids under pavement. Immediately pack Suitable Material in outside voids following excavation to avoid caving of trench walls.
- K. Coordinate excavation within 15 feet of pipeline with company's representative. Support pipeline with methods agreed to by pipeline company's representative. Use small, rubber-tired excavator, such as backhoe, to do exploratory excavation. Bucket that is used to dig in close proximity to pipelines shall not have teeth or shall have guard installed over teeth to approximate bucket without teeth. Excavate by hand within 1 foot of Pipeline Company's line. Do not use larger excavation equipment than normally used to dig trench in vicinity of pipeline until pipelines have been uncovered and fully exposed. Do not place large excavation and hauling equipment directly over pipelines unless approved by Pipeline Company's representative.
- L. When, during excavation to uncover pipeline company's pipelines, screwed collar or an oxy- acetylene weld is exposed, immediately notify Project Manager. Provide supports for collar or welds. Discuss with Pipeline Company's representative and determine methods of supporting collar or weld during excavation and later backfilling operations. When collar is exposed, request Pipeline Company to provide welder in a timely manner to weld ends of collar prior to backfilling of excavation.
- M. Excavation and shoring requirements for proposed work or utility installation adjacent to or across a LDWL:
1. Identify LDWL area in field and barricade off from construction activities. Allow no construction related activities including, but not limited to, loading of dump trucks and material staging or storage, on top of LDWL.

2. Employ a groundwater control system when performing excavation activities within ten feet of LDWL to:
 - a. Effectively reduce hydrostatic pressure affecting excavations.
 - b. Develop substantially dry and stable subgrade for subsequent construction operations.
 - c. Prevent loss of fines, seepage, boils, quick condition or softening of foundation strata.
 - d. Maintain stability of sides and bottom of excavations.
3. When edge of proposed trench or shoring is within a distance equal to one diameter of LDWL from outside of wall of LDWL, valve or appurtenance:
 - a. Maintain minimum of four (4) feet horizontal clearance and minimum of two (2) feet vertical clearance between proposed utility and LDWL.
 - b. Auger Construction.
 - (1) Maintain minimum of four (4) feet horizontal clearance between proposed utility and LDWL.
 - (2) Dry auger method required when auger hole is 12-inches and larger in diameter.
 - c. Open Cut Construction and Auger pits
 - (1) Perform hand excavation when within four (4) feet of LDWL.
 - (2) Employ hydraulic or pneumatic Shoring System. Do not use vibratory or impact driven shoring or piling.
 - (3) Expose no more than 30-feet of trench prior to backfilling.
 - (4) A maximum of one (1) foot of vertical trench shall be unbraced at a time to maintain constant pressure on face of excavated soil.
 - (5) Upon removal of Shoring System, inject flowable fill into void space left behind by Shoring System. Comply with Standard Specification 02322 - Flowable Fill.
 - d. When edge of utility excavation is greater than one diameter of LDWL from outside wall of LDWL, use a shielding system as required by Project Manager and proposed utility standards and practices.

3.06 HANDLING EXCAVATED MATERIALS

- A. Use only excavated materials, which are suitable as defined in this Section and conforming to Section 02320 - Utility Backfill Materials. Place material suitable for backfilling in stockpiles at distance from trench to prevent slides or cave-ins.
- B. When required, provide additional Backfill material conforming to requirements of Section 02320 - Utility Backfill Materials.
- C. Do not place stockpiles of excess excavated materials on streets and adjacent properties. Protect Backfill material to be used on site. Maintain site conditions in accordance with Section 01504 - Temporary Facilities and Controls. Excavate trench so that pipe is centered in trench. Do not obstruct sight distance for vehicles utilizing roadway or detours with stockpiled materials.

3.07 TRENCH FOUNDATION

- A. Excavate bottom of trench to uniform grade to achieve stable trench conditions and satisfactory compaction of foundation or bedding materials.
- B. When wet soil is encountered on trench bottom and dewatering system is not required, over excavate an additional 6-inches with approval by Project Manager. Place non-woven geotextile fabric and then compact 12-inches of crushed stone in one lift on top of fabric. Compact crushed stone with four passes of vibratory-type compaction equipment.
- C. Perform over excavation, when directed by Project Manager, in accordance with Paragraph 3.07.B above. Removal of unstable or Unsuitable Material may be required if approved by Project Manager.
 - 1. Even though Contractor has not determined material to be unsuitable, or
 - 2. If unstable trench bottom is encountered and an adequate ground water control system is installed and operating according to Section 01578 - Control of Ground and Surface Water.
- D. Place Trench Dams in Class I foundations in line segments longer than 100 feet between manholes and not less than one in every 500 feet of pipe placed. Install additional dams as needed to achieve workable construction conditions. Do not place Trench Dams closer than 5 feet from manholes.

3.08 PIPE EMBEDMENT, PLACEMENT, AND COMPACTION

- A. Remove loose, sloughing, caving, or otherwise unsuitable soil from bottoms and sidewalls of trenches immediately prior to placement of embedment materials.
- B. Place embedment including bedding, Haunching, and Initial Backfill as shown on Drawings.

- C. For pipe installation, manually spread embedment materials around pipe to provide uniform bearing and side support when compacted. Protect flexible pipe from damage during placing of pipe zone bedding material. Perform placement and compaction directly against undisturbed soils in trench sidewalls, or against sheeting which is to remain in place.
- D. Do not place Trench Shields or shoring within height of Embedment Zone unless means to maintain density of compacted embedment material are used. If moveable supports are used in Embedment Zone, lift supports incrementally to allow placement and compaction of material against undisturbed soil.
- E. Place geotextile to prevent particle migration from in-situ soil into open-graded (Class I) embedment materials or drainage layers.
- F. Do not damage coatings or wrappings of pipes during backfilling and compacting operations. When embedding coated or wrapped pipes, do not use crushed stone or other sharp, angular aggregates.
- G. Place Haunching material manually around pipe and compact it to provide uniform bearing and side support. If necessary, hold small-diameter or lightweight pipe in place during compaction of haunch areas and placement beside pipe with sand bags or other suitable means.
- H. Place electrical conduit, if used, directly on foundation without bedding.
- I. Shovel in-place and compact embedment material 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 next lift. Water tamping is not allowed.
- J. For water lines construction embedment, use bank run sand, concrete sand, gem sand, pea gravel, or crushed limestone as specified in Section 02320 - Utility Backfill Material. Adhere to the following subparagraph numbers 1 and 2.
 - 1. Class I, II and III Embedment Materials:
 - a. Maximum 6-inches compacted lift thickness.
 - b. Compact to achieve minimum of 95 percent of maximum dry density as determined according to ASTM D 698.
 - c. Moisture content to be within -3 percent to +5 percent of optimum as determined according to ASTM D 698, unless otherwise approved by Project Manager.
 - 2. Cement Stabilized Sand (where required for special installations):
 - a. Maximum 6-inches compacted thickness.

- b. Compact to achieve minimum of 95 percent of maximum dry density as determined according to ASTM D 698.
 - c. Moisture content to be on dry side of optimum as determined according to ASTM D 698 but sufficient for effective hydration.
- K. For Sanitary Sewers adhere to subparagraph number 1 and 2. For Storm Sewers provide cement stabilized sand Embedment per paragraph 2.
- 1. Class I Embedment Materials.
 - a. Maximum 6-inches compacted lift thickness.
 - b. Systematic compaction by at least two passes of vibrating equipment. Increase compaction effort as necessary to effectively embed pipe to meet deflection test criteria.
 - c. Moisture content as determined by Contractor for effective compaction without softening soil of trench bottom, foundation or trench walls.
 - 2. Class II Embedment and Cement Stabilized Sand.
 - a. Maximum 6-inches compacted thickness.
 - b. Compaction by methods determined by Contractor to achieve minimum of 95 percent of maximum dry density as determined according to ASTM D 698 for Class II materials and according to ASTM D 558 for cement stabilized materials.
 - c. Moisture content of Class II materials within 3 percent of optimum as determined according to ASTM D 698. Moisture content of cement stabilized sands on dry side of optimum as determined according to ASTM D 558 but sufficient for effective hydration
- L. Place Trench Dams in Class I embedment in line segments longer than 100 feet between manholes, and not less than one in every 500 feet of pipe placed. Install additional dams as needed to achieve workable construction conditions. Do not place Trench Dams closer than 5 feet from manholes.

3.09 TRENCH ZONE BACKFILL PLACEMENT AND COMPACTION

- A. Place Backfill for pipe or conduits and restore surface as soon as practicable. Leave only minimum length of trench open as necessary for construction.
- B. For water lines, under pavement and to within one foot back of curb, use Backfill materials described below:
 - 1. For water lines 20-inches in diameter and smaller, use bank run sand or select Backfill materials up to pavement base or subgrade.

2. For water lines 24-inches in diameter and larger, Backfill with suitable on-site material (random Backfill) up to 12-inches below pavement base or subgrade. Place minimum of 12-inches of select Backfill below pavement base or subgrade.
- C. For sewer pipes (Storm and Sanitary), use Backfill materials described by trench limits. For "Trench Zone Backfill" under pavement and to within one foot back of curb, use cement stabilized sand for pipes of nominal sizes 36-inches in diameter and smaller to level 12 inches below the pavement. For sewer pipes 42-inches in diameter and larger, under pavement or natural ground, backfill from 12-inches above top of pipe to 120 inches below pavement with suitable on-site material or Select Backfill. Use select Backfill for rigid pavements or flexible base material for asphalt pavements for 12-inch Backfill directly under pavement. For Backfill Materials reference Section 02320 - Utility Backfill Materials.
- D. For Storm Sewers constructed of thermoplastic pipe Backfill shall not exceed 20 ft. in depth from the top of pipe to the pavement surface/ground surface.
- E. Unless otherwise shown in the plans or permitted in writing, do not use heavy earth-moving equipment over the structure until a minimum of 4 ft. of permanent or temporary compacted fill is placed over the top of the structure.
- F. Where damage to completed pipe installation work is likely to result from withdrawal of sheeting, leave sheeting in place. Cut off sheeting 1.5 feet or more above crown of pipe. Remove trench supports within 5 feet from ground surface.
- G. Compaction: Unless otherwise shown on Drawings, use Trench Zone Backfills under pavement and to within one foot of edge of pavement as required in 3.09. B, 3.09.C and 3.09.D. Place Trench Zone Backfill in lifts and compact. Fully compact each lift before placement of next lift.
 1. Class I, II, or III or combination thereof:
 - a. Place in maximum 12-inch thick loose layers.
 - b. Compact by vibratory equipment to minimum of 95 percent of maximum dry density determined according to ASTM D 698.
 - c. Moisture content within zero percent to 5 percent above optimum determined according to ASTM D 698, unless otherwise approved by Project Manager.
 2. Cement-Stabilized Sand:
 - a. Maximum lift thickness determined by Contractor to achieve uniform placement and required compaction, but do not exceed 12-inches.
 - b. Compact by vibratory equipment to minimum of 95 percent of maximum dry density determined according to ASTM D 558.

- c. Moisture content on dry side of optimum determined according to ASTM D 558 but sufficient for cement hydration.
 3. Class IVA and IVB (Clay Soils):
 - a. Place in maximum 8-inch thick loose lifts.
 - b. Compaction by vibratory Sheepfoot roller to minimum of 95 percent of maximum dry density determined according to ASTM D 698.
 - c. Moisture content within zero percent to 5 percent above optimum determined according to ASTM D 698, unless approved by Project Manager.
- H. Unless otherwise shown on Drawings, for trench excavations not under pavement, random backfill of Suitable Material may be used in Trench Zone. This provision does not apply to flexible pipe used for storm sewers.
 1. Fat clays (CH) may be used as Trench Zone Backfill outside paved areas at Contractor's option. When required density is not achieved, at any additional cost to City, rework, dry out, use lime stabilization or other approved methods to achieve compaction requirements, or use different Suitable Material.
 2. Maximum 9-inch compacted lift thickness for clayey soils and maximum 12-inch lift thickness for granular soils.
 3. Compact to minimum of 90 percent of maximum dry density determined according to ASTM D 698.
 4. Moisture content as necessary to achieve density.
- I. For electric conduits, remove form work used for construction of conduits before placing Trench Zone Backfill.

3.10 MANHOLES, JUNCTION BOXES AND OTHER PIPELINE STRUCTURES

- A. Below paved areas or where shown on Drawings, encapsulate manhole with cement stabilized sand; minimum of 2 foot below base, minimum 2 foot around walls, up to pavement subgrade or natural ground. Compact in accordance with Paragraph 3.09.F.2 of this Section.
- B. In unpaved areas, use select fill for backfill. Existing material that qualifies as select material may be used, unless indicated otherwise on Drawings. Deposit Backfill in uniform layers and compact each layer as specified. Maintain Backfill Material at no less than 2 percent below nor more than 5 percent above optimum moisture content, unless otherwise approved by Project Manager. Place fill material in uniform 8-inch maximum loose layers. Compact fill to at least 95 percent of maximum Standard Proctor Density according to ASTM D 698.

- C. For LDWL projects, encapsulate manhole with cement stabilized sand; minimum of 1 foot below base, minimum of 2 feet around walls, up to within 12 inches of pavement subgrade or natural ground. For manholes over water line, extend encapsulation to bottom of trench. Compact in accordance with Paragraph 3.09 F.2 of this Section.

3.11 FIELD QUALITY CONTROL

- A. Test for material source qualifications as defined in Section 02320 - Utility Backfill Materials.
- B. Provide excavation and trench safety systems at locations and to depths required for testing and retesting during construction at no additional cost to City.
- C. Tests will be performed on 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 noticeable change in material gradation or plasticity, or when requested by Project Manager.
- D. At least three tests for moisture-density relationships will be performed initially for Backfill materials in accordance with ASTM D 698, and for cement-stabilized sand in accordance with ASTM D 558. Perform additional moisture-density relationship tests once a month or whenever there is 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 6938, and at following frequencies and conditions:
 - 1. For open cut construction projects and auger pits: Unless otherwise approved by Project Manager, successful compaction to be measured by one test per 40 linear feet measured along pipe for compacted embedment and two tests per 40 linear feet measured along pipe for compacted Trench Zone Backfill material. Length of auger pits to be measured to arrive at 40 linear feet.
 - 2. A minimum of three density tests for each full shift of Work.
 - 3. Density tests will be distributed among placement areas. Placement areas are: foundation, outer bedding, Haunching, Initial Backfill and Trench Zone.
 - 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. Density tests may be performed at various depths below fill surface by pit excavation. Material in previously placed lifts may therefore be subject to acceptance/rejection.

6. Two verification tests will be performed adjacent to in-place tests showing density less than acceptance criteria. Placement will be rejected unless both verification tests show acceptable results.
 7. Recompact placement will be retested at same frequency as first test series, including verification tests.
 8. Identify elevation of test with respect to natural ground or pavement.
- F. Recondition, recompact, and retest at Contractor's expense if tests indicate Work does not meet specified compaction requirements. For hardened soil cement with nonconforming density, core and test for compressive strength at Contractor's expense.
- G. Acceptability of crushed rock compaction will be determined by inspection.

3.12 DISPOSAL OF EXCESS MATERIAL

- A. Dispose of excess materials in accordance with requirements of Section 01576 – Waste Material Disposal.

END OF SECTION

SECTION 02318

EXTRA UNIT PRICE WORK FOR EXCAVATION AND BACKFILL

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Measurement and payment applicable to extra unit price work items for excavation and backfill made necessary by unusual or unforeseen circumstances encountered during utility installations.
- B. Extra unit price work for excavation and backfill is paid only when authorized in advance by Project Manager.

1.02 RELATED SECTIONS

- A. Section 01270 – Measurement and Payment
- B. Section 02316 – Excavation and Backfill for Structures
- C. Section 02317 – Excavation and Backfill for Utilities
- D. Section 02320 – Utility Backfill Materials

1.03 MEASUREMENT AND PAYMENT

A. UNIT PRICES

- 1. Excavation Around Obstructions: Payment for Excavation Around Obstructions is on cubic yard basis, measured in place, without deduction for volume occupied by portions of pipes, ducts, or other structures left in place across trenches excavated under this item.
- 2. Extra Hand Excavation: Payment for Extra Hand Excavation is on cubic yard basis, measured in place.
- 3. Extra Machine Excavation: Payment for Extra Machine Excavation is on cubic yard basis, measured in place.
- 4. Extra Placement of Backfill Material: Payment for Extra Placement of Backfill Material is on cubic yard basis, measured in place, for material installed as part of Work. At discretion of Project Manager, measurement of cubic yards may be calculated from volume of Extra Hand Excavation or Extra Machine Excavation for which replacement is made, minus volume of any Extra Placement of Granular Backfill authorized in conjunction with Work.

5. Extra Placement of Granular Backfill: Payment for Extra Placement of Granular Backfill material is on cubic yard basis, measured in place.
6. Extra Select Backfill: Payment for Extra Select Backfill is on cubic yard basis, measured in place for a theoretical minimum trench width. The Project Manager may authorize Extra Select Backfill when soil from the excavation work does not include adequate quantities for placement of suitable on-site material (random backfill).
7. Refer to Section 01270 – Measurement and payment for unit price procedures.

1.04 DEFINITIONS

- A. Excavation Around Obstructions: Excavation necessitated by obstruction of pipes (other than service connections 3 inches in diameter or less), ducts, or other structures, not shown on Drawings, and of an unusual or unforeseen nature which interfere with installation of utility piping by normal methods of excavation or auguring.
- B. Extra Hand Excavation: Excavation by manual labor made necessary by unusual or unforeseen circumstances at locations approved in advance by Project Manager.
- C. Extra Machine Excavation: Excavation by machine at or near project site to perform related work not included in original project scope but added for convenience of City, as approved in advance by Project Manager.
- D. Extra Replacement of Backfill Material: Handling, backfill, and compaction of excavated material authorized under extra work bid items for Extra Hand Excavation or Extra Machine Excavation. Placement and compaction shall conform to requirements specified for excavation and backfill in Sections 02316 – Excavation and Backfill for Structures and 02317 – Excavation and Backfill for Utilities.
- E. Extra Placement of Granular Backfill: Hauling, placing, and compacting granular backfill materials as approved by Project Manager in conjunction with Extra Replacement of Backfill Material. Materials placed under this item shall conform to requirements for Bank Run Sand, Cement Stabilized Sand, Concrete Sand, Gem Sand, Crushed Stone, or Crushed Concrete specified for backfill material in Sections 02316 – Excavation and Backfill for Structures and 02317 – Excavation and Backfill for Utilities.
- F. Extra Select Backfill: Unsuitable material removed from the project and select backfill material hauled to the project, or conditioning unsuitable material on the site to make it select backfill. Provide select backfill material specified in Section 02320 – Utility Backfill Materials.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 02320

UTILITY BACKFILL MATERIALS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Material Classifications.
- B. Utility Backfill Materials:

- 1. Concrete sand
- 2. Gem sand
- 3. Pea gravel
- 4. Crushed stone
- 5. Crushed concrete
- 6. Bank run sand
- 7. Select backfill
- 8. Random backfill
- 9. Cement stabilized sand

- C. Material Handling and Quality Control Requirements.

1.02 RELATED SECTIONS

- A. Section 01270 – Measurement and Payment
- B. Section 01330 – Submittal Procedures
- C. Section 01454 – Testing Laboratory Services
- D. Section 02316 – Excavation and Backfill for Structures
- E. Section 02317 – Excavation and Backfill for Utilities
- F. Section 02318 – Extra Unit Price Work Price Work for Excavation and Backfill
- G. Section 02321 – Cement Stabilized Sand
- H. Section 02711 – Hot Mix Asphalt Base Course

- I. Section 02712 – Cement Stabilized Base Course
- J. Section 02713 – Recycled Crushed Concrete Base Course
- K. Section 02951 – Pavement Repair and Restoration
- L. Section 03315 – Concrete for Utility Construction

1.03 MEASUREMENT AND PAYMENT

- A. Unit Prices.
 - 1. No payment will be made for backfill material. Include payment in unit price for applicable utility installation.
 - 2. Payment for backfill material, when included as separate pay item or when directed by Project Manager, is on cubic yard basis for material placed and compacted within theoretical trench width limits and thickness of material according to Drawings, or as directed by Project Manager.
 - 3. Payment for backfill of authorized over-excavation is in accordance with Section 02318 - Extra Unit Price Work for Excavation and Backfill.
 - 4. Refer to Section 01270 - Measurement and Payment for unit price procedures.
- B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.04 DEFINITIONS

- A. Unsuitable Material:
 - 1. Materials classified as ML, CL-ML, MH, PT, OH, and OL according to ASTM D 2487.
 - 2. Materials that cannot be compacted to required density due to gradation, plasticity, or moisture content.
 - 3. Materials containing large clods, aggregates, or stones greater than 4 inches in any dimension; debris, vegetation, or waste; or any other deleterious materials.
 - 4. Materials contaminated with hydrocarbons or other chemical contaminants.
- B. Suitable Material:
 - 1. Materials meeting specification requirements.
 - 2. Unsuitable materials meeting specification requirements for suitable soils after treatment with lime or cement.

- C. Foundation Backfill Materials: Natural soil or manufactured aggregate meeting Class I requirements and geotextile filter fabrics as required, to control drainage and material separation. Foundation backfill material is placed and compacted as backfill where needed to provide stable support for structure Foundation Base. Foundation Backfill Materials may include concrete fill and seal slabs.
- D. Foundation Base: Crushed stone aggregate with filter fabric as required, cement stabilized sand, or concrete seal slab. Foundation Base provides smooth, level working surface for construction of concrete Foundation.
- E. Backfill Material: Classified soil material meeting specified quality requirements for designated application as embedment or Trench Zone Backfill.
- F. Embedment Material: Soil material placed under controlled conditions within embedment zone extending vertically upward from top of Foundation to an elevation 12 inches above top of pipe, and including pipe bedding, haunching and initial backfill.
- G. Trench Zone Backfill: Classified soil material meeting specified quality requirements and placed under controlled conditions in trench zone from top of embedment zone to base course in paved areas or to surface grading material in unpaved areas.
- H. Foundation: Either suitable soil of trench bottom or material placed as backfill of over- excavation for removal and replacement of unsuitable or otherwise unstable soils.
- I. Source: Source selected by Contractor for supply of embedment or trench zone Backfill Material. Selected Source may be Project excavation, off-site borrow pits, commercial borrow pits, or sand and aggregate production or manufacturing plants.
- J. Refer to Section 02317 - Excavation and Backfill for Utilities for other definitions regarding utility installation by trench construction.

1.05 REFERENCES

- A. ASTM C 33 - Standard Specification for Concrete Aggregates.
- B. ASTM C 40 - Standard Test Method for Organic Impurities in Fine Aggregates for Concrete.
- C. ASTM C 123 - Standard Test Method for Lightweight Particles in Aggregate.
- D. ASTM C 131 - Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in Los Angeles Machine.
- E. ASTM C 136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.

- F. ASTM C 142 - Standard Test Method for Clay Lumps and Friable Particles in Aggregates.
- G. ASTM D 1140 - Standard Test Methods for Determining the Amount of Material Finer Than 75- μ m (No. 200) Sieve in soils by Washing.
- H. ASTM D 2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).
- I. ASTM D 4318 - Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
- J. TxDOT Tex-110-E - Sieve Analysis of Soils and Base Materials
- K. TxDOT Tex-460-A - Determining Crushed Face Particle count

1.06 SUBMITTALS

- A. Conform to requirements of Section 01330 - Submittal Procedures.
- B. Submit description of Source, material classification and product description, production method, and application of Backfill Materials.
- C. Submit test results for samples of off-site Backfill Materials. Comply with Paragraph 2.03, Material Testing.
- D. Before stockpiling materials, submit copy of approval from landowner for stockpiling Backfill Material on private property.
- E. Provide delivery ticket which includes Source location for each delivery of material that is obtained from off-site Sources or is being paid as specific bid item.

1.07 QUALITY ASSURANCE

- A. Perform tests of Sources for Backfill Material in accordance with Paragraph 2.03B.
- B. Verification tests of Backfill Materials may be performed by City in accordance with Section 01454 - Testing Laboratory Services and in accordance with Paragraph 3.03.

PART 2 PRODUCTS

2.01 MATERIAL CLASSIFICATIONS

- A. Classify materials for backfill for purpose of quality control in accordance with Unified Soil Classification Symbols as defined in ASTM D 2487. Material use and application is defined in utility installation specifications and Drawings either by class, as described in Paragraph 2.01B, or by product descriptions, as given in Paragraph 2.02.

B. Class Designations Based on Laboratory Testing:

1. Class I: Well-graded gravels and sands, gravel-sand mixtures, crushed well-graded rock, little or no fines (GW, SW):
 - a. Plasticity index: non-plastic.
 - b. Gradation: D60/D10 - 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 gravels and sands, little to moderate fines (GM, GP, SP, SM):
 - a. Plasticity index: non-plastic to 4.
 - b. Gradations:
 - (1) Gradation (GP, SP): amount passing No. 200 sieve - less than 5 percent.
 - (2) Gradation (GM, SM): amount passing No. 200 sieve - between 12 percent and 50 percent.
 - (3) Borderline gradations with dual classifications (e.g., SP-SM): amount passing No. 200 sieve - between 5 percent and 12 percent.
3. Class III: Clayey gravels and sands, poorly graded mixtures of gravel, sand, silt, and clay (GC, SC, and dual classifications, e.g., SP-SC):
 - a. Plasticity index: greater than 7.
 - b. Gradation: amount passing No. 200 sieve - between 12 percent and 50 percent.
4. Class IVA: Lean clays (CL).
 - a. Plasticity Indexes:
 - (1) Plasticity index: greater than 7, and above A line.
 - (2) Borderline plasticity with dual classifications (CL-ML): PI between 4 and 7.
 - b. Liquid limit: less than 50.
 - c. Gradation: amount passing No. 200 sieve - greater than 50 percent.
 - d. Inorganic.

5. Class IVB: Fat clays (CH)
 - a. Plasticity index: above A line.
 - b. Liquid limit: 50 or greater.
 - c. Gradation: amount passing No. 200 sieve - greater than 50 percent.
 - d. Inorganic.
6. Use soils with dual class designation according to ASTM D 2487, and which are not defined above, according to more restrictive class.

2.02 PRODUCT DESCRIPTIONS

- A. 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 not acceptable as Backfill Materials. These soils may be used for site grading and restoration in unimproved areas as approved by Project Manager. Soils in Class IVB, fat clay (CH) may be used as Backfill Materials where allowed by applicable backfill installation specification. Refer to Section 02316 - Excavation and Backfill for Structures and Section 02317 - Excavation and Backfill for Utilities.
- B. Provide Backfill Material that is free of stones greater than 6 inches, free of roots, waste, debris, trash, organic material, unstable material, non-soil matter, hydrocarbon or other contamination, conforming to 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 C 142.
 2. Lightweight pieces: Less than 5 percent when tested in accordance with ASTM C 123.
 3. Organic impurities: No color darker than standard color when tested in accordance with ASTM C 40.
- C. Manufactured materials, such as crushed concrete, may be substituted for natural soil or rock products where indicated in product specification, and approved by Project Manager, provided that physical property criteria are determined to be satisfactory by testing.
- D. Bank Run Sand: Durable bank run sand classified as SP, SW, or SM by Unified Soil Classification System (ASTM D 2487) meeting following requirements:
 1. Less than 15 percent passing number 200 sieve when tested in accordance with ASTM D 1140. Amount of clay lumps or balls may not exceed 2 percent.
 2. Material passing number 40 sieve shall meet the following requirements when tested in accordance with ASTM D 4318: Plasticity index: not exceeding 7.

- E. Concrete Sand: Natural sand, manufactured sand, or combination of natural and manufactured sand conforming to requirements of ASTM C 33 and graded within following limits when tested in accordance with ASTM C 136:

Sieve	Percent Passing
3/8"	100
No. 4	95 to 100
No. 8	80 to 100
No. 16	50 to 85
No. 30	25 to 60
No. 50	10 to 30
No. 100	2 to 10

- F. Gem Sand: Sand conforming to requirements of ASTM C 33 for course aggregates specified for number 8 size and graded within the following limits when tested in accordance with ASTM C 136:

Sieve	Percent Passing
3/8"	95 to 100
No. 4	60 to 80
No. 8	15 to 40

- G. Pea Gravel: Durable particles composed of small, smooth, rounded stones or pebbles and graded within the following limits when tested in accordance with ASTM C 136:

Sieve	Percent Passing
1/2"	100
3/8"	85 to 100
No. 4	10 to 30
No. 8	0 to 10
No. 16	0 to 5

- H. Crushed Aggregates: Crushed aggregates consist of durable particles obtained from an approved Source and meeting the following requirements:

1. Materials of one product delivered for same construction activity from single Source, unless otherwise approved by Project Manager.
2. Non-plastic fines.

3. Los Angeles abrasion test wear not exceeding 45 percent when tested in accordance with ASTM C 131.
4. Crushed aggregate shall have minimum of 90 percent of particles retained on No. 4 sieve with 2 or more crushed faces as determined by Tex-460-A, Part I.
5. Crushed stone: Produced from oversize plant processed stone or gravel, sized by crushing to predominantly angular particles from naturally occurring single Source. Uncrushed gravel is not acceptable materials for embedment where crushed stone is shown on applicable utility embedment drawing details.
6. Crushed Concrete: Crushed concrete is an acceptable substitute for crushed stone as utility backfill. Gradation and quality control test requirements are same as crushed stone. Provide crushed concrete produced from normal weight concrete of uniform quality; containing particles of aggregate and cement material, free from other substances such as asphalt, reinforcing steel fragments, soil, waste gypsum (calcium sulfate), or debris.
7. Gradations, as determined in accordance with Tex-110-E.

Sieve	Percent Passing by Weight for Pipe Embedment by Ranges of Nominal Pipes Sizes		
	>15"	15" - 8"	<8"
1"	95 - 100	100	-
3/4"	60 - 90	90 - 100	100
1/2"	25 - 60	-	90 - 100
3/8"	-	20 - 55	40 - 70
No. 4	0 - 5	0 - 10	0 - 15
No. 8	-	0 - 5	0 - 5

- I. Select Backfill: Class III clayey gravel or sand or Class IV lean clay with plasticity index between 7 and 20 or clayey soils treated with lime in accordance with Section 02951 - Pavement Repair and Restoration to meet plasticity criteria.
- J. Random Backfill: Any suitable soil or mixture of soils within Classes I, II, III and IV; or fat clay (CH) where allowed by applicable backfill installation specification. Refer to Section 02316 - Excavation and Backfill for Structures and Section 02317 - Excavation and Backfill for Utilities.
- K. Cement Stabilized Sand: Conform to requirements of Section 02321 - Cement Stabilized Sand.
- L. Concrete Backfill: Conform to Class B concrete as specified in Section 03315 - Concrete for Utility Construction.

- M. Flexible Base Course Material: Conform to requirements of applicable portions of Section 02711 - Hot Mix Asphaltic Base Course, Section 02712 - Cement Stabilized Base Course, and Section 02713 - Recycled Crushed Concrete Base Course.

2.03 MATERIAL TESTING

- A. Source Qualification. Perform testing to obtain tests by suppliers for selection of material Sources and products not from the Project site. Test samples of processed materials from current production representing material to be delivered. Use tests to verify that materials meet specification requirements. Repeat qualification test procedures each time Source characteristics change or there is planned change in Source location or supplier. Include the following qualification tests, as applicable:
 - 1. Gradation. Report complete sieve analyses regardless of specified control sieves from largest particle through No. 200 sieve.
 - 2. Plasticity of material passing No. 40 sieve
 - 3. Los Angeles abrasion wear of material retained on No. 4 sieve
 - 4. Clay lumps
 - 5. Lightweight pieces
 - 6. Organic impurities
- B. Production Testing. Provide reports to Project Manager from an independent testing laboratory that Backfill Materials to be placed in Work meet applicable specification requirements.
- C. Assist Project Manager in obtaining material samples for verification testing at Source or at production plant.

PART 3 EXECUTION

3.01 SOURCES

- A. Use of existing material in trench excavations is acceptable, provided applicable specification requirements are satisfied.
- B. Identify off-site Sources for Backfill Materials at least 14 days ahead of intended use so that Project Manager may obtain samples for verification testing.

- C. Materials may be subjected to inspection or additional verification testing after delivery. Materials which do not meet requirements of specifications will be rejected. Do not use material which, after approval, has become unsuitable for use due to segregation, mixing with other materials, or by contamination. Once material is approved by Project Manager, expense for sampling and testing required to change to different material will be credited to City through change order.
- D. Bank run sand, select backfill, and random backfill, if available in Project excavation, may be obtained by selective excavation and acceptance testing. Obtain additional quantities of these materials and other materials required to complete Work from off-site Sources.
- E. City does not represent or guarantee that any soil found in excavation work will be suitable and acceptable as Backfill Material.

3.02 MATERIAL HANDLING

- A. When Backfill Material is obtained from either commercial or non-commercial borrow pit, open pit to expose vertical faces of various strata for identification and selection of approved material to be used. Excavate selected material by vertical cuts extending through exposed strata to achieve uniformity in product.
- B. Establish temporary stockpile locations for practical material handling, control, and verification testing by Project Manager in advance of final placement. Obtain approval from landowner for storage of Backfill Material on adjacent private property.
- C. When stockpiling Backfill Material near Project site, use appropriate covers to eliminate blowing of materials into adjacent areas and prevent runoff containing sediments from entering drainage system.
- D. Place stockpiles in layers to avoid segregation of processed materials. Load material by making successive vertical cuts through entire depth of stockpile.

3.03 FIELD QUALITY CONTROL

- A. Quality Control
 - 1. The Project Manager may sample and test backfill at:
 - a. Sources including borrow pits, production plants and Contractor's designated off-site stockpiles.
 - b. On-site stockpiles.
 - c. Materials placed in Work.
 - 2. The Project Manager may re-sample material at any stage of Work or location if changes in characteristics are apparent.

- B. Production Verification Testing: City's testing laboratory will provide verification testing on Backfill Materials, as directed by Project Manager. Samples may be taken at Source or at production plant, as applicable.

END OF SECTION

SECTION 02321

CEMENT STABILIZED SAND

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Cement stabilized sand.

1.02 RELATED SECTIONS

- A. Section 01270 – Measurement and Payment
- B. Section 01330 - Submittal Procedures
- C. Section 01454 – Testing Laboratory Services
- D. Section 02320 – Utility Backfill Materials

1.03 MEASUREMENT AND PAYMENT

- A. Unit Prices.

1. No separate payment will be made for work performed under this Section. Include cost of such work in Contract unit prices for items listed in bid form requiring cement stabilized sand.
2. Refer to Paragraph 3.04 for material credit.
3. Refer to Section 01270 - Measurement and Payment for unit price procedures.

- B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.04 REFERENCES

- A. ASTM C 33 - Standard Specification for Concrete Aggregates.
- B. ASTM C 40 - Standard Test Method for Organic Impurities in Fine Aggregates for Concrete.
- C. ASTM C 42 - Standard Test Methods for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
- D. ASTM C 94 - Standard Specification for Ready-Mixed Concrete.
- E. ASTM C 123 - Standard Test Method for Lightweight Particles in Aggregate.

- F. ASTM C 142 - Standard Test Method for Clay Lumps and Friable Particles in Aggregates.
- G. ASTM C 150 - Standard Specification for Portland Cement.
- H. ASTM D 558 - Standard Test Method for Moisture-Density (Unit Weight) Relations of Soil-Cement Mixtures.
- I. ASTM D 1632 - Standard Practice for Making and Curing Soil-Cement Compression and Flexure Test Specimens in the Laboratory.
- J. ASTM D 1633 - Standard Test Method for Compressive Strength of Molded Soil-Cement Cylinders.
- K. ASTM D 2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).
- L. ASTM D 3665 - Standard Practice for Random Sampling of Construction Materials.
- M. ASTM D 4318 - Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils

1.05 SUBMITTALS

- A. Conform to requirements of Section 01330 - Submittal Procedures.
- B. Submit proposed target cement content and production data for sand-cement mixture in accordance with requirements of Paragraph 2.03, Materials Qualifications.

1.06 DESIGN REQUIREMENTS

- A. Use sand-cement mixture producing minimum unconfined compressive strength of 100 pounds per square inch (psi) in 48 hours.
 - 1. Design will be based on strength specimens molded in accordance with ASTM D 558 at moisture content within 3 percent of optimum and within 4 hours of batching.
 - 2. Determine minimum cement content from production data and statistical history. Provide no less than 1.1 sacks of cement per ton of dry sand.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Cement: Type I Portland cement conforming to ASTM C 150.

- B. Sand: Clean, durable sand meeting grading requirements for fine aggregates of ASTM C 33, or requirements for bank run sand of Section 02320 - Utility Backfill Materials, and the following requirements:
 - 1. Classified as SW, SP, SW-SM, SP-SM, or SM by Unified Soil Classification System of ASTM D 2487.
 - 2. Deleterious materials:
 - a. Clay lumps, ASTM C 142 - less than 0.5 percent.
 - b. Lightweight pieces, ASTM C 123; less than 5.0 percent.
 - c. Organic impurities, ASTM C 40, color no darker than standard color.
 - 3. Plasticity index of 4 or less when tested in accordance with ASTM D 4318.
- C. Water: Potable water, free of oils, acids, alkalis, organic matter or other deleterious substances, meeting requirements of ASTM C 94.

2.02 MIXING MATERIALS

- A. Add required amount of water and mix thoroughly in pugmill-type mixer.
- B. Stamp batch ticket at plant with time of loading. Reject material not placed and compacted within 4 hours after mixing.

2.03 SOURCE QUALITY CONTROL

- A. Determine target cement content of material as follows:
 - 1. Obtain samples of sand-cement mixtures at production facility representing range of cement content consisting of at least three points.
 - 2. Complete molding of samples within 4 hours after addition of water.
 - 3. Perform compressive strength tests (average of two specimens) at 48 hours and 7 days.
 - 4. Perform cement content tests on each sample.
 - 5. Perform moisture content tests on each sample.
 - 6. Plot average 48-hour strength vs. cement content.
 - 7. Record scale calibration date, sample date, sample time, molding time, cement feed dial settings, and silo pressure (if applicable).
- B. Test raw sand for following properties at point of entry into pug-mill:

1. Gradation
 2. Plasticity index
 3. Organic impurities
 4. Clay lumps and friable particles
 5. Lightweight pieces
 6. Moisture content
 7. Classification
- C. Present data obtained in format similar to that provided in sample data form attached to this Section.
- D. The target content may be adjusted when statistical history so indicates. For determination of minimum product performance use formula:

$$f'c\% \text{ 1/2 standard deviation}$$

PART 3 EXECUTION

3.01 PLACING

- A. Place sand-cement mixture in maximum 12-inch-thick loose lifts and compact to 95 percent of maximum density as determined in accordance with ASTM D 558, unless otherwise specified. Refer to related specifications for thickness of lifts in other applications. Target moisture content during compaction is +3 percent of optimum. Perform and complete compaction of sand-cement mixture within 4 hours after addition of water to mix at plant.
- B. Do not place or compact sand-cement mixture in standing or free water.
- C. Where potable water lines cross wastewater line, embed wastewater line with cement stabilized sand in accordance with Texas Administrative Code §290.44(e)(4)(B):
1. Provide minimum of 10% cement per cubic yard of cement stabilized sand mixture, based on loose dry weight volume. Use at least 2.5 bags of cement per cubic yard of mixture (2 sacks per ton of dry sand).
 2. Unless otherwise shown on Drawings, embed wastewater main or lateral minimum of six inches above and below.
 3. Use brown coloring in cement stabilized sand for wastewater main or lateral bedding for identification of pressure rated wastewater mains during future construction.

3.02 FIELD QUALITY CONTROL

- A. Testing will be performed under provisions of Section 01454 - Testing Laboratory Services.
- B. One sample of cement stabilized sand shall be obtained for each 150 tons of material placed per day with no less than one sample per day of production. Random samples of delivered cement stabilized sand shall be taken in the field at point of delivery in accordance with ASTM 3665. Obtain three individual samples of approximately 12 to 15 lb each from the first, middle, and last third of the truck and composite them into one sample for test purpose.
- C. Prepare and mold four specimens (for each sample obtained) in accordance with ASTM D 558, Method A, without adjusting moisture content. Samples will be molded at approximately same time material is being used, but no later than 4 hours after water is added to mix.
- D. After molding, specimens will be removed from molds and cured in accordance with ASTM D 1632.
- E. Specimens will be tested for compressive strength in accordance with ASTM D 1633, Method A. Two specimens will be tested at 48 hours plus or minus 2 hours and two specimens will be tested at 7 days plus or minus 4 hours.
- F. A strength test will be average of strengths of two specimens molded from same sample of material and tested at same age. Average daily strength will be average of strengths of all specimens molded during one day's production and tested at same age.
- G. Precision and Bias: Test results shall meet recommended guideline for precision in ASTM D 1633.
- H. Reporting: Test reports shall contain, as a minimum, the following information:
 - 1. Supplier and plant number
 - 2. Time material was batched
 - 3. Time material was sampled
 - 4. Test age (exact hours)
 - 5. Average 48-hour strength
 - 6. Average 7-day strength
 - 7. Specification section number
 - 8. Indication of compliance / non-compliance
 - 9. Mixture identification

10. Truck and ticket numbers
11. The time of molding
12. Moisture content at time of molding
13. Required strength
14. Test method designations
15. Compressive strength data as required by ASTM D 1633
16. Supplier mixture identification
17. Specimen diameter and height, in.
18. Specimen cross-sectional area, sq. in.

3.03 ACCEPTANCE

- A. Strength level of material will be considered satisfactory if:
 1. The average 48-hour strength is greater than 100 psi with no individual strength test below 70 psi.
 2. All 7-day individual strength tests (average of two specimens) are greater than or equal to 100 psi.
- B. Material will be considered deficient when 7-day individual strength test (average of two specimens) is less than 100 psi but greater than 70 psi. See Paragraph 3.04 Adjustment for Deficient Strength.
- C. The material will be considered unacceptable and subject to removal and replacement at Contractor's expense when individual strength test (average of two specimens) has 7-day strength less than 70 psi.
- D. When moving average of three daily 48-hour averages falls below 100 psi, discontinue shipment to Project until plant is capable of producing material, which exceeds 100 psi at 48 hours. Five 48-hour strength tests shall be made in this determination with no individual strength tests less than 100 psi.
- E. Testing laboratory shall notify Contractor, Project Manager, and material supplier by facsimile of tests indicating results falling below specified strength requirements within 24 hours.
- F. If any strength test of laboratory cured specimens falls below the specified strength, Contractor may, at Contractor's own expense, request test of cores drilled from the area in question in accordance with ASTM C42. In such cases, three (3) cores shall be taken for each strength test that falls below the values given in 3.03.A.

- G. Cement stabilized sand in an area represented by core tests shall be considered satisfactory if the average of three (3) cores is equal to at least 100 psi and if no single core is less than 70 psi. Additional testing of cores extracted from locations represented by erratic core strength results will be permitted.

3.04 ADJUSTMENT FOR DEFICIENT STRENGTH

- A. When mixture produces 7-day compressive strength greater than or equal to 100 psi, then material will be considered satisfactory and bid price will be paid in full.
- B. When mixture produces 7-day compressive strength less than 100 psi and greater than or equal to 70 psi, material shall be accepted contingent on credit in payment. Compute credit by the following formula:

$$\text{Credit per Cubic Yard} = \frac{\$30.00 \times 2 (100 \text{ psi} - \text{Actual psi})}{100}$$

- C. When mixture produces 7-day compressive strength less than 70 pounds per square inch, then remove and replace cement-sand mixture and paving and other necessary work at no cost to City.

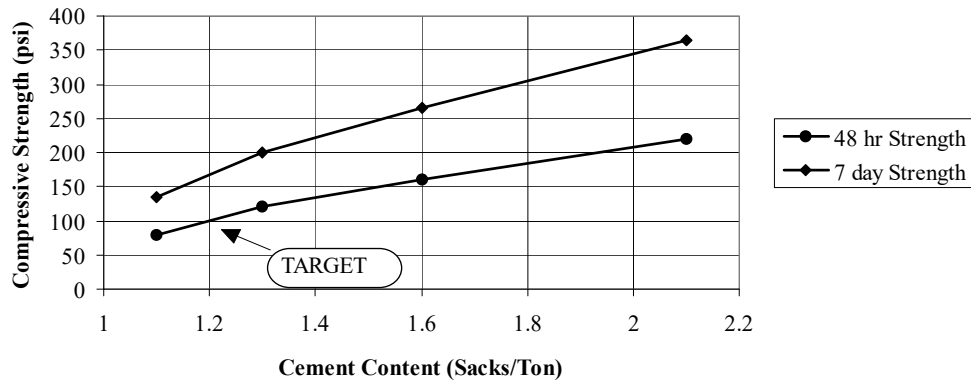
Supplier: City Stabilized Sand	Plant No: 1 - Main Street	Date of Tests: January 1, 1997
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Item	Raw Sand	1.1 Sack	100 psi	1.5 Sack	2.0 Sack
Moisture Content	10.9	15.7	14.0	13.8	13.7
Cement Feed Dial Setting	--	2.25	2.5	2.75	3.75
Silo Pressure (psi)	--	4	4	4	4
Batch Time	10:00	10:10	10:15	10:20	10:25
Sample Time	--	10:10	10:15	10:20	10:25
Molding Time	--	12:30	12:45	1:00	1:15
Cement Content (sacks/ton)	--	1.1	1.3	1.6	2.1
Compressive Strength at 48 hrs. (avg of 2)	--	80	120	160	220
Compressive Strength at 7 days (avg of 2)	--	135	200	265	365

Sieve size	Percent Passing	COH Spec. Section 02320
3/8 Inch	100	--
No. 16	100	--
No. 40	100	--
No. 50	99	--
No. 100	41	--
No. 200	11	0 to 15

Raw Sand Tests	Result	City of Houston
Plasticity Index	Non-Plastic	4 Maximum
Organic Impurities	Passing	No Darker Than
Clay Lumps & Friable Parts (%)	0.0	0.5 % Maximum
Lightweight Pieces (%)	0.0	5.0 % Maximum
Classification	SP-SM	SW, SP, SW-SM, SP-SM, SM

Compressive Strength vs Cement Content



END OF SECTION

SECTION 02330

EMBANKMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Construction of embankments with excess excavated material and borrow.

