PROJECT MANUAL
FOR
THE CONSTRUCTION OF

Ray Roberts Lake State Park

Isle Du Bois – Flood Damage Repairs
Project Number 128302

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Prepared for:
Texas Parks and Wildlife

2018

Halff Associates, Inc.

1201 North Bowser Road
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TEXAS
PARKS &
WILDLIFE

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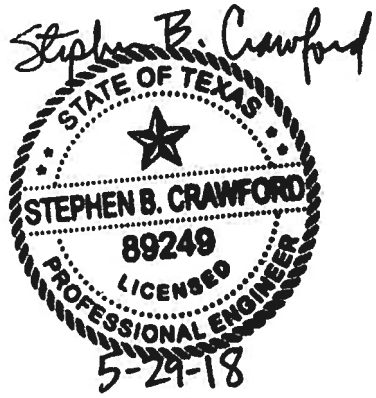
SEALS PAGE



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GEOTECHNICAL STUDY

FLOOD REPAIRS AT RAY ROBERT LAKE STATE PARK – ISLE DU BOIS
TEXAS PARKS & WILDLIFE DEPARTMENT
DENTON COUNTY, TEXAS

SUBMITTED TO

HALFF ASSOCIATES, INC.
2080 N STATE HIGHWAY 360, STE 350
GRAND PRAIRIE, TEXAS 75050

BY

HVJ ASSOCIATES®
DALLAS, TEXAS

AUGUST 29, 2017

REPORT NO. DG-16-10188

HVJ ASSOCIATES

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August 29, 2017

Mr. Stephen Crawford, PE, CFM
HALFF ASSOCIATES, INC.
2080 N State Highway 360, Ste 350
Grand Prairie, Texas 75050

Re: Geotechnical Investigation
Flood Repairs at Ray Roberts Lake State Park – Isle Du Bois
Denton County, Texas
Owner: Texas Parks & Wildlife Department
HVJ Project® No. DG1610188

Dear Mr. Crawford:

Submitted herein is the final report of our geotechnical investigation for the above referenced project. The study was performed in accordance with proposal number DG-16-10188 and sub contract agreement dated August 10, 2016 and is subject to the limitations presented in this report.

We appreciate the opportunity of working with you on this project. Please read the entire report and notify us if there are questions concerning this report or if we may be of further assistance.

Sincerely,

HVJ NORTH TEXAS - CHELLIAH CONSULTANTS, INC.
Texas Firm Registration No. F-17942

Robert H. Lawrence, PE
Project Manager

RL/FF/RE

STATE OF TEXAS
ROBERT H. LAWRENCE
120422
LICENSED
PROFESSIONAL ENGINEER
8/29/20

Ravi Teja Elepe, EIT
Staff Engineer

The seal appearing on this document was authorized by Robert H. Lawrence, P.E. 120422 on August 29, 2017. Alteration of a sealed document without proper notification to the responsible engineer is an offense under the Texas Engineering Practice Act.

- Main Text – 14 pages
- Plates – 9 pages
- Appendix A – 2 pages
- Appendix B – 2 pages
- Appendix C – 6 pages

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EXECUTIVE SUMMARY

HVJ Associates® was retained by Halff Associates, Inc. to perform a geotechnical investigation for the proposed repairs to flood damaged areas of Isle Du Bois State Park at Ray Roberts Lake in Denton County, Texas. The purpose of this study is to perform a geotechnical field exploration and provide geotechnical recommendations for the proposed repairs. The repairs include reconstruction of failed slopes caused by lake erosion, reconstruction of retaining wall for the sidewalk and replacement of playground canopy.

Subsurface conditions were evaluated by drilling four (4) borings B-1 through B-4 drilled to a depth ranging between 22 and 27 feet below the existing ground surface. A brief summary of the investigational findings is as follows:

1. Subsurface conditions encountered during our field activity in the borings are summarized in the following table.

Stratum Types Encountered

Boring ID	Approximate Depths of Strata Encountered at Borings (feet)		
	Silty/Clayey Sand(1)	Poorly Graded Sand(2)	Fat Clay(3)
B1	0-10.5	10.5-25(4)	-
B2	0-17 24-27(4)	-	17-24
B3	0-3	8-18	3-8 18-22(4)
B4	6-22(4)	0-6	-

Note:
(1) Medium dense to very dense; silty or clayey; moist or wet.
(2) Dense to very dense; poorly graded; moist or wet.
(3) Stiff to hard; fat; moist.
(4) Boring termination depth.