1.02 RELATED SECTIONS

- A. Section 01270 – Measurement and Payment
- B. Section 01454 – Testing Laboratory Services
- C. Section 01576 – Waste Material Disposal
- D. Section 02315 – Roadway Excavation
- E. Section 02316 – Excavation and Backfill for Structures
- F. Section 02317 – Excavation and Backfill for Utilities
- G. Section 02319 – Borrow
- H. Section 02320 – Utility Backfill Materials
- I. Section 02511 – Water Lines
- J. Section 02531 – Gravity Sanitary Sewers
- K. Section 02532 – Sanitary Sewer Force Mains

1.03 MEASUREMENT AND PAYMENT

- A. Unit Prices.
 - 1. No separate payment will be made for embankment under this section. Include payment in unit price for excavation or borrow.
 - 2. Refer to Section 01270 - Measurement and Payment for unit price procedures.
- B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.04 REFERENCES

- A. ASTM D 698 - Standard Test Methods for Laboratory Compaction Characteristics of Soils Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)).

- B. ASTM D 6938 - Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

PART 2 PRODUCTS

2.01 MATERIALS

- A. Refer to Section 02315 - Roadway Excavation for acceptable excess materials from roadway excavation.
- B. Refer to Section 02317 - Excavation and Backfill for Utilities for acceptable excess materials from utility excavation and trenching.
- C. Refer to Section 02319 - Borrow for acceptable borrow materials.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify borrow and excess excavated materials to be reused are approved.
- B. Verify removals and clearing and grubbing operations have been completed.

3.02 PREPARATION

- A. Backfill test pits, stump holes, small swales and other surface irregularities. Backfill and compact in designated lift depths to requirements for embankment compaction.
- B. Record location and plug and fill inactive water and oil wells. Conform to Texas State Health Department, Texas Commission on Environmental Quality and Texas Railroad Commission requirements. Notify City Engineer prior to plugging wells.
- C. Excavate and dispose of unsuitable soil and other unsuitable materials which will not consolidate. Backfill and compact to requirements for embankment. Unsuitable soil is defined in Section 02316 - Excavation and Backfill for Structures and Section 02320 - Utility Backfill Materials.
- D. Backfill new utilities below future grade. Conform to requirements of Sections 02317 - Excavation and Backfill For Utilities, 02511 - Water Lines, 02531 - Gravity Sanitary Sewers, and 02532 - Sanitary Sewer Force Mains.

3.03 PROTECTION

- A. Protect trees, shrubs, lawns, existing structures, and other features outside of embankment limits.
- B. Protect utilities above and below grade, which are to remain.

- C. Conform to protection requirements of Section 02315 - Roadway Excavation.

3.04 PLACING EMBANKMENT

- A. Do not conduct placement operations during inclement weather or when existing ground or fill materials exceed 3 percent of optimum moisture content. Contractor may manipulate wet material to facilitate drying, by disking or windrowing.
- B. Do not place embankment fill until density and moisture content of previously placed material comply with specified requirements.
- C. Scarify areas to be filled to minimum depth of 4 inches to bond existing and new materials. Mix with first fill layer.
- D. Spread fill material evenly, from dumped piles or windrows, into horizontal layers approximately parallel to finished grade. Place to meet specified compacted thickness. Break clods and lumps and mix materials by blading, harrowing, disking or other approved method. Extend each layer across full width of fill.
- E. Each layer shall be homogeneous and contain uniform moisture content before compaction. Mix dissimilar abutting materials to prevent abrupt changes in composition of fill.
- F. Layers shall not exceed the following compacted thickness:
 - 1. Areas indicated to be under future paving or shoulders, to be constructed within 6 months: 6 inches when compacted with pneumatic rollers, or 8 inches when compacted with other rollers.
 - 2. Other areas: 12 inches
- G. For steep slopes, cut benches into slope and scarify before placing fill. Place increasingly wider horizontal layers of specified depth to level of each bench.
- H. Build embankment layers on back slopes, adjacent to existing roadbeds, to level of old roadbed. Scarify top of old roadbed to minimum depth of 4 inches and recompact with next fill layer.
- I. Construct to lines and grades shown on Drawings.
- J. Remove unsuitable material and excess soil not being used for embankment from site in accordance with requirements of Section 01576 - Waste Material Disposal.
- K. Maintain moisture content of embankment materials to attain required density.
- L. Compact to following minimum densities at moisture content of optimum to 3 percent above optimum as determined by ASTM D 698, unless otherwise indicated on Drawings:

1. Areas under future paving and shoulders: Minimum density of 95 percent of maximum dry density.
2. Other areas: Minimum density of 90 percent of maximum dry density.

3.05 TOLERANCES

- A. Top of compacted surface: Plus or minus 1/2 inch in cross section or 16 foot length.

3.06 FIELD QUALITY CONTROL

- A. Compaction Testing will be performed in accordance with ASTM D 698 or ASTM D 6938 under provisions of Section 01454 - Testing Laboratory Services.
- B. A minimum of three tests will be taken for each 1000 linear feet per lane of roadway or 500 square yards of embankment per lift.
- C. If tests indicate work does not meet specified compaction requirements, recondition, recompact, and retest at no cost to City.

END OF SECTION

SECTION 02336

LIME STABILIZED SUBGRADE

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Foundation course of lime stabilized subgrade material.
 - 1. Application of lime slurry to subgrade.
 - 2. Mixing, compaction, and curing of lime slurry, water, and subgrade into a stabilized foundation.

1.02 RELATED SECTIONS

- A. Section 01270 – Measurement and Payment
- B. Section 01330 – Submittal Procedures
- C. Section 01454 – Testing Laboratory Services

1.03 MEASUREMENT AND PAYMENT

- A. Unit Prices.
 - 1. Measurement and payment for lime stabilized subgrade is on a square yard basis compacted in place to proper density. Separate measurement will be made for each required thickness of subgrade course.
 - a. Limits of measurement shall match actual pavement replaced, but no greater than maximum pavement replacement limits shown on Drawings. Limits for measurement will be extended to include installed lime stabilized subgrade material that extends 2 feet beyond outside edge of pavement to be replaced, except where proposed pavement section shares common longitudinal or transverse edge with existing pavement section. No payment will be made for lime stabilized subgrade in areas beyond these limits.
 - b. Limits of measurement and payment shall match pavement replacement limits shown on Drawings, except as noted in Paragraph 1.03.A.1.a, or as approved by Project Manager.
 - 2. Measurement and payment for lime is by ton of 2000 pounds dry weight basis. Calculate weight of dry solids for lime slurry based on percentage by dry weight solids.

3. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

1.04 DEFINITION

A. Moist Cure: Curing soil and lime to obtain optimum hydration.

B. 1000-Foot Roadway Section: 1000 feet per lane width or approximately 500 square yards of compacted subgrade for other than full-lane-width roadway sections.

1.05 REFERENCES

A. ASTM D 698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³).

B. ASTM D 4318 - Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

C. ASTM D 6938 - Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

D. TxDOT Tex-101-E (Part III) - Preparing and Testing Soils and Base Materials.

E. TxDOT Tex-140-E - Measuring Depth of Compacted Base and Treated Materials.

F. TxDOT Tex-600-J - Sampling and Testing Hydrated Lime, Quicklime, and Commercial Lime Slurry.

1.06 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit certification that hydrated lime, quicklime, or commercial lime slurry complies with specifications.

C. Submit weight tickets, certified by supplier, with each bulk delivery of lime to work site.

1.07 DELIVERY, STORAGE AND HANDLING

A. Bagged lime shall bear manufacturer's name, product identification, and certified weight. Bags varying more than 5 percent of certified weight may be rejected; average weight of 50 random bags in each shipment shall not be less than certified weight.

B. Store lime in weatherproof enclosures. Protect lime from ground dampness.

PART 2 PRODUCTS

2.01 WATER

- A. Use clean, clear water, free from oil, acids, alkali, or vegetation.

2.02 LIME

- A. Type A - Hydrated Lime: Dry material consisting essentially of calcium hydroxide or mixture of calcium hydroxide and an allowable percentage of calcium oxide as listed in chemical composition chart.
- B. Type B - Commercial Lime Slurry: Liquid mixture consisting essentially of lime solids and water in slurry form. Water or liquid portion shall not contain dissolved material in sufficient quantity to be injurious or objectionable for purpose intended.
- C. Type C - Quicklime: Dry material consisting essentially of calcium oxide. Furnish quicklime in either of the following grades:
 - 1. Grade DS: Pebble quicklime of gradation suitable for use in preparation of slurry for wet placing.
 - 2. Grade S: Finely-graded quicklime for use in preparation of slurry for wet placing. Donor use grade S quicklime for dry placing.
- D. Conform to the following requirements:

CHEMICAL COMPOSITION	TYPE		
	A	B	C
Active lime content, % by weight Ca(OH) ₂ +CaO	90.0 min ¹	87.0 min ²	-
Unhydrated lime content, % by weight CaO	5.0 max	-	87.0 min
Free water content, % by weight H ₂ O :	5.0 max	-	-
SIZING			
Wet Sieve, as % by weight residue retained:			
No. 6	0.2 max	0.2 max ²	8.0 max ³
No. 30	4.0 max	4.0 max ²	-
Dry sieve, as % by weight residue retained:			
1-inch	-	-	0.0
1/2-inch	-	-	10.0 max
Notes:			
1. Maximum 5.0% by weight CaO shall be allowed in determining total active lime content.			
2. Maximum solids content of slurry.			
3. Total active lime content, as CaO, in material retained on No. 6 sieve shall not exceed 2.0% by weight of original Type C lime.			

E. Deliver lime slurry to job site as commercial lime, or prepare at job site by using hydrated lime or quicklime. Provide slurry free of liquids other than water and of consistency that can be handled and uniformly applied without difficulty.

F. Lime containing magnesium hydroxide is prohibited.

2.03 SOIL.

A. Soil to receive lime treatment may include borrow or existing subgrade material, existing pavement structure, or combination of all three. Where existing pavement or base material is encountered, pulverized or scarify material so that 100 percent of sampled material passes 2- inch sieve.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify compacted subgrade will support imposed loads.

- B. Verify subgrade lines and grades.

3.02 PREPARATION

- A. Complete backfill of utilities prior to stabilization.
- B. Cut material to bottom of subgrade using an approved cutting and pulverizing machine meeting following requirements:
 - 1. Cutters accurately provide smooth surface over entire width of cut to plane of secondary grade.
 - 2. Provide cut to depth as specified or shown in the Drawings.
- C. Alternatively, scarify or excavate to bottom of stabilized subgrade. Remove material or windrow to expose secondary grade. Obtain uniform stability.
- D. Correct wet or unstable material below secondary grade by scarifying, adding lime, and compacting as directed by Project Manager.
- E. Pulverize existing material so that 100 percent passes a 1-3/4-inch sieve.

3.03 LIME SLURRY APPLICATION

- A. Apply slurry with distributor truck equipped with an agitator to keep lime and water in consistent mixture. Make successive passes over measured section of roadway to attain proper moisture and lime content. Limit spreading to an area where preliminary mixing operations can be completed on same working day.
- B. Minimum lime content shall be 5 percent of dry unit weight of subgrade as determined by ASTM D 698

3.04 PRELIMINARY MIXING

- A. Use approved single-pass or multiple-pass rotary speed mixers to mix soil, lime, and water to required depth. Obtain homogeneous friable mixture free of clods and lumps.
- B. Shape mixed subgrade to final lines and grades.
- C. Eliminate following operations and final mixing if pulverization requirements of Paragraph 3.05C can be met during preliminary mixing:
 - 1. Seal subgrade as precaution against heavy rainfall by rolling lightly with light pneumatic rollers
 - 2. Cure soil lime material for 24 to 72 hours or as required to obtain optimum hydration. Keep subgrade moist during cure.

3.05 FINAL MIXING

- A. Use approved single-pass or multiple-pass rotary speed mixers to uniformly mix cured soil and lime to required depth.
- B. Add water to bring moisture content of soil mixture to optimum or above.
- C. Mix and pulverize until all material passes 1-3/4-inch sieve; minimum of 85 percent, excluding non-slacking fractions, passes 3/4-inch sieve; and minimum of 60 percent excluding non-slacking fractions, passes No. 4 sieve. Test according to TxDOT Tex-101-E, Part III using dry method.
- D. Shape mixed subgrade to final lines and grades.
- E. Do not expose hydrated lime to open air for 6 hours or more during interval between application and mixing. Avoid excessive hydrated lime loss due to washing or blowing.

3.06 COMPACTION

- A. Aerate or sprinkle to attain optimum moisture content to 3 percent above optimum, as determined by ASTM D 698 on material sample from roadway after final mix with lime.
- B. Start compaction immediately after final mixing.
- C. Spread and compact in two or more equal layers where total compacted thickness is greater than equipment manufacturer's recommended range of mixing and compaction.
- D. Compact with approved heavy pneumatic or vibrating rollers, or combination of tamping rollers and light pneumatic rollers. Begin compaction at bottom and continue until entire depth is uniformly compacted.
- E. Do not allow stabilized subgrade to mix with underlying material. Correct irregularities or weak spots immediately by replacing material and recompacting.
- F. Compact subgrade to minimum density of 95 percent of maximum dry density, according to ASTM D 698, at moisture content of optimum to 3 percent above optimum, unless otherwise indicated on Drawings.
- G. Seal with approved light pneumatic tired rollers. Prevent surface hair line cracking. Rework and recompact at areas where hairline cracking develops.

3.07 CURING

- A. Moist Cure for minimum of 3 days before placing base or surface course, or opening to traffic. Subgrade may be opened to traffic after 2 days when adequate strength has been attained to prevent damage. Restrict traffic to light pneumatic rollers or vehicles weighing less than 10 tons.

- B. Keep subgrade surface damp by sprinkling. Roll with light pneumatic roller to keep surface knit together.
- C. Place base or surface within 14 days after final mixing and compaction. Restart compaction and moisture content of base material when time is exceeded.

3.08 TOLERANCES

- A. Completed surface: smooth and conforming to typical section and established lines and grades.
- B. Top of compacted surface: Plus or minus 1/4 inch in cross section or in 16-foot length.
- C. Depth of lime stabilization shall be plus or minus one inch of specified depth for each 1000- Foot Roadway Section.

3.09 FIELD QUALITY CONTROL

- A. Testing will be performed under provisions of Section 01454 - Testing Laboratory Services.
- B. Test soils, lime, and mixtures as follows:
 - 1. Tests and analysis of soil materials will be performed in accordance with ASTM D 4318, using the wet preparation method.
 - 2. Sampling and testing of lime slurry shall be in accordance with TxDOT Tex-600-J, except using a lime slurry cup.
 - 3. Sample mixtures of hydrated lime or quicklime in slurry form will be tested to establish compliance with specifications.
 - 4. Moisture-density relationship will be established on material sampled from roadway, after stabilization with lime and final mixing, in accordance with ASTM 698, Moist preparation Method.
- C. In-place depth will be evaluated for each 1000-Foot Roadway Section and determined in accordance with TxDOT Tex-140-E in hand excavated holes. For each 1000-foot section, 3 phenolphthalein tests will be performed. Average stabilization depth for 1000-foot section will be based on average depth for three tests.
- D. Perform compaction testing in accordance with ASTM D 6938. Three tests will be performed for each 1000-Foot Roadway Section.
- E. Pulverization analysis will be performed as required by Paragraph 3.05C on material sampled during mixing of each production area. Three tests will be performed per 1000-Foot Roadway Section or a minimum of once daily.

3.10 REWORK OF FAILED SECTIONS

- A. Rework sections that do not meet specified thickness.
- B. Perform the following steps when more than 72 hours have lapsed since completion of compaction.
 - 1. Moist Cure for minimum of 3 days after compaction to required density.
 - 2. Add lime at rate of 25 percent of specified rate at no additional cost to City.
 - 3. Moisture density test of reworked material must be completed by laboratory before field compaction testing can be completed.

3.11 PROTECTION

- A. Maintain stabilized subgrade to lines and grades and in good condition until placement of base or surface course. Protect asphalt membrane from being picked up by traffic.
- B. Repair defects immediately by replacing material to full depth.

END OF SECTION

SECTION 02531

GRAVITY SANITARY SEWERS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Gravity sanitary sewers and appurtenances, including stacks and service connections.

1.02 RELATED SECTIONS

- A. Section 01270 – Measurement and Payment
- B. Section 01330 – Submittal Procedures
- C. Section 01555 – Traffic Control and Regulation
- D. Section 01578 – Control of Ground and Surface Water
- E. Section 02081 – Cast-In-Place Concrete Manholes
- F. Section 02082 – Precast Concrete Manholes
- G. Section 02083 – Fiberglass Manholes
- H. Section 02090 – Frames, Grates, Rings, and Covers
- I. Section 02221 – Removing Existing Pavements, Structures, Wood, and Demolition Debris
- J. Section 02260 – Trench Safety System
- K. Section 02317 – Excavation and Backfill for Utilities
- L. Section 02320 – Utility Backfill Materials
- M. Section 02321 – Cement Stabilized Sand
- N. Section 02427 – Plastic Liner for Large-Diameter Concrete Sewers and Structures
- O. Section 02501 – Ductile Iron Pipe and Fittings
- P. Section 02504 – Fiberglass Reinforced Pipe
- Q. Section 02505 – High Density Polyethylene (HDPE) Solid and Profile Wall Pipe
- R. Section 02506 – Polyvinyl Chloride Pipe

- S. Section 02508 – Extra Strength Clay Pipe
 - T. Section 02532 – Sanitary Sewer Force Mains
 - U. Section 02533 – Acceptance Testing for Sanitary Sewers
 - V. Section 02534 – Sanitary Sewer Service Stubs or Reconnections
 - W. Section 02550 – Sliplining Sanitary Sewers
 - X. Section 02556 – Cured-In-Place Pipe
 - Y. Section 02558 – Cleaning and Television Inspection
 - Z. Section 02571 – Pipe Bursting/Crushing Sanitary Sewers
 - AA. Section 02611 – Reinforced Concrete Pipe
 - BB. Section 02911 – Topsoil
 - CC. Section 02921 – Hydro Mulch Seeding
 - DD. Section 02922 – Sodding
 - EE. Section 02951 – Pavement Repair and Restoration
- 1.03 MEASUREMENT AND PAYMENT
- A. Unit Prices.
 - 1. Payment for gravity sanitary sewers by open-cut or within Potentially Petroleum Contaminated Area (PPCA) is on linear foot basis, complete in place, including sewer pipe, connections to existing manholes, post installation television inspection and testing. Measurement will be taken along centerline of pipe from centerline to centerline of manholes.
 - 2. Payment for television inspection of existing gravity sanitary sewer will be on a linear foot basis. Measurement will be taken along centerline of pipe from centerline to centerline of manholes. See Section 02558 - Cleaning and Television Inspection.
 - 3. Refer to Section 01270 - Measurement and Payment for unit price procedures.
 - B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.
- 1.04 SUBMITTALS
- A. Conform to requirements of Section 01330 - Submittal Procedures.

- B. Submit proposed methods, equipment, materials and sequence of operations for sewer construction. Plan operations so as to minimize disruption of utilities to occupied facilities or adjacent property.
- C. Test Reports: Submit test reports and inspection videos as specified in Part 3 of this Section. Videos become property of City.

1.05 QUALITY ASSURANCE

- A. Qualifications. Install sanitary sewer that is watertight both in pipe-to-pipe joints and in pipe-to- manhole connections. Perform testing in accordance with Section 02533 - Acceptance Testing for Sanitary Sewers.
- B. Regulatory Requirements.
 - 1. Install sewer lines to meet minimum separation distance from potable water line, as scheduled below. Separation distance is defined as distance between outside of water pipe and outside of sewer pipe. When possible, install new sanitary sewers no closer to water lines than 9 feet in all directions. Where this separation distance cannot be achieved, new sanitary sewers shall be installed as specified in this section.
 - 2. Make notification to Project Manager when water lines are uncovered during sanitary sewer installation where minimum separation distance cannot be maintained.
 - 3. Lay gravity sewer lines in straight alignment and grade.

1.06 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Inspect pipe and fittings upon arrival of materials at job site.
- B. Handle and store pipe materials and fittings to protect them from damage due to impact, shock, shear or free fall. Do not drag pipe and fittings along ground. Do not roll pipe unrestrained from delivery trucks.
- C. Use mechanical means to move or handle pipe. Employ acceptable clamps, rope or slings around outside barrel of pipe and fittings. Do not use hooks, bars, or other devices in contact with interior surface of pipe to lift or move lined pipe.

PART 2 PRODUCTS

2.01 PIPE

- A. Provide piping materials for gravity sanitary sewers of sizes and types indicated on Drawings or as specified.
- B. Unlined reinforced concrete pipe is not acceptable.

- C. Pipe shall be color coded green.

2.02 PIPE MATERIAL SCHEDULE

- A. Unless otherwise shown on Drawings, use pipe materials that conform to requirements specified in one or more of following Sections:
 - 1. Section 02427 - Plastic Liner for Large-Diameter Concrete Sewers and Structures.
 - 2. Section 02501 - Ductile Iron Pipe and Fittings.
 - 3. Section 02504 - Fiberglass Reinforced Pipe.
 - 4. Section 02505 - High Density Polyethylene (HDPE) Solid and Profile Wall Pipe.
 - 5. Section 02506 - Polyvinyl Chloride Pipe.
 - 6. Section 02508 - Extra Strength Clay Pipe.
 - 7. Section 02611 - Reinforced Concrete Pipe.
 - 8. Section 02532 – Sanitary Sewer Force Mains.
- B. Where shown on Drawings, provide pipe meeting minimum class, dimension ratio, or other criteria indicated.
- C. Pipe materials other than those listed above shall not be used for gravity sanitary sewers.

2.03 APPURTENANCES

- A. Stacks. Conform to requirements of Section 02534 - Sanitary Sewer Service Stubs or Reconnections.
- B. Service Connections. Conform to requirements of Section 02534 - Sanitary Sewer Service Stubs or Reconnections.
- C. Roof, street or other type of surface water drains shall not be connected or reconnected into sanitary sewer lines.

2.04 BEDDING, BACKFILL, AND TOPSOIL MATERIAL

- A. Bedding and Backfill: Conform to requirements of Section 02317 - Excavation and Backfill for Utilities, Section 02320 - Utility Backfill Materials, and Section 02321 - Cement Stabilized Sand.
- B. Topsoil: Conform to requirements of Section 02911 - Topsoil.

PART 3 EXECUTION

3.01 PREPARATION

- A. Prepare traffic control plans and set up street detours and barricades in preparation for excavation when construction will affect traffic. Conform to requirements of Section 01555 - Traffic Control and Regulation.
- B. Provide barricades, flashing warning lights, and warning signs for excavations. Conform to requirements of Section 01555 - Traffic Control and Regulation. Maintain barricades and warning lights where work is in progress or where traffic is affected by work.
- C. Perform work in accordance with OSHA standards. Employ trench safety system as specified in Section 02260 - Trench Safety System for excavations over 5 feet deep.
- D. Immediately notify agency or company owning utility line which is damaged, broken or disturbed. Obtain approval from Project Manager and agency or utility company for repairs or relocations, either temporary or permanent.
- E. Remove old pavements and structures including sidewalks and driveways in accordance with requirements of Section 02221 - Removing Existing Pavements, Structures, Wood, and Demolition Debris.
- F. Install and operate dewatering and surface water control measures in accordance with Section 01578 - Control of Ground and Surface Water.
- G. Do not allow sand, debris or runoff to enter sewer system.

3.02 DIVERSION PUMPING

- A. Install and operate required bulkheads, plugs, piping, and diversion pumping equipment to maintain sewage flow and to prevent backup or overflow. Obtain approval for diversion pumping equipment and procedures from Project Manager.
- B. Design piping, joints and accessories to withstand twice maximum system pressure or 50 psi, whichever is greater.
- C. No sewage shall be diverted into area outside of sanitary sewer.
- D. In event of accidental spill or overflow, immediately stop overflow and take action to clean up and disinfect spillage. Promptly notify Project Manager so that required reporting can be made to Texas Natural Resources Conservation Commission and Environmental Protection Agency by Project Manager.

3.03 EXCAVATION

- A. Earthwork. Conform to requirements of Section 02317 - Excavation and Backfill for Utilities. Use bedding as indicated on Drawings.
- B. Line and Grade. Establish required uniform line and grade in trench from benchmarks identified by Project Manager. Maintain this control for minimum of 100 feet behind and ahead of pipe-laying operation. Use laser beam equipment to establish and maintain proper line and grade of work. Use of appropriately sized grade boards which are substantially supported is also acceptable. Protect boards and location stakes from damage or dislocation.
- C. Trench Excavation. Excavate pipe trenches to depths shown on Drawings and as specified in Section 02317 - Excavation and Backfill for Utilities.

3.04 PIPE INSTALLATION BY OPEN CUT

- A. Install pipe in accordance with pipe manufacturer's recommendations and as specified in following paragraphs.
- B. Install pipe only after excavation is completed, bottom of trench fine graded, bedding material is installed, and trench has been approved by Project Manager.
- C. Install pipe to line and grade indicated. Place pipe so that it has continuous bearing of barrel on bedding material and is laid in trench so interior surfaces of pipe follow grades and alignment indicated. Provide bell holes where necessary.
- D. Install pipe with spigot ends toward downstream end of flow such that water flows into bell and out the spigot.
- E. Form concentric joint with each section of adjoining pipe so as to prevent offsets.
- F. Keep interior of pipe clean as installation progresses. Remove foreign material and debris from pipe
- G. Provide lubricant, place and drive home newly laid sections with come-a-long winches so as to eliminate damage to sections. Install pipe to "home" mark where provided. Use of back hoes or similar powered equipment will not be allowed unless protective measures are provided and approved in advance by Project Manager.
- H. Keep excavations free of water during construction and until final inspection.
- I. When work is not in progress, cover exposed ends of pipes with approved plug to prevent foreign material from entering pipe.
- J. Where gravity sanitary sewer is to be installed under existing water line with separation distance of at least 2 feet and less than 9 feet, install new sewer pipe so that one full 18 foot long pipe is centered on water line crossing. Embed sewer pipe in cement stabilized sand for minimum distance of 9 feet on each side of crossing.

- K. Where gravity sanitary sewer is to be installed under existing water line with separation distance of less than 2 feet, install new sewer using pressure-rated pipe as shown on Drawings. Maintain minimum 1 foot separation distance.
- L. Where the length of the stub is not indicated, install the stub to the right-of-way line and seal the free end with an approved plug.

3.05 PIPE INSTALLATION OTHER THAN OPEN CUT

- A. For installation of pipe by augering, jacking, or tunneling, conform to requirements of specification sections on tunneling augering, jacking and microtunneling work as appropriate.
- B. For rehabilitation of existing sewer lines, conform to requirements of specification Section 02550- Sliplining Sanitary Sewers, Section 02556 - Cured-In-Place Pipe or Section 02571- Pipe Bursting/Crushing Sanitary Sewers.

3.06 INSTALLATION OF APPURTENANCES

- A. Service Connections. Install service connections to conform to requirements of Section 2534 - Sanitary Sewer Service Stubs or Reconnections.
- B. Stacks. Construct stacks to conform to requirements of Section 02534 - Sanitary Sewer Service Stubs or Reconnections.
- C. Construct manholes to conform to requirements of Section 02081 - Cast-in-Place Concrete Manholes, Section 02082 - Precast Concrete Manholes, and Section 02083 - Fiberglass Manholes, as applicable. Install frames, rings, and covers to conform to requirements of Section 02090 - Frames, Grates, Rings, and Covers.

3.07 INSPECTION AND TESTING

- A. Visual Inspection: Check pipe alignment in accordance with Section 02533 - Acceptance Testing for Sanitary Sewers.
- B. Mandrel Testing. Use Mandrel Test to test flexible pipe for deflection. Refer to Section 02533 - Acceptance Testing for Sanitary Sewers.
- C. Pipe Leakage Test. After backfilling line segment and prior to tie-in of service connections, visually inspect gravity sanitary sewers where feasible, and test for leakage in accordance with Section 02533 - Acceptance Testing for Sanitary Sewers. Maintain piezometer installed to conform with Section 01578 - Control of Ground and Surface Water, until acceptance testing is completed.

3.08 BACKFILL AND SITE CLEANUP

- A. Backfill and compact soil in accordance with Section 02317 - Excavation and Backfill for Utilities.

- B. Backfill trench in specified lifts only after pipe installation is approved by Project Manager.
- C. Repair and replace removed or damaged pavement, curbs, gutters, and sidewalks as specified in Section 02951 - Pavement Repair and Restoration.
- D. Provide hydro mulch seeding in areas of commercial, industrial or undeveloped land use over surface of ground disturbed during construction and not paved or not designated to be paved. Grade surface at uniform slope to natural grade as indicated on Drawings. Provide minimum of 4 inches of topsoil as specified in Section 02911 - Topsoil and apply hydro mulch according to requirements of Section 02921 – Hydro Mulch Seeding.
- E. Provide sodding in areas of residential land use over surface of ground disturbed during construction and not paved or not designated to be paved. Grade surface at uniform slope to natural grade as indicated on Drawings. Provide minimum of 4 inches of topsoil per Section 02911 - Topsoil. Sod disturbed areas in accordance with Section 02922 - Sodding.

3.09 POST-INSTALLATION TELEVISION INSPECTION

- A. Prior to final acceptance of newly constructed gravity sanitary sewers, perform cleaning and closed circuit television inspection. Post installation television inspection shall be performed in accordance with Section 02558 – Cleaning and Television Inspection.
- B. Provide TV inspection reports and video submittals in accordance with Section 02558 – Cleaning and Television Inspection for each line segment submitted.
- C. Upon completion of video review, Contractor will be notified regarding final acceptance of sewer segment.

END OF SECTION

SECTION 02533

ACCEPTANCE TESTING FOR SANITARY SEWERS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Acceptance testing for sanitary sewers including:
 - 1. Visual inspection of sewer pipes.
 - 2. Mandrel testing for flexible sewer pipes.
 - 3. Leakage testing of sewer pipes.
 - 4. Leakage testing of manholes.
 - 5. Smoke testing of point repairs.
 - 6. Television and Video Inspection.
- B. All tests listed in this Section are not necessarily required on this Project. Required tests are named in other Sections which refer to this Section for testing criteria and procedures.

1.02 RELATED SECTIONS

- A. Section 01270 – Measurement and Payment
- B. Section 01330 – Submittal Procedures
- C. Section 01578 – Control of Ground and Surface Water

1.03 MEASUREMENT AND PAYMENT

- A. Unit Prices.
 - 1. No payment will be made for acceptance testing under this Section. Include payment in unit price for work requiring acceptance testing.
 - 2. Refer to Section 01270 - Measurement and Payment for unit price procedures.
- B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.04 REFERENCES

- A. ASTM C 828 - Standard Test Method for Low-Pressure Air Test of Vitrified Clay Pipe Lines.
- B. ASTM D 3034 - Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
- C. ASTM F 794 - Standard Specification for Poly (Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter.
- D. ASTM F 1417 - Standard Practice for Installation Acceptance of Plastic Non-Pressure Sewer Lines Using Low-Pressure Air.
- E. ASTM C 1244 - Standard Test Method for Concrete Sewer Manholes by the Negative Air Pressure (Vacuum) Test Prior to Backfill.

1.05 PERFORMANCE REQUIREMENTS

- A. Gravity flow sanitary sewers are required to have straight alignment and uniform grade between manholes.
- B. Flexible pipe, including "semi-rigid" pipe, is required to show no more than 5 percent deflection. Test pipe no sooner than 30 days after backfilling of line segment but prior to final acceptance using standard mandrel to verify that installed pipe is within specified deflection tolerances.
- C. Must meet Texas Commission on Environmental Quality (TCEQ) Testing Requirements Chapter-217-57.

1.06 SUBMITTALS

- A. Conform to requirements of Section 01330 - Submittal Procedures.
- B. Test Plan: Before testing begins and in adequate time to obtain approval through submittal process, prepare and submit test plan for approval by Project Manager. Include testing procedures, methods, equipment, and tentative schedule. Obtain advance written approval for deviations from Drawings and Specifications.
- C. Test Reports: Submit test reports for each test on each segment of sanitary sewer.

1.07 GRAVITY SANITARY SEWER QUALITY ASSURANCE

- A. Repair, correct, and retest manholes or sections of pipe which fail to meet specified requirements when tested.
- B. Provide testing reports and video tape of television inspection as directed by Project Manager.
- C. Upon completion of tape reviews by Project Manager, Contractor will be notified regarding final acceptance of sewer segment.

1.08 SEQUENCING AND SCHEDULING

- A. Perform testing as work progresses. Schedule testing so that no more than 1000 linear feet of installed sewer remains untested at one time.
- B. Coordinate testing schedules with Project Manager. Perform testing under observation of Project Manager.

PART 2 PRODUCTS

2.01 DEFLECTION MANDREL

- A. Mandrel Sizing. Rigid mandrel shall have outside diameter (O.D.) equal to 95 percent of inside diameter (I.D.) of pipe. Inside diameter of pipe, for purpose of determining outside diameter of mandrel, shall be average outside diameter minus two minimum wall thicknesses for O.D. controlled pipe and average inside diameter for I.D. controlled pipe, dimensions shall be per appropriate standard. Statistical or other "tolerance packages" shall not be considered in mandrel sizing.
- B. Mandrel Design. Rigid mandrel shall be constructed of metal or rigid plastic material that can withstand 200 psi without being deformed. Mandrel shall have nine or more "runners" or "legs" as long as total number of legs is odd number. Barrel section of mandrel shall have length of at least 75 percent of inside diameter of pipe. Rigid mandrel shall not have adjustable or collapsible legs which would allow reduction in mandrel diameter during testing. Provide and use proving ring for modifying each size mandrel.
- C. Proving Ring. Furnish "proving ring" with each mandrel. Fabricate ring of 1/2-inch-thick, 3-inch-wide bar steel to diameter 0.02 inches larger than approved mandrel diameter.
- D. Mandrel Dimensions (5 percent allowance). Average inside diameter and minimum mandrel diameter are specified in Table 02533-5, Pipe vs. Mandrel Diameter, at end of this Section. Mandrels for higher strength, thicker wall pipe or other pipe not listed in table may be used when approved by Project Manager.

2.02 EXFILTRATION TEST

- A. Water Meter: Obtain transient water meter from City for use when water for testing will be taken from City system. Conform to City requirements for water meter use.
- B. Test Equipment:
 - 1. Pipe plugs.
 - 2. Pipe risers where manhole cone is less than 2 feet above highest point in pipe or service lead.

2.03 INFILTRATION TEST

A. Test Equipment:

1. Calibrated 90-degree V-notch weir.
2. Pipe plugs.

2.04 LOW PRESSURE AIR TEST

A. Minimum Requirement for Equipment:

1. Control panel
2. Low-pressure air supply connected to control panel.
3. Pneumatic plugs: Acceptable size for diameter of pipe to be tested; capable of withstanding internal test pressure without leaking or requiring external bracing.
4. Air hoses from control panel to:
 - a. Air supply.
 - b. Pneumatic plugs.
 - c. Sealed line for pressuring.
 - d. Sealed line for monitoring internal pressure.

- B. Testing Pneumatic Plugs: Place pneumatic plug in each end of length of pipe on ground. Pressurize plugs to 25 psig; then pressurize sealed pipe to 5 psig. Plugs are acceptable when they remain in place against test pressure without external aids.

2.05 GROUND WATER DETERMINATION

- A. Equipment: Pipe probe or small diameter casing for ground water elevation determination.

2.06 SMOKE TESTING

A. Equipment:

1. Pneumatic plugs.
2. Smoke generator as supplied by Superior Signal Company, or approved equal.
3. Blowers producing 2500 scfm minimum.

PART 3 EXECUTION

3.01 PREPARATION

- A. Provide labor, equipment, tools, test plugs, risers, air compressor, air hose, pressure meters, pipe probe, calibrated weirs, or any other device necessary for proper testing and inspection.
- B. Determine selection of test methods and pressures for gravity sanitary sewers based on ground water elevation. Determine ground water elevation using equipment and procedures conforming to Section 01578 - Control of Ground and Surface Water.

3.02 VISUAL INSPECTION OF GRAVITY SANITARY SEWERS

- A. Check pipe alignment visually by flashing light between structures. Verify if alignment is true and no pipes are misplaced. In case of misalignment or damaged pipe, remove and re-lay or replace pipe segment.

3.03 MANDREL TESTING FOR GRAVITY SANITARY SEWERS

- A. Perform deflection testing on flexible and semi-rigid pipe to confirm pipe has no more than 5 percent deflection. Mandrel testing shall conform to ASTM D 3034. Perform testing no sooner than 30 days after backfilling of line segment, but prior to final acceptance testing of line segment.
- B. Pull approved mandrel by hand through sewer sections. Replace any section of sewer not passing mandrel. Mandrel testing is not required for stubs.
- C. Retest repaired or replaced sewer sections.

3.04 LEAKAGE TESTING FOR GRAVITY COLLECTION SYSTEM PIPES

- A. For a collection system pipe that will transport wastewater by gravity flow, test gravity sanitary sewer pipes for leakage by either exfiltration or infiltration methods, as appropriate, or with low pressure air testing.
- B. Compensating for Ground Water Pressure:
 - 1. Where ground water exists, install pipe nipple at same time sewer line is placed. Use 1/2-inch capped pipe nipple approximately 10 inches long. Make installation through manhole wall on top of sewer line where line enters manhole.
 - 2. Immediately before performing line acceptance test, remove cap, clear pipe nipple with air pressure, and connect clear plastic tube to nipple. Support tube vertically and allow water to rise in tube. After water stops rising, measure height in feet of water over invert of pipe. Divide this height by 2.3 feet/psi to determine ground water pressure to be used in line testing.

C. Exfiltration test:

1. Determine ground water elevation.
2. Plug sewer in downstream manhole.
3. Plug incoming pipes in upstream manhole.
4. Install riser pipe in outgoing pipe of upstream manhole when highest point in service lead (house service) is less than 2 feet below bottom of manhole cone.
5. Fill sewer pipe and manhole or pipe riser, when used, with water to point 2-1/2 feet above highest point in sewer pipe, house lead, or ground water table, whichever is highest.
6. Allow water to stabilize for one to two hours. Take water level reading to determine drop of water surface, in inches, over one-hour period, and calculate water loss (1 inch of water in 4 feet diameter manhole equals 8.22 gallons) or measure quantity of water required to keep water at same level. Loss shall not exceed that calculated from allowable leakage according to Table 02533-1 at end of this Section.

D. Infiltration test: Ground water elevation must be not less than 2.0 feet above highest point of sewer pipe or service lead (house service).

1. Determine ground water elevation.
2. Plug incoming pipes in upstream manhole.
3. Insert calibrated 90-degree V-notch weir in pipe on downstream manhole.
4. Allow water to rise and flow over weir until it stabilizes.

E. Low Air Pressure Test: When using this test conform to ASTM C 828, or ASTM F 1417, as applicable, with holding time not less than that listed in Table 02533-2.

1. Low Pressure Air testing for sections of pipe shall be limited to lines less than 36-inch average inside diameter. Refer to charts 02533-2 and 02533-3.
2. Lines 36-inch average inside diameter and larger shall be tested at each joint. Minimum time allowable for pressure to drop from 3.5 pounds per square inch gauge to 2.5 pounds per square inch during joint test shall be 10 seconds, regardless of pipe size.

F. Retest: Repair and retest any section of pipe which fails to meet requirements.

3.05 TEST CRITERIA TABLES

A. Exfiltration and Infiltration Water Tests: Refer to Table 02533-1, Water Test Allowable Leakage, at end of this Section.

B. Low Pressure Air Test:

1. Times in Table 02533-2, Time Allowed for Pressure Loss from 3.5 psig to 2.5 psig, at end of this Section, are based on equation from Texas Commission on Environmental Quality (TCEQ) Design Criteria 217.57

$$T = 0.0850(D)(K)/(Q)$$

Where: T = time for pressure to drop 1.0 pounds per square inch gauge in seconds

K = 0.000419 DL, but not less than 1.0

D = average inside diameter in inches

L = length of line of same pipe size in feet

Q = rate of loss, 0.0015 ft³/min./sq. ft. internal surface

2. Since K value of less than 1.0 shall not be used, there are minimum testing times for each pipe diameter as given in Table 02533-3, Minimum Testing Times for Low Pressure Air Test.

Notes:

1. When two sizes of pipe are involved, compute time by ratio of lengths involved.
2. Lines with 27-inch average inside diameter and larger may be air tested at each joint.
3. Lines with average inside diameter greater than 36 inches must be air tested for leakage at each joint.
4. If joint test is used, perform visual inspection of joint immediately after testing.
5. For joint test, pipe is to be pressurized to 3.5 psi greater than pressure exerted by groundwater above pipe. Once pressure has stabilized, minimum times allowable for pressure to drop from 3.5 pounds per square inch gauge to 2.5 pounds per square inch gauge shall be 10 seconds.

3.06 LEAKAGE TESTING FOR MANHOLES

- A. After completion of manhole construction, wall sealing, or rehabilitation, but prior to backfilling, test manholes for water tightness using hydrostatic or vacuum testing procedures.
- B. Plug influent and effluent lines, including service lines, with suitably-sized pneumatic or mechanical plugs. Ensure plugs are properly rated for pressures required for test; follow manufacturer's safety and installation recommendations. Place plugs minimum of 6 inches outside of manhole walls. Brace inverts to prevent lines from being dislodged when lines entering manhole have not been backfilled.

- C. Vacuum testing:
1. Install vacuum tester head assembly at top access point of manhole and adjust for proper seal on straight top section of manhole structure. Following manufacturer's instructions and safety precautions, inflate sealing element to recommended maximum inflation pressure; do not over-inflate.
 2. Evacuate manhole with vacuum pump to 10 inches mercury (Hg), disconnect pump, and monitor vacuum for time period specified in Table 02533-4, Vacuum Test Time Table.
 3. A manhole passes the test if after 2.0 minutes and with all valves closed, the vacuum is at least 9.0 inches of mercury (Hg).
- D. Perform hydrostatic exfiltration testing as follows:
1. Seal wastewater lines coming into manhole with internal pipe plug. Then fill manhole with water and maintain it full for at least 1 hour.
 2. The maximum leakage for hydrostatic testing shall be 0.025 gallons per foot diameter per foot of manhole depth per hour.
 3. If water loss exceeds amount tabulated above, locate leaks, complete repairs necessary to seal manhole and repeat test procedure until satisfactory results are obtained.

3.07 SMOKE TEST PROCEDURES FOR POINT REPAIRS

- A. Application: Perform smoke test to:
1. Locate points of line failure for point repair.
 2. Determine when point repairs are properly made.
 3. Determine when service connections have been reconnected to rehabilitated sewer.
 4. Check integrity of connections to newly replaced service taps to liners and to existing private service connections.
- B. Limitations: Do not backfill service taps until completion of this test. Test only those taps in single manhole section at one time. Keep number of open excavations to minimum.
- C. Preparation: Prior to smoke testing, give written notices to area residents no fewer than 2 days, nor more than 7 days, prior to proposed testing. Also give notice to City of Houston Police and Fire Departments 24 hours prior to actual smoke testing.

- D. Isolate Section: Isolate manhole section to be tested from adjacent manhole sections to keep smoke localized. Temporarily seal annular space at manhole for sliplined sections.
- E. Smoke Introduction:
 - 1. Operate equipment according to manufacturer's recommendation and as approved by Project Manager.
 - 2. Conduct test by forcing smoke from smoke generators through sanitary sewer main and service connections. Operate smoke generators for minimum of 5 minutes.
 - 3. Introduce smoke into upstream and downstream manhole as appropriate. Monitor tap/connection for smoke leaks. Note sources of leaks.
- F. Repair and Retest: Repair and replace taps or connections noted as leaking and then retest. Taps and connections may be left exposed in only one manhole section at time. When repair or replacement, testing or retesting, and backfilling of excavation is not completed within 1 work day, properly barricade and cover each excavation as approved by Project Manager.
- G. Service Connections: On houses where smoke does not issue from plumbing vent stacks to confirm reconnection of sewer service to newly installed liner pipe, perform dye test to confirm reconnection. Introduce dye into service line through plumbing fixture inside structure or sewer cleanout immediately outside structure and flush with water. Observe flow at service reconnection or downstream manhole. Detection of dye confirms reconnection.