2. Groundwater was encountered at a depth of approximately 22 feet, 25 feet, 8 feet, and 9 feet at borings B-1, B-2, B-3 and B-4, respectively during drilling operations. Groundwater readings after completion of drilling operations were not measured because fluids were injected during drilling operations. It is anticipated that groundwater levels will fluctuate due to seasonal variations in climatic conditions.

3. A laboratory testing program, consisting of moisture contents, Atterberg limits, percent passing #200 sieve, unconfined compressive strength and unit weight were performed on select soil samples. The test results are included in boring logs presented on Plates 4 through 7. A laboratory summary table is included in Appendix A.

4. Sieve analysis and hydrometer tests were performed on select soil samples. The test results are included in Appendix B.

5. We understand that two new posts will be installed at the Quail Run retaining wall where the buried posts were exposed. Riprap will be used to wrap around the exposed area to prevent erosion. These two new posts will be anchored to the bottom of the exposed existing wall and installed to a depth of approximately 10 feet below the bottom of the wall. We recommend, neglecting the skin friction in the upper 10 feet of foundation soils to account for soil movement in the soil moisture variation zone and soil disturbance during construction and rely on the end bearing for the foundation of the new posts. An end bearing of 2,000 psf can be used to support the posts. We also recommend, neglecting the skin friction within the riprap zone.

6. We understand that the project involves construction of variable height gravity retaining wall at the side walk near trail area #3. The maximum wall height is approximately 3 feet at the highest point. Based on the provided layout, we ran external and global stability analyses and as shown in the table below the computed factors of safety met the minimum recommended.

Minimum Recommended and Calculated Factors of Safety

Stability Condition	Minimum Factor of Safety Recommended	Calculated Factor of Safety
Bearing pressure	2.0	4.1
Sliding	1.5	1.5
Overturning	2.0	3.8
Global	1.3	1.7

Based on our analysis, we recommend using L-shaped wall with with a minimum of 1-foot thick column and base and 4 feet wide footing to satisfy the above recommended factors of safety.

7. We understand that a shade structure will be installed at the playground area. The structure will be lightly loaded with vertical loads not more than 2,000 pounds. Based on the subsurface soils encountered, drilled shafts penetrating to a depth of 15 feet below the ground surface can be used as a foundation system to support the structure. The footings may be designed for an allowable net total load bearing pressure of 4,500 psf or an allowable net dead plus sustained live load bearing pressure of 3,000 psf; whichever is critical. These bearing pressures contain a factor of safety 2 and 3, respectively. We recommend ignoring the skin friction when calculating the compressive axial capacity in this case because the shafts will be relatively shallow.

Please note that this executive summary does not fully relate our findings and opinions. Those findings and opinions are only presented through our full report.

1 INTRODUCTION

1.1 General

HVJ Associates® was retained by Halff Associates, Inc. to perform a geotechnical investigation for the proposed repairs to flood damaged areas of Isle Du Bois State Park at Ray Roberts Lake in Denton County, Texas. The purpose of this study is to perform a geotechnical field exploration and provide geotechnical recommendations for the proposed repairs. The repairs include reconstruction of failed slopes caused by lake erosion, reconstruction of retaining wall for the sidewalk and replacement of playground. A site vicinity map showing the approximate project location is presented on Plate 1 of the report.

1.2 Geotechnical Study Program

The primary objectives of this study were to gather information on subsurface conditions at the project site and to develop design and construction recommendations for the proposed repairs. The objectives were accomplished by:

1. Drilling four (4) borings (B-1 through B-4) to a depth ranging between 22 and 27 feet below existing ground surface to obtain samples for laboratory testing;

2. Performing laboratory tests to determine physical characteristics of the soils,

3. Performing engineering analyses to develop design guidelines and recommendations for the proposed repairs.

Subsequent sections of this report contain descriptions of the field exploration, laboratory testing program, general site and subsurface conditions, design recommendations, and construction considerations.

2 FIELD EXPLORATION

2.1 General

The field exploration program was performed on June 26, 2017. Subsurface conditions were evaluated by drilling four (4) borings B-1 through B-4 drilled to a depth ranging between 22 and 27 feet below the existing ground surface. A site plans showing the approximate boring locations are presented on the Plan of Boring, Plate 3.