3.08 TELEVISION AND VIDEO INSPECTION PROCEDURE

- A. Refer to Document 02588- Cleaning and Television Inspection

Table 02533-1
 WATER TEST ALLOWABLE LEAKAGE

DIAMETER OF RISER OR STACK IN INCHES	VOLUME PER INCH OF DEPTH		ALLOWANCE LEAKAGE*	
	INCH	GALLONS	PIPE SIZE IN INCHES	GALLONS/MINUTE PER 100 FT.
1	0.7854	.0034	6	0.0039
2	3.1416	.0136	8	0.0053
2.5	4.9087	.0212	13	0.0066
3	7.0686	.0306	12	0.0079
4	12.5664	.0306	15	0.0099
5	19.6350	.0544	18	0.0118
6	28.2743	.1224	21	0.0138
8	50.2655	.2176	24	0.0158
			27	0.0177
			30	0.0197
			36	0.0237
			42	0.0276
For other diameters, multiply square of diameters by value for 1" diameter.			Equivalent to 50 gallons per inch of inside diameter per mile per 24 hours.	

* Allowable leakage rate must not exceed 10 gallons per inch of inside diameter per mile per 24 hours, when sewer is identified as located within 25-year flood plain.

Table 02533-2
 ACCEPTANCE TESTING FOR SANITARY SEWERS

TIME ALLOWED FOR PRESSURE LOSS FROM 3.5 PSIG TO 2.5 PSIG														
Pipe Diam. (in)	Min. Time (min:sec)	Length for Min. Time (ft)	Time for Longer Length (sec)	Specification Time for Length (L) Shown (min:sec)										
				100 ft	150 ft	200 ft	250 ft	300 ft	350 ft	400 ft	450 ft	500 ft	550 ft	600 ft
6	5:40	398	0.8548	5:40	5:40	5:40	5:40	5:40	5:40	5:42	6:25	7:07	7:50	8:33
8	7:33	298	1.5196	7:33	7:33	7:33	7:33	7:36	8:52	10:08	11:24	12:40	13:56	15:12
10	9:27	239	2.3743	9:27	9:27	9:27	9:54	11:52	13:51	15:50	17:48	19:47	21:46	23:45
12	11:20	199	3.4190	11:20	11:20	11:20	14:15	17:06	19:57	22:48	25:39	28:30	31:20	34:11
15	14:10	159	5.3423	14:10	14:10	17:48	22:16	26:43	31:10	35:37	40:04	44:31	48:58	53:25
18	17:00	133	7.6928	17:00	19:14	25:39	32:03	38:28	44:52	51:17	57:42	64:06	70:31	76:56
21	19:50	114	10.4708	19:50	26:11	34:54	43:38	52:21	61:05	69:48	78:32	87:15	95:59	104:42
24	22:40	99	13.6762	22:48	34:11	45:35	56:59	68:23	79:47	91:10	102:34	113:58	125:22	136:46
27	25:30	88	17.3089	28:51	43:16	57:42	72:07	86:33	100:58	115:24	129:49	144:14	158:40	173:05
30	28:20	80	21.3690	35:37	53:25	71:14	89:02	106:51	124:39	142:28	160:16	178:05	195:53	213:41
33	31:10	72	25.8565	43:06	64:38	86:11	107:44	129:17	150:50	172:23	193:55	215:28	237:01	258:34

Table 02533-3
 MINIMUM TESTING TIMES FOR LOW PRESSURE AIR TEST

PIPE DIAMETER (INCHES)	MINIMUM TIME (SECONDS)	LENGTH FOR MINIMUM TIME (FEET)	TIME FOR LONGER LENGTH (SECONDS/FT)
6	340	398	0.855
8	454	298	1.520
10	567	239	2.374
12	680	199	3.419
15	850	159	5.342
18	1020	133	7.693
21	1190	114	10.471
24	1360	100	13.676
27	1530	88	17.309
30	1700	80	21.369
33	1870	72	25.856

Table 02533-4 VACUUM TEST TIME TABLE

DEPTH IN FEET	TIME IN SECONDS BY PIPE DIAMETER		
	48"	60"	72"
4	10	13	16
8	20	26	32
12	30	39	48
16	40	52	64
20	50	65	80
24	60	78	96
*	5.0	6.5	8.0

*Add T times for each additional 2-foot depth.
 (The values listed above have been extrapolated from ASTM C 1244)

Table 02533-5
 PIPE VS. MANDREL DIAMETER

Material and Wall Construction	Nominal Size (Inches)	Average I.D. (Inches)	Minimum Mandrel Diameter (Inches)
PVC-Solid (SDR 26) 5.476	6	6	5.764
	8	7.715	7.329
	10	9.646	9.162
PVC-Solid (SDR 35) 11.150	12	12	11.737
	15	14.374	13.655
	18	17.629	16.748
	21	20.783	19.744
	24	23.381	22.120
	27	26.351	25.033
PVC-Truss	8	7.750	7.363
	10	9.750	9.263
	12	11.790	11.201
	15	14.770	14.032
PVC-Profile (ASTM F 794)	12	11.740	11.153
	15	14.370	13.652
	18	17.650	16.768
	21	20.750	19.713
	24	23.500	22.325
	27	26.500	25.175
	30	29.500	28.025

	36	35.500	33.725
	42	41.500	39.425
	48	47.500	45.125
HDPE-Profile	18	18.000	17.100
	21	21.000	19.950
	24	24.000	22.800
	27	27.000	25.650
	30	30.000	28.500
	36	36.000	34.200
	42	42.000	39.900
	48	48.000	45.600
	54	54.000	51.300
	60	60.000	57.000
Fiberglass (Class SN 46)	12	12.85	11.822
	18	18.66	17.727
	20	20.68	19.646
	24	24.72	23.484
	30	30.68	29.146
	36	36.74	34.903
	42	42.70	40.565
	48	48.76	46.322
	54	54.82	50.079
	60	60.38	57.361
Polypropylene	12	11.82	11.229
	15	14.78	14.041
	18	17.73	16.844
	24	23.64	22.458
	30	29.55	28.073
	36	35.46	33.687
	42	41.37	39.302
	48	47.28	44.916

END OF SECTION

SECTION 02631

STORM SEWERS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. New storm sewers and appurtenances, modifications to existing storm sewer system and installation of roadside ditch culverts.

1.02 RELATED SECTIONS

- A. Section 01270 – Measurement and Payment
- B. Section 01330 – Submittal Procedures
- C. Section 01555 – Traffic Control and Regulation
- D. Section 01578 – Control of Ground and Surface Water
- E. Section 02081 – Cast-In-Place Concrete Manholes
- F. Section 02082 – Precast Concrete Manholes
- G. Section 02086 – Adjusting Manholes, Inlets, and Valve Boxes to Grade
- H. Section 02090 – Frames, Grates, Rings, and Covers
- I. Section 02221 – Removing Existing Pavements, Structures, Wood, and Demolition Debris
- J. Section 02317 – Excavation and Backfill for Utilities
- K. Section 02320 – Utility Backfill Materials
- L. Section 02321 – Cement Stabilized Sand
- M. Section 02322 – Flowable Fill
- N. Section 02441 – Microtunneling
- O. Section 02445 – Jack and Bore/Jack and Mine/Pilot Tube Guided Boring Tunnels
- P. Section 02448 – Pipe and Casing Augering for Sewers
- Q. Section 02505 – High Density Polyethylene (HDPE) Solid and Profile Wall Pipe
- R. Section 02506 – Polyvinyl Chloride Pipe

- S. Section 02510 – Polypropylene (PP) Corrugated Wall Pipe
- T. Section 02531 – Gravity Sanitary Sewers
- U. Section 02533 – Acceptance Testing for Sanitary Sewers
- V. Section 02555 – Manhole Rehabilitation
- W. Section 02611 – Reinforced Concrete Pipe
- X. Section 02612 – Precast Reinforced Concrete Box Sewers
- Y. Section 02632 – Cast-In-Place Inlets, Headwalls, and Wingwalls
- Z. Section 02633 – Precast Concrete Inlets, Headwalls, and Wingwalls
- AA. Section 02642 – Corrugated Metal Pipe
- BB. Section 02911 – Topsoil
- CC. Section 02921 – Hydro Mulch Seeding
- DD. Section 02922 – Sodding
- EE. Section 02951 – Pavement Repair and Restoration

1.03 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for storm sewers, including elliptical or box storm sewer with or without seal slab, installed by open-cut, augered with or without casing, or tunneling is on linear foot basis. Measurement for storm sewers and roadside ditch culverts will be taken along center line of pipe from center line to center line of manholes or from end to end of culverts. Measurement for storm sewer will be taken along center line of storm sewer from inside wall of storm sewer junction box when installed in conjunction with storm sewer junction box. Payment will be made for each linear foot installed complete in place, including connections to existing manholes and inlets.
2. Payment for storm sewer leads, including elliptical leads, is on a linear foot basis.
3. Payment for corrugated metal pipe storm sewer outfall, including timber bents, is on a linear foot basis.
4. Refer to Section 01270 - Measurement and Payment for unit price procedures.

- B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

1.04 REFERENCES

- A. AASHTO LRFD Bridge Design Specifications, current edition.
- B. City of Houston Code of Ordinances, Chapter 42 – Subdivisions, Developments and Platting, Article I – In General.

1.05 DEFINITIONS

- A. Long Run Culvert: A culvert which is 40 feet or more in length.
- B. Local Street: As defined in the City of Houston Code of Ordinances, Chapter 42 – Subdivisions, Developments and Platting, Section 42-1.

1.06 SUBMITTALS

- A. Conform to requirements of Section 01330 - Submittal Procedures.
- B. Submit manufacturer's literature for product specifications and installation instructions.
- C. Submit proposed methods, equipment, materials, and sequence of operations for sewer construction. Plan operations to minimize disruption of utilities to occupied facilities or adjacent property.
- D. For thermoplastic pipe products, submit detailed calculations per AASHTO LRFD Bridge Design Specifications upon request by the Project Manager for cases including but not limited to variations from City minimum cover requirements, pipe design validation, pipe failure investigations, and product substitutions. When calculations are requested by Project Manager, limit calculations to the critical pipe locations that control the pipe designs within the project limits. Critical locations shall be approved by the Project Manager. Calculations shall be signed and sealed by a Professional Engineer licensed in the State of Texas. Engineer shall submit a cover letter for pipe design indicating that it is in full accordance with AASHTO's analysis and design criteria.

1.07 QUALITY ASSURANCE

- A. The Condition for acceptance shall be watertight storm sewer that is watertight both in pipe-to-pipe joints and in pipe-to-manhole connections
- B. Provide manufacturer's certification to Specifications.

1.08 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Comply with manufacturer's recommendations.

- B. Handle pipe, fittings, and accessories carefully with approved handling devices. Do not drop or roll pipe off trucks or trailers. Do not use Materials cracked, gouged, chipped, dented, or otherwise damaged shall not be use materials for installation.
- C. Store pipe and fittings on heavy timbers or platforms to avoid contact with ground.
- D. Unload pipe, fittings, and appurtenances as close as practical to location of installation to avoid unnecessary handling.
- E. Keep interiors of pipe and fittings free of dirt and foreign matter.
- F. Store HDPE and PP pipes out of direct sunlight unless manufacturer's specifications allow.
- G. Store PVC pipes out of direct sunlight.

PART 2 PRODUCTS

2.01 PIPE

- A. Provide piping materials for storm sewers shall be of sizes and types specified unless otherwise indicated on Drawings.
- B. In diameters where material alternatives are available, provide pipe from single manufacturer for each pipe diameter, unless otherwise approved by Project Manager or otherwise shown on Drawings.
- C. Existing pipe that has been removed during construction cannot be reused.

2.02 PIPE MATERIAL SCHEDULE

- A. Storm Sewer Pipe: Use pipe materials that conform to requirements specified in one or more of the following Sections as shown on the Drawings.
 - 1. Section 02506 - Polyvinyl Chloride Pipe. Not allowed in the following applications:
 - a. Potentially Petroleum Contaminated Areas (PPCA).
 - b. Augering/ jacking.
 - c. Installations in the City right-of-way and easements, except to convey storm water runoff from a private residential lot through a street curb or to a roadside ditch which fronts the residential lot.
 - d. Installations on projects handled by Capital Projects Service line unless allowed according to 2.02.A.1.c.
 - 2. Section 02510 - Polypropylene (PP) Corrugated Wall Pipe.

3. Section 02505 - High Density Polyethylene (HDPE) Solid and Profile Wall Pipe. For use only where Storm Sewers are associated with Local Streets, where Local Street is defined by City of Houston Code of Ordinances 42-1.
 4. Section 02611 - Reinforced Concrete Pipe.
 5. Section 02612 - Precast Reinforced Concrete Box Sewers.
 6. Section 02642 - Corrugated Metal Pipe use only where Corrugated Metal Pipe is shown on Drawings.
- B. Driveway Culvert Pipe for Streets with Open Ditches: Use pipe materials conforming to requirements specified in one or more of the following Sections as shown on the Drawings.
1. Section 02505 - High Density Polyethylene (HDPE) Solid and Profile Wall Pipe Use for Residential Culverts only.
 2. Section 02510 - Polypropylene (PP) Corrugated Wall Pipe.
 3. Section 02611 - Reinforced Concrete Pipe.
 4. Section 02612 - Precast Reinforced Concrete Box Sewers.
- C. Provide pipe meeting minimum class, dimension ratio, or other criteria indicated.
- D. Pipe materials other than those listed above shall not be used for storm sewers.

2.03 BEDDING, BACKFILL, AND TOPSOIL MATERIAL

- A. Bedding and Backfill Material: Conform to requirements of Sections 02317 - Excavation and Backfill for Utilities, Section 02320 - Utility Backfill Materials, and Section 2321 - Cement Stabilized Sand, and Section 02322 - Flowable Fill.
- B. Topsoil: Conform to requirements of Section 02911 - Topsoil.

PART 3 EXECUTION

3.01 PREPARATION

- A. Prepare traffic control plans and set up street detours and barricades in preparation for excavation when construction will affect traffic. Conform to requirements of Section 01555 - Traffic Control and Regulation.
- B. Provide barricades, flashing warning lights, and signs for excavations. Conform to requirements of Section 01555 - Traffic Control and Regulation. Maintain barricades and warning lights for streets and intersections while Work is in progress or where traffic is affected by Work.

- C. Immediately notify agency or company owning utility lines which are damaged, broken, or disturbed. Obtain approval from Project Manager and agency for repairs or relocations, either temporary or permanent.
- D. Remove old pavements and structures, including sidewalks and driveways in accordance with requirements of Section 02221 - Removing Existing Pavements, Structures, Wood, and Demolition Debris.
- E. Install and operate dewatering and surface water control measures in accordance with Section 01578 - Control of Ground and Surface Water.

3.02 EXCAVATION

- A. Earthwork. Conform to requirements of Section 02317 - Excavation and Backfill for Utilities. Use bedding as indicated on Drawings.
- B. Line and Grade. Establish required uniform line and grade trench from benchmarks identified by Project Manager. Maintain this control for minimum of 100 feet behind and ahead of pipe-laying operation. Use laser beam equipment to establish and maintain proper line and grade of Work. Or use appropriately sized grade boards which are substantially supported.
- C. Trench Excavation. Excavate pipe trenches to level as indicated on Standard Details. Backfill excavation with specified bedding material to level of lower one-third of pipe barrel. Tamp and compact backfill to provide bedding at indicated grade. Form bedding foundation to minimum depth of one-eighth of pipe diameter, but not less than 12-inches

3.03 PIPE INSTALLATION.

- A. Install in accordance with pipe manufacturer's recommendations and as specified in this section.
- B. Install pipe only after excavation is completed, bottom of trench is shaped, bedding material is installed, and trench has been approved by Project Manager.
- C. Install pipe to line and grade indicated on Drawings. Place pipe so that it has continuous bearing of barrel on bedding material with no voids, and is laid in trench so interior surfaces of pipe follows grades and alignments indicated.
- D. Install pipe with bells of pipe facing upstream of anticipated flow.
- E. Form concentric joint with each section of adjoining pipe to prevent offsets.
- F. Place and drive home newly laid sections with a sling or come-a-long winches to eliminate damage to sections. Unless otherwise approved by Project Manager, provide end protection to prevent damage while using back hoes or similar powered equipment to drive home newly laid sections.

- G. Keep interior of pipe clean as installation progresses.
- H. Keep excavations free of water during construction and until final inspection.
- I. When work is not in progress, cover exposed ends of pipes with pipe plug specifically designed to prevent foreign material from entering pipe.
- J. For Flexible Pipe Products:
 - 1. Provide a minimum cover as per City Standard detail from top of pavement to top of pipe, but no less than 2 feet.
 - 2. For thermoplastic pipes, provide minimum cover as shown on Drawings.
 - 3. Accomplish transitions to different material of pipe in a manhole or inlet box. No adapter, coupling for dissimilar pipe, or saddle connections allowed.
 - 4. Provide pipe sections in standard lengths with minimum length of 13 feet. Pipe may be field modified to shorten length no less than 4 feet, unless otherwise approved by Project Manager. Field modify pipe per manufacturer's recommendations.
 - 5. No beveling at joint allowed. Cut to be perpendicular to longitudinal axis.
 - 6. For thermoplastic pipes, provide gasketed bell and spigot joints installed per manufacturer's recommendations. Gasketed pipe joints; clean and free of debris, show no leakage after installation.
 - 7. Refer to Specification 02642 – Corrugated Metal Pipe for CMP joint requirements.

3.04 PIPE INSTALLATION OTHER THAN OPEN CUT OR TUNNELING

- A. Conform to requirements of Section 02448 - Pipe and Casing Augering for Sewers where required.
- B. Conform to requirements of Section 02441 - Microtunneling where required.
- C. Conform to requirements of Section 02445 – Jack and Bore/Jack and Mine/Pilot Tube Guided Boring Tunnels where required.
- D. Not allowed for plastic sewer pipe.

3.05 INSTALLATION OF APPURTENANCES

- A. Construct manholes to conform to requirements of Sections 02081 - Cast-in-place Concrete Manholes and Section 02082 - Precast Concrete Manholes. Install frames, grate rings, and covers to conform to requirements of Section 02090 - Frames, Grates, Rings, and Covers.

- B. Install pipe culverts with appropriate measures (e.g., headwalls, safety end treatments, riprap, sloped paving, earthen protection, etc.) as shown on Drawings.
- C. For inlets, headwalls, and wingwalls, conform to requirements of Section 02632 - Cast-in-place Inlets, Headwalls, and Wingwalls and Section 02633 - Precast Concrete Inlets, Headwalls, and Wingwalls.
- D. Rehabilitate existing manholes to conform to requirements of Section 02555 – Manhole Rehabilitation. Adjust manhole covers and inlets to grade conforming to requirements of Section 02086 - Adjusting Manholes, Inlets, and Valve Boxes to Grade.
- E. Dimension for Type C and Type E manholes shall be as shown on Drawings.

3.06 INSPECTION AND TESTING

- A. Perform post installation television inspection in accordance with Section 02531 – Gravity Sanitary Sewers. Hand held cameras may be used in storm sewers in lieu of requirements of Paragraph 3.09 of Section 02531 – Gravity Sanitary Sewers. Clearly stencil distance markings on each joint of pipe to indicate distance from starting manhole when using hand held cameras.
- B. Mandrel Testing: Use a mandrel to test flexible pipe for deflection. Refer to Section 02533 – Acceptance Testing for Sanitary Sewers for the mandrel and test requirements.

3.07 BACKFILL AND SITE CLEANUP

- A. Backfill trench after pipe installation is inspected and approved by Project Manager.
- B. Backfill and compact soil in accordance with Section 02317 - Excavation and Backfill for Utilities.
- C. Repair and replace removed or damaged pavement and sidewalks as specified in Section 02951 - Pavement Repair and Restoration.
- D. In unpaved areas, grade surface as uniform slope to natural grade as indicated on Drawings. Provide minimum of 4 inches of topsoil and seed according to requirements of Section 02921 Hydro Mulch Seeding, or Section 02922 - Sodding, as required.

END OF SECTION

SECTION 02633

PRECAST CONCRETE INLETS, HEADWALLS, AND WINGWALLS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Precast concrete inlets for storm or sanitary sewers, including cast iron frame and plate or grate.
- B. Precast concrete headwalls and wingwalls for storm sewers.
- C. Precast junction box with lid or grate top.

1.02 RELATED SECTIONS

- A. Section 01270 – Measurement and Payment
- B. Section 01330 – Submittal Procedures
- C. Section 02090 – Frames, Grates, Rings, and Covers
- D. Section 02317 – Excavation and Backfill for Utilities
- E. Section 04061 – Mortar

1.03 MEASUREMENT AND PAYMENT

- A. Unit Prices.
 - 1. Payment for inlets is on unit price basis for each inlet installed.
 - 2. Payment for headwalls and wingwalls is on unit price basis for each headwall and wingwall installed.
 - 3. Payment for junction box with lid or grate top is on unit price basis for each junction box installed.
 - 4. Payment for inlets, headwalls, wingwalls, and junction boxes includes connection of lines and furnishing and installing frames, grates, rings, and covers.
 - 5. Refer to Section 01270 - Measurement and Payment for unit price procedures.
- B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.04 REFERENCES

- A. ASTM C 858 - Standard Specification for Underground Precast Concrete Utility Structures.
- B. ASTM C 890 - Standard Practice for Minimum Structural Design Loading for Monolithic or Sectional Precast Concrete Water and Wastewater Structures.
- C. ASTM C 1889 – Standard Practice for Minimum Structural Design Loading for Monolithic or Sectional Precast Concrete Utility, Water, and Wastewater Structures Using AASHTO LRFD Design.
- D. AASHTO HL-93 design live loading loads as referred to in AASHTO LRFD Bridge Design.

1.05 SUBMITTALS

- A. Conform to requirements of Section 01330 - Submittal Procedures.
- B. Submit shop drawings for approval of design and construction details for precast concrete inlets, junction box headwalls, and wingwalls. Precast units differing from standard designs shown on Drawings will be rejected unless shop drawing submittals are approved. Clearly show proposed substitution is equal or superior in every aspect to standard designs.
- C. Submit manufacturers' data and details for frames, grates, rings, and covers.

1.06 STORAGE AND SHIPMENT

- A. Store precast units on level blocking. Do not place loads until design strength is reached. Shipment of acceptable units may be made when 28-day strength requirements have been met.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Concrete: Provide concrete for precast machine-made units meeting requirements of ASTM C 858 regarding reinforced concrete, cement, aggregate, mixture, and concrete test. Minimum 28-day compressive strength shall be 4,000 psi
- B. Design Loading Criteria: Inlets walls, transition slabs, top sections, and inlet base slabs shall be designed, by manufacturer, to requirements of ASTM C 890, and/or ASTM C 1889 for depth as shown on Drawings and to resist following loads
 - 1. AASHTO HL-93 design live loading loads as referred to in AASHTO LRFD Bridge Design Specifications applied to inlet cover and transmitted down to transition and base slabs.

2. Unit soil weight of 120 pcf located above portions of the inlet, including base slab projections.
 3. Lateral soil pressure based on saturated soil conditions producing an at-rest equivalent fluid pressure of 100 pcf.
 4. Internal liquid pressure based on unit weight of 63 pcf.
 5. Dead load of inlet sections fully supported by transition and base slabs.
- C. Reinforcing Steel: Place reinforcing steel to conform to details shown on Drawings and as follows:
1. Provide positive means for holding steel cages in place throughout production of concrete units. Maximum variation in reinforcement position is plus or minus 10 percent of wall thickness or plus or minus 1/2-inch, whichever is less. Regardless of variation, maintain minimum cover of concrete over reinforcement as shown on Drawings.
 2. Welding of reinforcing steel is not permitted unless noted on Drawings.
- D. Mortar and Hydraulic Cement: Conform to requirements of Section 04061 - Mortar.
- E. Miscellaneous Metal: Cast-iron frames and plates conforming to requirements of Section 02090 - Frames, Grates, Rings, and Covers.
- F. Third-Party Certification Requirement:
1. Precast concrete manufacturers supplying precast concrete products shall maintain active certification from an accepted third-party quality control program at the time of manufacture.
 2. Accepted third-party quality control programs are the National Precast Concrete Association (NPCA) Plant Certification Program and the American Concrete Pipe Association (ACPA) Q-Cast Program.
 3. Copies of certificates demonstrating compliance with the above third-party plant certification requirements shall be furnished upon the first delivery to the project. Certifications shall be resubmitted annually thereafter or upon request by the Project Manager.

2.02 SOURCE QUALITY CONTROL

- A. Tolerances: Allowable casting tolerances for concrete units are plus or minus 1/4 inch from dimensions shown on Drawings. Concrete thickness in excess of that required will not constitute cause for rejection provided that excess thickness does not interfere with proper jointing operations.

- B. Precast Unit Identification: Mark date of manufacture and name or trademark of manufacturer clearly on inside of inlet, headwall, or wingwall.
- C. Rejection: Precast units rejected for non-conformity with these specifications and for following reasons:
 - 1. Fractures or cracks passing through shell, except for single end crack that does not exceed depth of joint.
 - 2. Surface defects indicating honeycombed or open texture.
 - 3. Damaged or misshaped ends, where damage would prevent making satisfactory joint.
- D. Replacement: Immediately remove rejected units from Work site and replace with acceptable units.
- E. Repairs: Occasional imperfections resulting from manufacture or accidental damage may be repaired if, in opinion of Project Manager, repaired units conform to requirements of these specifications.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify lines and grades are correct.
- B. Verify compacted subgrade will support loads imposed by inlets.

3.02 INSTALLATION

- A. Install units complete in place to dimensions, lines, and grades as shown on Drawings.
- B. Excavate in accordance with requirements of Section 02317 - Excavation and Backfill for Utilities.
- C. Bed precast concrete units on foundations of firm, stable material shaped to conform to shape of unit bases.
- D. Provide adequate means to lift and place concrete units.

3.03 FINISHES

- A. Use hydraulic cement to seal joints, fill lifting holes and as otherwise required.
- B. When box section of inlet has been completed, shape floor of inlet with mortar to conform to Drawing details.

- C. Adjust cast iron inlet plate frames to line, grade, and slope shown on Drawings. Grout frame in place with mortar.
- D. Install precast adjustment rings above tops of cones or flat-top sections as required to adjust finished elevation and to support inlet plate frame.
- E. Place at least two precast concrete grade rings with thickness of 12 inches or less, under casting. Refer to standard details for additional requirements of precast concrete grade rings.

3.04 FIELD QUALITY CONTROL

- A. Verify that inlets are free of leaks. Repair leaks in approved manner.

3.05 CONNECTIONS

- A. Connect storm sewer leads to inlets as shown on Drawings. Seal connections inside and outside with hydraulic cement. Make connections watertight.

3.06 BACKFILL

- A. Backfill area of excavation surrounding each completed inlet, headwall, or wingwall according to requirements of Section 02317 - Excavation and Backfill for Utilities.

END OF SECTION

SECTION 02713

RECYCLED CRUSHED CONCRETE BASE COURSE

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Recycled crushed concrete base (RCCB) course.

1.02 RELATED SECTIONS

- A. Section 01270 – Measurement and Payment
- B. Section 01330 – Submittal Procedures
- C. Section 01452 – Inspection Services
- D. Section 01454 – Testing Laboratory Services
- E. Section 02315 – Roadway Excavation
- F. Section 02330 – Embankment
- G. Section 02336 – Lime Stabilized Subgrade
- H. Section 02337 – Lime/Fly Ash Stabilized Subgrade
- I. Section 02338 – Portland Cement Stabilized Subgrade
- J. Section 02742 – Prime Coat

1.03 MEASUREMENT AND PAYMENT

- A. Unit Prices.
 - 1. Payment for RCCB is on per ton basis furnished and compacted in place.
 - 2. Payment for RCCB for transitions and base repairs, if required, is on a per ton basis.
 - 3. No separate payment will be made for RCCB for temporary driveway, temporary detour pavement, temporary road shoulders and etc. Include payment in unit price for related work.
 - 4. Refer to Section 01270 - Measurement and Payment for unit price procedures.
- B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

1.04 REFERENCES

- A. ASTM C 150 - Standard Specification for Portland Cement.
- B. TxDOT Tex-101-E - Preparing Soil and Flexible Base Materials for Testing.
- C. TxDOT Tex-106-E - Calculating the Plasticity Index of Soils.
- D. TxDOT Tex-110-E - Determining Particle Size Analysis of Soils.
- E. TxDOT Tex-113-E - Laboratory Compaction Characteristics and Moisture-Density Relationship of Base Materials.
- F. TxDOT Tex-115-E - Field Method for Determining In-place Density of Soils and Base Materials.
- G. TxDOT Tex-120-E - Soil-Cement Testing.

1.05 SUBMITTALS

- A. Conform to requirements of Section 01330 - Submittal Procedures.
- B. Submit representative samples of crushed concrete for testing.
- C. Submit weight tickets, certified by supplier, for each delivery of recycled crushed concrete, gravel, and soil binder.
- D. Submit manufacturer's description and characteristics for pug mill and associated equipment, mixer trucks, spreading and compaction equipment for approval.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Provide materials from stockpiles that are protected during storage from contaminants detrimental to concrete base.
- B. Load material from same area of stockpile to maintain uniformity of each successive delivery to Project site.
- C. Store cement in weatherproof enclosures. Protect from ground dampness.

PART 2 PRODUCTS

2.01 SYSTEM DESCRIPTION

- A. Provide RCCB with following performance:
 - 1. Minimum 7 percent cement.

2. Minimum compressive strength: 650 psi at 14 days following TxDOT Tex-120-E.
 3. Prepare concrete product in on-site or off-site pug mill, or in on-site or off-site portable concrete mixer.
- B. Preliminary Design: Prepare preliminary mix with minimum cement to crushed concrete ratios of 5 percent by dry mass of materials.
1. Designate source of concrete for crushing. Follow Section 01454 - Testing Laboratory Services for tests of concrete from source.
 2. Results of laboratory and compression tests will be used by Project Manager to select final mix design.

2.02 PORTLAND CEMENT

- A. ASTM C 150 Type I, II, or III; bulk or sacked.

2.03 WATER

- A. Potable.

2.04 AGGREGATE

- A. Recycled Crushed Concrete: Material retained on No. 40 Sieve, and durable coarse particles of crusher-run reclaimed cured Portland cement concrete, obtained from approved source. Organic material is prohibited. The crushed concrete shall be substantially free of foreign matter including but not limited to asphalt, base, and dirt.
- B. Soil Binder (classified below): Meeting following requirements when tested following TxDOT Tex-106-E:
1. Maximum liquid limit: 35
 2. Maximum plasticity index: 10
- C. Mixed Aggregate and Soil Binder: Grading following TxDOT Tex-101-E and Tex-110-E within following limits:

<u>Sieve</u>	<u>Percent Crushed Concrete Retained</u>
1-3/4 inch	0 to 10
No. 4	45 to 75
No. 40	55 to 80; classified as Soil Binder

1. Bank sand may be added to mix at pug mill.

2.05 ASPHALTIC SEAL CURE

- A. Acquire written approval from Project Manager before curing and before proceeding with curing.
- B. Use following as option to curing by sprinkling:
 - 1. Cut-back asphalt: MC30 following Section 02742 - Prime Coat.
 - 2. Emulsified petroleum resin: EPR-1 Prime following Section 02742 - Prime Coat.

2.06 MATERIAL MIX

- A. Design mix for minimum compressive strength of 650 psi at 14 days following TxDOT Tex-120-E unconfined compressive strength.
- B. Cement Ratio: Follow Paragraph 2.01A. Increase cement content in two percent steps up to 9 percent maximum when compressive strength of design mix samples fail TxDOT Tex-120E test.

2.07 MIXING EQUIPMENT

- A. Mix following Paragraph 2.01A, with metering devices adding specified quantities of crushed concrete, cement, and water into mixer. Dry mix crushed concrete and cement prior to adding water. Produce homogeneous and uniformly mixed product.

2.08 SOURCE QUALITY CONTROL

- A. Test following Section 01454 -Testing Laboratory Services.
- B. When directed by Project Manager, test for unconfined compressive strength following Test Method TxDOT Tex-120-E as follows:
 - 1. Mold minimum of three samples each day or for each 500 tons of production or one for each day.
 - 2. Compressive strength: average of 3 specimens for each sample lot.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Follow Section 01452 - Inspection Services.
- B. Verify buried utility work is complete.
- C. Verify lime treatment of base is complete.
- D. Verify subgrade is ready to support imposed loads. Verify flatwork, foundations, projecting reinforcement and similar Work interfacing with base is in place.

- E. Verify lines and grades are correct.

3.02 PREPARATION

- A. Complete backfill of new utilities below future grade.
- B. Prepare subgrade in accordance with requirements of Section 02330 - Embankment and Section 02315 - Roadway Excavation, or Section 02336 - Lime Stabilized Subgrade and Section 02337 - Lime/Fly Ash Stabilized Subgrade and Section 02338 - Portland Cement Stabilized Subgrade.
- C. Correct subgrade deviations in excess of plus or minus 1/4 inch in cross section, or in 16 foot length by loosening, adding or removing material, reshaping and recompacting by sprinkling and rolling.
- D. Prepare sufficient subgrade in advance of base course for efficient operations.
- E. Have sufficient products and equipment on hand to expeditiously apply base.

3.03 MIXING

- A. Maintain moisture content of between optimum and 5 percent above optimum.

3.04 PLACEMENT

- A. Place mixture with approved spreading equipment. Spread to eliminate planes of weakness or pockets of nonuniformly graded material resulting from hauling and dumping operations.
- B. Provide approximately vertical construction joints between fresh base and base-in-place 4 hours or longer. Form joint with temporary header or make vertical cut of in-place base immediately before placing fresh base.
- C. Make cold joints at center line of head-to-head parking stalls.
- D. Place base so that projecting reinforcing steel from curbs remain at approximate center of base. Provide proper bond between reinforcement and base.
- E. Transverse and longitudinal joints shall be vertical.
- F. Unless noted otherwise, place recycled crushed concrete base in courses not to exceed 8 inches in depth. All courses shall be placed on same working day unless approved by Project Manager. Construction joints between new base and base previously placed shall be wetted and coated with dry cement prior to addition of new base.
- G. Complete finishing operations within period of 6 hours after cement is added to base materials.

3.05 COMPACTION

- A. Start compaction maximum 3 hours after start of mixing. Compact loose mixture with approved tamping rollers until entire depth is uniformly compacted. Do not allow base to mix with underlying material.
 - 1. Do not rework uncompacted material that has set up for more than 30 minutes.
 - 2. Complete placement and compaction work within 6 hours from start of moist mixing.
- B. Correct irregularities or weak spots immediately by replacing material and recompacting.
- C. Apply water to maintain moisture between optimum and 5 percent above optimum moisture.
- D. Remove and reconstruct sections where average moisture content exceeds ranges specified at time of final compaction.
- E. Finish by blading surface to final grade after compacting final course. Seal with approved pneumatic tired rollers or flat wheel rollers which are sufficiently light to prevent surface hair line cracking.
- F. Compact to minimum density of 95 percent of dry density, following TxDOT Tex - 113-E, at moisture content of treated material between optimum and 5 percent above optimum.
- G. Test roadway base course compaction in accordance with TxDOT Tex-115-E.
- H. Maintain surface to required lines and grades throughout operation.

3.06 CURING

- A. Moist cure for minimum of 72 hours before adding pavement courses.
- B. Use sprinkling or, at option, apply following curing membrane as soon as initial set begins, using approved light-weight self-propelled pressure distributor:
 - 1. MC30: 0.1 gallon per square yard.
 - 2. EPR-1 Prime: 0.15 gallon of asphalt residual per square yard.
- C. Do not use cut-back asphalt during period of April 16 through September 15.

3.07 TOLERANCES

- A. Completed Surface: Smooth and conform to typical section and established lines and grades.
- B. Top Surface of Base Course: Plus or minus 1/4 inch in cross section or in 16 foot length.

3.08 FIELD QUALITY CONTROL

- A. Test following Section 01454 - Testing Laboratory Services.
- B. Perform compaction tests following TxDOT Tex-113-E at randomly selected locations. Remove and replace areas failing compaction requirements at no additional cost to City.
- C. Test and analyze aggregate and binder products following TxDOT Tex-110-E.

3.09 PROTECTION

- A. Maintain base in proper condition until surface is placed. Surface must be placed within 14 days after final mixing and compaction unless otherwise approved by Project Manager. Repair unacceptable base course immediately by replacing base to full depth.
- B. Curing membrane may remain in place at areas where surface courses or other base courses are applied.
- C. Prevent construction traffic on base for minimum 3 days. Light vehicles, used to maintain proper cure, are permitted on base after initial set or as permitted by Project Manager.

END OF SECTION

SECTION 02714

FLEXIBLE BASE COURSE FOR TEMPORARY DRIVEWAYS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Foundation course of crushed concrete or stone.

1.02 RELATED SECTIONS

- A. Section 01270 – Measurement and Payment
- B. Section 01330 – Submittal Procedures
- C. Section 01454 – Testing Laboratory Services
- D. Section 02315 – Roadway Excavation
- E. Section 02336 – Lime Stabilized Subgrade
- F. Section 02337 – Lime/Fly Ash Stabilized Subgrade

1.03 MEASUREMENT AND PAYMENT

A. UNIT PRICES

1. Measurement for flexible base course payment is on each driveway basis. To maintain access or temporary driveway, separate measurement will be made for each different type of driveway (residential, commercial, or custom properties) or as identified on the Drawings.
2. Payment limits for temporary driveways are based upon the width of the driveway access (not to exceed 12-feet for residential, 24-feet for commercial, or custom dimensioned properties) and the length from permanent or temporary roadway to the remaining permanent driveway or street right-of-way, as necessary to maintain access to properties.
3. No separate payment will be made for flexible base course for temporary roads, detour pavements, and shoulder under this Section unless it is included as an extra unit bid and as approved for payment by the project manager. Flexible base course for temporary driveways or access if included under the extra unit bid item is on a cubic yard basis.
4. Temporary driveways will be paid only once per driveway location shown to be replaced on the Drawing and payment shall be made based upon actual installation.

5. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If the Contract is a Stipulated Price Contract, payment for work in this Section is included in the total Stipulated Price.

1.04 REFERENCES

- A. ASTM C 131 – Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
- B. ASTM D 1556 - Standard Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method.
- C. ASTM D 698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12.44 ft-lbf/ft³).
- D. ASTM D 4318 - Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
- E. ATMD D 6938 - Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)
- F. TxDOT Tex-101-E - Preparing Soil and Flexible Base Materials for Testing.
- G. TxDOT Tex-110-E - Particle Size Analysis of Soils.

1.05 SUBMITTALS

- A. Submittals shall conform to requirements of Section 01330 - Submittals Procedures.
- B. Submit samples of flexible base course and soil binder for testing.

1.06 TESTS

- A. Tests and analysis of soil materials will be performed in accordance with ASTM C 131, ASTM D 698, ASTM D 4318, Tex-101-E, and Tex-110-E under provisions of Section 01454 - Testing Laboratory Services.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Provide materials from stockpiles that are protected during storage from contaminants that would be detrimental to the flexible base course.
- B. Load materials from same area of stockpile to maintain uniformity of each successive delivery to the project site.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Crushed Stone or Concrete: Material retained on the No. 40 sieve meeting the following requirements:
 - 1. Durable particles of crusher-run broken limestone, crushed concrete, crushed sandstone, or granite obtained from an approved source.
- B. Soil Binder: Material passing the No. 40 sieve meeting the following requirements when tested in accordance with ASTM D 4318:
 - 1. Maximum Liquid Limit: 40
 - 2. Maximum Plasticity Index: 12
 - 3. Maximum Lineal Shrinkage: 7 (when calculated from volumetric shrinkage at liquid limit).
- C. Mixed Materials shall meet the following requirements:
 - 1. Minimum compressive strength of 35 psi at 0 psi lateral pressure and 175 psi at 15 psi lateral pressure using triaxial testing procedures.
 - 2. Grading in accordance with Tex-101-E and Tex-110-E within the following limits:

Sieve	Percent Retained
1-3/4 inch	0 to 10
No. 4	45 to 75
No. 40	60 to 85

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify compacted subgrade is ready to support imposed loads.
- B. Verify lines and grades are correct.

3.02 PREPARATION

- A. Complete backfill of new utilities below future grade.
- B. Prepare subgrade in accordance with requirements of Section 02315 - Roadway Excavation or Sections 02336 - Lime Stabilized Subgrade and 02337 - Lime/Fly-ash Stabilized Subgrade.

- C. Correct subgrade deviations in excess of plus or minus 1/2 inch in cross section, or in 16 foot length by loosening, adding or removing material, reshaping and recompacting by sprinkling and rolling.
- D. Prepare sufficient subgrade in advance of base course operations.

3.03 PLACEMENT

- A. Spread and shape in lifts to compacted thickness not to exceed 6 inches in depth. Complete spreading, shaping, and compacting on same day material is deposited.
- B. Place base so that projecting reinforcing steel from curbs remain at approximate center of base. Secure a firm bond between reinforcement and base.
- C. Start rolling operations as soon as possible after placement. Use sheepfoot, steel, or pneumatic rollers as approved. Roll longitudinally with subgrade starting from sides. Overlap successive strips by one-half width of each rear wheel.
- D. Maintain moisture between optimum and 3 percent above optimum moisture.
- E. Compact to 95 percent of Proctor density in accordance with ASTM D 698, unless otherwise indicated on the Drawings.
- F. Finish to grade and compact lift before placing successive lift.
- G. Maintain shape by grading throughout operation.
- H. Provide total thickness indicated on Drawings.

3.04 TOLERANCES

- A. Completed surface shall be smooth and conform to typical section and established lines and grades.

3.05 FIELD QUALITY CONTROL

- A. Testing will be performed under provisions of Section 01454 - Testing Laboratory Services.
- B. Compaction Testing will be performed in accordance with ASTM D 698 or ASTM D 6938 at a random location near each depth determination core. Rework and recompact areas that do not conform to compaction requirements.

3.06 PROTECTION

- A. Sprinkle to prevent excessive loss of moisture.
- B. Restrict construction traffic on finished base to equipment required to complete the work.

END OF SECTION

SECTION 02751

CONCRETE PAVING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Portland cement concrete paving.

1.02 RELATED SECTIONS

- A. Section 01270 – Measurement and Payment
- B. Section 01330 – Submittal Procedures
- C. Section 01454 – Testing Laboratory Services
- D. Section 02751 – Concrete Paving
- E. Section 02752 – Concrete Pavement Joints
- F. Section 02753 – Concrete Pavement Curing
- G. Section 02951 – Pavement Repair and Restoration

1.03 MEASUREMENT AND PAYMENT

- A. Unit Prices.
 - 1. Payment for concrete paving is on square yard basis. Separate pay items are used for each different required thickness of pavement.
 - 2. Payment for concrete paving, high early strength, is on square yard basis.
 - 3. Payment for pavement repair or pavement replacement for utility projects is on a square yard basis and includes base materials in accordance with Section 02951 – Pavement Repair and Restoration.
 - 4. Refer to Section 01270 - Measurement and Payment for unit price procedures.
 - 5. Refer to Paragraph 3.15, Unit Price Adjustment.
- B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

1.04 REFERENCES

- A. ASTM A1064 - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
- B. ASTM A615 - Standard Specification for Deformed and Carbon-Steel Bars for Concrete Reinforcement.
- C. ASTM C 31 - Standard Practice for Making and Curing Concrete Test Specimens in the Field.
- D. ASTM C 33 - Standard Specifications for Concrete Aggregates.
- E. ASTM C 39 - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
- F. ASTM C 40 - Standard Test Method for Organic Impurities in Fine Aggregates for Concrete.
- G. ASTM C 42 - Standard Test Method of Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
- H. ASTM C 78 - Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Third Point Loading).
- I. ASTM C 94 - Standard Specification for Ready-Mixed Concrete.
- J. ASTM C 131 - Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
- K. ASTM C 136 - Standard Method for Sieve Analysis of Fine and Coarse Aggregates.
- L. ASTM C 138 - Standard Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete.
- M. ASTM C 143 - Standard Test Method for Slump of Hydraulic Cement Concrete.
- N. ASTM C 150 - Standard Specification for Portland Cement.
- O. ASTM C 174 - Standard Test Method for Measuring Thickness of Concrete Elements Using Drilled Concrete Cores.
- P. ASTM C 231 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
- Q. ASTM C 260 - Standard Specification for Air-Entraining Admixtures for Concrete.
- R. ASTM C 494 - Standard Specification for Chemical Admixtures for Concrete.
- S. ASTM C 618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for use in Concrete.