2.2 Sampling Methods

Samples were obtained continuously to a depth of 10 feet and at 5-foot intervals thereafter to the maximum termination depth of borings. Cohesive soil samples were obtained with a three-inch thin-walled (Shelby) tube sampler in general accordance with ASTM D-1587 standard. Granular soils were obtained by split spoon sampler. Each sample was removed from the sampler in the field, carefully examined and then classified. The shear strength of the cohesive soils was estimated by a hand penetrometer in the field. Suitable portions of each sample were sealed and packaged for transportation to our laboratory.

Detailed descriptions of the soils encountered in the borings are given on the boring logs presented on Plates 4 through 7. Keys to the terms and symbols used for soil classification on the boring logs are presented on Plate 8.

2.3 Groundwater Observations

Groundwater was encountered at a depth of approximately 22 feet, 25 feet, 8 feet, and 9 feet at borings B-1, B-2, B-3 and B-4, respectively during drilling operations. Groundwater readings after completion of drilling operations were not measured because fluids were injected during drilling operations. It is anticipated that groundwater levels will fluctuate due to seasonal variations in climatic conditions.

2.4 Borehole Completion

The project borings were backfilled with soil cuttings/bentonite chips upon completion of drilling so as to match the existing surface.

3 LABORATORY TESTING

Selected soil samples were tested in the laboratory to determine applicable physical and engineering properties. Tests were generally performed according to the relevant ASTM Standards. These tests consisted of moisture contents, Atterberg limits, and percent passing #200, unconfined compressive strength, unit weight, sieve analysis, and hydrometer test were performed on select soil samples.

The Atterberg limits and percent passing No. 200 sieve tests were utilized to verify field classification by the Unified Soil Classification System. Unconfined compressive strength and hand penetrometer were utilized to obtain the undrained shear strength of the soil. The type and number of tests performed for this investigation are summarized below.

Table 3-1 – Type and Number of Laboratory Tests

Type of Test	Number of Tests
Moisture Content (ASTM D2216)	17
Atterberg Limits (ASTM D4318)	7
Percent Passing No. 200 Sieve (ASTM D1140)	9
Unconfined Compression Soil (ASTM D2166)	1
Sieve Analysis (ASTM D422)	1
Hydrometer (ASTM D422)	1

The summary of laboratory test results are presented in Appendix A. The test results for sieve analysis and hydrometer are presented in Appendix B.

4 SITE CHARACTERIZATION

4.1 Site Vicinity

The project site is located at Isle Du Bois State Park at Ray Roberts Lake north of Denton, Texas. A site vicinity map is included in Plate 1.

4.2 General Geology

According to the University of Texas at Austin, Bureau of Economic Geology "Geologic Atlas of Texas Sherman Sheet," the project area lies within the Woodbine Formation (map symbol Kwb).

Woodbine Formation which dominantly consists of sandstone, shale, and some clay, fine grained thickness 175 to 200 feet northward. The primary rock type is Shale. A geology map is presented on Plate 2.

4.3 Soil Stratigraphy

Our interpretation of soil and groundwater conditions at the project site is based on information obtained at the boring locations only. This information has been used as the basis for our conclusions and recommendations. Significant variations at areas not explored by the project borings may require reevaluation of our findings and conclusions.

Based on our field investigation, the subsurface soils observed are presented below:

Table 4-1 – Stratum Types Encountered

Boring ID	Approximate Depths of Strata Encountered at Borings (feet)		
	Silty/Clayey Sand(1)	Poorly Graded Sand(2)	Fat Clay(3)
B1	0-10.5	10.5-25(4)	-
B2	0-17 24-27(4)	-	17-24
B3	0-3	8-18	3-8 18-22(4)
B4	6-22(4)	0-6	-

Note:
(1) Medium dense to very dense; silty or clayey; moist or wet.
(2) Dense to very dense; poorly graded; moist or wet.
(3) Stiff to hard; fat; moist.
(4) Boring termination depth.

Detailed descriptions of the soils encountered in the borings are given on the boring logs presented on Plates 4 through 7. Keys to the terms and symbols used for soil classification on the boring logs are presented on Plate 8.

5 QUAIL RUN RETAINING WALL

5.1 General

The project involves repairs at the Quail Run retaining wall. Due to lake erosion the buried posts that supports the wall were exposed. The existing wall height is approximately 4 feet and another 4 feet of buried posts were exposed. Boring B-1 was drilled to a depth of approximately 25 feet below existing grade at the top of the retaining wall. We understand that two new posts will be installed where the buried posts were exposed. Riprap will be used to wrap around the exposed area to prevent erosion. These two new posts will be anchored to the bottom of the exposed existing wall and installed to a depth of approximately 10 feet below the bottom of the wall.