- T. TxDOT Tex-203-F - Sand Equivalent Test.
- U. TxDOT Tex-406-A - Material Finer than 75 μ m (No. 200) Sieve In Mineral Aggregates (Decantation Test for Cement Aggregates).

1.05 SUBMITTALS

- A. Conform to requirements of Section 01330 - Submittal Procedures.
- B. Submit proposed mix design and test data for each type and strength of concrete in Work. Include proportions and actual flexural strength obtained from design mixes at required test ages.
- C. Submit for approval manufacturer's description and characteristics for mixing equipment, and for traveling form paver, when proposed for use.
- D. Submit manufacturer's certificates giving properties of reinforcing steel. Include certificate of compliance with ASTM A 1064. Provide specimens for testing when required by Project Manager.

1.06 HANDLING AND STORAGE

- A. Do not mix different classes of aggregate without written permission of Project Manager.
- B. Class of aggregate being used may be changed before or during Work with written permission of Project Manager. Comply new class with specifications.
- C. Reject segregated aggregate. Before using aggregate whose particles are separated by size, mix them uniformly to grading requirements.
- D. Reject aggregates mixed with dirt, weeds, or foreign matter.
- E. Do not dump or store aggregate in roadbed.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Portland Cement:
 - 1. Sample and test cement to verify compliance with Standards of ASTM C 150, Type I or Type III.
 - 2. Bulk cement which meets referenced standards may be used when method of handling is approved by Project Manager. When using bulk cement, provide satisfactory weighing devices.

- 3. Fly ash which meets standards of ASTM C 618 may be used as mineral fill when method of handling is approved by Project Manager.
- B. Water: Conform to requirements for water in ASTM C 94.
- C. Coarse Aggregate: Crushed stone, gravel, or combination thereof, which is clean, hard, and durable, conforms to requirements of ASTM C 33, and has abrasion loss not more than 45 percent by weight when subjected to Los Angeles Abrasion Test (ASTM C 131).

- 1. Maximum percentage by weight of deleterious substances shall not exceed following values:

<u>Item</u>	<u>Percent by Weight of Total Sample Maximum</u>
Clay lumps and friable particles	3.0
Material finer than 75- μ m (No. 200) sieve:	
Concrete subject to abrasion	3.0*
All Other concrete	5.0*
Coal and lignite:	
Where surface appearance of concrete is of importance	0.5
All other concrete	1.0

* In case of manufactured sand, when material finer than 75- μ m (No. 200) sieve consists of dust of fracture, essentially free from clay or shale, these limits may be increased to 5 and 7 percent, respectively.

- 2. Conform coarse aggregate (size 1 1/2-inch to No. 4 sieve) to requirements of ASTM C33. Use gradation within following limits when graded in accordance with ASTM C 136:

Sieve Designation (Square Openings)	Percentage by Weight
Retained on 1 3/4" sieve	0
Retained on 1 1/2" sieve	0 to 5
Retained on 3/4" sieve	30 to 65
Retained on 3/8" sieve	70 to 90
Retained on No. 4 sieve	95 to 100
Loss by Decantation Test *Method Tex-406-A	1.0 maximum

* In case of aggregates made primarily from crushing of stone, when material finer than 200 sieve is dust of fracture essentially free from clay or shale as established by Part III of TxDOT Tex-406-A, percent may be increased to 1.5.

- D. Fine Aggregate: Sand, manufactured sand, or combination thereof, composed of clean, hard, durable, uncoated grains, free from loams or other injurious foreign matter. Conform fine aggregate for concrete to requirements of ASTM C 33. Use gradation within following limits when graded in accordance with ASTM C 136:

Sieve Designation (Square Openings)	Percentage by Weight
Retained on 3/8" sieve	0
Retained on No. 4 sieve	0 to 5
Retained on No. 8 sieve	0 to 20
Retained on No. 16 sieve	15 to 50
Retained on No. 30 sieve	35 to 75
Retained on No. 50 sieve	65 to 90
Retained on No. 100 sieve	90 to 100
Retained on No. 200 sieve	97 to 100

1. When subjected to color test for organic impurities (ASTM C 40), fine aggregate shall not show color darker than standard color. Fine aggregate shall be subjected to Sand Equivalent Test (Tex-203-F). Sand equivalent value shall not be less than 80, unless higher value is shown on Drawings.
- E. Mineral Filler: Type "C" or Type "F" fly ash of acceptable quality and meeting requirements of ASTM C 618 may be used as mineral admixture in concrete mixture. When fly ash mineral filler is used, store and inspect in accordance with ASTM C 618. Do not use fly ash in amounts to exceed 25 percent by weight of cementitious material in mix design. Cement content may be reduced when strength requirements can be met. Note: When fly ash is used, term "cement" is defined as cement plus fly ash.
- F. Air Entraining Agent: Furnish air entraining agent conforming to requirements of ASTM C 260.
- G. Water Reducer: Water reducing admixture conforming to requirements of ASTM C 494 may be used when required to improve workability of concrete. Amount and type of admixture is subject to approval by Project Manager.
- H. Reinforcing Steel:
1. Provide new billet steel manufactured by open hearth process and conforming to ASTM A 615, Grade 60. Store steel to protect it from mechanical injury and rust. At time of placement, steel shall be free from dirt, scale, rust, paint, oil, or other injurious materials.
 2. Cold bend reinforcing steel to shapes shown. Once steel has been bent, it may not be rebent.

3. Provide wire fabric conforming to ASTM A 1064. Use fabric in which longitudinal and transverse wires have been electrically welded at points of intersection. Welds shall have sufficient strength not to be broken during handling or placing. Conform welding and fabrication of fabric sheets to ASTM A 1064.

2.02 EQUIPMENT

- A. Conform Equipment to requirements of ASTM C94.

2.03 MIXING

- A. Flexural strength shall be as specified using test specimens prepared in accordance with ASTM C 31 and tested in accordance with ASTM C78 (using simple beam with third-point loading). Compressive strength shall be as specified using test specimens prepared in accordance with ASTM C 31 and tested in accordance with ASTM C 39. Determine and measure batch quantity of each ingredient, including water for batch designs and all concrete produced for Work. Mix shall conform to these specifications and other requirements indicated on Drawings.

- B. Mix design to produce concrete which will have flexural strength of 500 psi at 7 days and 600 psi at 28 days. Minimum compressive strength shall be 3,000 pounds per square inches for 7 days and 4,000 pounds per square inches at 28 days when tested in accordance with ASTM C39. Slump of concrete shall be at least 2-inches but no more than 5-inches, when tested in accordance with ASTM C143.

1. Concrete pavement, including curb, curb and gutter, and saw-tooth curb, shall contain at least 5 1/2 sacks (94 pounds per sack) of cement per cubic yard, with not more than 6.5 gallons of water, net, per sack of cement (water-cement ratio maximum 0.57). Determine cement content in accordance with ASTM C 138. Addition of mineral filler may be used to improve workability or plasticity of concrete to limits specified.

2. Coarse dry aggregate shall not exceed 85 percent of loose volume of concrete.

3. Add air-entraining admixture to ensure uniform distribution of agent throughout batch. Base air content of freshly mixed air-entrained concrete upon trial mixes with materials to be used in Work, adjusted to produce concrete of required plasticity and workability. Percentage of air entrainment in mix shall be 4 1/2 percent plus or minus 1 1/2 percent. Determine air content by testing in accordance with ASTM C 231.

4. Use retardant when temperature exceeds 90 degrees F. Proportion as recommended by manufacturer. Use same brand as used for air-entraining agent. Add and batch material using same methods as used for air-entraining agent.

- C. Use high early strength concrete pavement to limits shown on Drawings. Design to meet following:

1. Concrete Mix: Flexural strength greater than or equal to 500 psi at 72 hours.
2. Cement: Minimum of 7 sacks of cement per cubic yard of concrete.
3. Water-Cement Ratio maximum of 0.45. Slump of concrete shall a maximum of 5-inches, when tested in accordance with ASTM C 143.
4. Other requirements for proportioning, mixing, execution, testing, etc., shall be in accordance with this Section 02751 - Concrete Paving.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify compacted base is ready to support imposed loads and meets compaction requirements.
- B. Verify lines and grades are correct.

3.02 PREPARATION

- A. Properly prepare, shape and compact each section of subgrade before placing forms, reinforcing steel or concrete. After forms have been set to proper grade and alignment, use subgrade planer to shape subgrade to its final cross section. Check contour of subgrade with template.
- B. Remove subgrade that will not support loaded form. Replace and compact subgrade to required density.

3.03 EQUIPMENT

- A. Alternate equipment and methods, other than those required by this Section, may be used provided equal or better results will be obtained. Maintain equipment for preparing subgrade and for finishing and compacting concrete in good working order.
- B. Subgrade Planer and Template:
 1. Use subgrade planer with adjustable cutting blades to trim subgrade to exact section shown on Drawings. Select planer mounted on visible rollers which ride on forms. Planer frame must have sufficient weight so that it will remain on form, and have strength and rigidity that, under tests made by changing support from wheels to center, planer will not develop deflection of more than 1/8-inch. Tractors used to pull planer shall not produce ruts or indentations in subgrade. When slip form method of paving is used, operate subgrade planer on prepared track grade or have it controlled by electronic sensor system operated from string line to establish horizontal alignment and elevation of subbase.

2. Provide template for checking contour of subgrade. Template shall be long enough to rest upon side forms and have strength and rigidity that, when supported at center, maximum deflection shall not exceed 1/8-inch. Fit template with accurately adjustable rods projecting downward at 1-foot intervals. Adjust these rods to gauge cross sections of slab bottom when template is resting on side forms.
- C. Machine Finisher: Provide power-driven, transverse finishing machine designed and operated to strike off and consolidate concrete. Machine shall have two screeds accurately adjusted to crown of pavement and with frame equipped to ride on forms. Use finishing machine with rubber tires when it operates on concrete pavement.
- D. Hand Finishing:
1. Provide mechanical strike and tamping template 2-feet longer than width of pavement to be finished. Shape template to pavement section.
 2. Provide two bridges to ride on forms and span pavement for finishing expansion and dummy joints. Provide floats and necessary edging and finishing tools.
- E. Burlap Drag or transverse broom for Finishing Slab: Furnish four plies of 10-ounce burlap material fastened to bridge to form continuous strip of burlap full width of pavement. Maintain contact 3-foot width of burlap material with pavement surface. Keep burlap drags clean and free of encrusted mortar.
- F. Vibrators: Furnish mechanically-operated, synchronized vibrators mounted on tamping bar which rides on forms and hand-manipulated mechanical vibrators. Furnish vibrators with frequency of vibration to provide maximum consolidation of concrete without segregation.
- G. Traveling Form Paver: Approved traveling form paver may be used in lieu of construction methods employing forms, consolidating, finishing and floating equipment. Meet requirements of this specification for subgrade, pavement tolerances, pavement depth, alignments, consolidation, finishing and workmanship. When traveling form paver does not provide concrete paving that meets compaction, finish, and tolerance requirements of this Specification, immediately discontinue its use and use conventional methods.
1. Equip traveling paver with longitudinal transangular finishing float adjustable to crown and grade. Use float long enough to extend across pavement to side forms or edge of slab.
 2. Ensure that continuous deposit of concrete can be made at paver to minimize starting and stopping. Use conventional means of paving locations inaccessible to traveling paver, or having horizontal or vertical curvature that traveling paver cannot negotiate.

3. Where Drawings require tie bars for adjacent paving, securely tie and support bars to prevent displacement. Tie bars may be installed with approved mechanical bar inserter mounted on traveling-form paver. Replace pavement in which tie bars assume final position other than that shown on Drawings.

3.04 FORMS

- A. Side Forms: Use metal forms of approved shape and section. Preferred depth of form is equal to required edge thickness of pavement. Forms with depths greater or less than required edge thickness of pavement will be permitted, provided difference between form depth and edge thickness when not greater than 1-inch, and further provided that forms of depth less than pavement edge are brought to required edge thickness by securely attaching wood or metal strips to bottom of form, or by grouting under form. Bottom flange of form shall be same size as thickness of pavement. Aluminum forms are not allowed. Forms shall be approved by Project Manager. Length of form sections shall be not less than 10-feet and each section shall provide for staking in position with not less than 3 pins. Flexible or curved forms of wood or metal of proper radius shall be used for curves of 200-foot radius or less. Forms shall have ample strength and shall be provided with adequate devices for secure setting so that when in-place they will withstand, without visible springing or settlement, impact and vibration of finishing machine. In no case shall base width be less than 8-inches for form 8-inches or more in height. Forms shall be free from warp, bends or kinks and shall be sufficiently true to provide straight edge on concrete. Top of each form section, when tested with straight edge, shall conform to requirements specified for surface of completed pavement. Provide sufficient forms for satisfactory placement of concrete. For short radius curves, forms less than 10-feet in length or curved forms may be used. For curb returns at street intersections and driveways, wood forms of good grade and quality may be used.
- B. Form Setting:
 1. Rest forms directly on subgrade. Do not shim with pebbles or dirt. Accurately set forms to required grade and alignment and, during entire operation of placing, compacting and finishing of concrete, do not deviate from this grade and alignment more than 1/8-inch in 10-feet of length. Do not remove forms for at least 8 hours after completion of finishing operations. Provide supply of forms that will be adequate for orderly and continuous placing of concrete. Set forms and check grade for at least 300-feet ahead of mixer or as approved by Project Manager.
 2. Adjacent slabs may be used instead of forms, provided that concrete is well protected from possible damage by finishing equipment. Do not use adjacent slabs for forms until concrete has aged at least 7 days.

3. Prior to form setting, grade subgrade appropriately so that when the forms are set, and the concrete is poured, finished, and cured, there is positive drainage, free of sitting water / ponding in the gutter (“gutter ponds”) or on the pavement area of new panels. This requirement may not be capable of being met at the construction joint between an existing pavement panel and a new individual pavement panel that is properly installed to match the existing panel. However, this requirement shall be met between two new panels and within the area of new panels.

3.05 REINFORCING STEEL AND JOINT ASSEMBLIES

- A. Place reinforcing steel and joint assemblies and position securely as indicated on Drawings. Wire reinforcing bars securely together at intersections and splices. Bars and coatings shall be free of rust, dirt or other foreign matter when concrete is placed. Secure reinforcing steel to chairs.
- B. Position pavement joint assemblies at required locations and elevations, and rigidly secure in position. Install dowel bars in joint assemblies, each parallel to pavement surface and to center line of pavement, as shown.
- C. Cut header boards, joint filler, and other material used for forming joints to receive each dowel bar.
- D. Secure in required position to prevent displacement during placing and finishing of concrete.
- E. Drill dowels into existing pavement, secure with epoxy, and provide paving headers as required to provide rigid pavement sections.
- F. Use sufficient number of chairs for steel reinforcement bars to maintain position of bars within allowable tolerances. Place reinforcement as shown on Drawings. In plane of steel parallel to nearest surface of concrete, bars shall not vary from plan placement by more than 1/12 of spacing between bars. In plane of steel perpendicular to nearest surface of concrete, bars shall not vary from plan placement by more than 1/4-inch.

3.06 FIBROUS REINFORCING

- A. Do not use fibrous reinforcing to replace structural, load-bearing, or moment-reinforcing steel.

3.07 PLACEMENT

- A. Place concrete when air temperature taken in shade and away from artificial heat is above 35 degrees F and rising. Do not place concrete when temperature is below 40 degrees F and falling.
- B. Place concrete within 90 minutes after initial water had been added. Remove and dispose of concrete not placed within this period.

- C. Concrete slump during placement shall be 1 to 5-inches, except when using traveling-form paver, slump shall be maximum of 2-inches.
- D. Deposit concrete continuously in successive batches. Distribute concrete in manner that will require as little rehandling as possible. Where hand spreading is necessary, distribute concrete with shovels or by other approved methods. Use only concrete rakes in handling concrete. At placement interruption of more than 30 minutes, place transverse construction joint at stopping point. Remove and replace sections less than 10-feet long.
- E. Take special care in placing and spading concrete against forms and at longitudinal and transverse joints to prevent honeycombing. Voids in edge of finished pavement will be cause for rejection.

3.08 COMPACTION

- A. Consolidate concrete using mechanical vibrators as specified herein. Extend vibratory unit across pavement, not quite touching side forms. Space individual vibrators at close enough intervals to vibrate and consolidate entire width of pavement uniformly. Mount mechanical vibrators to avoid contact with forms, reinforcement, transverse or longitudinal joints.
- B. Furnish enough hand-manipulated mechanical vibrators for proper consolidation of concrete along forms, at joints and in areas not covered by mechanically controlled vibrators.

3.09 FINISHING

- A. Finish concrete pavement with power-driven transverse finishing machines or by hand finishing methods.
 - 1. Hand finish with mechanical strike and tamping template in same width as pavement to be finished. Shape template to pavement section shown on Drawings. Move strike template forward in direction of placement, maintaining slight excess of material in front of cutting edge. Make minimum of two trips over each area. Screed pavement surface to required section. Work screed with combined transverse and longitudinal motion in direction work is progressing. Maintain screed in contact with forms. Use longitudinal float to level surface.
- B. On narrow strips and transitions, finish concrete pavement by hand. Thoroughly work concrete around reinforcement and embedded fixtures. Strike off concrete with strike-off screed. Move strike-off screed forward with combined transverse and longitudinal motion in direction work is progressing, maintaining screed in contact with forms, and maintaining slight excess of materials in front of cutting edge. Tamp concrete with tamping template. Use longitudinal float to level surface.

- C. After completion of straightedge operation, make first pass of burlap drag or transverse broom as soon as construction operations permit and before water sheen has disappeared from surface. Follow with as many passes as required to produce desired texture depth. Permit no unnecessary delays between passes. Keep drag wet, clean and free from encrusted mortar during use.

3.10 JOINTS AND JOINT SEALING

- A. Conform to requirements of Section 02752 - Concrete Pavement Joints.

3.11 CONCRETE CURING

- A. Conform to requirements of Section 02753 - Concrete Pavement Curing.

3.12 TOLERANCES

- A. Test entire surface before initial set and correct irregularities or undulations. Bring surface within requirements of following test and then finish. Place 10-foot straightedge parallel to center of roadway to bridge depressions and touch high spots. Do not permit ordinates measured from face of straight edge to surface of pavement to exceed 1/16-inch per foot from nearest point of contact. Maximum ordinate with 10-foot straightedge shall not exceed 1/8-inch. Grind spots in excess of required tolerances to meet surface test requirements. Restore texture by grooving concrete to meet surface finishing specifications.

3.13 FIELD QUALITY CONTROL

- A. Perform testing under provisions of Section 01454 - Testing Laboratory Services.
- B. Compressive Strength Test Specimens: Make four test specimens for compressive strength test in accordance with ASTM C 31 for each 150 cubic yards or less of pavement that is placed in one day. Test two specimens at 7 days or at number of hours as directed by the Project Manager for high early strength concrete. Test remaining two specimens at 28 days. Test specimens in accordance with ASTM C 39. Minimum compressive strength shall be 3000 pounds per square inch for first two specimens and 3500 pounds per square inch at 28 days.
- C. When compressive test indicates failure, make yield test in accordance with ASTM C 138 for cement content per cubic yard of concrete. When cement content is found to be less than that specified per cubic yard, increase batch weights until amount of cement per cubic yard of concrete conforms to requirements.
- D. Minimum of one 4-inch core will be taken at random locations per 375-feet per 12-foot lane or 500 square yards of pavement to measure in-place depth. Measure depth in accordance with ASTM C 174. Each core may be tested for 28 day compressive strength according to methods of ASTM C 42. 28 day compressive strength of each core tested shall be a minimum of 3000 pounds per square inch.

- E. Request, at option, three additional cores in vicinity of cores indicating nonconforming in- place depths at no cost to City. In-place depth at these locations shall be average depth of four cores.
- F. Fill cores and density test sections with new concrete paving or non-shrink grout.

3.14 NONCONFORMING PAVEMENT

- A. Remove and replace areas of pavement found deficient in thickness by more than 10 percent, or that fail compressive strength tests, with concrete of thickness shown on Drawings.
- B. When measurement of any core is less than specified thickness by more than 10 percent, actual thickness of pavement in this area will be determined by taking additional cores at 10-foot intervals parallel to centerline in each direction from deficient core until, in each direction, core is taken which is not deficient by more than 10 percent. Exploratory cores for deficient thickness will not be used in averages for adjusted unit price. Exploratory cores are to be used only to determine length of pavement in unit that is to be removed and replaced. Replace nonconforming pavement sections at no additional cost to City.
- C. Remove and replace new pavement panels that do not have positive drainage and are not free of sitting water / ponding in the gutter (“gutter ponds”) or on the pavement area of new panels. This requirement does not apply at the construction joint between existing pavement and a new individual panel that is properly installed to match the existing panel. However, this requirement applies between two new panels and within the area of new panels.

3.15 UNIT PRICE ADJUSTMENT

- A. Unit price adjustments shall be made for in-place depth determined by cores as follows:
 - 1. Adjusted Unit Price shall be ratio of average thickness as determined by cores to thickness bid upon, times unit price.
 - 2. Apply adjustment to lower limit of 90 percent and upper limit of 100 percent of unit price.
 - 3. Average depth below 90 percent but greater than 80 percent may be accepted by Project Manager at adjusted Unit Price of:
 - a. $\text{Unit Price Bid} - [2 \times (1 - \text{ratio}) \times \text{Unit Price Bid}]$
 - b. Ratio equals average core thickness divided by thickness bid upon
 - c. 0.9 ratio pays 80 percent of unit price and 0.8 ratio pays 60 percent of unit price.

4. Average depth below 80 percent will be rejected by Project Manager.
- 3.16 PAVEMENT MARKINGS
- A. Restore pavement markings to match those existing in accordance with City of Houston standard specifications and details and Project Manager's requirements.
- 3.17 PROTECTION
- A. Barricade pavement section to prevent use until concrete has attained minimum design strength. Cure barricade pavement section for minimum 72 hours before use. Do not open pavement to traffic until concrete is at least 10 days old. Pavement may be open to traffic earlier provided Contractor pays for testing and additional specimen once 7 day specified strength is obtained. Pavement may be opened when high early strength concrete is used meeting specified 72 hour strength.
 - B. High early strength concrete may be used to provide access at driveways, street intersections, esplanades and other locations approved by Project Manager.
 - C. On those sections of pavement to be opened to traffic, seal joints, clean pavement, and place earth against pavement edges before permitting use by traffic. Opening of pavement to traffic shall not relieve responsibility for Work.
 - D. Maintain concrete paving in good condition until completion of Work.
 - E. Repair defects by replacing concrete to full depth.

END OF SECTION

SECTION 02752

CONCRETE PAVEMENT JOINTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Joints for concrete paving; concrete sidewalks, concrete driveways, curbs, and curb and gutters.
- B. Saw-cutting existing concrete or asphalt pavements for new joints.

1.02 RELATED SECTIONS

- A. Section 01270 – Measurement and Payment
- B. Section 01330 – Submittal Procedures

1.03 MEASUREMENT AND PAYMENT

- A. Unit Prices.
 - 1. Payment for street pavement expansion joints, with or without load transfer, is on linear foot basis.
 - 2. Payment for horizontal dowels is on a unit price basis for each horizontal dowel.
 - 3. No separate payment will be made for formed or sawed street pavement contraction joints and longitudinal weakened plane joints. Include payment in unit price for Concrete Paving.
 - 4. No separate payment will be made for joints for Curb, Curb and Gutter, Saw-tooth Curb, Concrete Sidewalks, and Concrete Driveways. Include payment in unit price for Curb and Gutter, Concrete Sidewalks, and Concrete Driveways.
 - 5. Payment will be made for Preformed Expansion Joints on a linear foot basis only when field conditions require that sidewalk be moved adjacent to existing concrete structure (i.e., street, back of curb, etc.).
 - 6. Refer to Section 01270 - Measurement and Payment for unit price procedures.
- B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.04 REFERENCES

- A. ASTM A 615 - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement. ASTM D 994 - Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type).
- B. ASTM D 1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
- C. ASTM D 6690 - Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements.
- D. TxDOT Tex-525-C - Tests for Asphalt and Concrete Joint Sealers

1.05 SUBMITTALS

- A. Conform to requirements of Section 01330 - Submittal Procedures.
- B. Submit product data for joint sealing compound and proposed sealing equipment for approval.
- C. Submit samples of dowel cup, metal supports, and deformed metal strip for approval. Submit manufacturer's recommendation for placing sealant(s).

PART 2 PRODUCTS

2.01 BOARD EXPANSION JOINT MATERIAL

- A. Filler board of selected stock. Use wood of density and type as follows:
 - 1. Construction heart cypress weighing no more than 40 pounds per cubic foot, after being oven dried to constant weight.
 - 2. Construction heart redwood weighing no more than 30 pounds per cubic foot, after being oven dried to constant weight.

2.02 PREFORMED EXPANSION JOINT MATERIAL

- A. Bituminous fiber and bituminous mastic composition material conforming to ASTM D 994 and ASTM D 1751.

2.03 JOINT SEALING COMPOUND

- A. Conform joint sealants to one of sealant classes described in this section.
- B. Conform hot-poured rubber-asphalt compound to ASTM D 6690.
- C. Two-component Synthetic Polymer.

1. Curing is to be by polymerization and not by evaporation of solvent or fluxing of harder particles.
2. Cure sufficiently at average temperature of 25 ± 1 C (77 ± 2 F) so as not to pick up under wheels of traffic in maximum three hours.
3. Performance requirements, when tested in accordance with TxDOT Tex-525-C, shall meet above curing times and requirements as follows:

Cold-Extruded and Cold-Pourable (Self-Leveling) Specifications	
Property	Requirement
Penetration, 25°C (77°F) 150 g Cone, 5 s, 0.1 mm (in.), maximum	130
Bond and Extension 50%, -29°C (-20°F), 3 cycles*: <ul style="list-style-type: none"> • Dry Concrete Block • Steel blocks (Primed, if recommended by manufacturer) • Steel blocks shall be used when armor joints are specified 	Pass Pass
Flow at 70°C (158°F)	None
Water content % by mass, maximum	5.0
Resilience: <ul style="list-style-type: none"> • Original sample, % min. (cured) • Oven-aged at 70°C (158°F), % min. 	50 50
Cold-extruded material only - Cold Flow (10 minutes)	None

* After bond and extension test, there shall be no evidence of cracking, separation or other opening that is over 3 millimeters (1/8-inch) deep in sealer or between sealer and test blocks.

4. Provide cold-extruded type for vertical or sloping joints.
 5. Provide self-leveling type for horizontal joints.
- D. Self-Leveling, Low Modulus Silicone or Polyurethane Sealant for Asphaltic Concrete and Portland Cement Concrete Joints. This shall be a single component self-leveling silicone or polyurethane material that is compatible with both asphalt and concrete pavements. The sealer shall not require a primer for bond; a backer rod shall be required which is compatible with the sealant; no reaction shall occur between rod and sealant.
1. When tested in accordance with TxDOT Tex-525-C, self-leveling sealant shall meet following requirements:

Self-Leveling, Low Modulus Silicone or Polyurethane Sealant	
Property	Requirements
Tack Free Time, 25 ± 1°C (77 ± 2°F), minutes	120 maximum
Nonvolatile content, % by mass	93 minimum
Tensile Strength and 24 Hour Extension Test: * Initial, 10-day cure, 25 ± 1°C (77 ± 2°F), kPa (psi) * After Water Immersion, kPa (psi) * After Heat Aging, kPa (psi) * After Cycling, -29°C (-20°F), 50%, 3 cycles, kPa (psi) * 24 Hour Extension	* 21 to 69 (3 to 10) * 21 to 69 (3 to 10) * 21 to 69 (3 to 10) * 21 to 69 (3 to 10) * Pass (All Specimens) After 24 hours, there shall be no evidence of cracking, separation or other opening that is over 3 mm (1/8 in.) deep at any point in the sealer or between the sealer and test blocks.

2.04 LOAD TRANSMISSION DEVICES

- A. Smooth, steel dowel bars conforming to ASTM A 615, Grade 60. When indicated on Drawings, encase one end of dowel bar in approved cap having inside diameter 1/16-inch greater than diameter of dowel bar.
- B. Deformed steel tie bars conforming to ASTM A 615, Grade 60.

2.05 SUPPORTS FOR REINFORCING STEEL AND JOINT ASSEMBLY

- A. Employ supports of approved shape and size that will secure reinforcing steel and joint assembly in correct position during placing and finishing of concrete. Space supports as directed by Project Manager.

PART 3 EXECUTION

3.01 PLACEMENT

- A. When new Work is adjacent to existing concrete, place joints at same location as existing joints in adjacent pavement.
- B. If limit of removal of existing concrete or asphalt pavement does not fall on existing joint, saw cut existing pavement minimum of 2-inches deep to provide straight, smooth joint surface without chipping, spalling or cracks.

3.02 CONSTRUCTION JOINTS

- A. Place transverse construction joint wherever concrete placement must be stopped for more than 30 minutes. Place longitudinal construction joints at interior edges of pavement lanes using No. 6 deformed tie bars, 30-inches long and spaced 18-inches on centers.

3.03 EXPANSION JOINTS

- A. Place 3/4-inch expansion joints at radius points of curb returns for cross street intersections, or as located in adjacent pavement but no further than 80 feet apart. Use no boards shorter than 6 feet. When pavement is 24 feet or narrower, use not more than 2 lengths of board. Secure pieces to form straight joint. Shape board filler accurately to cross section of concrete slab. Use load transmission devices of type and size shown on Drawings unless otherwise specified or shown as "No Load Transfer Device." Seal with joint sealing compound.

3.04 CONTRACTION JOINTS

- A. Place contraction joints at same locations as in adjacent pavement or at spaces indicated on Drawings. Place smoothed, painted and oiled dowels accurately and normal to joint. Seal groove with joint sealing compound.

3.05 LONGITUDINAL WEAKENED PLANE JOINTS

- A. Place longitudinal weakened plane joints at spaces indicated on Drawings. If more than 15 feet in width is poured, longitudinal joint must be saw cut. Seal groove with joint sealing compound.

3.06 SAWED JOINTS

- A. Use sawed joints as alternate to contraction and weakened plane joints. Use circular cutter capable of cutting straight line groove minimum of 1/4-inch wide. Maintain depth of one quarter of pavement thickness. Commence sawing as soon as concrete has hardened sufficiently to permit cutting without chipping, spalling or tearing and prior to initiation of cracks. Once sawing has commenced, continue until completed. Make saw cut with one pass. Complete sawing within 24 hours of concrete placement. Saw joints at required spacing consecutively in sequence of concrete placement.
- B. Concrete Saw: Provide sawing equipment adequate in power to complete sawing to required dimensions and within required time. Maintain ample supply of saw blades at work site during sawing operations. Maintain sawing equipment on job during concrete placement.

3.07 TRANSVERSE WEAKENED PLANE JOINTS

- A. Saw cut transverse contraction joints every 20-feet (nominally) in the pavement, but no greater than 20-feet between saw cuts. The spacing of the saw cuts shall be at regular intervals between expansion joints. The width of the saw cuts shall be a minimum of ¼-inch wide, and the depth of the saw cuts shall be one-quarter of the pavement thickness. Commence saw cutting as soon as concrete has hardened sufficiently to allow saw cutting without damage to the pavement (affecting finish, chipping, spalling, tearing, etc.) and within 24 hours after concrete placement, but prior to initiation of cracks. Once sawing has commenced on a cut, continue until the cut is completed. Make each saw cut with one pass. Make saw cuts at required spacing consecutively in sequence of concrete placement. Seal the saw cuts (grooves) with joint sealing compound. The goal of the transverse saw cutting is to create weakened joints that will prevent random, non-linear, surface contraction cracking.
- B. The dimension D/3 (but no less than 3-inches) on City of Houston Standard Drawing Number 02751-01 is measured from the bottom of the concrete slab.
- C. Equipment requirements shall be in accordance with paragraph 3.06.B.

3.08 JOINTS FOR CURB, CURB AND GUTTER

- A. Place ¾-inch preformed expansion joints through curb and gutters at locations of expansion and contraction joints in pavement, at end of radius returns at street intersections and driveways, and at curb inlets. Maximum spacing shall be 120-foot centers.

3.09 JOINTS FOR CONCRETE SIDEWALKS

- A. Provide ¾-inch expansion joints conforming to ASTM A 1751 along and across sidewalk at back of curbs, at intersections with driveways, steps, and walls; and across walk at intervals not to exceed 36 feet. Provide expansion joint material conforming to ASTM D 994 for small radius curves and around fire hydrants and utility poles. Extend expansion joint material full depth of slab.

3.10 JOINTS FOR CONCRETE DRIVEWAYS

- A. Provide ¾-inch expansion joints conforming to ASTM D 1751 across driveway in line with street face of sidewalks, at existing concrete driveways, and along intersections with sidewalks and other structures. Extend expansion joint material full depth of slab.

3.11 JOINT SEALING

- A. Seal joints only when surface and joints are dry, ambient temperature is above 50 degrees F and less than 85 degrees F and weather is not foggy or rainy.

- B. Use joint sealing equipment in like new working condition throughout joint sealing operation, and be approved by Project Manager. Use concrete grooving machine or power-operated wire brush and other equipment such as plow, brooms, brushes, blowers or hydro or abrasive cleaning as required to produce satisfactory joints.
- C. Clean joints of loose scale, dirt, dust and curing compound. The term joint includes wide joint spaces, expansion joints, dummy groove joints or cracks, either preformed or natural. Remove loose material from concrete surfaces adjacent to joints.
- D. Fill joints neatly with joint sealer to depth shown. Pour sufficient joint sealer into joints so that, upon completion, surface of sealer within joint will be 1/4-inch above level of adjacent surface or at elevation as directed.

3.12 PROTECTION

- A. Maintain joints in good condition until completion of Work.
- B. Replace damaged joints material with new material as required by this Section.

END OF SECTION

SECTION 02753

CONCRETE PAVEMENT CURING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Curing of Portland cement concrete paving.

1.02 RELATED SECTIONS

- A. Section 01270 – Measurement and Payment
- B. Section 01330 – Submittal Procedures

1.03 MEASUREMENT AND PAYMENT

- A. Unit Prices.
 - 1. No separate payment will be made for concrete curing under this Section. Include payment in unit price for Concrete Paving, Concrete Sidewalks, Concrete Driveways, Curbs, and Curb and Gutters.
 - 2. Refer to Section 01270 - Measurement and Payment for unit price procedures.
- B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

1.04 REFERENCES

- A. ASTM C 156 - Standard Test Method for Water Loss [from a Mortar Specimen] Through Liquid Membrane-Forming Curing Compounds for Concrete.
- B. ASTM C 171 - Standard Specifications for Sheet Materials for Curing Concrete.
- C. ASTM C 309 - Standard Specifications for Liquid Membrane-Forming Compounds for Curing Concrete.

1.05 SUBMITTALS

- A. Conform to requirements of Section 01330 - Submittal Procedures.
- B. Submit manufacturer's product data for cover materials and liquid membrane-forming compounds.

PART 2 PRODUCTS

2.01 COVER MATERIALS FOR CURING

- A. Conform curing materials to one of the following:
1. Polyethylene Film: Opaque pigmented white film conforming to requirements of ASTM C 171.
 2. Waterproofed Paper: Paper conforming to requirements of ASTM C 171.
 3. Cotton Mats: Single layer of cotton filler completely enclosed in cover of cotton cloth. Mats shall contain not less than 3/4 of a pound of uniformly distributed cotton filler per square yard of mat. Cotton cloth used for covering materials shall weigh not less than 6 ounces per square yard. Stitch mats so that mat will contact surface of pavement at all points when saturated with water.

2.02 LIQUID MEMBRANE-FORMING COMPOUNDS

- A. Conform liquid membrane-forming compounds to ASTM C 309. Membrane shall restrict loss of water to not more than 0.55 kg/m² in 72 hours using test method ASTM C 156.

PART 3 EXECUTION

3.01 CURING REQUIREMENT

- A. Cure concrete pavement by protecting against loss of moisture for period of not less than 72 hours immediately upon completion of finishing operations. Do not use membrane curing for concrete pavement to be overlaid by asphalt concrete.
- B. Failure to provide sufficient cover material shall be cause for immediate suspension of concreting operations.

3.02 POLYETHYLENE FILM CURING

- A. Immediately after finishing surface, and after concrete has taken its initial set, apply water in form of fine spray. Cover surface with polyethylene film so film will remain in direct contact with surface during specified curing period.
- B. Cover entire surface and both edges of pavement slab. Overlap joints in film sheets minimum of 12 inches. Immediately repair tears or holes occurring during curing period by placing acceptable moisture-proof patches or replacing.

3.03 WATERPROOFED PAPER CURING

- A. Immediately after finishing surface, and after concrete has taken its initial set, apply water in form of fine spray. Cover surface with waterproofed paper so paper will remain in direct contact with surface during specified curing period.

- B. Prepare waterproofed paper to form blankets of sufficient width to cover entire surface and both edges of pavement slab, and not be more than 60 feet in length. Overlap joints in blankets caused by joining paper sheets not less than 5 inches and securely seal with asphalt cement having melting point of approximately 180 degrees F. Place blankets to secure overlap of at least 12 inches. Immediately repair tears or holes appearing in paper during curing period by cementing patches over defects.

3.04 COTTON MAT CURING

- A. Immediately after finishing surface, and after concrete has taken its initial set, completely cover surface with cotton mats, thoroughly saturated before application, maintaining contact with surface of pavement equally at all points.
- B. Keep mats on pavement for specified curing period. Keep mats saturated so that, when lightly compressed, water will drip freely from them. Keep banked earth or cotton mat covering edges saturated.

3.05 LIQUID MEMBRANE-FORMING COMPOUNDS

- A. Immediately after free surface moisture, and after concrete has dispersed, apply liquid membrane-forming compound in accordance with manufacturer's instructions.
- B. Moisten concrete by water fogging prior to application of membrane when surface has become dry.
- C. Seal concrete surface with single coat at rate of coverage recommended by manufacturer and directed by Project Manager, but not less than one gallon per 200 square feet of surface area.

3.06 TESTING MEMBRANE

- A. Treated areas will be visually inspected for areas of lighter color of dry concrete as compared to dump concrete. Test suspected areas by placing few drops of water on surface. Membrane passes test when water stands in rounded beads or small pools which can be blown along surface of concrete without wetting surface.
- B. Reapply membrane compound immediately at no cost to City when membrane fails above test.

END OF SECTION

SECTION 02754

CONCRETE DRIVEWAYS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Portland cement concrete driveways.

1.02 RELATED SECTIONS

- A. Section 01270 – Measurement and Payment
- B. Section 02336 – Lime Stabilized Subgrade
- C. Section 02337 – Lime/Fly Ash Stabilized Subgrade
- D. Section 02338 – Portland Cement Stabilized Subgrade
- E. Section 02751 – Concrete Paving
- F. Section 02752 – Concrete Pavement Joints
- G. Section 02753 – Concrete Pavement Curing

1.03 MEASUREMENT AND PAYMENT

- A. Unit Prices.
 - 1. Payment for concrete driveways is on square foot basis, including excavation.
 - 2. No payment will be made for work in areas where driveway has been removed or replaced for Contractor's convenience.
 - 3. Refer to Section 01270 - Measurement and Payment for unit price procedures.
- B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Concrete: Conform to material and proportion requirements for concrete of Section 02751 - Concrete Paving.

- B. Reinforcing Steel: Conform to material requirements for reinforcing steel of Section 02751 - Concrete Paving.
- C. Preformed Expansion Joint Material: Conform to material requirements for preformed expansion joint material of Section 02752 - Concrete Pavement Joints.
- D. Expansion Joint Filler: Conform to material requirements for expansion joint material of Section 02752 - Concrete Pavement Joints.
- E. Subgrade Materials: Conform to subgrade material requirements of Section 02336 - Lime Stabilized Subgrade, Section 02337 - Lime/Fly-Ash Stabilized Subgrade, or Section 02338 - Portland Cement Stabilized Subgrade.

PART 3 EXECUTION

3.01 PREPARATION

- A. Prepare subgrade in accordance with applicable portions of Section 02336 - Lime Stabilized Subgrade, Section 02337 - Lime/Fly-Ash Stabilized Subgrade, and Section 02338 - Portland Cement Stabilized Subgrade.

3.02 PLACEMENT

- A. Place and finish concrete in accordance with applicable portions of Section 02751 - Concrete Paving.

3.03 JOINTS

- A. Install joints in concrete driveway in accordance with Section 02752 - Concrete Pavement Joints.

3.04 CONCRETE CURING

- A. Cure concrete driveway in accordance with Section 02753 - Concrete Pavement Curing.

3.05 PROTECTION

- A. Conform to applicable requirements of Section 02753 - Concrete Pavement Curing.

END OF SECTION

SECTION 02767

THERMOPLASTIC PAVEMENT MARKINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. This item includes the application of thermoplastic pavement markings, in conformance with the minimum optical and physical properties required for a thermoplastic road marking compound described herein, in a molten state, onto a pavement surface.

1.02 RELATED SECTIONS

- A. Section 01270 – Measure and Payment
- B. Section 02762 - Blast Cleaning of Pavement

1.03 MEASUREMENT AND PAYMENT

A. Unit Prices

1. Payment for thermoplastic pavement markings is on a linear foot basis.
2. Payment for words and symbols is for each word or symbol.
3. Payment for green colored pavement markings is on a square foot basis.
4. Payment for railroad crossing markings, to include stop line and two transverse lines, is for each crossing marked. For multi-lane approaches to railroad crossings, the solid 8-inch lines will be measured in linear feet, complete in place.
5. Unit price bid for each item shall be full compensation for materials, application of pavement markings, equipment, labor, tools, and incidentals necessary to complete Work in accordance with the plans and specifications.
6. Refer to Section 01270 – Measure and Payment for unit price procedures.

- B. Stipulated Price (Lump Sum). When Contract is Stipulated Price Contract, payment for work in the Section is included in total Stipulated Price.

1.04 REFERENCES

- A. FHWA memorandum dated 4/15/2011: "Interim Approval for Optimal Use of Green Colored Pavement for Bike Lanes (IA-14)"
- B. TxDOT DMS-8220 "Hot Applied Thermoplastic".

- C. Texas Manual on Uniform Traffic Control Devices.

1.05 QUALITY ASSURANCE

- A. Acceptance.

1. Sampling Procedure. Random samples may be taken at the job site at the discretion of the City Traffic Engineer for quality assurance. The City reserves the right to conduct the tests deemed necessary to identify component materials and verify results of specific tests indicated in conjunction with the specification requirements.
2. The sample(s) shall be labeled as to the shipment number, lot number, date, quantity, and any other pertinent information. At least three randomly selected bags shall be obtained from each lot. A 10 pound) sample from the three bags shall be submitted for testing and acceptance. The lot size shall be approximately 44,000 pounds unless the total order is less than this amount.

- B. Notification.

1. The contractor shall notify the Construction Inspector 72 hours prior to the placement of the thermoplastic markings to enable the inspector to be present during the application operation. At the time of notification, the Contractor shall indicate the manufacturer and the lot numbers of the thermoplastic that will be used.
2. A check should be made by the contractor to ensure that the approved lot numbers appear on the material package. Failure to do so is cause for rejection.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Packaging.

1. Containers. The thermoplastic material shall be delivered in 50 pound containers or bags of sufficient strength to permit normal handling during shipment and handling on the job without loss of material.
2. Labeling. Each container shall be clearly marked to indicate the color of the material, the process batch number and/or manufacturer's formulation number, the manufacturer's name and address and the date of manufacture.

1.07 WARRANTY

- A. Warranty or Guarantee. If the normal trade practice for manufacturers is to furnish warranties or guarantees for the materials and equipment specified herein, the Contractor shall turn the guarantees and warranties over to the Engineer for potential dealing with the manufacturers. The extent of such warranties or guarantees will not be a factor in selecting the successful bidder.

PART 2 PRODUCTS

2.01 MATERIALS

- A. All materials shall conform to the requirements of TxDOT DMS-8220 "Hot Applied Thermoplastic." Thermoplastic materials shall be stored in a dry environment to minimize the amount of moisture retained during storage.
- B. Materials used for green colored pavement (bicycle green) shall be manufactured with appropriate pigment to ensure that the resulting colors comply with the Light Green color as specified in the FHWA memorandum dated 4/15/2011: "Interim Approval for Optimal Use of Green Colored Pavement for Bike Lanes (IA-14)". Green colored pavement to be defined as transverse markings.

2.02 SOURCE QUALITY CONTROL

- A. Manufacturer's Responsibility.
 - 1. Sampling and Testing. The manufacturer shall submit test results from an approved independent laboratory. All material samples shall be obtained 20 days in advance of the pavement marking operations. The cost of testing shall be included in the price of thermoplastic material. The approved independent laboratory's test results shall be submitted to the City Traffic Engineer in the form of a certified test report.
 - 2. Bill of Lading. The manufacturer shall furnish the Material and Tests Laboratory with copies of Bills of Lading for all materials inspected. Bill of lading shall indicate the consignee and the destination, date of shipment, lot numbers, quantity, type of material, and location of source.
 - 3. Material Acceptance. Final acceptance of a particular lot of thermoplastic will be based on the following.
 - a. Compliance with the specification for material composition requirements verified by approved independent laboratory with tests results.
 - b. Compliance with the specification for the physical properties required and verified by an approved independent laboratory with test results.
 - c. Manufacturer's test results for each lot thermoplastic have been received.
 - d. Identification requirements are satisfactory.

PART 3 EXECUTION

3.01 EQUIPMENT

- A. Provide the necessary equipment to conduct the work specified herein. All equipment shall be maintained in good working order such that neat and clean thermoplastic markings are applied at the proper thicknesses and glass beads are placed at the correct rate. Equipment that is deemed deficient by the Engineer shall be replaced immediately.

3.02 CONSTRUCTION

- A. The appearance of the finished markings shall have a uniform surface, crisp edges with a minimum over-spray, clean cut-off, meet straightness requirements and conform to the design drawings and/or engineer instructions.
- B. The contractor shall provide the Engineer with certification from the marking manufacturer that contractor has been adequately trained and certified to apply the manufacturer's material. This certification shall be considered current if the certification date provided by the manufacturer is within two years of the date of marking application.
- C. All striping and pavement markings shall be placed in accordance with the requirements of this specification, the detailed plans, and the current edition of the Texas Manual on Uniform Traffic Control Devices (TMUTCD). The Contractor shall provide all other engineering services necessary for pre-marking of all proposed stripe within the limits of the designated work.
- D. Unless authorized otherwise in writing by the Engineer, striping shall be accomplished during daylight hours. Approved lighting arrangements will be required for night time operations when allowed. The Contractor may be required to place markings over existing markings, as determined by the Engineer. The Contractor shall adjust the operation of the thermoplastic screed shoe to match the previous lengths of stripes and skips, when necessary.
- E. Failure of the striping material to adhere to the pavement surface during the life of the contract shall be prima facie evidence that the materials, even though complying with these specifications, or the application thereof, was inconsistent with the intent of the requirements for the work under the latest City specifications and shall be cause for ordering corrective action or replacement of the marking without additional cost to the City.
- F. Unless otherwise approved by the Engineer, permanent pavement markings on newly constructed pavements surfaced with asphaltic concrete or bituminous seals shall not be applied for a minimum of 14 days or a maximum 35 days. Temporary pavement marking shall be provided during the 14 to 35-day period.
- G. Surface Preparation.

1. **Moisture.** All surfaces shall be inspected for moisture content prior to application of thermoplastic. Approximately two square feet of a clear plastic or tar paper shall be laid on the road surface and held in place for 15 to 20 minutes. The underside of the plastic or tar paper shall then be inspected for a buildup of condensed moisture from the road surface. Pavement is considered dry if there is no condensation on the underside of the plastic or tarpaper. In the event of moisture, this test shall be repeated until there is no moisture on the underside of the plastic or tar paper.
2. **Cleaning.** All surfaces shall be clean and dry, before thermoplastic can be applied. Loose dirt and debris shall be removed by thoroughly blowing compressed air over the area to be striped. If the thermoplastic is to be applied over existing paint lines, the paint line shall be swept with a mechanical sweeper or wire brush to remove poorly adhered paint and dirt that would interfere with the proper bonding of the thermoplastic. Additional cleaning through the use of compressed air may be required to remove embedded dirt and debris after sweeping. Latence and curing compound shall be removed from all new Portland cement concrete surfaces in accordance with Section 02762, "Blast Cleaning of Pavement."
3. **Layout.** The pavement markings shall be placed in proper alignment with guidelines established on the roadway. Deviation from the alignment established shall not exceed 2 inches and, in addition, the deviation in alignment of the marking being placed shall not exceed 1 inch per 200 feet of roadway nor shall any deviation be abrupt.
 - a. No striping material shall be applied over a guide cord; only longitudinal joints, existing stripes, primer, or other approved type guides will be permitted. In the absence of a longitudinal joint or existing stripe, the Contractor shall mark the points necessary for the placing of the proposed stripe. Edge striping shall be adjusted as necessary so that the edge stripe will be parallel to the centerline and shall not be placed off the edge of the pavement.
 - b. Longitudinal markings shall be offset at least 2-inches from construction joints of Portland cement concrete surfaces and joints and shoulder breaks of asphalt surfaces.
4. **Primer Sealer.** Primer sealer shall be used on all Portland cement concrete surfaces. A primer sealer shall be used on asphalt surfaces that are over two years old and/or on asphalt surfaces that are worn or oxidized to a condition where 50 percent or more of the wearing surface is exposed aggregate. Existing pavement markings may act as the primer sealer if, after cleaning, more than 70 percent of the existing pavement marking is still properly bonded to the asphalt surface.

5. Primer Sealer Application. When required as described, the primer-sealer shall be applied to the road surface in a continuous film at a minimum thickness of 3 to 5 mils. Before the Thermoplastic is applied, the primer-sealer shall be allowed to dry to a tacky state. The thermoplastic shall be applied within 4 hours after the primer application.
- H. Temperature Requirements.
1. Ambient Conditions. The ambient air and road surface shall be 55°F and rising before application of thermoplastic can begin.
 2. Material Requirements. Unless otherwise specified by the material manufacturer, the thermoplastic compound shall be heated from 400°F to 450°F and shall be a minimum of 400°F as it makes contact with road surface during application. An infrared temperature gun shall be used to determine the temperature of the thermoplastic as it is being applied to the road surface.
- I. Drop-on Glass Sphere Application.
1. Application Rate. Retro-reflective glass spheres shall be applied at the rate of 10 pounds per 100 square feet of applied markings. This application rate shall be determined by confirming the following consumption rates:
 - a. 200 pounds of drop on glass spheres per ton of applied thermoplastic when the thermoplastic is being applied at 0.090 inch film thickness.
 - b. 150 pounds of drop on glass spheres per ton of applied thermoplastic when the thermoplastic is being applied at 0.125 inch thickness.
 2. Application Method. Retro-reflective glass spheres shall be applied by a mechanical dispenser properly calibrated and adjusted to provide proper application rates and uniform distribution of the spheres across the cross section of the entire width of the line. To enable the spheres to embed themselves into the hot thermoplastic, the sphere dispenser shall be positioned immediately behind the thermoplastic application device. This insures that the spheres are applied to the thermoplastic material while it is still in the molten state.
- J. Application Thickness.

1. Longitudinal and Transverse Markings. On previously unmarked pavements or pavements where markings have been effectively removed, all lane lines, center lines, transverse markings and pavement markings in traffic areas with :S 1 ,000 vehicles per day per lane shall have a minimum film thickness of 0.090 inch at the edges and a maximum of 0.145 inch at the center. A minimum average film thickness of 0.090 inch shall be maintained. On pavements with existing markings, meeting the traffic requirements stated above, all lane lines, center lines, transverse markings and pavement markings shall have a minimum film thickness of 0.060 inch for re-application over existing strip line.

2. High Wear Longitudinal and Transverse Marking. On previously unmarked pavements or pavements where markings have been effectively removed, all lane lines, center lines, transverse markings and pavement markings in high traffic areas (>1,000 vehicles per day per lane) shall have a minimum film thickness of 0.125 inch at the edges and a maximum of 0.188 inch at the center. A minimum average film thickness of 0.125 inch shall be maintained. On pavements with existing markings, meeting the traffic requirements stated above, all lane lines, center lines, transverse markings and pavement markings shall have a minimum film thickness of 0.090 inch for re-application over existing strip line.

END OF SECTION

SECTION 02771

CURB, CURB AND GUTTER, AND HEADERS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Reinforced concrete curb, reinforced monolithic concrete curb and gutter, and mountable curb.
- B. Paving headers and railroad headers poured monolithically with concrete base or pavement.

1.02 RELATED SECTIONS

- A. Section 01270 – Measurement and Payment
- B. Section 01330 – Submittal Procedures
- C. Section 02751 – Concrete Paving
- D. Section 02752 – Concrete Pavement Joints
- E. Section 02753 – Concrete Pavement Curing

1.03 MEASUREMENT AND PAYMENT

- A. Unit Prices.
 - 1. Payment for curbs, curbs and gutter, and esplanade curbs is on linear foot basis measured along face of curb.
 - 2. Payment for 3-foot concrete valley gutter is on a linear foot basis.
 - 3. Payment for mountable concrete curbs is on a square foot basis.
 - 4. Payment for concrete paving headers and concrete railroad headers is on a linear foot basis.
 - 5. Payment for headers is on linear foot basis measured between lips of gutters adjacent to concrete base and measured between backs of curbs adjacent to concrete pavement.
 - 6. Refer to Section 01270 - Measurement and Payment for unit price procedures.
- B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.04 SUBMITTALS

- A. Conform to requirements of Section 01330 - Submittal Procedures.
- B. Submit details of proposed form work for approval.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Concrete: Conform to material and proportion requirements for concrete of Section 02751 - Concrete Paving.
- B. Reinforcing Steel: Conform to material requirements for welded wire fabric of Section 02751 - Concrete Paving.
- C. Grout: Nonmetallic, non-shrink grout containing no chloride producing agents conforming to following requirements.
 - 1. Compressive strength
 - a. at 7 days: 3500 psi
 - b. at 28 days: 8000 psi
 - 2. Initial set time: 45 minutes
 - 3. Final set time: 1.5 hours
- D. Preformed Expansion Joint Material: Conform to material requirements for preformed expansion joint material of Section 02752 - Concrete Pavement Joints.
- E. Expansion Joint Filler: Conform to material requirements for expansion joint filler of Section 02752 - Concrete Pavement Joints.
- F. Mortar: Mortar finish composed of one part Portland cement and 1 1/2 parts of fine aggregate. Use only when approved by Project Manager.

PART 3 EXECUTION

3.01 PREPARATION

- A. Prepare subgrade in accordance with applicable portions of sections on excavation and fill, embankment, and subgrade and roadbed.

3.02 PLACEMENT

- A. Guideline: Set to follow top line of curb. Attach indicator to provide constant comparison between top of curb and guideline. Ensure flow lines for monolithic curb and gutters conform to slopes indicated on Drawings.
- B. Forms: Brace to maintain position during pour. Use metal templates cut to section shown on Drawings.
- C. Reinforcement: Secure in position so that steel will remain in place throughout placement. Reinforcing steel shall remain at approximate center of base or pavement as indicated on Drawings.
- D. Joints: Place in accordance with Section 02752 - Concrete Pavement Joints. Place dummy groove joints at to match concrete pavement joints at right angles to curb lines. Cut dummy grooves 1/4-inch deep using approved edging tool.
- E. Place concrete in forms to required depth. Consolidate thoroughly. Do not permit rock pockets in form. Entirely cover top surfaces with mortar.

3.03 MANUAL FINISHING

- A. After concrete is in place, remove front curb forms. Form exposed portions of curb, and of curb and gutter, using mule which conforms to curb shape, as shown on Drawings.
- B. Thin coat of mortar may be worked into exposed face of curb using mule and two-handed wooden darby at least 3 feet long.
- C. Before applying final finish move 10 foot straightedge across gutter and up curb to back form of curb. Repeat until curb and gutter are true to grade and section. Lap straightedge every 5 feet.
- D. Steel trowel finish surfaces to smooth, even finish. Make face of finished curb true and straight.
- E. Edge outer edge of gutter with 1/4-inch edger. Finish edges with tool having 1/4 inch radius.
- F. Finish visible surfaces and edges of finished curb and gutter free from blemishes, form marks and tool marks. Finished curb or curb and gutter shall have uniform color, shape and appearance.

3.04 MECHANICAL FINISHING

- A. Mechanical curb forming and finishing machines may be used instead of, or in conjunction with, previously described methods, when approved by Project Manager. Use of mechanical methods shall provide specified curb design and finish.

3.05 CURING

- A. Immediately after finishing operations, cure exposed surfaces of curbs and gutters in accordance with Section 02753 - Concrete Pavement Curing.

3.06 TOLERANCES

- A. Top surfaces of curb and gutter shall have uniform width and shall be free from humps, sags or other irregularities. Surfaces of curb top, curb face and gutter shall not vary more than 1/8 inch from edge of straightedge laid along them, except at grade changes.

3.07 PROTECTION

- A. Maintain curbs and gutters in good condition until completion of Work.
- B. Replace damaged curbs and gutters to comply with this Section.

END OF SECTION

SECTION 02775

CONCRETE SIDEWALKS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Reinforced concrete sidewalks.
- B. Wheelchair ramps and curb ramps.

1.02 RELATED SECTIONS

- A. Section 01270 – Measurement and Payment
- B. Section 01330 – Submittal Procedures
- C. Section 01454 – Testing Laboratory Services
- D. Section 01576 – Waste Material Disposal
- E. Section 02233 – Clearing and Grubbing
- F. Section 02320 – Utility Backfill Materials
- G. Section 02336 – Lime Stabilized Subgrade
- H. Section 02751 – Concrete Paving
- I. Section 02752 – Concrete Pavement Joints
- J. Section 02753 – Concrete Pavement Curing
- K. Section 02761 – Colored Concrete for Medians and Sidewalks
- L. Section 02922 – Sodding
- M. Section 02951 – Pavement Repair and Restoration

1.03 MEASUREMENT AND PAYMENT

- A. Unit Prices.
 - 1. Payment for concrete sidewalks is on square foot basis.
 - 2. No payment will be made for work outside these limits or in areas where driveway has been removed or replaced for Contractor's convenience.

3. Payment for wheelchair ramps and curb ramps of each type specified is on square foot basis. Staining of wheelchair ramps and curb ramps is included in cost of ramp.
 4. Removal and replacement of existing sidewalk, curb or curb and gutter and saw-cutting is paid by unit cost for each item. Sodding will be paid one foot on each side of sidewalk unless otherwise noted.
 5. Refer to Section 01270 - Measurement and Payment for unit price procedures.
- B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.04 REFERENCES

- A. ASTM C 31 - Standard Practice for Making and Curing Concrete Test Specimens in Field.
- B. ASTM C 39 - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
- C. ASTM C 42 - Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
- D. ASTM C 138 - Standard Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete
- E. ASTM C 143 - Standard Test Method for Slump of Hydraulic Cement Concrete.
- F. ASTM C 172 - Standard Practice for Sampling Freshly Mixed Concrete.
- G. ASTM D 698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)).
- H. Texas Accessibility Standards of Architectural Barriers Act, Article 9102, Texas Civil Statutes.

1.05 SUBMITTALS

- A. Conform to requirements of Section 01330 - Submittal Procedures.
- B. Submit certified testing results and certificates of compliance.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Concrete: Conform to material and proportion requirements for concrete of Section 02751 - Concrete Paving.

- B. Reinforcing Steel: Conform to material requirements of Section 02751 - Concrete Paving for reinforcing steel. Use No. 3 reinforcing bars.
- C. Preformed Expansion Joint Material: Conform to material requirements for preformed expansion joint material of Section 02752 - Concrete Pavement Joints.
- D. Expansion Joint Filler: Conform to material requirements for expansion joint material of Section 02752 - Concrete Pavement Joints.
- E. Forms: Use straight, unwarped wood or metal forms with nominal depth equal to or greater than proposed sidewalk thickness. The use of 2 inch by 4 inch lumber as forms will not be allowed.
- F. Sand Bed: Conform to material requirements for bank run sand of Section 02320 - Utility Backfill Materials.
- G. Sodding: Conform to material requirements for sodding of Section 02922 - Sodding.

PART 3 EXECUTION

3.01 REPLACEMENT

- A. Replace sidewalks and slope paving which are removed or damaged during construction with thickness and width equivalent to one removed or damaged, unless otherwise shown on Drawings. Finish surface (exposed aggregate, brick pavers, etc.) to match existing sidewalk.
- B. Provide replaced and new sidewalks with wheelchair ramps when sidewalk intersects curb at street or driveway.

3.02 PREPARATION

- A. Identify and protect utilities which are to remain.
- B. Protect living trees, other plant growth, and features designated to remain.
- C. Conduct clearing and grubbing operations in accordance with Section 02233 - Clearing and Grubbing.
- D. Excavate subgrade 6 inches beyond outside lines of sidewalk. Shape to line, grade and cross section. For soils with plasticity index above 40 percent, stabilize soil with lime in accordance with Section 02336 – Lime-Stabilized Subgrade. Compact subgrade to minimum of 90 percent maximum dry density at optimum to 3 percent above optimum moisture content, as determined by ASTM D 698.
- E. Immediately after subgrade is prepared, cover with compacted sand bed to depth as shown on Drawings. Lay concrete when sand is moist but not saturated.

3.03 PLACEMENT

- A. Setting Forms: Straight, unwarped wood or metal forms with nominal depth equal to or greater than proposed sidewalk thickness. Use of 2 by 4's as forms will not be allowed. Securely stake forms to line and grade. Maintain position during concrete placement.
- B. Reinforcement:
 - 1. Install reinforcing bars.
 - 2. Install reinforcing steel as shown on the drawings. Lay longitudinal bars in walk continuously, except through expansion joints.
 - 3. Use sufficient number of chairs to support reinforcement in manner to maintain reinforcement in center of slab vertically during placement.
 - 4. Drill dowels into existing paving, sidewalk and driveways, secure with epoxy, and provide headers as required.
 - 5. Use sufficient number of chairs for steel reinforcement bars to maintain position of bars within allowable tolerances. Place reinforcement as shown on Drawings. In plane of steel parallel to nearest surface of concrete, bars shall not vary from plan placement by more than 1/12 of spacing between bars. In plane of steel perpendicular to nearest surface of concrete, bars shall not vary from plan placement by more than 1/4 inch.
- C. Expansion Joints: Install expansion joints with load transfer units in accordance with Section 02752 - Concrete Pavement Joints.
- D. Place concrete in forms to specified depth and tamp thoroughly with "jitterbug" tamp, or other acceptable method. Bring mortar to surface.
- E. Strike off to smooth finish with wood strike board. Finish smoothly with wood hand float. Brush across sidewalk lightly with fine-haired brush.
- F. Apply coating to wheelchair ramp with contrasting color in accordance with Section 02761 - Colored Concrete for Medians and Sidewalks.
- G. Unless otherwise indicated on Drawings, mark off sidewalk joints 1/8 inch deep, at spacing equal to width of walk. Use joint tool equal in width to edging tool.
- H. Finish edges with tool having 1/4 inch radius.
- I. After concrete has set sufficiently, refill space along sides of sidewalk to one-inch from top of walk with suitable material. Tamp until firm and solid, place sod as applicable. Dispose of excess material in accordance with Section 01576 - Waste Material Disposal. Repair driveways and parking lots damaged by sidewalk excavation in accordance with Section 02951 - Pavement Repair and Restoration.

3.04 CURING

- A. Conform to requirements of Section 02753 - Concrete Pavement Curing.

3.05 FIELD QUALITY CONTROL

- A. Testing will be performed under provisions of Section 01454 - Testing Laboratory Services.
- B. Compressive Strength Test Specimens: Four test specimens for compressive strength test will be made in accordance with ASTM C 31 for each 30 cubic yards or less of sidewalk that is placed in one day. Two specimens will be tested at 7 days. Remaining two specimens will be tested at 28 days. Specimens will be tested in accordance with ASTM C 39. Minimum compressive strength: 3000 psi at 7 days and 3500 psi at 28 days.
- C. Yield test for cement content per cubic yard of concrete will be made in accordance with ASTM C 138. When cement content is found to be less than that specified per cubic yard, reduce batch weights until amount of cement per cubic yard of concrete conforms to requirements.
- D. If the Contractor places concrete without notifying the laboratory, the City will have the concrete tested by means of core test as specified in ASTM C 42. When concrete does not meet specification, cost of test will be deducted from payment.
- E. Sampling of fresh concrete shall be in accordance with ASTM C 172.
- F. Take slump tests when cylinders are made and when concrete slump appears excessive.
- G. Concrete shall be acceptable when average of two 28 day compression tests is equal to or greater than minimum 28 day strength specified.
- H. If either of two tests on field samples is less than average of two tests by more than 10 percent, that entire test shall be considered erratic and not indicative of concrete strength. Core samples will be required of in-place concrete in question.
- I. If 28 day laboratory test indicates that concrete of low strength has been placed, test concrete in question by taking cores as directed by Project Manager. Take and test at least three representative cores as specified in ASTM C 42 and deduct cost from payment due.

3.06 NONCONFORMING CONCRETE

- A. Remove and replace areas that fail compressive strength tests, with concrete of thickness shown on Drawings.
- B. Replace nonconforming sections at no additional cost to City.

3.07 PROTECTION

- A. Maintain newly place concrete in good condition until completion of Work.
- B. Replace damaged areas.

END OF SECTION

SECTION 02870 - SITE FURNISHINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Seating.
 - 2. Trash receptacles.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples: For each exposed finish.
- C. Material Certificates: For site furnishings, signed by manufacturers.
- D. Maintenance Data.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Refer to equipment list on drawings for all site furnishings, materials, finishes, colors, etc.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine subgrades, finished surfaces and installation conditions. Do not start site furnishings work until unsatisfactory conditions are corrected.

3.2 LOCATION AND INSTALLATION

- A. All locations shall be staked by Contractor and approved by Owner's representative prior to commencement of work. Location shall be as indicated on drawings.
- B. Install site furnishings as per manufacturer's instructions. The manufacturer's instructions shall be considered a part of these Specifications. Installation contractor shall be a contractor approved by manufacturer for installation of manufacturer's equipment.
- C. All areas surrounding locations of site furnishings shall be minimally disturbed. Contractor shall re-grade and repair areas and return site to original condition.

3.3 INSTALLATION

A. Site Furnishings

1. Assemble sections per manufacturer's recommendations.
2. Install level and plumb. Shim as required to obtain an unyielding surface.
3. Touch up all abraded, welded and scratched surfaces with matching rust inhibitive paint supplied by manufacturer.

PART 4 - COMPLETION

4.1 CLEAN-UP

- A. The Contractor shall clean the site daily from trash and debris resulting from construction operations at no additional cost to Owner. All walks, roads and circulation routes shall be kept clean and free from debris, material and equipment.
- B. Upon completion of the work covered by this section, the Contractor shall clean up all areas by removing spoil piles, surplus material and equipment from the site. The ground surface shall be restored to its original condition.

END OF SECTION 02870

SECTION 02924 - SODDING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Sod.
 - 2. Fertilization.

1.2 DEFINITIONS

- A. Finish Grade: Elevation of finished surface of soil.
- B. Manufactured Topsoil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.
- C. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. This includes insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. It also includes substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.
- D. Pests: Living organisms that occur where they are not desired or that cause damage to plants, animals, or people. These include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.
- E. Topsoil shall be friable clay loam surface soil reasonably free of clay lumps, stones, weeds, roots and other objectionable material, a product of on site operations.
- F. Subgrade: Surface or elevation of subsoil remaining after excavation is complete, or top surface of a fill or backfill before planting soil is placed.
- G. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Certification of grass sod.
 - 1. Sod Certification: Certification shall be submitted from the sod nursery as to the grass species, location of the field from which the sod has been stripped and the date of stripping. Certification shall accompany the delivery of the sod.
- C. Fertilizer certification: Certification shall be submitted from the fertilizer manufacturer as to the chemical analysis of the fertilizer, a listing of the elements contained therein and their percentages. Certification shall also indicate that the fertilizer is in accordance with the requirements of the local and state authorities.

1.4 QUALITY ASSURANCE

- A. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.
 - 1. Pesticide Applicator: State licensed, commercial.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Sod Delivery: Sod shall be delivered on pallets with the root system protected from exposure to wind and sun. Stripping and delivery shall be timed so that sod will be placed within 48 hours of stripping.
- B. Fertilizer Delivery: Fertilizer shall be delivered in the manufacturer's unopened containers, labeled to indicate the manufacturer's name and product identification. Containers shall be stored protected from ground contact and from the elements.

1.6 MAINTENANCE SERVICE

- A. Initial Turf Maintenance Service: Provide full maintenance by skilled employees of landscape Installer. Begin maintenance immediately after each area is planted and continue until acceptable turf is established.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Sod shall be nursery grown Common Bermuda sod having a healthy, virile root system of dense, thickly matted roots throughout the soil of the sod for a minimum thickness of 1 inch. Sod shall be free of noxious weeds and undesirable native grasses. Soil attached to the sod shall be free of stones and debris.
- B. Sod shall have been mowed within 7 days of being stripped. Sod shall be provided in rectangular pads of not less than 12 inches nor more than 24 inches. Dry sod will be rejected.
- C. Staples shall be 6 by 1 by 6 inch, 6 inch gauge steel "U" shaped sod samples.
- D. Fertilizer for sod areas shall be a commercial all organic, all natural biological fertilizer, which includes humates, rock minerals, bio-inoculants and bio-stimulants. Fertilizer shall be granular, uniform in composition, free flowing, and suitable for application with approved equipment. Fertilizer which has been exposed to high humidity and moisture has become caked or otherwise damaged making it unsuitable for use will not be acceptable. Fertilizer shall be MicroLife Ultimate 6-2-4 as manufactured by San Jacinto Environmental Supply, 2221 A West 34th Street, Houston, TX 77018, 713-957-0909, or approved equal. Fertilizer shall be applied at the rate of 15 lbs. per 1,000 sq. ft.

PART 3 - EXECUTION

3.1 INSPECTIONS

- A. Surfaces indicated to receive sod shall be inspected to verify that all preparatory work in the area has been completed. Seeding shall not start until all preparatory work has been completed. Requests for inspections shall be made at least two days prior to anticipated date of inspection.

3.2 PREPARATION

- A. Strip existing vegetation and 1 inch of existing soil from all areas to receive sod not stripped and graded under previous work.
- B. After stripping, loosen soil to a depth of 2 inches prior to laying sod. Break up compacted soil. Remove all stones, roots, vegetation, rubbish, debris and other foreign matter 1 inch in diameter or larger from the top 2 inches of soil. No foreign matter may be buried on site.
- C. Care shall be taken to avoid erosion of slopes during preparation of hydromulch areas specifically on detention pond slopes. Contractor to install erosion measures as required to keep all slopes stable and avoid any erosion.
- D. Contractor to avoid chemical contamination of existing waterways including detention ponds and streams during preparation and seeding.
- E. Hand rake to achieve a uniform loose depth to 2 inches and a smooth, consistent grade immediately prior to laying sod.
- F. Immediately prior to placing sod, apply the fertilizer and lightly moisten.

3.3 INSTALLATION

- A. All sod shall be carefully laid in parallel rows in a smooth manner, alternating all sod joints. Fit sod strips tightly together so that no joints are visible and tamp firmly. Cut pieces of sod to fill any voids left.
- B. Sod strips to comply with SWPPP (Storm Water Pollution Prevention Plan) shall be as drawings and local and regional regulations. Prepare areas and fertilize as for lawn areas. Lay strips tightly together so that no joints are visible. Water and roll. Maintain as per Section 02935, Exterior Landscape Maintenance.
- C. Pin sod with steel staples, minimum 2 for each 1 by 2 foot block wherever slope is 4:1 or greater, pin all blocks of sod on sod strips required for compliance with SWPPP.
- D. Water sod immediately after planting, slowly but thoroughly, to secure at least six (6) inches penetration into the soil below the sod. Do not allow the blades of grass to wilt. The sodded area shall be thoroughly rolled in 2 directions to form a thoroughly even, solid mat. Any voids left in block sodding shall be filled with cut sod pieces and/or topsoil.
- E. Following the completion of the installation, the sod shall be watered in an amount and as often as necessary to maintain healthy growth of the grass.

- F. Treat entire areas of sod for fire ants during the maintenance period as per manufacturer's instructions and Section 02930, Plants.
- G. Apply second application of fertilizer 60 days after planting as per Section 02930, Plants.

3.4 MAINTENANCE OF SODDED AREAS

- A. Sodded area shall be maintained in good condition throughout the installation process and throughout the maintenance period.
- B. Mowing lawn/grass areas shall be accomplished with sharp, properly adjusted mowers of the correct size for the various areas.
- C. Mowing frequency shall be as per the Landscape Maintenance Program. Blade heights shall be set according to the following schedule.
 - 1. 1-1/2 inches Initial Mowing
 - 2. 1-1/2 inches April to November
 - 3. 2 inches December to March
- D. In the event of a prolonged rainy period and a surge of leaf growth is anticipated, the mower height may be readjusted to prevent "scalping" or skinning of lawn on preceding cuts.
- E. Lawn shall be edged evenly at all walks, headers and other structures as per the schedule. Use an edger, not a line trimmer.
- F. Until the establishment of the turf, the Contractor will be responsible for replacing soils that have eroded onto the paved areas. Residual soils on paving will be removed and if not mingled with objectionable materials may be re-used in eroded areas.
- G. Immediately upon observing any lawn grass spreading into shrub or groundcover areas, the Contractor shall initiate a program of removal and maintain this program throughout the maintenance period.
- H. Any lawn grass appearing in paved areas shall receive an application of soil sterilant according to manufacturer's direction. The sterilant shall be approved and will not be detrimental structurally to paved areas.
- I. Special effort shall be given to the control to fire ants infesting the site. After control is accomplished, the ant mounds shall be lowered and tamped to the existing grade.
- J. Apply top dress fertilizer after grassing, if needed.
- K. Upon completion of work, clean areas within Contract limits, remove tools, supplies and equipment. Wash down curbs and pavement areas. Scrub curbs and walks as necessary to ensure a clean surface. Provide site clean and free of materials and suitable for use as intended.

3.5 GUARANTEE

- A. A written guarantee shall be provided guaranteeing to maintain the treated areas in a healthy, vigorous, undamaged condition for a period of 60 days beginning on the date of written acceptance of the work.

- B. Guarantee shall provide for timely filling, leveling and repairing eroded areas, reseeding areas exhibiting lack of healthy growth and mowing as necessary to maintain a neat appearance.

END OF SECTION 02924

SECTION 02930 - PLANTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Plants.
 - 2. Planting soils.
 - 3. Plant drainage.

1.2 DEFINITIONS

- A. Backfill: The earth used to replace or the act of replacing earth in an excavation.
- B. Finish Grade: Elevation of finished surface adjacent to planting bed.
- C. Prepared Backfill Mix: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.
- D. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. This includes insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. It also includes substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.
- E. Pests: Living organisms that occur where they are not desired, or that cause damage to plants, animals, or people. These include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.
- F. Topsoil: Standardized topsoil; existing, native surface topsoil; existing, in-place surface soil; imported topsoil; or manufactured topsoil that is modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.
- G. Root Flare: Also called "trunk flare." The area at the base of the plant's stem or trunk where the stem or trunk broadens to form roots; the area of transition between the root system and the stem or trunk.
- H. Subgrade: Surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.
- I. Subsoil: All soil beneath the topsoil layer of the soil profile and typified by the lack of organic matter and soil organisms.

1.3 SUBMITTALS

- A. Work Schedule: Contractor shall submit a work schedule for all planting work prior to purchase and installation of plant material.
- B. Product Data: For each type of product indicated, including soils.
- C. Samples of backfill mix.

- D. Samples of mulch.
- E. Product certificates.
- F. Maintenance Instructions: Recommended procedures to be established by Owner for maintenance of plants during a calendar year. Including manufacturer's recommendations and instructions recommending procedures to be established by Owner for maintenance of planting work. Submit instructions prior to expiration of Contractor's required maintenance period.

1.4 QUALITY ASSURANCE

- A. Installer: Installation of planting work shall be performed by a single firm specializing in landscape and planting work. Contractor shall be licensed by the Texas Association of Nurserymen, shall possess an agricultural certificate, shall be a licensed pest applicator, and shall have not less than 5 years of experience in this type of work.
- B. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.
 - 1. Pesticide Applicator: State licensed, commercial.
- C. Provide quality, size, genus, species, and variety of plants indicated, complying with applicable requirements in ANSI Z60.1. Provide healthy, vigorous stock, grown in recognized nursery in accordance with good horticultural practice and free of disease, insects, eggs, larvae and defects such as knots, sunscald, injuries, abrasions or disfigurement.
- D. Delivery, Storage and Handling
 - 1. Compliance: Ship planting materials with Certificates of Inspection as required by governing authorities. Comply with all applicable local, state, and federal requirements regarding materials, methods of work, and disposal of excess and waste materials.
 - 2. Substitutions: Do not make substitutions unless approved in writing by Owner's Representative. If specified planting material is not obtainable, submit proof of non-availability to Owner's Representative together with proposal for use of equivalent material. Contractor shall submit proposal in a timely manner as to not impact project completion or installation of other work.
 - 3. Analysis and Standards: All packaged products shall be delivered in original manufacturer's sealed containers. For unpackaged materials, submit analysis by recognized laboratory made in accordance with methods established by the Association of Official Agriculture Chemists, wherever applicable.
 - 4. Inspection: Notify Owner's Representative at least 2 weeks prior to installation, of location where materials that have been selected for planting may be inspected, either at place of growth or the site prior to planting. Plant material will be inspected for compliance with requirements for genus, species, variety, size and quality. Owner's Representative retains right to further inspect trees for size and conditions of balls and root systems, insects, injuries and latent defects, and to reject unsatisfactory or defective material at any time during progress of work. Contractor shall remove rejected trees immediately from site and replace with specified materials. Plant material not installed in accordance with Contract Documents will be rejected.

1.5 WARRANTY

- A. Special Warranty: Installer agrees to repair or replace plantings and accessories that fail in materials, workmanship, or growth within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Death and unsatisfactory growth, except for defects resulting from abuse, lack of adequate maintenance, or neglect by Owner, or incidents that are beyond Contractor's control.
 - b. Structural failures including plantings falling or blowing over.
 - 2. Warranty Periods from Date of Substantial Completion:
 - a. Trees: 12 months.
 - 3. Remove and replace trees, shrubs and groundcover found to be dead or in unhealthy condition during warranty period. Replace trees, shrubs and groundcover which are in doubtful condition at end of warranty period. However, if in the opinion of Owner, such doubtful material may survive, Contractor shall extend the warranty period for a full growing season. Owner will determine which items are in doubtful condition.

1.6 MAINTENANCE SERVICE

- A. Initial Maintenance Service: Provide maintenance by skilled employees of landscape Installer. Begin maintenance immediately after plants are installed throughout the maintenance period. See Section 02935 – Exterior Landscape Maintenance.

1.7 JOB CONDITIONS

- A. Work Scheduling: Proceed with and complete planting work in a timely manner, working within seasonal limitations for each kind of planting work required.
- B. Planting Time
 - 1. Correlate planting with specified maintenance periods to provide maintenance from date of Substantial Completion.
 - 2. Plant frost-tender trees only after danger of frost is past or sufficiently before frost season to allow for establishment before first frost. Do not plant in frozen ground.
 - 3. Plant trees, shrubs and groundcover after final grades are established and prior to planting of lawns, unless otherwise directed by Owner's Representative in writing. If planting occurs after lawn work, protect lawn areas and promptly repair damage to lawns resulting from planting operations.
- C. Utilities: Refer to drawings and coordinate with Utility Contractor for location of utilities. Contractor shall be responsible for damage to existing utilities and structures.
- D. Security: The Owner will not assume any responsibility for security of any materials, equipment, etc. during construction of the project until project acceptance.
- E. Excavation: When conditions detrimental to plant growth are encountered, such as rubble fill, adverse drainage conditions beyond the scope of this contract, or obstructions, notify Owner's Representative of such conditions, immediately and before planting.

- F. Pollution Control: Control dust caused by planting operations. Dampen surfaces as necessary. Comply with pollution control regulations of governing authorities.

PART 2 - PRODUCTS

2.1 PLANT MATERIAL

- A. General: Furnish nursery-grown plants true to genus, species, variety, cultivar, stem form, shearing, and other features indicated in Plant Schedule or Plant Legend shown on Drawings and complying with ANSI Z60.1; and with healthy root systems developed by transplanting or root pruning. Provide well-shaped, fully branched, healthy, vigorous stock, densely foliated when in leaf and free of disease, pests, eggs, larvae, and defects such as knots, sun scald, injuries, abrasions, and disfigurement.

2.2 FERTILIZERS

- A. Fertilizer for planting areas shall be a commercial all organic, all-natural biological fertilizer, which includes humates, rock minerals, bio-inoculants and bio-stimulants. Fertilizer shall be granular, uniform in composition, free flowing, and suitable for application with approved equipment. Fertilizer which has been exposed to high humidity and moisture has become caked or otherwise damaged making it unsuitable for use will not be acceptable. Fertilizer shall be MicroLife Ultimate (8-4-6) as manufactured by San Jacinto Environmental Supply, 2221 A West 34th Street, Houston, TX 77018, 713-957-0909, or approved equal.

- B. Additional fertilizer, MicroLife 6-2-4, shall be evenly dispersed through soil in planting pits for all plants 15 gal. and above.

<u>Material</u>	<u>No. of Ounces per Planting Pit</u>
15 gallon	2 oz.
30 gallon	3 oz.
45 gallon	4 oz.
65 gallon	6 oz.
100 gallon	10 oz.

- C. Tree Inoculant: Mycorrhizal Inoculant shall be applied to all trees and plant materials 45 gallons and larger. Inoculant shall be JRM Tree Transplant Pack as supplied by San Jacinto Landscape Supply, Houston, TX, at the rate of one 3 oz. dry pack per caliper inch or approved equal.

2.3 PLANTING SOILS

- A. Prepared Planting Soil Backfill Mix: Shall be "Garden & Flowerbed Mix" as supplied by Nature's Way Resources, Conroe, TX, "Bed Mix – Flower Bed Soil" as supplied by The Ground Up, Houston, TX, "Living Earth Soil Mix consisting of equal parts Forest Floor Compost, Composted Hardwood Finest Sand" as supplied by LETCO, Houston, TX, or approved equal commercially available soil mix containing sharp sand, compost and topsoil.

- B. Compost to be included in bed prep/soil backfill mix and for seed preparation shall be leaf mold compost as supplied by Nature's Way Resources, Inc., Conroe, Texas, "Compost DS" as supplied by The Ground Up, Houston, Texas, "Forest Floor Compost" as supplied by LETCO, Houston, Texas, or approved equal.

- 1. Contractor shall furnish copies of manufacturer's literature, certifications, sources, samples, or laboratory analytical data for all items submitted as an approved equal. Certificates of inspection

required for transportation shall accompany each shipment of materials. Provide certificates to Owner's Representative.

2. Testing:
 - a. Chemical and Physical - All compost components shall be tested by the following testing laboratories for conformity to the specifications:
 - b. Texas Plant and Soil Lab, 5115 West Monte Cristo, Edinburg, Texas 78539, (956) 383-0739; A&L Plains Agricultural Laboratories, Inc., 302 34th Street, Lubbock, Texas 79404, (806) 763-4278; Soil and Plant Laboratory, Incorporated, Post Office Box 153, Santa Clara, California 95052, (408) 243-0330.
 - c. Biological: Soil Food Web. 1128 NE 2nd Street, Suite 120, Corvallis, Oregon 97330, (541) 752-5066.
 - d. If herbicide contamination is suspected, then a radish/rye-grass growth trial must be performed. For delivered material, test one grab sample for each fifty (50) cubic yards of bulk material delivered to the site. Testing will be at the expense of Contractor. Deviations greater than plus or minus twenty (20%) percent from control data may be grounds for rejection of mixes tested. Non-conforming materials shall not be used and shall be removed from the site.
3. Biological, physical and chemical specifications:
 - a. Specifications: Stability/Maturity (Carbon Dioxide Evolution Rate) Shall be less than 8 mg CO₂-C per g OM (organic matter) per day and greater than 6.0 on the Solvita™ Compost Maturity Test.
 - b. Biological components: Bacteria and fungus ratio shall be minimum 50:50 ratio demonstrating balanced ratio or fungal dominance. Bacteria (active) - minimum of 15-25 micrograms per gram of compost; Bacteria (total) - minimum of 150 micrograms per gram of compost; Fungus (active) - minimum of 15-25 micrograms per gram of compost; Fungus (total) - minimum of 150 micrograms per gram of compost; Fungus (hyphal diameter) – should be greater than 1 mm; Protozoa: flagellates - 8,000 or higher per gram of compost; amoebae - 8,000 or higher per gram of compost; ciliates - 50-100 or higher per gram of compost; Root Feeding Nematodes should not be present (beneficial nematodes are a benefit)
4. PHYSICAL Specifications: Moisture Content - 30-60%, wet weight basis; Moisture Holding Capacity - 75-200% of dry weight; Organic Matter Content - 30-70% (40-50% preferred), dry weight basis; Particle Size: Standard Grade Compost - 100% passing through a 1" rectangular mesh screen or smaller; Fine Grade Compost - 100% passing through a 3/8" rectangular mesh screen or smaller; Bulk Density - 700-1,200 (800-1,000 preferred), pounds per cubic yard; Electrical Conductivity (Soluble Salt Concentration) -10 dS/m max., (2.0-3.6 or less preferred).
5. CHEMICAL Specifications: pH 6.0-8.5; Total Salinity-2,000 ppm or lower; Chemical components (H₂O extraction): Nitrogen-10 ppm or higher, Phosphorus-100 ppm or higher, Potassium- 400 ppm or higher, Calcium-2000 ppm or higher, Magnesium-200 ppm or higher, Zinc-6 ppm or higher, Iron-25 ppm or higher, Manganese - 8 ppm or higher, Copper-1 ppm or higher, Sodium-1000 ppm or less, Sulfur-10 ppm or higher Boron-1 ppm or higher.

C. Topsoils

1. Provide topsoil, which is fertile, friable, natural loam, surface soil, free of subsoil, clay lumps, brush, weeds and other litter, and free of roots, stumps, stones larger than 2 inches in any dimension and other extraneous or toxic matter harmful to plant growth.
2. Obtain topsoil only from naturally, well-drained sites where topsoil occurs in a depth of not less than 4 inches. Topsoil shall not be collected from sites that are infected with growth of, or the

reproductive parts of noxious weeds, especially nut grass. Topsoil shall not be stripped, collected or deposited while wet. Topsoil shall not be excessively acid or alkaline or contain toxic substances which may be harmful to plant growth. Topsoil shall be without admixture of subsoil.

- D. Sharp Sand: Sand shall be thoroughly washed, coarse, graded sharp, construction or brick sand, free of clay balls, weeds, and grass. So-called cushion sand, blow sand, or creek silt is not acceptable for substitution where sharp sand is specified.

2.4 MULCHES

- A. Mulch for Top Dressing: Shredded hardwood Organic mulch free from deleterious materials and suitable for top dressing of trees, shrubs or plants. Mulch shall be composted, well-rotted, blended double-shredded hardwood mulch, black or dark brown in color. Mulch pieces shall be sized to pass through a 1 inch screen. No dyes, mushroom compost or other additives shall be used to artificially enhance the appearance of the level of composting. Mulch shall be Native Hardwood Mulch as supplied by Nature's Way Resources, 101 Sherbrook Circle, Conroe, TX, or approved equal.

2.5 PESTICIDES

- A. General: Pesticide registered and approved by EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.

2.6 HERBICIDE

- A. Pre-emergent herbicide shall be Team Pro as manufactured by Bonus Corp Fertilizer, Houston, TX, or approved equal. Apply pre-emergent over all planting areas prior to spreading mulch at the rate of 7 lbs./1000 sq. feet.
- B. If necessary, contact herbicide shall be Roundup by Monsanto, 800 N. Lindbergh, St. Louis, MO 63167, 314-694-1000, or approved equal. Apply Roundup only if necessary and if approved by owner or owner's representative. Do not exceed manufacturer's recommended rate of application.

2.7 STAKING AND GUYING

- A. Reference drawings for staking and guying material.

PART 3 - EXECUTION

3.1 PLANTING

- A. Excavation for Trees
 1. Excavate pits with vertical sides and with bottom of excavation slightly raised at center to provide proper drainage. Rough up sides of pit.
 2. Make excavations at least half again as wide as the ball diameter and equal to the ball depth, plus 4 inch allowance for setting of ball on a layer of compacted backfill.
 3. Dispose of subsoil removed from planting excavations. Do not mix with planting soil or use as backfill.

B. Planting Trees

1. Set stock on layer of compacted prepared planting soil backfill mix, plumb and in center of pit at same elevation as adjacent finished planting grades. Distribute additional fertilizer evenly throughout backfill mix in hole at specified rate. Place prepared planting soil backfill mix around base and sides of ball and work each layer to settle backfill and eliminate voids and air pockets. When excavation is approximately 2/3 full, water thoroughly before placing remainder of backfill. For trees, apply Tree Inoculant at rate specified according to size of tree. Repeat watering until no more water is absorbed. Dish top of backfill to allow for mulching.
2. Prune, thin out, and shape shrubs in accordance with standard horticultural practice. Prune shrubs to retain natural character. Remove and replace excessively pruned or misformed stock resulting from improper pruning.
3. Stake and guy trees as per the drawings.