5.2 Geotechnical Recommendations

Boring B-1 was drilled to a depth of approximately 25 feet below existing grade at the top of the retaining wall. The foundation material at the toe side of the wall consists of poorly graded sand

which was encountered at a depth of approximately 10 feet at boring B-1. We recommend, neglecting the skin friction in the upper 10 feet of foundation soils to account for soil movement in the soil moisture variation zone and soil disturbance during construction and rely on the end bearing for the foundation of the new posts. An end bearing of 2,000 psf can be used to support the posts.

The posts will be subject to lateral loads. The parameters for lateral load analysis are provided in table below for use in Ensoft's L-PILE computer program.

Table 5-1 – Soil L-Pile Parameters for B-1

Boring#	Depth (feet)	Soil Type	Material Type For L-Pile	Undrained Cohesion (psi)	Friction Angle (Degrees)	Effective Soil Unit Weight (pci)	Strain Factor E_{50}	P-Y Modulus, K (pci)	
								STATIC K_S	CYCLIC K_C
B-1	7-10	Sand	Medium Dense Sand w/free water (Reese)	-	28	0.0362	-	60	-
	10-25	Sand	Dense sand w/free water (Reese)	-	30	0.0362	-	125	-

The upper 7 feet of soil should be neglected in passive resistance unless the post is surrounded by concrete or pavements.

To prevent erosion we recommend, backfilling the exposed area with stone riprap in accordance with TxDOT Item 432, Type R or Type F. We recommend, neglecting the skin friction within the riprap zone.

6 TRAIL AREA #3 RETAINING WALL

6.1 General

We understand that the project involves construction of variable height gravity retaining wall at the side walk near trail area #3. The maximum wall height is approximately 3 feet at the highest point.

Based on the provided layout, we ran external and global stability analyses and as shown in the table below the computed factors of safety met the minimum recommended.

Table 6-1 – Minimum Recommended and Calculated Factors of Safety

Stability Condition	Minimum Factor of Safety Recommended	Calculated Factor of Safety
Bearing pressure	2.0	4.1
Sliding	1.5	1.5
Overturning	2.0	3.8
Global	1.3	1.32

Based on our analysis, we recommend using L-shaped wall with a minimum of 1-foot thick column and base and 4 feet wide footing to satisfy the above recommended factors of safety. Global slope stability analyses were performed for the end of construction case, long-term case and rapid drawdown cases. The 100 year flood elevations for the rapid draw down was assumed to be at the

wall top elevation. The soil parameters used in each case are discussed below and were estimated based on the boring B-2 field and laboratory data developed for this investigation.

- End of Construction. The end of construction case models the initial undrained condition of the soil. For this analysis, unconsolidated undrained soil parameters were used.
- Long Term. The long-term design case represents steady state piezometric and stress conditions. When embankment is constructed, altered stress conditions create pore pressure changes and the undrained strength of the embankment soils is mobilized. After time, these pore pressures drain and drained shear strength conditions govern the embankment global stability.
- Rapid drawdown Conditions. The rapid drawdown case models the condition where high flood water saturates and piezometerically "loads" the embankment, and then quickly recede leaving a large unbalanced piezometric head in the embankment. This unbalanced force increases the shear stresses in the embankment soils. The water level was taken at the bottom of the wall, and was extended inside the embankment to the 100 year flood level. **Proper drainage is required to insure that water pressure does not accumulate behind the wall.**

The results of the global stability analysis are presented in Appendix C.

7 SHADE STRUCTURE RECOMMENDATIONS

7.1 General

We understand that a shade structure will be installed at the playground area. The structure will be lightly loaded with vertical loads not more than 2,000 pounds. One of the major design factors for lightly loaded structures in the general project area is the shrinking and swelling potential of fine-grained soils. The shrink/swell movements can be estimated through the use of the Plasticity Index (PI). Generally, the higher the PI of a material is, the greater the potential for soil movements during moisture changes. Based on the soil conditions encountered in the borings B-3 and B-4 drilled in this study, the soils encountered have an effective PI of approximately 22 in the upper 10 feet.