3.2 PLANT MAINTENANCE

- A. Maintain plantings by pruning, cultivating, watering, weeding, fertilizing, mulching, restoring planting saucers, resetting to proper grades or vertical position, and performing other operations as required to establish healthy, viable plantings. Spray or treat as required to keep trees and shrubs free of insects and disease.
- B. Fill in as necessary soil subsidence that may occur because of settling or other processes. Replace mulch materials damaged or lost in areas of subsidence.
- C. Apply treatments as required to keep plant materials, planted areas, and soils free of pests and pathogens or disease. Use practices to minimize the use of pesticides and reduce hazards.
- D. Apply pesticides and other chemical products and biological control agents in accordance with authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with Owner's operations and others in proximity to the Work. Notify Owner before each application is performed.
- E. Protect plants from damage due to landscape operations and operations of other contractors and trades. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged plantings.

END OF SECTION 02930

SECTION 02951

PAVEMENT REPAIR AND RESTORATION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Repairing and replacing streets, highways, and other pavements as required per street cut ordinance that have been cut, broken, or damaged due to utility excavation.

1.02 RELATED SECTIONS

- A. Section 01270 – Measurement and Payment
- B. Section 01576 – Waste Material Disposal
- C. Section 02221 – Removing Existing Pavements, Structures, Wood, and Demolition Debris
- D. Section 02315 – Roadway Excavation
- E. Section 2316 - Excavation and Backfill for Structures
- F. Section 2317 – Excavation and Backfill for Utilities
- G. Section 2318 - Extra Unit Price Work for Excavation and Backfill
- H. Section 02319 – Borrow
- I. Section 02330 – Embankment
- J. Section 02336 – Lime Stabilized Subgrade
- K. Section 02337 – Lime/Fly Ash Stabilized Subgrade
- L. Section 02338 – Portland Cement Stabilized Subgrade
- M. Section 02711 – Hot Mix Asphalt Base
- N. Section 02712 – Cement Stabilized Base Course
- O. Section 02713 – Recycled Crushed Concrete Base Course
- P. Section 02741 – Asphaltic Concrete Pavement
- Q. Section 02751 – Concrete Paving
- R. Section 02754 – Concrete Driveways

S. Section 02771 – Curb, Curb and Gutter, and Headers

T. Section 02775 – Concrete Sidewalks

1.03 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for pavement repair and replacement for utility projects is on a square yard basis and includes surface and base materials as required per street cut ordinance.
2. Measurement for utility projects: Match actual pavement replaced but no greater than maximum pavement replacement limits in accordance with the street cut ordinance or otherwise shown on drawings.
3. Refer to Section 01270 - Measurement and Payment for other unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this section is included in total Stipulated Price.

PART 2 PRODUCTS

2.01 MATERIALS

A. Subgrade:

1. Provide backfill material as required by applicable excavation and fill sections (Sections 02315 through 02319) and Section 02330 - Embankment.
2. Provide material for stabilization as required by applicable portions of Section 02336 - Lime Stabilized Subgrade, Section 02337 - Lime/Fly-Ash Stabilized Subgrade, and Section 02338 - Portland Cement Stabilized Subgrade.

B. Base: Provide base material as required by applicable portions of Section 02711 - Hot Mix Asphaltic Base Course, Section 02712 - Cement Stabilized Base Course, and Section 02713 - Recycled Crushed Concrete Base Course.

C. Pavement: Provide paving materials as required by applicable portions of Section 02741 - Asphaltic Concrete Pavement, Section 02751- Concrete Paving, Section 02754 - Concrete Driveways, and Section 02771 - Curb, Curb and Gutter, and Headers, and Section 02775 - Concrete Sidewalks.

PART 3 EXECUTION

3.01 PREPARATION

- A. Notify City prior to commencement of excavation in pavement for which an Excavation in Public Way permits has been obtained. Follow directions contained in the permit.
- B. Conform to requirement of Section 02221 - Removing Existing Pavements, Structures, Wood, and Demolition Debris, for removals.
- C. Saw cut pavement 18 inches wider than width of trench needed to install utilities unless otherwise indicated on Drawings.
- D. When removing pavement to existing deformed metal strip (i.e. dummy joint), saw cut pavement minimum 2 inches deep on opposite side of deformed metal strip. Place saw joint far enough behind deformed metal strip to obtain continuously straight joint. Remove damaged portion of deformed metal strip as required to provide proper joint. Saw cut and remove metal strip before placement of new concrete pavement.
- E. Protect edges of existing pavement to remain from damage during removals, utility placement, backfill, and paving operations. For concrete pavement, protect undisturbed subgrade that is to remain to support replacement slab.
- F. Dowel in existing pavement where no reinforcement is found or is broken due to construction activities. Unless otherwise directed by Project Manager, provide No. 6 bars 24 inches long, drilled and embedded 8 inches into center of existing slab with 'PO-ROC' epoxy grout or approved equal. Space dowels to match new pavement reinforcement spacing.
- G. Provide transitional paving and earthwork as required to tie proposed pavement to existing pavement when unable to dowel new pavement into existing pavement.

3.02 INSTALLATION

- A. Parking Areas, Service Drives, Driveways, and Sidewalks: Replace with material equal to or better than existing or as indicated on Drawings. Conform to applicable requirements of sections referenced in Paragraph 2.01, Materials.
- B. Street Pavements and Curbs, Curbs and Gutters: Replace subgrade, base, and surface course with like materials or as indicated on Drawings and City of Houston Standard Detail 02951.01. Curbs and curbs and gutters shall match existing. Conform to requirements of sections referenced in Paragraph 2.01, Materials.
- C. For concrete pavement, install size and length of reinforcing steel and pavement thickness indicated on Drawings and City of Houston Standard Detail 02751.01. Place types and spacing of joints to match existing or as indicated on Drawings.
- D. Where existing pavement consists of concrete pavement with asphaltic surfacing, resurface with minimum 2-inch depth asphaltic pavement.
- E. Repair state highway and county crossings in accordance with TxDOT permit or county requirements as appropriate and within 1 week after utility work is installed.

3.03 WASTE MATERIAL DISPOSAL

- A. Dispose of waste material in accordance with requirements of Section 01576 - Waste Material Disposal.

3.04 PROTECTION

- A. Maintain pavement in good condition until completion of Work.
- B. Replace pavement damaged by Contractor's operations at no cost to City.

END OF SECTION

SECTION 03315

CONCRETE FOR UTILITY CONSTRUCTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Cast-in-place concrete work for utility construction or rehabilitation, such as slabs on grade, small vaults, site-cast bases for precast units, and in-place liners for manhole rehabilitation.

1.02 RELATED SECTIONS

- A. Section 01270 – Measurement and Payment
- B. Section 01330 – Submittal Procedures
- C. Section 01454 – Testing Laboratory Services

1.03 MEASUREMENT AND PAYMENT

- A. Unit Prices.
 - 1. No payment will be made for concrete for utility construction under this Section. Include cost in applicable utility structure.
 - 2. Obtain services of and pay for certified testing laboratory to prepare design mixes shall be considered incidental to the bid item for the applicable utility structure.
 - 3. Payment for extra grade 60 reinforcing steel in place is on per pound basis.
 - 4. Payment for extra class A concrete with or without forms is on a cubic yard basis.
 - 5. Refer to Section 01270 - Measurement and Payment for unit price procedures.
- B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.04 REFERENCES

- A. ACI 117 - Standard Tolerances for Concrete Construction and Materials.
- B. ACI 211.1 - Standard Practice for Selecting Proportions for Normal - Density and High - Density Concrete.
- C. ACI 302.1R - Guide for Concrete Floor and Slab Construction.

- D. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete.
- E. ACI 308.1-23 - External Curing of Cast-in-Place Concrete-Specification.
- F. ACI 309R - Guide for Consolidation of Concrete.
- G. ACI 311.6-18 - Specification for Testing Ready-Mixed Concrete.
- H. ACI 311.7-18 - Specification for Inspection of Concrete Construction.
- I. ACI 315-18 - Guide to Presenting Reinforcing Steel Design Details.
- J. ACI 318 - Building Code Requirements for Reinforced Concrete and Commentary.
- K. ACI 544.3-08 - Guide for Specifying, Proportioning, and Production of Fiber-Reinforced Concrete.
- L. ASTM A 615 - Standard Specification for Deformed and Plain Carbon -Steel Bars for Concrete Reinforcement.
- M. ASTM A 767 - Standard Specifications for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement.
- N. ASTM A 775 - Standard Specification for Epoxy-Coated Reinforcing Steel Bars.
- O. ASTM A 820 - Standard Specification for Steel Fibers for Fiber-Reinforced Concrete.
- P. ASTM A 884 - Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Reinforcement.
- Q. ASTM A 1064 - Standard Specification for Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
- R. ASTM C 31 - Standard Practice for Making and Curing Concrete Test Specimens in the Field.
- S. ASTM C 33 - Standard Specification for Concrete Aggregates.
- T. ASTM C 39 - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
- U. ASTM C 42 - Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
- V. ASTM C 94 - Standard Specification for Ready-Mixed Concrete.
- W. ASTM C 138 - Standard Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete.
- X. ASTM C 143 - Standard Test Method for Slump of Hydraulic Cement Concrete.

- Y. ASTM C 150 - Standard Specification for Portland Cement.
- Z. ASTM C 172 - Standard Practice for Sampling Freshly Mixed Concrete.
- AA. ASTM C 173 - Standard Test Method for Air Content of Freshly Mixed Concrete by Volumetric Method.
- BB. ASTM C 231 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
- CC. ASTM C 260 - Standard Specification for Air-Entraining Admixtures for Concrete.
- DD. ASTM C 309 - Standard Specifications for Liquid Membrane-Forming Compounds for Curing Concrete.
- EE. ASTM C 494 - Standard Specification for Chemical Admixtures for Concrete.
- FF. ASTM C 595 - Standard Specification for Blended Hydraulic Cements.
- GG. ASTM C 685 - Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing.
- HH. ASTM C 1064 - Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete.
- II. ASTM C 1077 - Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation.
- JJ. CPMB 100M-00 - Concrete Plant Standards of the Concrete Plant Manufacturers Bureau.
- KK. CRD-C572 - Corps of Engineers Specifications For Polyvinyl Chloride Waterstops.
- LL. CRSI MSP-1 - Manual of Standard Practice.
- MM. CRSI - Placing Reinforcing Bars.
- NN. Federal Specification SS-S-210A - Sealing Compound, Preformed Plastic, for Expansion Joints and Pipe Joints.

1.05 SUBMITTALS

- A. Conform to requirements of Section 01330 - Submittal Procedures.
- B. Submit proposed mix design and test data for each type and strength of concrete in Work.
- C. Submit laboratory reports prepared by independent testing laboratory stating that materials used comply with requirements of this Section.

- D. Submit manufacturer's mill certificates for reinforcing steel. Provide specimens for testing when required by Project Manager.
- E. Submit certification from concrete supplier that materials and equipment used to produce and deliver concrete comply with this Specification.
- F. When required on Drawings, submit shop drawings showing reinforcement type, quantity, size, length, location, spacing, bending, splicing, support, fabrication details, and other pertinent information.
- G. For waterstops, submit product information sufficient to indicate compliance with this Section, including manufacturer's descriptive literature and specifications.

1.06 HANDLING AND STORAGE

- A. Cement: Store cement off the ground in well-ventilated, weatherproof building.
- B. Aggregate: Prevent mixture of foreign materials with aggregate and preserve gradation of aggregate.
- C. Reinforcing Steel: Store reinforcing steel to protect it from mechanical injury and formation of rust. Protect epoxy-coated steel from damage to coating.

PART 2 PRODUCTS

2.01 CONCRETE MATERIALS

- A. Cementitious Material:
 - 1. Portland Cement: ASTM C 150, Type II, unless use of Type III is authorized by Project Manager; or ASTM C 595, Type IP. For concrete in contact with sewage use Type II cement.
 - 2. When aggregates are potentially reactive with alkalis in cement, use cement not exceeding 0.6 percent alkali content in form of $\text{Na}_2\text{O} + 0.658\text{K}_2\text{O}$.
- B. Water: Clean, free from harmful amounts of oils, acids, alkalis, or other deleterious substances, and meeting requirements of ASTM C 94.
- C. Aggregate:
 - 1. Coarse Aggregate: ASTM C 33. Unless otherwise indicated, use following ASTM standard sizes: No. 357 or No. 467; No. 57 or No. 67, No. 7. Maximum size: Not larger than 1/5 of narrowest dimension between sides of forms, nor larger than 3/4 of minimum clear spacing between reinforcing bars.
 - 2. Fine Aggregate: ASTM C 33.

3. Determine potential reactivity of fine and coarse aggregate in accordance with Appendix to ASTM C 33.
- D. Air Entraining Admixtures: ASTM C 260.
- E. Chemical Admixtures:
1. Water Reducers: ASTM C 494, Type A.
 2. Water Reducing Retarders: ASTM 494, Type D.
 3. High Range Water Reducers (Superplasticizers): ASTM C 494, Types F and G.
- F. Prohibited Admixtures: Admixtures containing calcium chloride, thiocyanate, or materials that contribute free chloride ions in excess of 0.1 percent by weight of cement.
- G. Reinforcing Steel:
1. Use new billet steel bars conforming to ASTM A 615, ASTM A 767, or ASTM A 775, grade 40 or grade 60, as shown on Drawings. Use deformed bars except where smooth bars are specified. When placed in work, keep steel free of dirt, scale, loose or flaky rust, paint, oil or other harmful materials.
 2. Where shown, use welded wire fabric with wire conforming to ASTM A 1064 or ASTM A 884. Supply gauge and spacing shown, with longitudinal and transverse wires electrically welded together at points of intersection with welds strong enough not to be broken during handling or placing.
 3. Wire: ASTM A 1064. Use 16 1/2 gauge minimum for tie wire, unless otherwise indicated.
- H. Fiber:
1. Fibrillated Polypropylene Fiber:
 - a. Addition Rate: 1.5 pounds of fiber per cubic yard of concrete.
 - b. Physical Properties:
 - (1) Material: Polypropylene
 - (2) Length: 1/2 inch or graded
 - (3) Specific Gravity: 0.91
 - c. Acceptable Manufacturer: W. R. Grace Company, Fibermesh, or approved equal.

2. Steel Fiber: Comply with applicable provisions of ACI 544.3-08 and ASTM A 820.
 - a. Ratio: 50 to 200 pounds of fiber per cubic yard of concrete.
 - b. Physical Properties
 - (1) Material: Steel
 - (2) Aspect Ratio (for fiber lengths of 0.5 to 2.5 inch, length divided by diameter or equivalent diameter): 30:1 to 100:1
 - (3) Specific Gravity: 7.8
 - (4) Tensile Strength: 40-400 ksi
 - (5) Young's Modulus: 29,000 ksi
 - (6) Minimum Average Tensile Strength: 50,000 psi
 - (7) Bending Requirements: Withstand bending around 0.125-inch diameter mandrel to angle of 90 degrees, at temperatures not less than 60 degrees F, without breaking
- I. Curing Compounds: Type 2 white-pigmented liquid membrane-forming compounds conforming to ASTM C 309.

2.02 FORM WORK MATERIALS

- A. Lumber and Plywood: Seasoned and of good quality, free from loose or unsound knots, knot holes, twists, shakes, decay and other imperfections which would affect strength or impair finished surface of concrete. Use S4S lumber for facing or sheathing. Forms for bottoms of caps: At least 2 inches (nominal) lumber or 3/4 inch form plywood backed adequately to prevent misalignment. For general use, provide lumber of 1 inch nominal thickness or form plywood of approved thickness.
- B. Form work for Exposed Concrete Indicated to Receive Rubbed Finish: Form or form-lining surfaces free of irregularities; plywood of 1/4 inch minimum thickness, preferably oiled at mill.
- C. Chamfer Strips and Similar Moldings: Redwood, cypress, or pine that will not split when nailed and which can be maintained to true line. Use mill-cut molding dressed on all faces.
- D. Form Ties: Metal or fiberglass of approved type with tie holes not larger than 7/8 inch in diameter. Do not use wire ties or snap ties.

- E. Metal Forms: Clean and in good condition, free from dents and rust, grease, or other foreign materials that tend to disfigure or discolor concrete in gauge and condition capable of supporting concrete and construction loads without significant distortion. Countersink bolt and rivet heads on facing sides. Use only metal forms which present smooth surface and which line up properly.

2.03 PRODUCTION METHODS

- A. Use either ready-mixed concrete conforming to requirements of ASTM C 94, or concrete produced by volumetric batching and continuous mixing in accordance with ASTM C 685.

2.04 MEASUREMENT OF MATERIALS

- A. Measure dry materials by weight, except volumetric proportioning may be used when concrete is batched and mixed in accordance with ASTM C 685.
- B. Measure water and liquid admixtures by volume.

2.05 DESIGN MIX

- A. Use design mixes prepared by certified testing laboratory in accordance with ASTM C 1077 and conforming to requirements of this section.
- B. Proportion concrete materials based on ACI 211.1 to comply with durability and strength requirements of ACI 318, and this specification. Prepare mix design of Class A concrete so minimum cementitious content is 564 pounds per cubic yard. Submit concrete mix designs to Project Manager for review.
- C. Proportioning on basis of field experience or trial mixtures in accordance with requirements of ACI 318 may be used, when approved by Project Manager.
- D. Classification:

CLASS	TYPE	MINIMUM COMPRESSIVE STRENGTH (LBS/SQ. IN.)		MAXIMUM W/C RATIO	AIR CONTENT (PERCENT)	CONSISTENCY RANGE IN SLUMP (INCHES)
		7-DAY	28-DAY			
A	Structural	3200	4000	0.45	4± 1	2 to 4*
B	Pipe Block Fill, Thrust Block	----	1500	----	4± 1	5 to 7

*When ASTM C 494, Type F or Type G admixture is used to increase workability, this range may be 6 to 9.

- E. Add steel or polypropylene fibers only when called for on Drawings or in another section of these Specifications.
- F. Determine air content in accordance with ASTM C 138, ASTM C 173 or ASTM C 231.
- G. Use of Concrete Classes: Use classes of concrete as indicated on Drawings and other Specifications. Use Class B for unreinforced concrete used for plugging pipes, seal slabs, thrust blocks, trench dams, tunnel inverts and concrete fill unless indicated otherwise. Use Class A for all other applications.

2.06 PVC WATERSTOPS

- A. Extrude from virgin polyvinyl chloride elastomer. Use no reclaimed or scrap material. Submit waterstop manufacturer's current test reports and manufacturer's written certification that material furnished meets or exceeds Corps of Engineers Specification CRD-C572 and other specified requirements.
- B. Flat Strip and Center-Bulb Waterstops:
 - 1. Thickness: not less than 3/8 inch.
 - 2. Acceptable Manufacturers:
 - a. Kirkhill Rubber Co., Brea, California
 - b. Water Seals, Inc., Chicago, Illinois
 - c. Progress Unlimited, Inc., New York, New York
 - d. Greenstreak Plastic Products Co., St. Louis, Missouri
 - e. Approved equal

2.07 RESILIENT WATERSTOP

- A. Resilient Waterstop: Where shown on Drawings; either bentonite- or adhesive-type material.
- B. Bentonite Waterstop:
 - 1. Material: 75 percent bentonite, mixed with butyl rubber-hydrocarbon containing less than 1.0 percent volatile matter, and free of asbestos fibers or asphaltics.
 - 2. Manufacturer's rated temperature ranges: For application, 5 to 125 degrees F; in service, -40 to 212 degrees F.
 - 3. Cross-sectional dimensions, unexpanded waterstop: 1 inch by 3/4 inch.

4. Provide with adhesive backing capable of producing excellent adhesion to concrete surfaces.
- C. Adhesive Waterstop:
1. Preformed plastic adhesive waterstop at least 2 inches in diameter.
 2. Meets or exceeds requirements of Federal Specification SS-S-210A.
 3. Supplied wrapped completely by 2 part protective paper.
 4. Submit independent laboratory tests verifying that material seals joints in concrete against leakage when subjected to minimum of 30 psi water pressure for at least 72 hours.
 5. Provide primer, to be used on hardened concrete surfaces, from same manufacturer who supplies waterstop material.
 6. Acceptable Manufacturer: Synko-Flex Preformed Plastic Adhesive Waterstop, Synko-Flex Products, Inc.; or approved equal.

PART 3 EXECUTION

3.01 FORMS AND SHORING

- A. Provide mortar-tight forms sufficient in strength to prevent bulging between supports. Set and maintain forms to lines designated such that finished dimensions of structures are within tolerances specified in ACI 117. Construct forms to permit removal without damage to concrete. Forms may be given slight draft to permit ease of removal. Provide adequate clean out openings. Before placing concrete, remove extraneous matter from within forms.
- B. Install rigid shoring having no excessive settlement or deformation. Use sound timber in shoring centering. Shim to adjust and tighten shoring with hardwood timber wedges.
- C. Design Loads for Horizontal Surfaces of Forms and Shoring: Minimum fluid pressure, 175 pounds per cubic foot; live load, 50 pounds per square foot. Maximum unit stresses: 125 percent of allowable stresses used for form materials and for design of support structures.
- D. Back form work with sufficient number of studs and wales to prevent deflection.
- E. Re-oil or lacquer liner on job before using. Facing may be constructed of 3/4 inch plywood made with waterproof adhesive backed by adequate studs and wales. In such cases, form lining will not be required.

- F. Unless otherwise indicated, form outside corners and edges with triangular 3/4 inch chamfer strips (measured on sides).
- G. Remove metal form ties to depth of at least 3/4 inch from surface of concrete. Do not burn off ties. Do not use pipe spreaders. Remove spreaders which are separate from forms as concrete is being placed.
- H. Treat facing of forms with approved form coating before concrete is placed. When directed by Project Manager, treat both sides of face forms with coating. Apply coating before reinforcement is placed. Immediately before concrete is placed, wet surface of forms which will come in contact with concrete.

3.02 PLACING REINFORCEMENT

- A. Place reinforcing steel accurately in accordance with approved Drawings. Secure steel adequately in position in forms to prevent misalignment. Maintain reinforcing steel in place using approved concrete and hot-dip galvanized metal chairs and spacers. Place reinforcing steel in accordance with CRSI Publication "Placing Reinforcing Bars." Request inspection of reinforcing steel by Project Manager and obtain acceptance before concrete is placed.
- B. Minimum spacing center-to-center of parallel bars: 2 1/2 times nominal bar diameter. Minimum cover measured from surface of concrete to face of reinforcing bar unless shown otherwise on Drawings: 3 inches for surfaces cast against soil or subgrade, 2 inches for other surfaces.
- C. Detail bars in accordance with ACI 315-18. Fabricate reinforcing steel in accordance with CRSI Publication MSP-1, "Manual of Standard Practice." Bend reinforcing steel to required shape while steel is cold. Excessive irregularities in bending will be cause for rejection.
- D. Do not splice bars without written approval of Project Manager. Approved bar bending schedules or placing drawings constitute written approval. Splice and development length of bars shall conform to ACI 318, Chapters 7 and 12, and as shown on Drawings. Stagger splices or locate at points of low tensile stress.

3.03 EMBEDDED ITEMS

- A. Install conduit and piping as shown on Drawings. Accurately locate and securely fasten conduit, piping, and other embedded items in forms.
- B. Install waterstops as specified in other sections and according to manufacturer's instructions. Securely position waterstops at joints as indicated on Drawings. Protect waterstops from damage or displacement during concrete placing operations.

3.04 BATCHING, MIXING AND DELIVERY OF CONCRETE

- A. Measure, batch, mix, and deliver ready-mixed concrete in accordance with ASTM C 94. Produce ready-mixed concrete using automatic batching system as described in CPMB 100M-00 - Concrete Plant Standards of the Concrete Plant Manufacturers Bureau, Part 2 - Plant Control Systems.
- B. Measure, mix and deliver concrete produced by volumetric batching and continuous mixing in accordance with ASTM C 685.
- C. Maintain concrete workability without segregation of material and excessive bleeding. Obtain approval of Project Manager before adjustment and change of mix proportions.
- D. Ready-mixed concrete delivered to site shall be accompanied by batch tickets providing information required by ASTM C 94. Concrete produced by continuous mixing shall be accompanied by batch tickets providing information required by ASTM C 685.
- E. When adverse weather conditions affect quality of concrete, postpone concrete placement. Do not mix concrete when air temperature is at or below 40 degrees F and falling. Concrete may be mixed when temperature is 35 degrees F and rising. Take temperature readings in shade, away from artificial heat. Protect concrete from temperatures below 32 degrees F until concrete has cured for minimum of 3 days at 70 degrees F or 5 days at 50 degrees F.
- F. Clean, maintain and operate equipment so that it thoroughly mixes material as required.
- G. Hand-mix only when approved by Project Manager.

3.05 PLACING CONCRETE

- A. Give sufficient advance notice to Project Manager (at least 24 hours prior to commencement of operations) to permit inspection of forms, reinforcing steel, embedded items and other preparations for placing concrete. Place no concrete prior to Project Manager's approval.
- B. Schedule concrete placing to permit completion of finishing operations in daylight hours. However, when necessary to continue after daylight hours, light site as required. When rainfall occurs after placing operations are started, provide covering to protect work.
- C. Use troughs, pipes and chutes lined with approved metal or synthetic material in placing concrete so that concrete ingredients are not separated. Keep chutes, troughs and pipes clean and free from coatings of hardened concrete. Allow no aluminum material to be in contact with concrete.

- D. Limit free fall of concrete to 4 feet. Do not deposit large quantities of concrete at one location so that running or working concrete along forms is required. Do not jar forms after concrete has taken initial set; do not place strain on projecting reinforcement or anchor bolts.
- E. Use tremies for placing concrete in walls and similar narrow or restricted locations. Use tremies made in sections, or provide in several lengths, so that outlet may be adjusted to proper height during placing operations.
- F. Place concrete in continuous horizontal layers approximately 12 inches thick. Place each layer while layer below is still plastic.
- G. Compact each layer of concrete with concrete spading implements and mechanical vibrators of approved type and adequate number for size of placement. When immersion vibrators cannot be used, use form vibrators. Apply vibrators to concrete immediately after depositing. Move vibrator vertically through layer of concrete just placed and several inches into plastic layer below. Do not penetrate or disturb layers previously placed which have partially set. Do not use vibrators to aid lateral flow concrete. Closely supervise consolidation to ensure uniform insertion and duration of immersion.
- H. Handling and Placing Concrete: Conform to ACI 302.1R, ACI 304R and ACI 309R.

3.06 WATERSTOPS

- A. Embed waterstops in concrete across joints as shown. Waterstops shall be continuous for extent of joint; make splices necessary to provide continuity in accordance with manufacturer's instructions. Support and protect waterstops during construction operations; repair or replace waterstops damaged during construction.
- B. Install waterstops in concrete on one side of joints, leaving other side exposed until next pour. When waterstop will remain exposed for 2 days or more, shade and protect exposed waterstop from direct rays of sun during entire exposure and until exposed portion of waterstop is embedded in concrete.
- C. Splicing PVC Waterstops:
 - 1. Splice waterstops by heat-sealing adjacent waterstop sections in accordance with manufacturer's printed instructions.
 - 2. Butt end-to-end joints of two identical waterstop sections may be made in forms during placement of waterstop material.

3. Prior to placement in form work, prefabricate waterstop joints involving more than two ends to be joined together, angle cut, alignment change, or joining of two dissimilar waterstop sections, allowing not less than 24 inches long strips of waterstop material beyond joint. Upon inspection and approval by Project Manager, install prefabricated waterstop joint assemblies in form work, and butt-weld ends of 24 inches strips to straight- run portions of waterstop in forms.
- D. Setting PVC Waterstops:
1. Correctly position waterstops during installation. Support and anchor waterstops during progress of work to ensure proper embedment in concrete and to prevent folding over of waterstop by concrete placement. Locate symmetrical halves of waterstops equally between concrete pours at joints, with center axis coincident with joint openings. Thoroughly work concrete in joint vicinity for maximum density and imperviousness.
 2. Where waterstop in a vertical wall joint does not connect with any other waterstop, and is not intended to be connected to waterstop in future concrete placement, terminate waterstop 6 inches below top of wall.
- E. Replacement of Defective Field Joints: Replace waterstop field joints showing evidence of misalignment, offset, porosity, cracks, bubbles, inadequate bond or other defects with products and joints complying with Specifications.
- F. Resilient Waterstop:
1. Install resilient waterstop in accordance with manufacturer's instructions and recommendations.
 2. When requested by Project Manager, provide technical assistance by manufacturer's representative in field at no additional cost to City.
 3. Use resilient waterstop only where complete confinement by concrete is provided; do not use in expansion or contraction joints.
 4. Where resilient waterstop is used in combination with PVC waterstop, lap resilient waterstop over PVC waterstop minimum of 6 inches and place in contact with PVC waterstop. Where crossing PVC at right angles, melt PVC ribs to form smooth joining surface.
 5. At free top of walls without connecting slabs, stop resilient waterstop and grooves (where used) 6 inches from top in vertical wall joints.
 6. Bentonite Waterstop:
 - a. Locate bentonite waterstop as near as possible to center of joint and extend continuous around entire joint. Minimum distance from edge of waterstop to face of member: 5 inches.

- b. Where thickness of concrete member to be placed on bentonite waterstop is less than 12 inches, place waterstop in grooves at least 3/4 inch deep and 1 1/4 inches wide formed or ground into concrete. Minimum distance from edge of waterstop placed in groove to face of member: 2.5 inches.
 - c. Do not place bentonite waterstop when waterstop material temperature is below 40 degrees F. Waterstop material may be warmed so that it remains above 40 degrees F during placement but means used to warm it shall in no way harm material or its properties. Do not install waterstop where air temperature falls outside manufacturer's recommended range.
 - d. Place bentonite waterstop only on smooth and uniform surfaces; grind concrete smooth when necessary to produce satisfactory substrate, or bond waterstop to irregular surfaces using epoxy grout which completely fills voids and irregularities beneath waterstop material. Prior to installation, wire brush concrete surface to remove laitance and other substances that may interfere with bonding of epoxy.
 - e. In addition to adhesive backing provided with waterstop, secure bentonite waterstop in place with concrete nails and washers at 12 inches maximum spacing.
7. Adhesive Waterstop:
- a. With wire brush thoroughly clean concrete surface on which waterstop is to be placed and then coat with primer.
 - b. If surface is too rough to allow waterstop to form complete contact, grind to form adequately smooth surface.
 - c. Install waterstop with top protective paper left in place. Overlap joints between strips minimum of 1 inch and cover back over with protective paper.
 - d. Do not remove protective paper until just before final form work completion. Place concrete immediately. time that waterstop material is uncovered prior to concrete placement shall be minimized and shall not exceed 24 hours.

3.07 CONSTRUCTION JOINTS

A. Definitions:

- 1. Construction joint: Contact surface between plastic (fresh) concrete and concrete that has attained initial set.

2. Monolithic: Manner of concrete placement to reduce or eliminate construction joints; joints other than those indicated on Drawings will not be permitted without written approval of Project Manager. Where so approved, make additional construction joints with details equivalent to those indicated for joints in similar locations.
3. Preparation for Construction Joints: Roughen surface of concrete previously placed, leaving some aggregate particles exposed. Remove laitance and loose materials by sandblasting or high-pressure water blasting. Keep surface wet for several hours prior to placing of plastic concrete.

3.08 CURING

- A. Comply with ACI 308.1-23. Cure by preventing loss of moisture, rapid temperature change and mechanical injury for period of 7 curing days when Type II or IP cement has been used and for 3 curing days when Type III cement has been used. Start curing as soon as free water has disappeared from concrete surface after placing and finishing. A curing day is any calendar day in which temperature is above 50 degrees F for at least 19 hours. Colder days may be counted when air temperature adjacent to concrete is maintained above 50 degrees F. In continued cold weather, when artificial heat is not provided, removal of forms and shoring may be permitted at end of calendar days equal to twice required number of curing days. However, leave soffit forms and shores in place until concrete has reached specified 28-day strength, unless directed otherwise by Project Manager.
- B. Cure formed surfaces not requiring rubbed-finished surface by leaving forms in place for full curing period. Keep wood forms wet during curing period. Add water as needed for other types of forms. Or, at Contractor's option, forms may be removed after 2 days and curing compound applied.
- C. Rubbed Finish:
 1. At formed surfaces requiring rubbed finish, remove forms as soon as practicable without damaging surface.
 2. After rubbed-finish operations are complete, continue curing formed surfaces by using either approved curing/sealing compounds or moist cotton mats until normal curing period is complete.
- D. Unformed Surfaces: Cure by membrane curing compound method.
 1. After concrete has received final finish and surplus water sheen has disappeared, immediately seal surface with uniform coating of approved curing compound, applied at rate of coverage recommended by manufacturer or as directed by Project Manager. Do not apply less than 1 gallon per 180 square feet of area. Provide satisfactory means to properly control and check rate of application of compound.

2. Thoroughly agitate compound during use and apply by means of approved mechanical power pressure sprayers equipped with atomizing nozzles. For application on small miscellaneous items, hand-powered spray equipment may be used. Prevent loss of compound between nozzle and concrete surface during spraying operations.
3. Do not apply compound to dry surface. When concrete surface has become dry, thoroughly moisten surface immediately prior to application. At locations where coating shows discontinuities, pinholes or other defects, or when rain falls on newly coated surface before film has dried sufficiently to resist damage, apply additional coat of compound at specified rate of coverage.

3.09 REMOVAL OF FORMS AND SHORING

- A. Remove forms from surfaces requiring rubbing only as rapidly as rubbing operation progresses. Remove forms from vertical surfaces not requiring rubbed-finish when concrete has aged for required number of curing days. When curing compound is used, do not remove forms before 2 days after concrete placement.
- B. Leave soffit forms and shores in place until concrete has reached specified 28-day strength, unless directed otherwise by Project Manager.

3.10 DEFECTIVE WORK

- A. Immediately repair defective work discovered after forms have been removed. When concrete surface is bulged, uneven, or shows excess honeycombing or form marks which cannot be repaired satisfactorily through patching, remove and replace entire section.

3.11 FINISHING

- A. Patch honeycomb, minor defects and form tie holes in concrete surfaces with cement mortar mixed one part cement to two parts fine aggregate. Repair defects by cutting out unsatisfactory material and replacing with new concrete, securely keyed and bonded to existing concrete. Finish to make junctures between patches and existing concrete as inconspicuous as possible. Use stiff mixture and thoroughly tamp into place. After each patch has stiffened sufficiently to allow for greatest portion of shrinkage, strike off mortar flush with surface.
- B. Apply rubbed finish to exposed surfaces of formed concrete structures as noted on Drawings. After pointing has set sufficiently, wet surface with brush and perform first surface rubbing with No. 16 carborundum stone, or approved equal. Rub sufficiently to bring surface to paste, to remove form marks and projections, and to produce smooth, dense surface. Add cement to form surface paste as necessary. Spread or brush material, which has been ground to paste, uniformly over surface and allow to reset. In preparation for final acceptance, clean surfaces and perform final finish rubbing with No. 30 carborundum stone or approved equal. After rubbing, allow paste on surface to reset; then wash surface with clean water. Leave structure with clean, neat and uniform-appearing finish.

- C. Apply wood float finish to concrete slabs.

3.12 FIELD QUALITY CONTROL

- A. Testing shall be performed under provisions of Section 01454 - Testing Laboratory Services.
- B. Unless otherwise directed by Project Manager, following minimum testing of concrete is required. Testing shall be performed by qualified individuals employed by approved independent testing agency, and conform to requirements of ASTM C 1077.
 - 1. Take concrete samples in accordance with ASTM C 172.
 - 2. Make one set of four compression test specimens for each mix design at least once per day and for each 150 cubic yards or fraction thereof. Make, cure and test specimens in accordance with ASTM C 31 and ASTM C 39.
 - 3. When taking compression test specimens, test each sample for slump according to ASTM C 143, for temperature according to ASTM C 1064, for air content according to ASTM C 231, and for unit weight according to ASTM C 138.
 - 4. Inspect, sample and test concrete in accordance with ASTM C 94, Section 13, 14, and 15, and ACI 311.6-18 and ACI 311.7-18.
- C. Test Cores: Conform to ASTM C 42.
- D. Testing High Early Strength Concrete: When Type III cement is used in concrete, specified 7-day and 28-day compressive strengths shall be applicable at 3 and 7 days, respectively.
- E. If 7-day or 3-day test strengths (as applicable for type of cement being used) fail to meet established strength requirements, extended curing or resumed curing on those portions of structure represented by test specimens may be required. When additional curing fails to produce required strength, strengthening or replacement of portions of structure which fail to develop required strength may be required by Project Manager, at no additional cost to City.

3.13 PROTECTION

- A. Protect concrete against damage until final acceptance by City.
- B. Protect fresh concrete from damage due to rain, hail, sleet, or snow. Provide protection while concrete is still plastic, and whenever precipitation is imminent or occurring.

- C. Do not backfill around concrete structures or subject them to design loadings until components of structure needed to resist loading are complete and have reached specified 28-day compressive strength, except as authorized otherwise by Project Manager.

END OF SECTION

SECTION 01566

TREE AND PLANT PROTECTION



PART 1 – GENERAL

1.1 SUMMARY

- A. Section includes requirements for:
 - 1. Standard Practice References
 - 2. Submittal Requirements
 - 3. Site Protection for Tree Protection Zones (TPZ).
 - 4. Best Management Practices (BMP) for TPZ.
 - 5. Post ground disturbance maintenance and fertilization of trees.
 - 6. Techniques for Root Protection (Root collar excavation, Air Spading, and Root Pruning Trenches).

1.2 MEASUREMENT AND PAYMENT

- A. When there is not a separate item listed for work in this section, no separate measurement and payment is made. Include cost for work under this section in the related unit price work.
- B. Measurement and Payment is as noted on the Unit Price Schedule.
- C. Refer to Section 01270 – Measurement and Payment for unit price procedures.

1.3 REFERENCE

- A. ANSI A300 - Part 1: Tree, Shrub, and Other Woody Plant Maintenance - Standard Practices (Pruning)
- B. ANSI A300 – Part 2: Tree, Shrub and Other Woody Plant Maintenance – Standard Practices (Soil Management a. Modification, b. Fertilization, and c. Drainage)
- C. ANSI A300 - Part 5: Tree, Shrub and Other Woody Plant Maintenance – Standard Practices (Management of Trees and Shrubs During Site Planning, Site Development and Construction)
- D. Best Management Practices – Managing Trees During Construction
- E. Best Management Practices – Tree and Shrub Fertilization
- F. Best Management Practices – Tree Pruning
- G. Guide for Plant Appraisal, Latest Edition
- H. Texas Supplement to the Guide for Plant Appraisal – Latest Edition

1.4 SUBMITTALS

- A. Submit documentation showing successful completion of the requirements for one of the following:

1. International Society of Arboriculture (ISA) Certified Arborist.
 2. Proof of a degree in forestry from a Society of American Foresters (SAF) accredited university or college.
- B. Submit a soil and foliar nutrient analysis report for each Project Site prior to the start of any work.
- C. Submit a soil nutrient analysis report to determine nutrient needs for trees to be air spaded. The soil nutrient analysis report should be done by an accredited laboratory and should include findings on the following:
1. Soil Fertility Testing portion of report to include; soil pH, organic matter, nitrogen, potassium, phosphorus, manganese, magnesium, sulfur, zinc, iron and Cation Exchange Capacity (CEC).
 2. Foliar Nutrient Testing portion of report to include; nitrogen, potassium, phosphorus, manganese, magnesium, sulfur, zinc and iron.

1.5 SITE PROTECTION

- A. Preserve and protect all trees and plants located in identified TPZ to prevent foliage, branch, trunk, or root damage that could result from construction operations.
- B. Review of the installed TPZ's, pruning work and any other tree care operations, on-site with a Forester prior to the start of any clearing, grubbing, or any other site prep or construction operations.
- C. Provide 24-hour notice to Forester and Inspector for work that requires review/meeting on site.
- D. For further information on the execution of site protection refer to Part 3 of this specification.
- E. Prevent or minimize the following types of damage to trees and plants designated for preservation:
1. Compaction of root zone by foot or vehicular traffic, or material storage.
 2. Trunk or branch damage from equipment operations, material storage, or from nailing or bolting.
 3. Trunk or branch damage caused by ropes or guy wires.
 4. Root poisoning from spilled solvents, gasoline, paint or other noxious materials.
 5. Branch damage due to improper pruning or trimming (See notes/details on plans for tree pruning).
 6. Alteration of soil pH factor caused by depositing lime, concrete, plaster or other base materials near roots.
 7. Cutting of roots larger than 1-1/2 inches in diameter without prior approval from the Forester.

1.6 METHODS TO PROTECT EXISTING TREES

- A. Protect designated trees for preservation using one or more of the following methods:

1. Root Collar excavation
 2. Air-Spading excavation
 3. Root Pruning Trenches
- B. Final grade adjacent to the tree shall be at the direction of the Forester and shall match the surrounding proposed grading.
- C. Monitor and assist with field layout of the tree protection zones before demolition and construction operations begin. Ensure tree protection procedures and techniques are practiced as specified and address conditions specific to each site.

1.7 TREE PROTECTION ZONES

- A. Install tree protection zones around designated trees to be preserved in accordance with best management practices. Refer to Part 3.6 Exhibits for additional details on best management practices for tree protection zones.
- B. Implement the following best management practices when installing tree protection zones:
1. Define Tree Protection Zones (TPZ)
 2. Protect soil and roots
 3. Follow TPZ fencing guidelines
 4. Provide Trunk protection
 5. Use TPZ Signage
 6. Follow root pruning guidelines
 7. Consider grade changes
 8. Consider fertilization
- C. For additional information on TPZ BMP's, see Section 3.6 Exhibits, included in this Specification.

PART 2 – PRODUCTS – Not Used

PART 3 – EXECUTION

3.1 PROTECTION AND MAINTENANCE OF EXISTING TREES IN TREE PROTECTION

- A. Install tree protection fencing for all trees to be preserved and as specified in the Best Management practices – Managing Trees During Construction.
- B. Install tree protection fencing prior to site work or construction activity. Do not remove or relocate tree protection fencing without direct approval of the Forester.
- C. Do not operate equipment within Tree Protection Zones (TPZ) or fenced areas without approval of the Forester.
- D. Prevent damage to or compaction of TPZ by construction activities.

- E. Do not store equipment, construction materials, vehicles, topsoil or fill dirt inside a fence or TPZ. Entryways and access into a protected area shall not be provided unless approved by the Forester.
- F. Where a fence is closer than four (4) feet to a trunk, protect the trunk with a trunk protection structure.
- G. Exercise caution when working near TPZ.
- H. Repair damages to tree protection fencing at no additional cost to HCFCD.
- I. Prevent scarring of trunks or limbs by equipment or other means.
- J. Place six (6) to twelve (12) inches of mulch in the TPZ areas where construction access extends into the TPZ of a tree designated to remain.
- K. Ensure that mulch does not cover root collar or trunk. Place mulch in a manner that does not compact the soil. Once access is no longer needed, mulch shall be spread around the tree to a depth of no more than three (3) inches.
- L. Remove and dispose of tree protection fencing upon completion of all construction activities in each work zone.
- M. For additional information on TPZ fence material, and etc., see Section 3.6 Exhibits, included in this Specification.

3.2 MAINTENANCE AND FERTILIZATION OF AIR SPADED OR ROOT PRUNED TREES

- A. When a Root Stimulation Application is necessary, apply deep root fertilizer to air spaded trees according to Best Management Practices – Tree and Shrub Fertilization, as based on the findings of the report submitted.
- B. Regularly water trees, which were air spaded or root pruned, to eliminate additional stress caused by lack of moisture. Water thoroughly to saturate the entire root zone area within the drip line of the tree.
- C. Chemically treat trees with symptoms or signs of any pest or pathogen with the appropriate approved pesticide mixed and applied per the manufacturer's product application recommendations. Treat trees within 24 hours after observance of pest or pathogen. Forester has final approval on best product and method of application.
- D. Regular watering is defined as no less than ten gallons of water per diameter inch per week for each condition listed above.

3.3 ROOT PROTECTION MEASURES

- A. Root Collar Excavation: Use a pneumatic excavation tool to remove excessive soil from tree root systems within a three (3) foot radius of the trunk. Beyond the three (3) foot radius, additional hand equipment and light machinery may be used to remove excessive soil. Remove adventitious roots if they fall within the depth of excavation. Excavate soil around trees to a depth where root swell becomes visible in order to expose top of root ball and root flares and provide soil aeration within the Critical Root Zone. Perform

work under the direct supervision of the Forester, unless otherwise directed by the Forester.

- B. Air Spading Excavation: Use a pneumatic excavation tool with a rated operating pressure of 6.2-7.0 bar, air stream velocity at the cutting head of 2,200-2,500 km/hr. and an air displacement of 4,000-5,000 L/min. Use an air compressor adequately sized as required to power the pneumatic excavation tool in accordance with the manufacturers recommendations for the pneumatic excavation tool.
- C. Root Pruning Trenches: Install root pruning trenches prior to site work or construction activity. Cut all roots by chainsaw, handsaw or loppers. Cut roots cleanly, do not rip, tear, or chop roots. Backfill trench and compact immediately after inspection for cleanly cut roots has been completed by a Forester or an Inspector. (Refer to Damage Assessment, Section 3.5 of this document).
 - 1. Final grade adjacent to the tree shall be at the discretion of the Forester and shall match the surrounding proposed grading.
 - 2. Cover exposed roots to reduce damage caused by desiccation. Cover roots with soil or mulch and water to help protect them from drying as a result of the excavation process.
 - 3. Use extreme care to prevent excessive damage to root systems.