Potential Vertical Rise (PVR) values were estimated by the TEX 124-E method for the upper 7 feet of soils at the site, using worst condition (dry state) and existing condition. The PVR represents the potential ability of a soil material at a specific density, moisture and loading condition to swell. It indicates the potential movement of the soils that may be realized if the soils become wet from a relatively dry condition. The PVR value is provided to demonstrate the relative severity of the swell potential of the clayey soils at the site; however, this value is not intended to be used directly as a design parameter. The actual amount of swell depends on many variables, such as the time of construction, which are not known at the time of this study.

The estimated PVR values are summarized in the table below for different soil conditions at boring locations B-3 and B-4.

Table 7-1 – PVR values

Condition	B-3	B-4
Existing	1.6	0.3
Dry	1.9	0.3

7.2 Foundation Selection

Foundations for the structure must satisfy two basic design criteria. First, bearing pressure transmitted to the foundation soils should not exceed the allowable bearing pressures computed with an adequate factor of safety. Second, foundation movement due to soil volume change must be within desirable limits.

Based on our PVR estimates, at/near grade foundations may experience movements as high as 1.9 inches. Therefore, we recommended a foundation system founded below the zone of seasonal moisture change, such as drilled shafts.

7.3 Drilled Shafts

Based on the subsurface soils encountered, drilled shafts penetrating to a depth of 15 feet below the ground surface can be used as a foundation system to support the structure. The footings may be designed for an allowable net total load bearing pressure of 4,500 psf or an allowable net dead plus sustained live load bearing pressure of 3,000 psf; whichever is critical. These bearing pressures contain a factor of safety 2 and 3, respectively. We recommend ignoring the skin friction when calculating the compressive axial capacity in this case because the shafts will be relatively shallow.

The shaft settlement is expected to occur as the column loads are applied. With the indicated bearing pressures and loads for a lightly loaded building, settlement is estimated to be less than one inch. Differential settlement will result from variances in subsurface condition, loading conditions and construction procedures, such as cleanliness of the bearing area. Differential movement between adjacent columns is estimated to be about one-half the total settlement.

The soil induced uplift loads at this site can be approximated by applying a uniform uplift of 1,000 psf over the shaft perimeter for a shaft length of 5 feet in the upper clay layer. To counter the uplift loads, we recommend using an uplift skin friction of 300 psf in the soils below depth 10 feet.

The drilled shafts will be subject to lateral loads. The parameters for lateral load analysis are provided in table below for use in Ensoft's L-PILE computer program.

Table 7-2 – Soil L-Pile Parameters for B-3 and B-4

Boring#	Depth (feet)	Soil Type	Material Type For L-Pile	Undrained Cohesion (psi)	Friction Angle (Degrees)	Effective Soil Unit Weight (pci)	Strain Factor E_{50}	P-Y Modulus, K (pci)	
								STATIC K_S	CYCLIC K_C
B-3	7-8	Clay	Stiff clay w/ free water (Reese)	7.8	-	0.0362	0.007	500	200
	8-18	Sand	Dense sand w/free water (Reese)	-	30	0.0362	-	125	-
	18-25	Clay	Very stiff clay w/ free water (Reese)	14	-	0.0362	0.005	1000	400
B-4	7-22	Sand	Dense sand w/free water (Reese)	-	30	0.0362	-	125	-

The upper 7 feet of soil should be neglected in passive resistance unless the shaft is surrounded by concrete or pavements.

7.4 Drilled Shaft Construction Considerations

Drilled shaft construction and installation should follow TxDOT Standard Specification Item 416. Slurry displacement methods for drilled shaft construction are allowed under TxDOT Standard Specifications. Presented below are a few specific recommendations.

1. Drilled shaft excavations should be inspected for verticality and side sloughing. Verticality is specified at one inch in ten feet of the shaft length, and should be checked to the full depth of dry auguring prior to introducing drilling mud.

2. Before placing concrete, the shaft bottom should be cleaned out with a drilling bucket in order to remove any sediments that may not be displaced by the concrete. The shaft bottoms should be cleaned with a "clean-out" bucket until rotation on the bottom without crowd (i.e. penetration under force) produces little spoil. Probing after clean out is essential to verify the condition of the base of the shaft.

3. Concrete placement should be accomplished as directed in TxDOT Standard Specification Item 416.3. The tremie pipe diameter should be at least eight times as large as the largest concrete aggregate size.