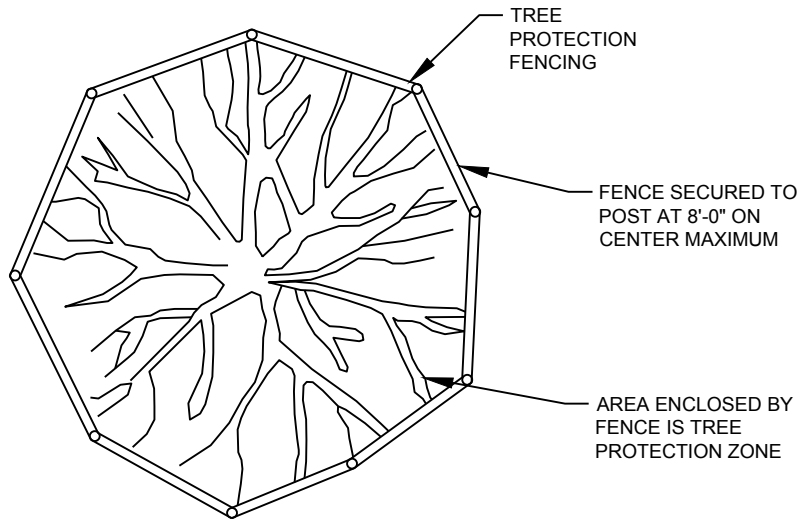
3.4 DAMAGE ASSESSMENT

- A. Repairable Damage: The contractor shall be assessed a penalty of \$1,000.00 per occurrence for each tree damaged as a result of construction operations or by other means, defined in General Section 1.5 within a designated TPZ. Correct any damage to the tree as directed by the Forester. This may include but is not limited to corrective pruning, root pruning, deep root fertilization and soil decompaction.
- B. Irreparable Damage: Trees determined to be damaged beyond repair will be removed by the contractor at no additional cost to HCFCD. A penalty will be assessed by the Forester using the Trunk Formula Method for valuing each tree (Refer to Guide for Plant Appraisal).

3.5 Exhibits

- A. Tree Protection Fencing (See Attached Detail)
- B. Trench Excavation Requirements (See Attached Detail)
- C. Root Pruning Detail (See Attached Detail)
- D. Access Road Tree Protection (See Attached Detail)
- E. Tree Island Detail (See Attached Detail)
- F. Tree Well Detail (See Attached Detail)

END OF SECTION

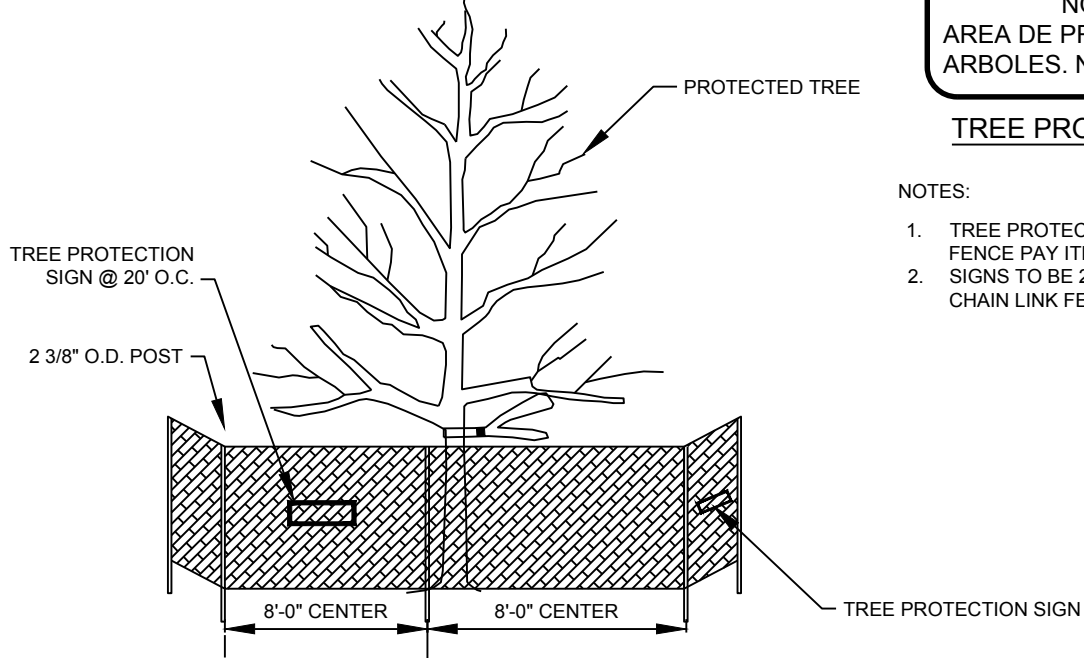


DBH*	MINIMUM DISTANCE FROM BASE OF TREE (FT)
<6"	3 FT.
6" ≤ 20"	1 FT. PER INCH OF TRUNK DIAMETER @ DBH
>20"	CONSULT ARBORIST

* MEASURE TREE DIAMETER AT BREAST HEIGHT (DBH)

PLAN VIEW - TREE PROTECTION FENCING DETAIL

N.T.S.



FRONT VIEW - TREE PROTECTION FENCING DETAIL

N.T.S.

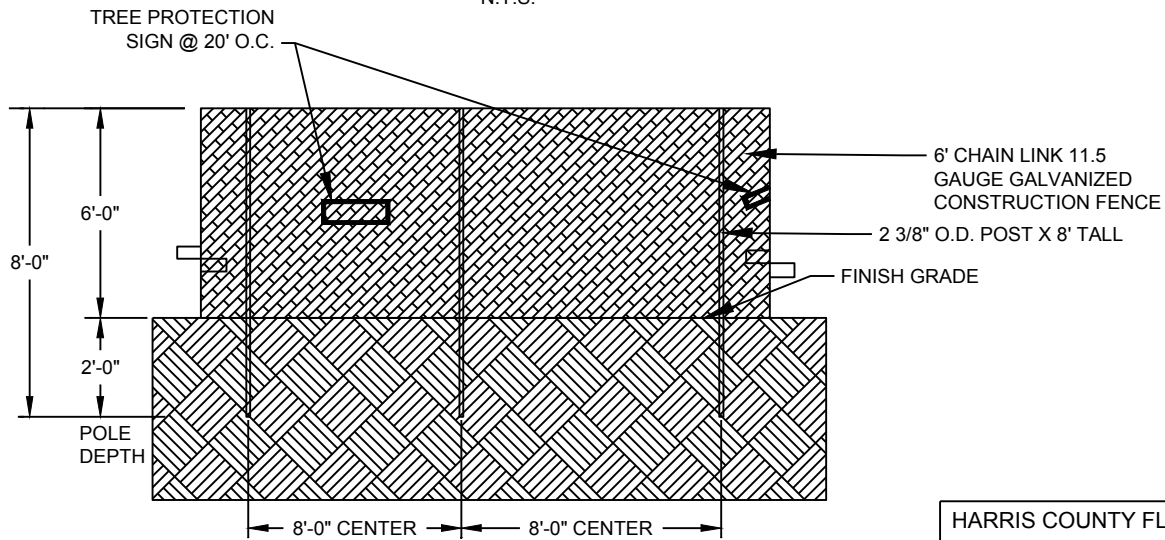
1.5" LETTER HEIGHT
**TREE PRESERVATION AREA.
 NO ENTRY.
 AREA DE PRESERVACION DE ARBOLES. NO HAY ENTRADA.**

TREE PROTECTION SIGN

N.T.S.

NOTES:

1. TREE PROTECTION SIGNS TO BE INCIDENTAL TO FENCE PAY ITEM.
2. SIGNS TO BE 20' O.C. SPACING ATTACHED TO CHAIN LINK FENCE.



PROTECTIVE CHAIN LINK FENCE

N.T.S.

HARRIS COUNTY FLOOD CONTROL DISTRICT
 TREE PROTECTION FENCING

TREE PROTECTION
 GENERAL REQUIREMENTS
 N.T.S.

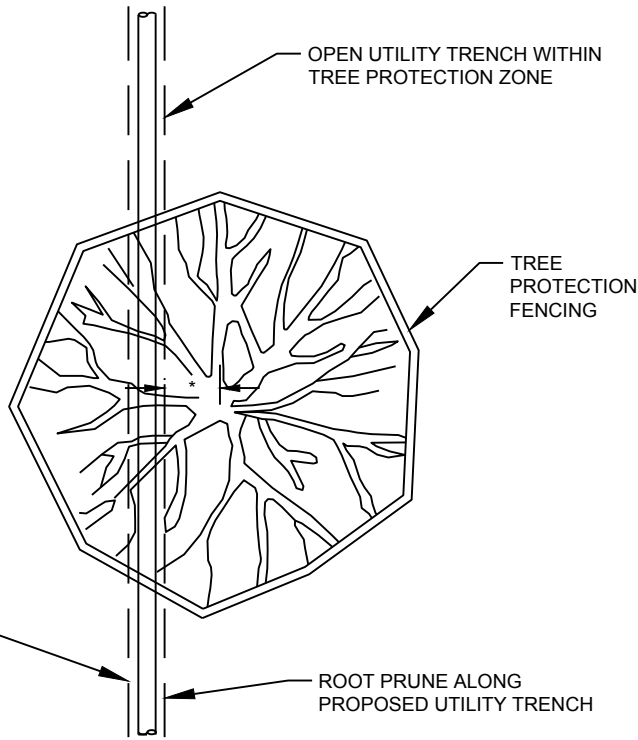
DATE: 2-07-2019

DWG. NO. 01562-01

Exhibit A

N.T.S.

* MINIMUM DISTANCE FROM TREE TRUNK TO EDGE OF UTILITY TRENCH



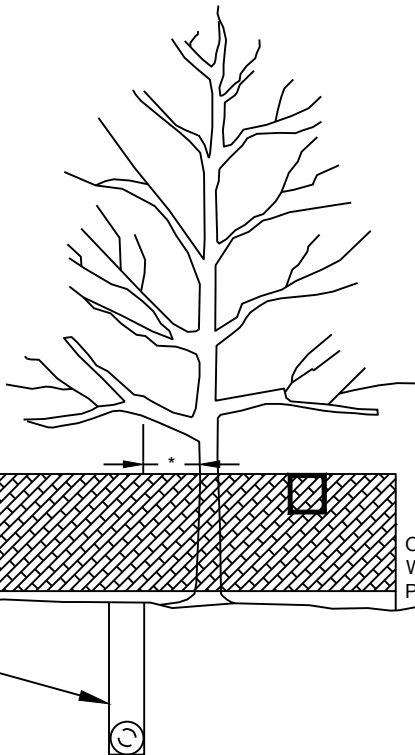
TRENCH WIDTH = PIPE DIAMETER + 24" (TYP.)

DBH*	MINIMUM DISTANCE FROM BASE OF TREE (FT)
<6"	3 FT.
6" ≤ 20"	1 FT. PER INCH OF TRUNK DIAMETER @ DBH
>20"	CONSULT ARBORIST

* MEASURE TREE DIAMETER AT BREAST HEIGHT (DBH)

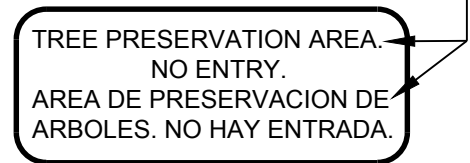
PLAN VIEW TRENCH EXCAVATION

N.T.S.



MOVE AND REPLACE TREE PROTECTION FENCE AS NECESSARY FOR TRENCH EXCAVATION

PIPE BEDDING AND BACKFILL PER COH STDS.



TREE PROTECTION SIGN

N.T.S.

NOTES:

1. TREE PROTECTION SIGNS TO BE INCIDENTAL TO FENCE PAY ITEM.
2. SIGNS TO BE 20' O.C. SPACING ATTACHED TO CHAIN LINK FENCE.

SECTION VIEW TRENCH EXCAVATION

N.T.S.

Exhibit B

HARRIS COUNTY FLOOD CONTROL DISTRICT
TRENCH EXCAVATION REQUIREMENTS

TREE PROTECTION
TRENCH REQUIREMENTS
N.T.S.

DATE: 2-07-2019

DWG. NO. 01562-02

DBH*	MINIMUM DISTANCE FROM BASE OF TREE (FT)
<6"	3 FT.
6" ≤ 20"	1 FT. PER INCH OF TRUNK DIAMETER @ DBH
>20"	CONSULT ARBORIST

* MEASURE TREE DIAMETER AT BREAST HEIGHT (DBH)

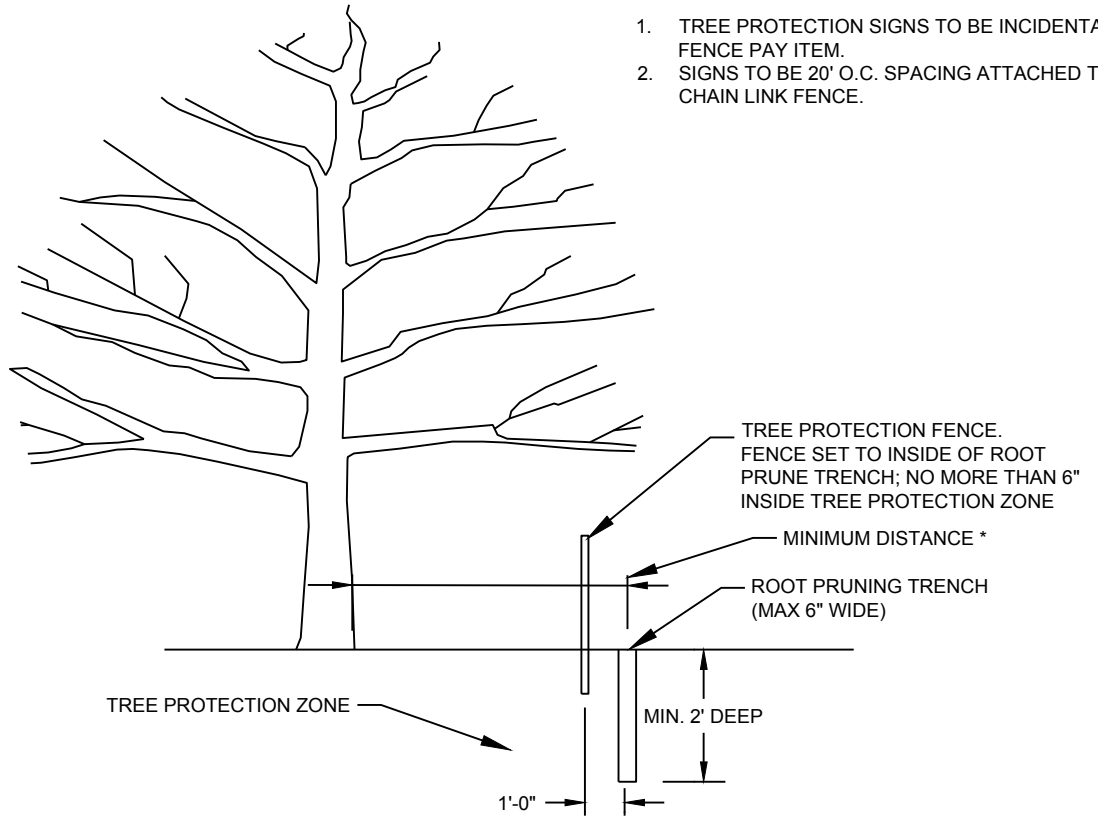
1.5" LETTER HEIGHT

TREE PRESERVATION AREA.
NO ENTRY.
AREA DE PRESERVACION DE ARBOLES. NO HAY ENTRADA.

TREE PROTECTION SIGN
N.T.S.

NOTES:

1. TREE PROTECTION SIGNS TO BE INCIDENTAL TO FENCE PAY ITEM.
2. SIGNS TO BE 20' O.C. SPACING ATTACHED TO CHAIN LINK FENCE.



ROOT PRUNING DETAIL
N.T.S.

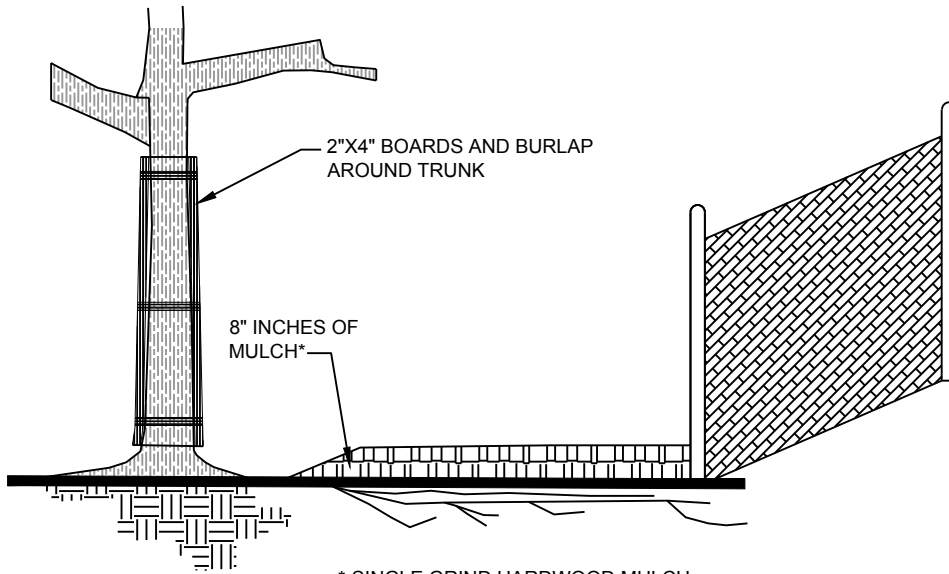
NOTE: APPLICABLE TO ROOT PRUNING ON ONE SIDE OF TREE ONLY. CONSULT ARBORIST FOR MORE EXTENSIVE ROOT PRUNING.

Exhibit C

HARRIS COUNTY FLOOD CONTROL DISTRICT
ROOT PRUNING DETAIL

TREE PROTECTION
TREE AND ROOT PRUNING
N.T.S.

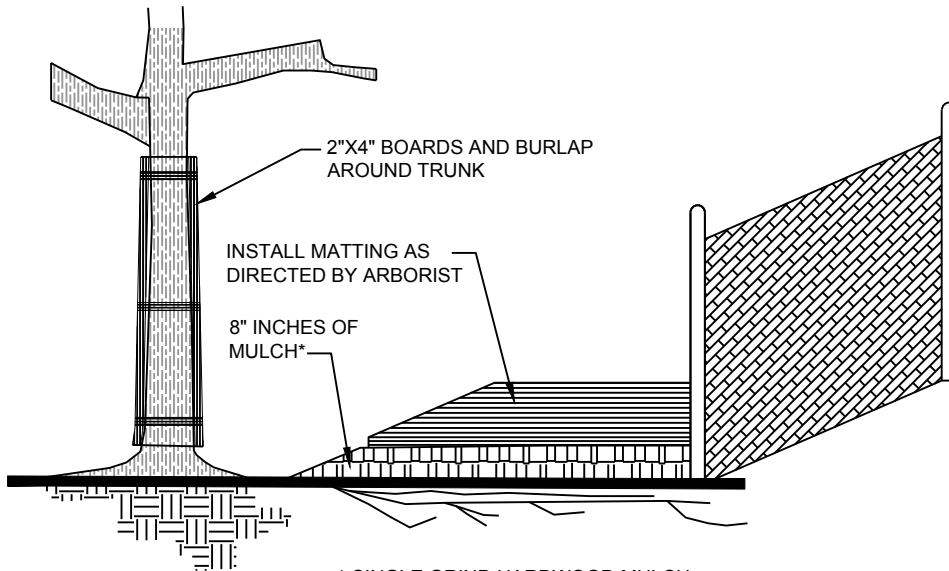
DATE: 2-07-2019 DWG. NO. 01562-03



* SINGLE GRIND HARDWOOD MULCH

NOTES:

1. ONE COMPLETE WRAP OF BURLAP AROUND TREE TRUNK.
2. STRAPS OR WIRE ARE USED ON OUTSIDE OF PLANK TO BIND BOARDS IN PLACE.
3. NO FASTENERS SHOULD BE DRIVEN INTO TREE.
4. TRUNK PROTECTION SHOULD BE ADJUSTED TO ALLOW GROWTH IF TRUNK PROTECTION IS IN PLACE DURING PERIODS OF TRUNK DIAMETER GROWTH.
5. REMOVE TRUNK PROTECTION UPON PROJECT COMPLETION.



* SINGLE GRIND HARDWOOD MULCH

HARRIS COUNTY FLOOD CONTROL DISTRICT
ACCESS ROAD TREE PROTECTION

ACCESS ROAD TREE PROTECTION

N.T.S.

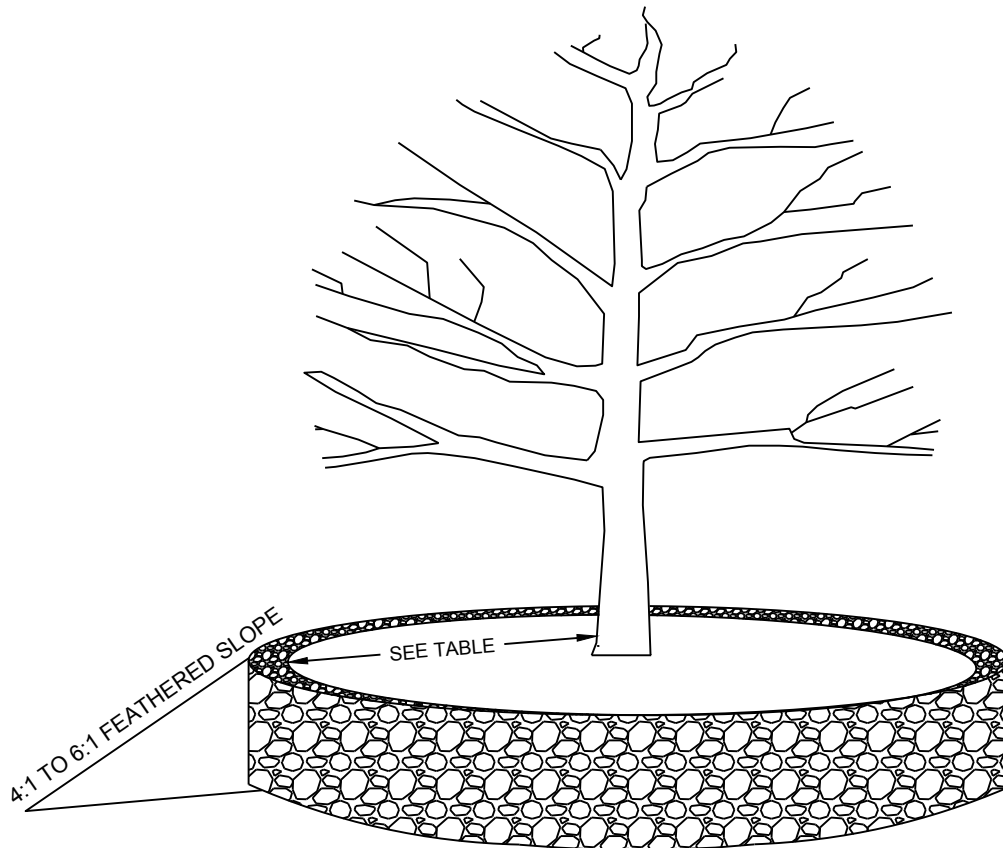
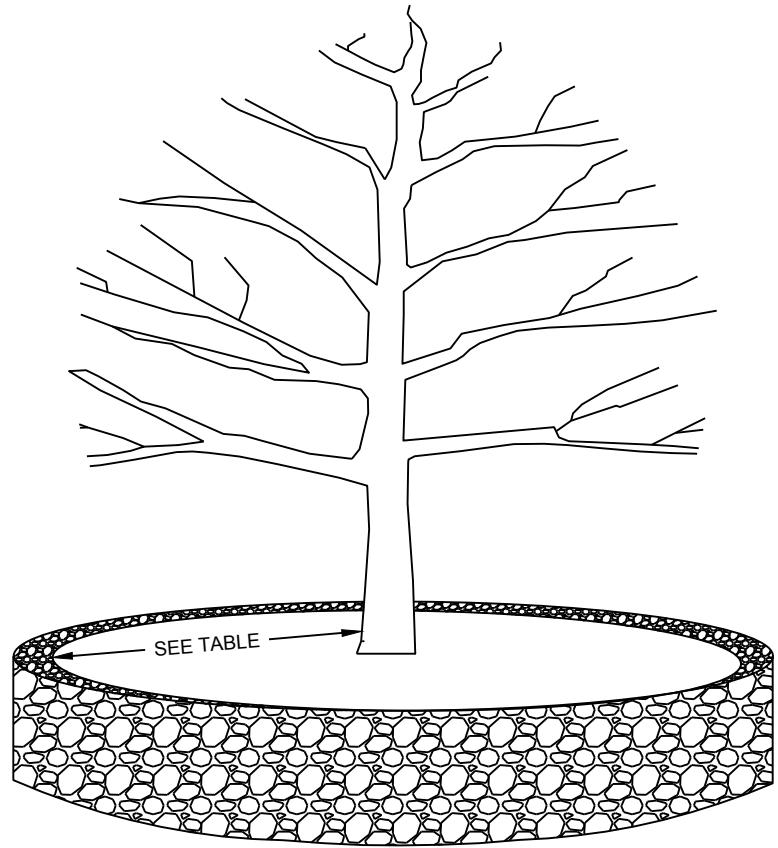
DATE: 2-07-2019

DWG. NO. 01562-04

Exhibit D

DBH*	MINIMUM DISTANCE FROM BASE OF TREE (FT)
<6"	3 FT.
6" ≤ 20"	1 FT. PER INCH OF TRUNK DIAMETER @ DBH
>20"	CONSULT ARBORIST

* MEASURE TREE DIAMETER AT BREAST HEIGHT (DBH)



HARRIS COUNTY FLOOD CONTROL DISTRICT
TREE ISLAND DETAIL

A TREE ISLAND MAY BE CONSTRUCTED
IF THE GRADE MUST BE LOWERED
COMPLETELY AROUND A TREE.
N.T.S.

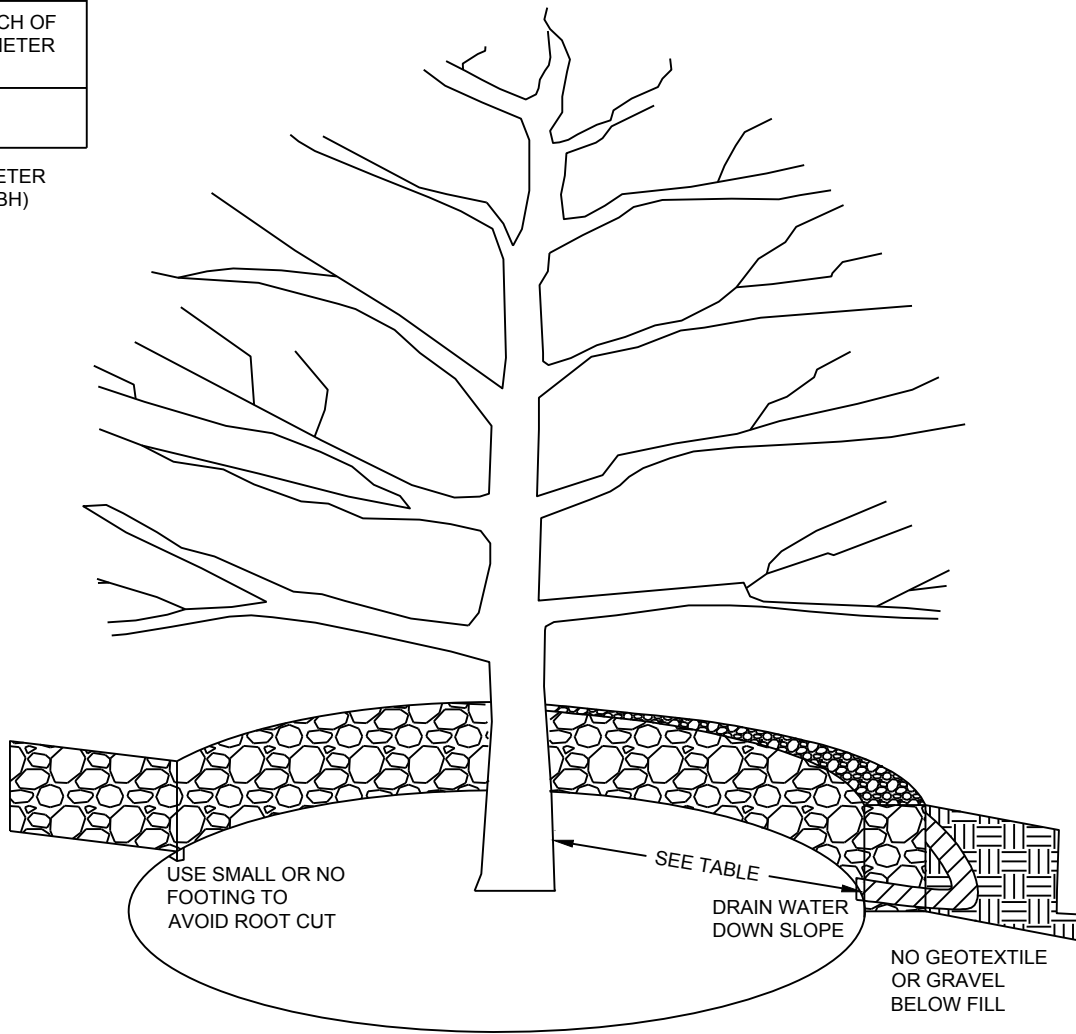
DATE: 2-07-2019

DWG. NO. 01562-05

Exhibit E

DBH*	MINIMUM DISTANCE FROM BASE OF TREE (FT)
<6"	3 FT.
6" ≤ 20"	1 FT. PER INCH OF TRUNK DIAMETER @ DBH
>20"	CONSULT ARBORIST

* MEASURE TREE DIAMETER AT BREAST HEIGHT (DBH)



HARRIS COUNTY FLOOD CONTROL DISTRICT TREE WELL DETAIL	
A TREE WELL MAY BE CONSTRUCTED TO MINIMIZE SOIL FILL OVER TREE ROOT SYSTEM	
N.T.S.	
DATE: 2-07-2019	DWG. NO. 01562-06

Exhibit F

SECTION 02361

REINFORCED SILT FENCE



PART 1 – GENERAL

1.1 SUMMARY

- A. Section includes requirements for furnishing, installing, maintaining and removing temporary reinforced silt fence.

1.2 MEASUREMENT AND PAYMENT

- A. Measurement and payment is as noted on the Unit Price Schedule.
- B. Refer to Section 01270 - Measurement and Payment for unit price procedures.
- C. No separate measurement and payment will be made for maintenance or removal of accumulated sediment. Removal of the reinforced silt fence is incidental to the cost of the reinforced silt fence.

1.3 REFERENCES

- A. AASHTO M 288 - Geotextile Specification for Highway Applications.
- B. ASTM D 4355 - Deterioration of Geotextiles by Exposure to Light, Moisture and Heat in a Xenon-Arc Type Apparatus.
- C. ASTM D 4491 - Water Permeability of Geotextiles by Permittivity.
- D. ASTM D 4632 - Grab Breaking Load and Elongation of Geotextiles.
- E. ASTM D 4751 - Determining Apparent Opening Size of a Geotextile.

1.4 SUBMITTALS

- A. Refer to Section 01330 - Submittal Procedures.
- B. Submit catalog data and mill certificate for the reinforced silt fence geotextile and catalog data for welded wire fabric mesh or plastic grid mesh reinforcement to be used.

PART 2 – PRODUCTS

2.1 GEOTEXTILE FABRIC

- A. Geotextile fabric shall consist of long-chain synthetic polymers composed of at least 95 percent by weight of polyolefins in a woven fabric.
- B. Geotextile fabric shall contain stabilizers and/or inhibitors to make the fibers resistant to deterioration resulting from exposure to sunlight or heat. The geotextile fabric shall be resistant to commonly encountered soil chemicals, mildew, rot and insects.

LITTLE VINCE BAYOU GREENWAY

LITTLE VINCE BAYOU GREENWAY

- C. Geotextile fabric shall be free of defects or flaws that affect its physical properties.
- D. Provide a geotextile fabric with a minimum grab strength of 100 lbs (ASTM D 4632).
- E. Provide reinforced silt fence with properties in accordance with AASHTO M 288 *Geotextile Specification for Highway Applications* Table 6.

2.2 SUPPORTS

- A. Provide wooden stakes or steel fence supports having a minimum length of 4 feet.
- B. Provide mesh reinforcement of galvanized 2 inch by 4 inch welded wire fabric mesh.

PART 3 – EXECUTION

3.1 GENERAL

- A. Install reinforced silt fences at locations shown on Plans or as approved by the Engineer.
- B. Place reinforced silt fences in a continuous manner and transverse to the runoff. Place the reinforced silt fence to follow the contours of the site. Do not allow water to flow around the end of the fence.
- C. Provide continuous rolls of the reinforced silt fence fabric and cut to length to minimize the use of fabric joints. When joints are necessary, the fabric shall be spliced together only at a support with a minimum 6 inch overlap.

3.2 MAINTENANCE

- A. Inspect reinforced silt fence after each rainfall, daily during periods of daily rainfall, and, at a minimum, once every week. Repair and/or replace any component of the reinforced silt fence that becomes defective from intended use.
- B. Remove sediment deposits when the deposit reaches 1/3 the height of the fence. Dispose of sediment properly.
- C. Remove reinforced silt fence and dispose of any sediment accumulations promptly when directed by Engineer.

3.3 DAMAGED MATERIAL

- A. Repair damage to reinforced silt fence and supports immediately.

3.4 DISPOSAL

- A. Refer to Section 02120 – Material Disposal.

END OF SECTION

SECTION 02365

STABILIZED CONSTRUCTION ACCESS



PART 1 – GENERAL

1.1 SUMMARY

- A. Section includes requirements for construction, maintenance and removal of stabilized construction access.

1.2 MEASUREMENT AND PAYMENT

- A. Measurement and payment is as noted on the Unit Price Schedule.
- B. Refer to Section 01270 - Measurement and Payment for unit price procedures.
- C. No separate measurement and payment will be made for maintenance or removal.

1.3 SUBMITTALS

- A. Refer to Section 01330 - Submittals.
- B. Refer to Section 02379 - Geotextiles for Erosion Control Systems.
- C. Submit gradation for 3 inch to 5 inch granular fill. Refer to Section 02378 - Riprap and Granular Fill.

PART 2 – PRODUCTS

2.1 GEOTEXTILE SEPARATION FABRIC

- A. Provide a geotextile of woven or spunbond nonwoven fibers consisting of long-chain synthetic polymers composed of at least 95 percent by weight of polyolefins. Provide geotextile fabric equal to the following average roll values or as directed by the Engineer:
 - 1. Minimum average roll value.
 - a. Elongation < 50 percent.
 - b. Grab Strength \geq 200 pounds.
 - c. Puncture Strength \geq 75 pounds.
 - d. UV Stability (retained strength) \geq 50 percent after 500 hours of exposure.
 - 2. Maximum average roll value.
 - a. Apparent Opening Size (AOS) - 0.212 to 0.6 mm (#70 to #30 US sieve).

LITTLE VINCE BAYOU GREENWAY

LITTLE VINCE BAYOU GREENWAY

2.2 GRANULAR FILL

- A. Refer to Section 02378 - Riprap and Granular Fill.

PART 3 – EXECUTION

3.1 GENERAL

- A. Provide stabilized access, washing areas and parking areas at locations shown on the Plans or as approved by the Engineer.
- B. Furnish and place geotextile fabric as a permeable separator to prevent mixing of granular fill with underlying soil.
- C. Place 3 inch to 5 inch granular fill to dimensions and depths shown on the Plans, or as directed by the Engineer. The minimum thickness shall be 8 inches.
- D. Granular Fill being reused shall be free of sediment, and meet the requirements of Specification 02378 - Riprap and Granular Fill.
- E. Roads and parking areas shall be graded to provide sufficient drainage away from stabilized areas. Use sandbags, gravel, boards or similar methods to prevent sediment from entering public rights-of-way, storm drains, ditches and watercourses.

3.2 MAINTENANCE

- A. Inspect and maintain stabilized areas daily. Provide periodic top dressing with additional granular fill as necessary.
- B. Repair or replace components of stabilized access areas that become defective from intended use.
- C. Maintain stabilized access areas until acceptance of the Project or as directed by Engineer.
- D. Remove stabilized access promptly when directed by Engineer. Restore areas where stabilized construction access was removed to final project grade in preparation of turf establishment by others.

3.3 DISPOSAL

- A. Refer to Section 02120 - Material Disposal.

END OF SECTION

SPECIAL SPECIFICATION

ITEM 08120

BASALT FIBER REINFORCED POLYMER (BFRP) FOR CONCRETE
REINFORCEMENT

8120.1 Description. This work consists of furnishing and placing basalt fiber reinforced polymer (BFRP) reinforcement as detailed on the plans and specified herein.

8120.2 Materials. Furnish BFRP reinforcement that meet the following material specifications and requirements and are fabricated in accordance with the details on the plans. The size of BFRP bars shall be consistent with typical standard sizes of steel reinforcing bars.

1. Fibers. Use fibers in the form of unidirectional rovings of given size and weight with fiber sizing and coupling agents that are compatible with the resin system used to impregnate them. The BFRP reinforcement must contain 70 percent minimum, by weight of basalt fiber.
2. Resin Matrix. Use commercial grades of epoxy resin. Ensure the glass transition temperature (T_g) of the resin is not less than 212 degrees Fahrenheit (F). The glass transition temperature of the resin does not represent a service level maximum temperature, but a quality assurance tool used by the manufacturer. Test the resin matrix in accordance with the Differential Scanning Calorimetry (DSC) method as described in ASTM E 1356.
3. Fillers: Inorganic fillers and secondary fibers may be used, but their quantity shall not exceed 20% by weight of the base polymer resin specified. Commercial grade additives and process aids such as release agents, low profile shrink additives, initiators, promoters, hardeners, catalysts, pigments, fire-retardants, and ultra violet inhibitors are permitted and depend on the process method. If used, limit shrink additives to less than 20% by weight of the polymer resin.
4. Mechanical properties. Furnish BFRP with the following minimum requirements:
 - a. Tensile Strength: this property varies with bar size. The minimum tensile strength of BFRP reinforcement is listed in Table 1. Testing shall be in accordance to ASTM D7205.

Table 1. Minimum Tensile Strength Requirements.

Bar	Minimum Tensile Strength (ksi)
3	140
4	135
5	130
6	125
7	120
8	110

- b. Tensile Modulus: The nominal tensile modulus of elasticity shall average 6,000 ksi according to ASTM D7205.
- c. Transverse Shear: Transverse shear is tested according to ASTM D7617. The minimum transverse shear for all bars shall be 20 ksi.
- d. Moisture Absorption: Moisture absorption tests shall be determined in accordance with ASTM D570. The maximum value of this test shall follow ACI recommendations and be less than 1.0%.
- e. Bond Strength: The guaranteed bond strength for all bars must follow ACI recommendations of ACI 440.6-08, 1.4 ksi. The manufacturer is to disclose the test method used for testing bond strength. A suggested test method is ACI 440.3R test method B3.
- f. Ultimate Tensile Strain: The ultimate tensile strain shall be calculated by dividing the guaranteed tensile strength by the nominal tensile modulus of elasticity. The nominal values obtained by this procedure should at least be 1.4%.

Provide BFRP rebar (GatorBar) or approved equal, typical manufacturer listed below;

Neuvokas Corp., 3206 Number 6 Road, PO Box 220, Ahmeek, MI 49901, (906) 934-2661,

8120.3 Submittals. Provide four 4 foot long quality assurance samples of each size BFRP bar at the beginning of each project or as determined by the Department.

Submit independent laboratory test reports including the following, for each size of BFRP used on the project.

1. Results of the tensile test of BFRP reinforcement, for each size of reinforcement used, including the following:
 - a. Diameter(s);
 - b. Breaking load;
 - c. Tensile modulus, and
 - d. Strain at ultimate tensile load

2. Results of the transverse shear test of BFRP reinforcement, including the following:
 - a. Diameter(s)
 - b. Breaking load, and;
 - c. Shear modulus

Provide the Engineer a certification stating the materials furnished meets the specifications as described herein. The certification shall include:

1. The basalt fiber and percentage by weight in the reinforcement;
2. The resin matrix material, composition percentage of filler material, and resin glass transition temperature (T_g);
3. Guaranteed bond strength, including the test method used, and;
4. Results of moisture absorption testing

The BFRP reinforcement may not be incorporated into the work until the submittal approval is received by the Engineer. Allow 10 working days for approval.

8120.4 Construction. Before ordering material, submit approved drawings and specifications to manufacturer for quotation. This should include: bar size, length, bent shape and radius of bends, and quantities in linear feet. BFRP reinforcement bars shall be uniform in diameter/ size and free of defects that would be injurious to the mechanical and durability properties. Defects include: cracks, kinks, and surface pitting. Slight discoloration over time is typical and is not cause for concern.

1. Field fabrication. No field fabrication is permitted except tying of BFRP reinforcing bars, field cutting in accordance with the plans, or both. Field cut BFRP reinforcement only when specifically permitted using high speed grinding cutter, fine blade saw, diamond blade, or masonry blade. When BFRP bars are cut in the field, shear cutting is not permitted. All surface

damage due to cutting shall be inspected by the Engineer and repaired or replaced at the Contractor's expense.

2. Handling. BFRP bars can be handled similar to their steel counterparts. If lifting long sections, use two or three pickup points. Minor scratches and chipping are allowed and do not affect performance. More than .04 inch of chipping should be repaired or replaced. When more than 2% of the surface area of the bar is excessively chipped or cracked it must be replaced.
3. Storage of BFRP reinforcement. Store reinforcement above the surface of the ground on platforms, skids, pallets, or other supports as close as possible to the point of placement. If stored outdoors for more than two (2) months, the BFRP bars shall be covered with a tarp or other protective cover. Protective cover must be at least opaque in color.
4. Placing and Fastening. Place all reinforcement within the tolerances recommended in the CRSI "Manual of Standard Practice" unless otherwise specified. Hold reinforcement firmly during the placing and setting of the concrete. If BFRP reinforcement is not adequately supported or tied to resist settlement, floating upward, or movement in any direction during concrete placement, concrete placement shall be halted until corrective measures are taken.
5. Ties and Supports: All accessories for use with the BFRP bars such as tie wires, bar chairs, supports or clips can be either steel or plastic variances or other tie specialties. Keep reinforcement properly positioned during placement of concrete according to the following:
 - a. Use appropriate ties (plastic or wire) to support the top mat of deck reinforcement
 - b. When pre-cast mortar blocks are used provide blocks that have cast-in wires ties
 - c. Provide nylon or plastic wire ties (zips), or pneumatically installed injection molded ties (KodiKilps)
 - d. Place all reinforcement in designated position and securely hold in position while placing and consolidating concrete
 - e. Fasten bars together with ties at all intersections for both top and bottom mats
 - f. Do not use pebbles, pieces of broken glass, stone or brick, metal pipe or wooden blocks as bar supports or to separate layers of bars
 - g. Provide the same cover clearances for splices that is shown or specified for the reinforcement.

6. Lap Splices: Lap splice is the only approved method to tie bars together to make a continuous bar. Mechanical splices are not allowed. Lap length and spacing shall be (40X bar diameter) or as specified on the plans.

8120.5 Measurement & Payment. Basalt Fiber Reinforced Polymer (BFRP) For Concrete Reinforcement quantities will not be measured or paid for directly. All costs of furnishing, fabrication, placement, ties, chairs, bending, labor and equipment shall be considered subsidiary to bids for concrete structures, requiring reinforcement.

There are no line code(s), description(s), or unit(s) for this Item.

END OF ITEM 8120

Item 441-00 Steel Structures



1. DESCRIPTION

Fabricate and erect structural steel and other metals used for steel structures or for steel portions of structures.