4. A computation of the final concrete volume for each shaft should be made. Shafts taking an unreasonably high or low volume of concrete should be cored to check their integrity.

5. Due to the fact that clayey sands were encountered in the borings B-3 and B-4, we anticipate that casing or slurry may be needed to prevent caving. Groundwater was encountered in the upper soils in the borings B-3 and B-4 during drilling operations at a depth of approximately 8 feet and 9 feet, respectively. However, it is anticipated that groundwater levels will fluctuate due to seasonal variations in climactic conditions. If casing is used, the level of concrete within the casing should be maintained well above the groundwater level outside the casing prior to and during extraction. The casing should be extracted slowly and smoothly with a vibratory hammer without rotation. Our analyses assume no casing will be left in place. We should be informed if casing will be left in place so we may provide revised shaft capacity calculations.

6. Appropriate shaft excavation equipment should be used for shaft excavation in soil layers.

7. Shaft excavations should not be made within three shaft diameters (edge to edge) of shafts that have been concreted within the last 24 hours.

8 SITE PREPARATION

Select fill should consist of very sandy clay to clayey sand with a liquid limit less than 35 and a plasticity index between 7 and 20. Fill material should be placed in loose lifts not exceeding eight inches in thickness and should be compacted to 95 percent of ASTM D698 at -1 to +2 percentage points of the soil's optimum moisture content.

Imported fill material for site grading should be clean soil with a liquid limit (LL) of less than 35 and plasticity index 20 percent and contain no rock greater than 4 inches in maximum dimension. This gradation requirement is recommended to prevent the presence of voids around large rocks. Prior to placing any fill, the areas to receive fill should be stripped and grubbed. The subgrade should then be scarified to a minimum depth of 6 inches and compacted to a minimum of 95 percent of the

Standard Proctor (ASTM D698) maximum dry density. The soil should be compacted at or above the optimum moisture content determined by that test.

9 FILL SLOPE STABILITY

The following table summarizes the maximum recommended slopes for a factor of safety of 1.3 for long term conditions based on the material plasticity index:

Table 9-1 – Recommended Slopes

Slope	Plasticity Index
2.5(H):1(V)	<5
3(H):1(V)	<20
3.5(H):1(V)	<35
4(H):1(V)	<55
4.5(H):1(V)	<85

It should be noted that the sandy material will be subject to erosion, and we recommend that these slopes be hydroseeded for erosion protection purposes. In addition, our recommendations for the fill compaction and imported fill are described in the section of "Site Preparation" of the report.

10 DESIGN REVIEW

HVJ Associates® should review the design and construction plans and specifications prior to release to make certain that the geotechnical recommendations and design criteria presented herein have been properly interpreted.

11 LIMITATIONS

This investigation was performed for the exclusive use of Halff Associates, Inc. to perform a geotechnical investigation for the proposed repairs to flood damaged areas of Isle Du Bois State Park at Ray Roberts Lake in Denton County, Texas. HVJ Associates® has endeavored to comply with generally accepted geotechnical engineering practice common in the local area. HVJ Associates® makes no warranty, express or implied. The analyses and recommendations contained in this report are based on data obtained from subsurface exploration, laboratory testing, the project information provided to us and our experience with similar soils and site conditions. The methods used indicate subsurface conditions only at the specific locations where samples were obtained, only at the time they were obtained, and only to the depths penetrated. Samples cannot be relied on to accurately reflect the strata variations that usually exist between sampling locations. Should any subsurface conditions other than those described in our boring logs be encountered, HVJ Associates® should be immediately notified so that further investigation and supplemental recommendations can be provided.

PLATES

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Image obtained from Google Maps, July 2017.