2. MATERIALS

- 2.1. **Base Metal.** Use metal that meets Item 442, “Metal for Structures.”
- 2.2. **Approved Electrodes and Flux-Electrode Combinations.** Use only electrodes and flux-electrode combinations conforming to AWS A5 specifications and pertinent classifications for the applicable welding processes. When requested, submit a current Certificate of Conformance (COC) containing all test results as required by the applicable AWS A5 specification and welding code. Provide proof of Buy America compliance for welding consumables when requested. For bridge main member fabrication, submit the COC annually.
- 2.3. **High-Strength Bolts.** Use fasteners that meet Item 447, “Structural Bolting.” Use galvanized fasteners on field connections of bridge members when ASTM F3125, Grade A325 bolts are specified and steel is painted.
- 2.4. **Paint Systems.** Provide the paint system (surface preparation, primer, intermediate, and appearance coats as required) shown on the plans. Provide System IV if no system is specified.
- 2.4.1. **Standard Paint Systems.** Standard paint systems for painting new steel include the following.
- 2.4.1.1. **System III-B.** Provide paint in accordance with [DMS-8101](#), “Structural Steel Paints—Performance.” Provide inorganic zinc (IOZ) prime coat, epoxy intermediate coat, and urethane appearance coat for all outer surfaces except those to be in contact with concrete. Provide epoxy zinc prime coat for touchup of IOZ.
- 2.4.1.2. **System IV.** Provide paint in accordance with [DMS-8101](#). Provide IOZ prime coat and acrylic latex appearance coat for all outer surfaces except those to be in contact with concrete. Provide epoxy zinc prime coat for touchup of IOZ.
- 2.4.2. **Paint Inside Tub Girders and Closed Boxes.** Provide IOZ primer meeting the requirements of [DMS-8101](#) to all interior surfaces, including faying surfaces and splice plates.
- 2.4.3. **Special Protection System.** Provide the type of paint system shown on the plans or in conformance with special provisions to this Item. Special Protection Systems must have completed AASHTO Product Evaluation & Audit Solutions Structural Steel Coatings (SSC) testing regimen as a complete system, with full data available from AASHTO, and be approved before use.
- 2.4.4. **Galvanizing.** Provide galvanizing, as required, in accordance with Item 445, “Galvanizing.”
- 2.4.5. **Paint over Galvanizing.** Paint over galvanized surfaces, when required, in accordance with Item 445.
- 2.4.6. **Field Painting.** Provide field paint, as required, in accordance with Item 446, “Field Cleaning and Painting Steel.”

3. CONSTRUCTION

3.1. General Requirements.

3.1.1. Applicable Codes. Perform all fabrication of bridge members in accordance with AASHTO/NSBA Steel Bridge Collaboration S2.1. Follow all applicable provisions of the appropriate AWS code (D1.5 or D1.1) except as otherwise shown on the plans or in accordance with this Item. Weld sheet steel (thinner than 1/8 in.) in accordance with ANSI/AWS D1.3, *Structural Welding Code—Sheet Steel*. Unless otherwise stated, requirements of this Item are in addition to the requirements of S2.1 for bridge members. Follow the more stringent requirement in case of a conflict between this Item and S2.1. Perform all bolting in accordance with Item 447.

Fabricate railroad underpass structures in accordance with the AREMA *Manual for Railway Engineering* and this Item. In the case of a conflict between this Item and the AREMA manual, the more stringent requirements apply.

3.1.2. Notice of Fabrication. Give adequate notice before commencing fabrication as specified in Table 1. Include a schedule for all major fabrication processes and dates when inspections are to occur.

**Table 1
Notice of Commencing Fabrication**

Plant Location	Notice Required
In Texas	7 days
In the contiguous United States	21 days
Outside the contiguous United States	60 days

Perform no Department work in the plant before the Engineer authorizes fabrication. The Contractor must bear all costs associated with the Department’s inspection when changes to their fabrication schedules occur and are not adequately conveyed to the Department in accordance with Table 1.

When any structural steel is fabricated outside the contiguous 48 states, the additional cost of inspection will be in accordance with Article 6.4., “Sampling, Testing, and Inspection.”

3.1.3. Bridge Members. Primary bridge members include:

- web and flanges of plate, tub, and box girders;
- rolled beams and cover plates;
- floor beam webs and flanges;
- arch ribs and arch tie beams or girders;
- truss members;
- diaphragm members for curved plate girders or beams;
- pier diaphragm members for tub girders;
- splice plates for primary members; and
- any other member designated as “primary” or “main” on the plans.

Secondary bridge members include:

- bracing (diaphragms, cross frames, and lateral bracing); and
- all other miscellaneous bridge items not considered primary bridge members.

3.1.4. Responsibility. The Contractor is responsible for the correctness and completeness of shop drawings and for the fit of shop and field connections.

3.1.5. **Qualification of Plants and Personnel.**

- 3.1.5.1. **Plants.** Fabrication plants that produce bridge members must be approved in accordance with [DMS-7370](#), "Steel Bridge Member Fabrication Plant Qualification." The Department's MPL has a list of approved bridge member fabrication plants.

Fabrication plants that produce the following non-bridge steel members must be approved in accordance with [DMS-7380](#), "Steel Non-Bridge Member Fabrication Plant Qualification":

- Item 610, "Roadway Illumination Assemblies,"
- Item 613, "High Mast Illumination Poles,"
- Item 614, "High Mast Illumination Assemblies,"
- Item 650, "Overhead Sign Supports,"
- Item 654, "Sign Walkways,"
- Item 686, "Traffic Signal Pole Assemblies," and
- Special Specification, "Intelligent Transportation System (ITS) Pole with Cabinet."

The Materials and Tests Division (MTD) maintains a list of approved non-bridge fabrication plants on the Department MPL that produce these members.

Fabrication plants that produce metal bridge rail must be approved in accordance with [DMS-7395](#), "Metal Railing Fabrication Plant Qualification." The Department's MPL has a list of approved metal bridge railing fabrication plants.

- 3.1.5.2. **Personnel.** Provide a QC staff qualified in conformance with the applicable AWS code. Provide an adequate number of qualified QC personnel for each specific production operation. QC must be onsite and independent of production personnel, as the Engineer determines. QC personnel must be proficient in using the applicable plans, specifications, and test methods, and in verifying compliance with the plant QC and production procedures. Welding inspectors must be current AWS Certified Welding Inspectors for bridge member plants and for non-bridge member plants requiring Department approval in accordance with [DMS-7380](#) and [DMS-7395](#). The QC staff must provide inspection of all materials and workmanship before the Department's inspection. Provide the Department inspector with adequate personnel and equipment needed to move material for inspection access. QC is solely the Contractor's responsibility.

- 3.1.5.3. **Nondestructive Testing (NDT).** Personnel performing NDT must be qualified in conformance with the applicable AWS code and the employer's Written Practice. Level III personnel who qualify Level I and Level II technicians must be certified by ASNT within the areas in which the NDT Level III is qualified. In addition, NDT technicians must pass hands-on tests administered by MTD. This will remain current provided they continue to perform testing on Department materials as evidenced by test reports requiring their signature. A technician who fails any of the hands-on tests must wait 3 mo. or as approved before retesting. Qualification to perform NDT will be revoked when the technician's employment is terminated or when the technician does not perform a test on a Department project for 6 consecutive mo. The technician must pass a new hands-on test to be re-certified. Testing of similar weld joints for non-Department projects may be considered by the Engineer instead of re-testing, provided sufficient documentation is submitted with the signature of the project's Engineer. These requirements also apply to testing agencies and individual third-party contractors.

- 3.1.5.4. **Welding Procedure Specifications (WPSs) Qualification Testing.** For fabricators qualified in accordance with [DMS-7370](#), [DMS-7380](#), or [DMS-7395](#), laboratories performing procedure qualification testing for WPSs must be accredited by a nationally recognized agency that performs testing in accordance with ISO/International Electrotechnical Commission (IEC) 17025 in the mechanical field of testing.

3.1.6. **Drawings.**

- 3.1.6.1. **Erection Drawings.** Submit erection drawings prepared by a licensed professional engineer, including calculations, for approval in accordance with Item 5, "Control of the Work," at least 4 weeks before erecting any portion of field-spliced (welded or bolted) girders, railroad underpasses, trusses, arches, or other

members for which erection drawings are required on the plans. Include drawings and calculations for any temporary structures used to support partially erected members. Erection drawings are not required for rolled I-beam units unless otherwise shown on the plans.

Prepare erection drawings following the procedures outlined in Section 2.2 of AASHTO/NSBA Steel Bridge Collaboration S10.1. At minimum, include:

- plan of work area showing structure location relative to supports and all obstructions;
- equipment to be used, including allowable load information;
- erection sequence for all pieces;
- member weights and center of gravity location of pieces to be lifted;
- locations of cranes, holding cranes, and temporary supports (falsework), including when to release load from temporary supports and holding cranes;
- details of falsework, including specific bracing requirements with maximum allowable design wind speed clearly indicated;
- girder lifting points;
- diaphragm and bracing requirements; and
- minimum connection requirements when more than the standard requirements.

Perform erection engineering evaluation of the structural adequacy and stability of constructing the bridge system for each step of the steel erection.

Do not proceed if site conditions differing from those depicted on the approved erection drawings could affect temporary support stresses, erected girders, or public safety in any manner. Revise erection drawings and resubmit to the Engineer for approval before proceeding.

- 3.1.6.2. **Shop Drawings.** Prepare and electronically submit shop drawings before fabrication for each detail of the general plans requiring the use of structural steel, forgings, wrought iron, or castings in accordance with the Bridge Division *Guide to Shop Drawing Submittals* available on the Department's website, and as directed for other items the standard specifications require.

Indicate joint details on shop drawings for all welds. Provide a title block on each sheet in the lower right corner that includes:

- project identification data, including federal and state project numbers,
- sheet numbering for the shop drawings,
- name of the structure or stream for bridge structures,
- name of owner or developer,
- name of the fabricator or supplier, and
- name of the Contractor.

Provide one complete approved 11 × 17-in. set in hardcopy to the Department Inspector at the fabrication plant. Stamp it "For Materials and Tests Division Inspector." The Engineer may require additional complete hardcopy sets.

- 3.1.6.2.1. **Bridge Members.** Prepare drawings in accordance with AASHTO/NSBA Steel Bridge Collaboration G1.3, "Shop Detail Drawing Presentation," unless otherwise approved. Print a bill of material on each sheet, including the Charpy V-Notch (CVN) and fracture-critical requirements, if any, for each piece. Indicate fracture-critical areas of members.

- 3.1.6.2.2. **Non-Bridge Members.** Furnish shop drawings for non-bridge members when shown on the plans or in conformance with pertinent Items.

- 3.1.7. **Welding Procedure Specifications (WPSs).** Submit WPSs and test reports in conformance with the applicable AWS code to MTD before fabrication begins and notify the Engineer which procedures will be used for each joint or joint type. Do not begin fabrication until the Engineer approves WPSs.

Post the approved WPSs for the welding being performed on each welding machine or use another approved method of ensuring the welder always has access to the procedure information.

- 3.1.8. **Documentation.** Provide a completed Material Statement Form 1818 (D-9-USA-1) with supporting documentation [such as mill test reports (MTRs)] that the producing mill issues and qualified personnel verify. Ensure the documentation legibly reflects all information the applicable ASTM specifications require. Supply documents electronically to the Department.

Provide a copy of the shipping or storage invoice, as material is shipped or placed in approved storage, that reflects:

- member piece mark identification and calculated weight per piece from the Contract drawings,
- number of pieces shipped or in storage,
- total calculated weight for each invoice per bid item, and
- the unique identification number of the shipping or storage invoice.

The Inspector's acceptance of material or finished members will not prohibit subsequent rejection if the material or members are found to be damaged or defective. Replace rejected material promptly.

- 3.1.9. **Material Identification.** Assembly-mark individual pieces and issue cutting instructions to the shop using a system that will maintain identity of the original piece.

Identify structural steel by standard and grade of steel. Also differentiate between material toughness requirements (CVN or fracture-critical) as well as any other special physical requirements. In addition, identify structural steel for primary members by mill identification numbers (heat numbers). Use an approved identification system. Use either paint or low-stress stencils to make identification markings on the metal. Mark the material as soon as it enters the shop and carry the markings on all pieces through final fabrication. Transfer the markings before cutting steel for primary members of bridge structures into smaller pieces. Loss of identification marking on any piece, with no other positive identification, or loss of heat number identification on any primary member piece will render the piece unacceptable for use. Unidentifiable material may be approved for use after testing to establish acceptability to the satisfaction of the Engineer. Have an approved testing facility perform testing and a licensed professional engineer sign and seal the results.

Low-stress stencil marks must have a radius instead of a sharp point. Acceptable stencils include dot, vibration, and rounded-V stencils. Label these stencils so that they are easily distinguishable from other stencils that are not low-stress.

3.2. **Welding.**

3.2.1. **Details.**

- 3.2.1.1. **Rolled Edges.** Trim plates with rolled edges used for webs by thermal cutting.

- 3.2.1.2. **Weld Tabs.** Use weld tabs at least 2 in. long for manual and semi-automatic processes, at least 3 in. long for automatic processes, and in all cases at least as long as the thickness of the material being welded. Use longer weld tabs as required for satisfactory work. Duplicate the configuration of the weld tab to the joint detail being fabricated.

- 3.2.1.3. **Weld Termination.** Terminate fillet welds approximately 1/4 in. from the end of the attachment except for galvanized structures and flange-to-web welds, for which the fillet weld must run the full length of the attachment, unless otherwise shown on the plans.

- 3.2.1.4. **No-Paint Areas at Field-Welded Connections.** Keep surfaces within 4 in. of groove welds or within 2 in. of fillet welds free of shop paint.

- 3.2.1.5. **Galvanized Assemblies.** Completely seal all edges of tightly contacting surfaces by welding before galvanizing.

- 3.2.1.6. **Submerged-Arc Welding (SAW).** Do not use hand-held semiautomatic SAW for welding bridge members unless altered to provide automatic guidance or otherwise approved.
- 3.2.1.7. **Non-Bridge Member Weathering Steel Welds.** Provide weld metal with atmospheric corrosion resistance and coloring characteristics similar to that of the base metal for weathering steel structures fabricated in accordance with AWS D1.1.
- 3.2.2. **Shop Splices.**
- 3.2.2.1. **Shop Splice Locations.** Keep at least 6 in. between shop splices and stiffeners or cross-frames. Obtain approval for shop splices added after shop drawings are approved.
- 3.2.2.2. **Grinding Splice Welds.** Grind shop groove welds in flange plates smooth and flush with the base metal on all surfaces, whether the joined parts are of equal or unequal thickness. Grind so the finished grinding marks run in the direction of stress and keep the metal below the blue brittle range (below 350°F). Groove welds in web plates, except at locations of intersecting welds, need not be ground unless shown on the plans except as required to meet AWS welding code requirements.
- 3.2.3. **Joint Restraint.** Never restrain a joint on both sides when welding.
- 3.2.4. **Stiffener Installation.**
- 3.2.4.1. **Flange Tilt.** Members must meet combined tilt and warpage tolerances before the installation of stiffeners. Cut stiffeners to fit acceptable flange tilt and cupping. Minor jacking that does not deform the material will be permitted.
- 3.2.4.2. **Stiffeners Near Field Splices.** Tack weld intermediate stiffeners within 12 in. of a welded field splice point in the shop. Weld the stiffeners in the field in accordance with Item 448, "Structural Field Welding," after the splice is made.
- 3.2.5. **Nondestructive Testing (NDT).** Perform magnetic particle testing (MT), radiographic testing (RT), or ultrasonic testing (UT) at the Contractor's expense in accordance with AWS code D1.5 for bridge structures. The Engineer will periodically witness, examine, verify, and interpret NDT. Additional welds may be designated for NDT on the plans. Retest repaired groove welds in conformance with the applicable AWS code after repairs are made and have cooled to ambient temperature. Complete NDT and repairs before assembly of parts into a member, but after any heat-correction of weld distortion.
- 3.2.5.1. **Radiographic Testing (RT).** Radiographs must have a density of at least 2.5 and no more than 3.5, as confirmed by a radiographer. The density in any single radiograph showing a continuous area of constant thickness must not vary in this area by more than 0.5. Use only ASTM System Class I radiographic film in accordance with ASTM E1815. Use low-stress stencils to make radiograph location identification marks on the steel.
- 3.2.5.2. **Ultrasonic Testing (UT).** Have UT equipment calibrated yearly by an authorized representative of the equipment manufacturer or by an approved testing laboratory.
- 3.2.5.3. **Magnetic Particle Testing (MT).** Use alternating current (AC) when using the yoke method unless otherwise approved. Welds may be further evaluated using half-wave rectified direct current (DC) for subsurface indications. Centerline cracking may be detected by aluminum prod method when approved.
- 3.3. **Bolt Holes.** Detail holes on shop drawings 1/16 in. larger in diameter than the nominal bolt size shown on the plans, unless another hole size is shown on the plans.

Thoroughly clean the contact surfaces of connection parts in accordance with Item 447 before assembling them for hole fabrication. Make holes in primary members full-size (by reaming from a subsize hole, drilling full-size, or punching full-size where permissible) only in assembly unless otherwise approved.

Ream and drill with twist drills guided by mechanical means unless otherwise approved. If subpunching holes, punch them at least 3/16 in. smaller than the nominal bolt size. Submit the proposed procedures for approval to accomplish the work from initial drilling or punching through check assembly when numerically controlled (N/C) equipment is used. Use thermal cutting for holes only with permission. Permission for thermal cutting is not required for making slotted holes, when slotted holes are shown on the plans, by drilling or punching two holes and then thermally cutting the straight portion between them. Perform all thermal cutting in accordance with Section 441.3.5.1., "Thermal Cutting."

Slightly conical holes that naturally result from punching operations are acceptable provided they do not exceed the tolerances of AASHTO/NSBA Steel Bridge Collaboration S2.1. The tolerance for anchor bolt hole diameter for bridge bearing assemblies is +1/8 in., -0.

3.4. **Dimensional Tolerances.** Meet tolerances in conformance with the applicable AWS specifications except as modified in this Section.

3.4.1. **Rolled Sections.** Use ASTM A6 mill tolerances for rolled sections, except AWS D1.5 camber tolerances apply to rolled sections with a specified camber.

3.4.2. **Flange Straightness.** Ensure flanges of completed girders are free of kinks, short bends, and waviness that depart from straightness or the specified camber by more than 1/8 in. in any 10 ft. along the flange. Rolled material must meet this straightness requirement before being laid out or worked. Plates must meet this requirement before assembly into a member. Inspect the surface of the metal for evidence of fracture after straightening a bend or buckle. The Engineer may require NDT.

3.4.3. **Alignment of Deep Webs in Welded Field Connections.** For girders 48 in. deep or deeper, the webs may be slightly restrained while checking compliance for lateral alignment at field-welded connections. In the unrestrained condition, webs 48 in. deep or deeper must meet the tolerances shown in Table 2. Girders under 48 in. deep must meet the alignment tolerances in accordance with AWS D1.5.

Table 2
Web Alignment Tolerances for Deep Girders

Web Depth (in.)	Maximum Web Misalignment (in.)
48	1/16
60	1/8
72	1/4
84	5/16
96	5/16
108	3/8
120	7/16
132	7/16
144	1/2

3.4.4. **Bearings.** Correct bearing areas of shoes, beams, and girders using heat, external pressure, or both. Grind or mill only if the actual thickness of the member is not reduced by more than 1/16 in. below the required thickness.

3.4.4.1. **I-Beams, Plate Girders, and Tub Girders.** The plane of the bearing area of beams and girders must be perpendicular to the vertical axis of the member within 1/16 in. in any 24 in.

3.4.4.2. **Closed Box Girders.** Meet these tolerances.

- The plane of the bearing areas of the box girder is perpendicular to the vertical axis of the girder within 1/16 in. across any horizontal dimension of the bearing.
- The planes of the beam supports on the box girder are true to the vertical axis of the supported beams or girders to 1/16 in. in any 24 in.

In the shop, verify the plane of all bearing areas with the box placed on its bearings to field grade, using an approved process for verification.

- 3.4.4.3. **Shoes.** Meet these tolerances.
- The top bolster has the center 75% of the long dimension (transverse to the girder) true to 1/32 in., with the remainder true to 1/16 in., and is true to 1/32 in. across its entire width in the short dimension (longitudinal to the girder).
 - The bottom bolster is true to 1/16 in. across its diagonals.
 - For a pin-and-rocker type expansion shoe, the axis of rotation coincides with the central axis of the pin.
 - When the shoe is completely assembled, as the top bolster travels through its full anticipated range, no point in the top bolster plane changes elevation by more than 1/16 in. and the top bolster does not change inclination by more than 1°, for the full possible travel.
- 3.4.4.4. **Beam Supports.** Fabricate beam support planes true to the box girder bearing to 1/16 in. in the short direction and true to the vertical axis of the nesting girders to 1/16 in.
- 3.4.5. **End Connection Angles.** For floor beams and girders with end connection angles, the tolerance for the length back-to-back of connection angles is $\pm 1/32$ in. Do not reduce the finished thickness of the angles below that shown on the shop drawings if end connections are faced.
- 3.5. **Other Fabrication Processes.**
- 3.5.1. **Thermal Cutting.** Use a mechanical guide to obtain a true profile. Hand-cut only where approved. Hand-cutting of radii for beam copes, weld access holes, and width transitions is permitted if acceptable profile and finish are produced by grinding. Provide a surface finish on thermal-cut surfaces, including holes, in accordance with AWS D1.5 requirements for base metal preparation. Obtain approval before using other cutting processes.
- 3.5.2. **Oxygen-Gouging.** Do not oxygen-gouge quenched and tempered (Q&T), normalized, or thermo-mechanically controlled processed (TMCP) steel.
- 3.5.3. **Annealing and Normalizing.** Complete all annealing or normalizing (as defined in ASTM A941) before finished machining, boring, and straightening. Maintain the temperature uniformly throughout the furnace during heating and cooling so the range of temperatures at all points on the member is no more than 100°F.
- 3.5.4. **Machining.** Machine the surfaces of expansion bearings so the travel direction of the tool is in the direction of expansion.
- 3.5.5. **Camber.** Complete cambering in accordance with AASHTO/NSBA Steel Bridge Collaboration S2.1 before any heat-curving.
- 3.5.6. **Heat Curving.** Heat-curve in accordance with AASHTO/NSBA Steel Bridge Collaboration S2.1. The methods in the AASHTO bridge construction specifications are recommended. Attach cover plates to rolled beams before heat-curving only if the total thickness of one flange and cover plate is less than 2-1/2 in. and the radius of curvature is greater than 1,000 ft. Attach cover plates for other rolled beams only after heat-curving is completed. Locate and attach connection plates, diaphragm stiffeners, and bearing stiffeners after curving, unless girder shrinkage is accounted for.
- 3.5.7. **Bending of Quenched and Tempered (Q&T) Steels.** The cold-bending radius limitations for HPS 70W in AASHTO/NSBA Steel Bridge Collaboration S2.1 apply to all Q&T steels.
- 3.5.8. **Hammering.** Do not perform hammering on any portion of the member that causes the material to permanently deform. Avoid damage to the material by measures such as use of brass or aluminum hammers or by padding the area to be hammered.
- 3.6. **Nonconformance Reports (NCRs).** Submit an NCR to the Engineer for approval when the requirements of this Item are not met. Submit NCRs in conformance with MTD's NCR guidelines document. Have readily available access to the services of a licensed professional engineer experienced in steel structures design

and fabrication. This licensed professional engineer may be responsible for reviewing potentially structurally deficient members in conformance with the NCR guidelines document. Receive Department approval before beginning repairs. Perform all repair work in strict compliance with the approved NCR and repair procedure.

3.7. **Shop Assembly.**

3.7.1. **General Shop Assembly.** Shop-assemble field connections of primary members of trusses, arches, continuous beam spans, bents, towers (each face), plate girders, field connections of floor beams and stringers (including for railroad structures), field-bolted diaphragms for curved plate girders and railroad underpasses, and rigid frames. Field-bolted cross-frames and rolled-section diaphragms do not require shop assembly. Complete fabrication, welding (except for shear studs), and field splice preparation before members are removed from shop assembly. Obtain approval for any deviation from this procedure. The Contractor is responsible for accurate geometry.

Use a method and details of preassembly consistent with the erection procedure shown on the erection plans and camber diagrams. The sequence of assembly may start from any location in the structure and proceed in one or both directions. An approved method of sequential geometry control is required unless the full length of the structure is assembled.

Verify by shop assembly the fit of all bolted and welded field connections between bent cap girders and plate girders or between plate girders and floor beams.

Do not measure horizontal curvature and vertical camber for final acceptance until all welding and heating operations are completed and the steel has cooled to a uniform temperature. Check horizontal curvature and vertical camber in a no-load condition.

3.7.2. **Bolted Field Connections.** Each shop assembly, including camber, alignment, accuracy of holes, and fit of milled joints, must be approved before the assembly is dismantled.

Assemble with milled ends of compression members in full bearing. Assemble non-bearing connections to the specified gap. Ream all subsize holes to the specified size while the connections are assembled, or drill full size while the connections are assembled. Notify the Engineer before shipping if fill plates or shims are added. Adding or increasing the thickness of shims or fill plates in bearing connections requires approval. Use drift pins and snug-tight bolts during the drilling process to ensure all planes of the connection (webs and flanges) can be assembled simultaneously. Do not use tack welds to secure plates while drilling.

Secure parts not completely bolted in the shop with temporary bolts to prevent damage in shipment and handling. Never use tack welds in place of temporary bolts.

Match-mark connecting parts in field connections using low-stress stencils in conformance with the diagram on the erection drawings.

3.7.3. **Welded Field Connections.** Mill or grind bevels for groove welds. Do not cut into the web when cutting the flange bevel adjacent to the web. End preparation, backing, and tolerances for girder splices must be in accordance with Item 448. Details for all other field welds must conform to the applicable AWS code unless otherwise shown on the plans.

In the shop, prepare ends of beams or girders to be field-welded taking into account their relative positions in the finished structure due to grade, camber, and curvature. Completely shop-assemble and check each splice. Match-mark the splice while it is assembled with low-stress stencils in conformance with the diagram on the erection drawings.

3.8. **Finish and Painting.**

3.8.1. **Shop Painting.** Perform shop painting of bridge members in accordance with [DMS-8104](#), "Paint, Shop Application for Steel Bridge Members." Grind corners on new steel items to be painted that are sharp or form

essentially 90° angles to an approximately 1/16-in. flat surface before blast cleaning. (A corner is the intersection of two plane faces.) This requirement does not apply to punched or drilled holes. Do not omit shop paint to preserve original markings.

Ensure painted faying surfaces meet the required slip and creep coefficients for bolted connections in accordance with [DMS-8104](#).

Use a Class A slip (minimum slip coefficient of 0.33) if no slip coefficient or corresponding surface condition is specified. Perform all required testing at no expense to the Department.

Surface preparation and painting the interiors of tub girders and closed boxes must be in accordance with [DMS-8104](#).

Measure the anchor profile after blast cleaning at random locations along the thermal cut surfaces. If specified anchor profile is not achieved over the entire flame-cut surface, grind the edges and re-blast to achieve the required anchor pattern.

3.8.2. **Weathering Steel.** Provide an SSPC-SP 6, "Commercial Blast Cleaning," blast in the shop to all fascia surfaces of unpainted weathering steel beams. Fascia surfaces include:

- exterior sides of outermost webs and undersides of bottom flanges of plate girders and rolled beams,
- all outer surfaces of tub girders and box girders,
- all surfaces of truss members,
- webs and undersides of bottom flanges of plate diaphragms,
- bottom surfaces of floor beams, and
- any other surfaces designated as "fascia" on the plans.

Do not mark fascia surfaces. Use one of the following methods as soon as possible to remove any markings or any other foreign material that adheres to the steel during fabrication and could inhibit the formation of oxide film:

- SSPC-SP 1, "Solvent Cleaning,"
- SSPC-SP 2, "Hand Tool Cleaning,"
- SSPC-SP 3, "Power Tool Cleaning," and
- SSPC-SP 7, "Brush-Off Blast Cleaning."

Do not use acids to remove stains or scales. Feather out touched-up areas over several feet.

3.8.3. **Machined Surfaces.** Clean and coat machine-finished surfaces that are in sliding contact, particularly pins and pinholes, using a non-drying, water-repellent, grease-type material containing rust-inhibitive compounds. Ensure the coating material contains no ingredients that might damage the steel. Protect machined surfaces from abrasive blasting.

3.9. **Handling and Storage of Materials.** Prevent damage when storing or handling girders or other materials. Remove or repair material damaged by handling devices or improper storage by acceptable means in accordance with ASTM A6 and the applicable AWS code.

Place stored materials on skids or acceptable dunnage above the ground. Keep materials clean and avoid damaging the applied coating. Shore girders and beams to keep them upright and free of standing water. Place support skids close enough to prevent excessive deflection in long members such as columns. Do not stack completed girders or beams at the jobsite.

Protect structural steel from salt water or other corrosive environments during storage and transit.

3.10. **Marking and Shipping.** Mark all structural members in conformance with the erection drawings. If a surface is painted, make the marks over the paint. Do not use impact-applied stencils to mark painted surfaces.

Mark the weight directly on all members weighing more than 3 tons.

Keep material clean and free of damage during loading, transportation, unloading, and storage. Pack bolts of each length and diameter, and loose nuts or washers of each size, separately, and ship them in boxes, crates, kegs, or barrels. Plainly mark a list and description of the contents on the outside of each package.

- 3.11. **Field Erection.** Do not lift and place any steel member, including girders and diaphragms, over an open highway or other open travel way unless otherwise approved. Do not allow traffic to travel under erected members until sufficiently stable as shown on approved erection drawings.
- 3.11.1. **Pre-Erection Conference.** Schedule and attend a pre-erection conference with the Engineer at least 7 days before commencing steel erection operations. Do not install falsework or perform any erection operations before the meeting.
- 3.11.2. **Methods and Equipment.** Do not tack-weld parts instead of using erection bolts. Do not tack-weld parts to hold them in place for bolting. Provide falsework, tools, machinery, and appliances, including drift pins and erection bolts. Provide enough drift pins, 1/32 in. larger than the connection bolts, to fill at least 1/4 of the bolt holes for primary connections. Use erection bolts of the same diameter as the connection bolts.
- Securely tie, brace, or shore steel beams or girders immediately after erection as shown on the erection drawings. Maintain bracing or shoring until the diaphragms are in place and as specified on the erection drawings. Protect railroad, roadway, and marine traffic underneath previously erected girders or beams from falling objects associated with other construction activities.
- Only welders certified or working directly under the supervision of a foreman certified in accordance with Item 448 may handle torches when applying heat to permanent structural steel members.
- 3.11.3. **Falsework.** Construct falsework in conformance with the erection plan. Construct foundations for shore towers as shown on erection drawings. Do not use timber mats with deteriorated timbers or soil to construct shore tower foundations. Notify the Engineer of completed falsework to obtain approval before opening roadway to traffic or starting girder erection activities. Ensure falsework is protected from potential vehicle impact. Inspect and maintain falsework daily. Use screw jacks or other approved methods to control vertical adjustment of falsework to minimize the use of shims.
- 3.11.4. **Handling and Assembly.** Accurately assemble all parts as shown on the plans and the approved shop drawings. Verify match-marks. Handle parts carefully to prevent bending or other damage. Do not hammer if doing so damages or distorts members. Do not weld any member for transportation or erection unless shown on the plans or approved.
- 3.11.4.1. **Welded Connections.** Weld flange splices to 50% of their thickness and meet the minimum erection bracing and support requirements before releasing the erection cranes, as shown on the plans and on the approved erection plans. Field-weld in accordance with Item 448.
- 3.11.4.2. **Bolted Connections.** Before releasing the erection cranes:
- install 50% of the bolts in the top and bottom flanges and the web with all nuts finger-tight,
 - meet the minimum erection bracing and support requirements shown on the plans and on the approved erection plans, and
 - install top lateral bracing across the connection for tub girders, and fully tension the bolts connecting the bracing to the top flanges.

Install high-strength bolts, including erection bolts, in accordance with Item 447. Clean bearing and faying surfaces for bolted connections in accordance with Item 447. Clean the areas of the outside ply under washers, nuts, and bolt heads before bolt installation. Ensure the required faying surface condition is present at the time of bolting.

- 3.11.5. **Misfits.** Correct minor misfits. Ream no more than 10% of the holes in a plate connection (flange or web), and ensure no single hole is more than 1/8 in. larger than the nominal bolt diameter. Submit proposed correction methods for members with defects that exceed these limits or prevent the proper assembly of parts. Straighten structural members in accordance with AASHTO/NSBA Steel Bridge Collaboration S2.1. Make all corrections in the presence of the Engineer at no expense to the Department. Do not remove and reweld gusset plates without approval.
- 3.11.6. **Bearing and Anchorage Devices.** Place all bearing devices such as elastomeric pads, castings, bearing plates, or shoes on properly finished bearing areas with full and even bearing on the concrete. Place metallic bearing devices on 1/4-in. thick preformed fabric pads manufactured in accordance with [DMS-6160](#), "Water Stops, Nylon-Reinforced Neoprene Sheet, and Elastomeric Pads," to the dimensions shown on the plans. Provide holes in the pad that are no more than 1/4 in. larger than the bolt diameter.
- Build the concrete bearing area up to the correct elevation once it has been placed below grade using mortar that meets Item 420, "Concrete Substructures," and provide adequate curing. Use only mortar for buildups between 1/8 in. and 3/8 in. thick. Use galvanized steel shims or other approved shim materials in conjunction with mortar if the bearing area must be raised more than 3/8 in.
- Provide at least 75% contact of flange to shoe with no separation greater than 1/32 in. for beams and girders. Make corrections using heat or pressure in accordance with AASHTO/NSBA Steel Bridge Collaboration S2.1 or using galvanized shims. Correct small irregularities by grinding.
- Provide at least 85% contact between the rocker plate and the base plate. Adjust the location of slotted holes in expansion bearings for the prevailing temperature. Adjust the nuts on the anchor bolts at the expansion ends of spans to permit free movement of the span. Provide lock nuts or burr the threads.
- Remove all foreign matter from sliding or machine-finished surfaces before placing them in the structure.
- Restore distorted bearing pads or expansion bearings to an equivalent 70°F position after completion of all welded or bolted splices, using an approved method of relieving the load on the bearing devices.
- 3.11.7. **Erecting Forms.** Do not erect forms until all welding or bolting is complete and the unit is positioned and properly set on the bearings, unless otherwise shown on the plans.
- 3.11.8. **Field Finish.** Paint in accordance with Item 446. Restore weathering steel that will remain unpainted to a uniform appearance by solvent cleaning, hand cleaning, power brush, or blast cleaning after all welding and slab concrete placement have been completed. Remove from all unpainted weathering steel fascia surfaces (as listed in Section 441.3.8.2., "Weathering Steel") any foreign material, including markings, that adheres to the steel and could inhibit formation of oxide film as soon as possible. Feather out touched-up areas over several feet. Do not use acids to remove stains or scales.

4. MEASUREMENT AND PAYMENT

The work performed, materials furnished, equipment, labor, tools, and incidentals will not be measured or paid for directly, but will be subsidiary to pertinent Items.

Item 442-00

Metal for Structures



1. DESCRIPTION

Provide structural steel, high-strength bolts, forgings, steel castings, iron castings, wrought iron, steel pipe and tubing, aluminum castings and tubing, or other metals used in structures, except reinforcing steel and metal culvert pipe.

2. MATERIALS

Furnish mill test reports (MTRs), supplemental test documentation, and certifications required by this Item and other pertinent Items.

2.1. **Structural Steel.** The Engineer may sample and test steel in accordance with ASTM A370.

2.1.1. **Bridge Structures.** Provide the grade of ASTM A709 steel shown on the plans. Grade 50W, 50S, or HPS 50W may be substituted for Grade 50 at no additional cost to the Department. Use Zone 1 if no AASHTO temperature zone is shown on the plans.

2.1.2. **Non-Bridge Structures.**

2.1.2.1. **Steel Classifications.** Provide the types and grades of steel in accordance with this Section unless otherwise shown on the plans.

2.1.2.1.1. **Carbon Steel.** Meet ASTM A36.

2.1.2.1.2. **Low-Alloy Steel.** Meet the requirements of one of the following:

- ASTM A529 Grade 50;
- ASTM A572 Grade 50 or Grade 55;
- ASTM A588;
- ASTM A709 Grade 50, 50S, 50W, or HPS 50W; or
- ASTM A992.

Specify ASTM A6 supplemental requirement S18, "Maximum Tensile Strength," for material used for sign, signal, and luminaire supports.

2.1.2.2. **Impact Testing.** The following components, if greater than 1/2 in. thick, and other members designated on the plans must meet the Charpy V-notch (CVN) requirements of Table 1:

- base plates for roadway illumination assemblies, traffic signal pole assemblies, high mast illumination poles, ITS poles, and overhead sign supports;
- pole mounting plates, arm mounting plates, and clamp-on plates for traffic signal pole assemblies;
- arm stiffeners, pole gussets, and stiffeners for traffic signal pole long mast arm assemblies (50 ft. and greater);
- pole shafts, ground sleeves, and handhole frames for high mast illumination poles;
- W-columns, tower pipes, multiple-sided shafts, tower pipe and multiple-sided shaft connection plates, chord angles, chord splice plates or angles, and truss bearing angles for truss type overhead sign supports; and

- pipe posts, pipe arms, post and arm flange plates, and handhole frames for monotube overhead sign supports.

Table 1
CVN Requirements for Non-Bridge Steel

Material	Thickness	Minimum CVN Toughness
ASTM A36, A53, A242, A500, A501, A709, Grade 36, any other steel with minimum specified yield point below 40 ksi	up to 4"	15 foot-pounds (ft.-lb.) at 70°F
ASTM A5721, A5881, A6331, any other steel with minimum specified yield point between 40 and 65 ksi, inclusive	up to 2"	15 ft.-lb. at 70°F
	over 2" to 4", mechanically fastened	15 ft.-lb. at 70°F
	over 2" to 4", welded	20 ft.-lb. at 70°F
Any steel with minimum specified yield point over 65 ksi and under 90 ksi ²	up to 2-1/2"	20 ft.-lb. at 50°F
	over 2-1/2" to 4", mechanically fastened	20 ft.-lb. at 50°F
	over 2-1/2" to 4", welded	25 ft.-lb. at 50°F

1. Reduce the testing temperature by 15°F for each 10-ksi increment or fraction thereof above 65 ksi if the yield point of the material given on the MTR exceeds 65 ksi.
2. Reduce the testing temperature by 15°F for each 10-ksi increment or fraction thereof above 85 ksi if the yield point of the material given on the MTR exceeds 85 ksi.

Use the (H) frequency of testing for material with minimum specified yield point up to 50 ksi. Use the (P) frequency of testing for material with minimum specified yield point greater than 50 ksi. Ensure steel is sampled and tested in accordance with ASTM A673.

2.1.3. **Other Components.**

2.1.3.1. **Miscellaneous Bridge Components.** Provide steel that meets ASTM A36, A709 Grade 36, or A500 Grade B for members such as steel bearing components not bid under other Items, steel diaphragms for use with concrete bridges, and armor and finger joints, unless otherwise shown on the plans.

2.1.3.2. **Shear Connectors and Anchors.** Provide cold-drawn bars for stud shear connectors, slab anchors, and anchors on armor and finger joints that meet the requirements of ASTM A108, Grade 1010, 1015, 1018, or 1020, either semi-killed or killed, and that have the tensile properties shown in Table 2 after drawing or finishing. Determine tensile properties in accordance with ASTM A370.

Table 2
Minimum Tensile Properties for Bar Stock

Tensile strength	60 ksi
Yield strength	50 ksi
Elongation	20% (2")
Reduction of area	50%

Provide certification from the manufacturer that the studs or anchors as delivered have the required material properties.

2.1.3.3. **Fasteners.** Provide high-strength bolts that meet ASTM F3125 Grade A325, unless otherwise shown on the plans. The Department may sample high-strength bolts, nuts, and washers for structural connections in accordance with [Tex-719-I](#).

Follow the requirements of Item 447, "Structural Bolting," for tests, test reports, and supplemental requirements for high-strength bolts, nuts, and washers.

2.1.3.4. **Slip-Resistant Deck Plates.** Furnish steel for deck plates that meets ASTM A786 and one of ASTM A242, A588, or A709 Grade 50W. State the type and trade name of material to be used on the shop drawings.

- 2.1.3.5. **Rail Posts.** Provide material for rail posts that meets ASTM A36 or ASTM A709 Grade 36 unless otherwise shown on the plans.
- 2.2. **Steel Forgings.** Provide steel forgings for pins, rollers, trunnions, or other forged parts that meet ASTM A668, Class C, D, F, or G, as shown on the plans. For pins 4 in. or smaller in diameter for non-railroad structures, material that meets ASTM A108 Grade 1016–Grade 1030, with a minimum yield strength of 36 ksi, may be used instead.
- 2.3. **Steel Castings.** Provide steel castings that meet ASTM A27, Grade 70-36.
- 2.4. **Iron Castings.** Provide iron castings that are true to pattern in form and dimensions; free of pouring faults, sponginess, cracks, blow holes, and other defects in positions affecting their strength and value for the service intended; and meet the standards shown in Table 3.

**Table 3
Standards for Iron Castings**

Casting Material	ASTM Standard	Grade or Class
Gray iron	A48	35B
Malleable iron	A47	32510
Ductile iron	A536	70-50-05

- 2.5. **Steel Tubing.** Provide steel tubing that meets ASTM A500 Grade B, unless otherwise shown on the plans. Tubing that meets API Standard 5L Grade X52 may be used if produced by a mill listed in the standard API specifications as authorized to produce pipe with the API monogram. Hydrostatic tests are not required for API 5L steel, and instead of an MTR, the manufacturer may furnish a certificate for each lot or shipment certifying the tubing meets the requirements of this Section.
- 2.6. **Aluminum.** Provide aluminum materials that meet the standards shown in Table 4 unless otherwise shown on the plans.

**Table 4
Aluminum Standards**

Material	ASTM Standard	Alloy-Temper
Castings	B108	A444.0-T4
Extrusions	B221	6061-T6
Sheet or plate	B209	6061-T6

When testing is required, cut test specimens from castings from the lower 14 in. of the tension flange, but not at the junction of the rib or base. Flatten the curved surfaces before machining. Provide standard test specimens in accordance with ASTM E8.

3. CONSTRUCTION

- 3.1. **Fabrication, Erection, and Painting.** Fabricate, weld, and erect metal structures in accordance with Item 441, “Steel Structures”; Item 447, “Structural Bolting”; and Item 448, “Structural Field Welding”; and in conformance with the applicable AWS welding code. Paint in accordance with Item 446, “Field Cleaning and Painting Steel.” Aluminum or galvanized steel members do not require painting unless otherwise shown on the plans.
- 3.2. **Galvanizing.** Galvanize fabricated steel items, steel castings, bolts, nuts, screws, washers, and other miscellaneous hardware, when required, in accordance with Item 445, “Galvanizing.”

4. MEASUREMENT

This Item will be measured by the pound of structural metal furnished and placed in a complete structure not including the weight of erection bolts, paint, or weld metal.

This is a plans quantity measurement item. The quantity to be paid is the quantity shown in the proposal, unless modified by Article 9.2., "Plans Quantity Measurement." Additional measurements or calculations will be made if adjustments of quantities are required.

The maximum percent variance from the plans quantity will be as shown in Table 5.

Table 5
Percent Variance

Quantity	Variance
Over 1,000,000 lb.	1/2%
100,000–1,000,000 lb.	1%
Under 100,000 lb.	1-1/2%

If the requests for increases in sizes or weights of members are approved, measurement will be made on the sizes or weights shown on the plans.

Castings, bearing plates, anchor bolts, drains, deck plates, armor and finger joints, and other metal for which no separate measurement is specified will be included in the total quantity of structural steel.

The weights of rolled materials (e.g., structural shapes and plate) will be computed based on nominal weights and dimensions using measurements shown on the plans. Deductions will not be made for material that is removed for copes, clips, planing, or weld preparation. The weight of castings will be computed from the dimensions shown on the plans. Shoes will be measured by the weights shown on the plans.

Weight of high-strength fasteners will be based on Table 6. Weight of other metal will be based on Table 7.

Table 6
Pay Weight for High-Strength Fasteners, Pounds per Hundred Units

Diameter	Item		
	Bolt Heads	Nuts	Washers
3/4"	15	19	4.8
7/8"	23	30	7
1"	32	43	9.4
1-1/8"	45	59	11
1-1/4"	64	79	14

Table 7
Pay Weight for Metals

Material	Weight (lb./cu. in.)
Steel	0.2836
Cast iron	0.2604
Wrought iron	0.2777

Splices will be measured as follows.

- No additional weight will be allowed for weld metal in a welded splice.
- Where a bolted splice is permitted as an alternate for a welded splice, measurement will be made based on a welded splice.
- Where a bolted splice is required, the weight of the splice material, bolt heads, washers, and nuts will be measured with no deduction for holes.

5. PAYMENT

The work performed and materials furnished in accordance with this item and measured as provided under "Measurement" will be paid for at the unit price bid for "Structural Steel" of the type ("Rolled Beam," "Plate Girder," "Tub Girder," "Box Girder," "Railroad Through-Girder," "Railroad Deck-Girder," "Miscellaneous Bridge," "Miscellaneous Non-Bridge," "Pedestal," "Diaphragm," and "Stiffener") specified. This price is full

compensation for materials, fabrication, transportation, erection, paint, painting, galvanizing, equipment, tools, labor, and incidentals.