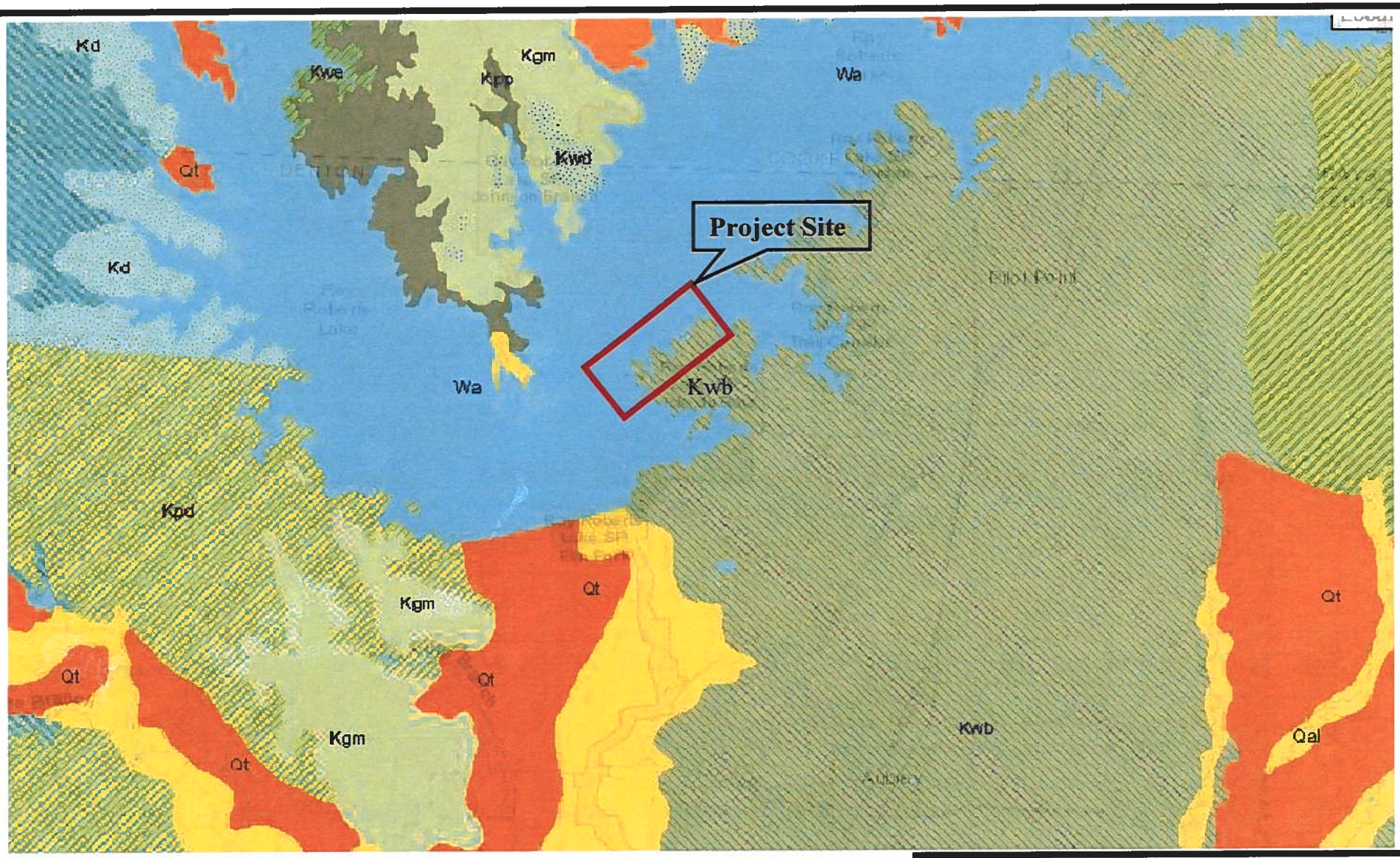
HVJ ASSOCIATES

8701 John Carpenter Fwy Suite 250
Dallas, TX 75247

DATE: 7/19/2017	APPROVED BY: RL	PREPARED BY: BT

SITE VICINITY MAP
FLOOD REPAIRS AT LAKE RAY ROBERTS

PROJECT NO.: DG-16-10188	DRAWING NO.: PLATE 1



Qal: Alluvium deposits
Qt: Fluviatile Terrace deposits
Kwb: Woodbine Formation

N

Source: Geologic Atlas of Texas Sherman Sheet
UT Austin Bureau of Economic Geology

HVJ ASSOCIATES
8701 John Carpenter Fwy Suite 250
Dallas, TX 75247

DATE: 7/19/2017	APPROVED BY: RL	PREPARED BY: BT

GEOLOGY MAP
FLOOD REPAIRS AT LAKE RAY ROBERTS

PROJECT NO.: DG-16-10188	DRAWING NO.: PLATE 2

Approximate Boring Location

N

Image obtained from Google Earth, July 2017.

HVJ ASSOCIATES
8701 John Carpenter Fwy Suite 250
Dallas, TX 75247

DATE: 7/19/2017	APPROVED BY: RL	PREPARED BY: BT

PLAN OF BORINGS
FLOOD REPAIRS AT LAKE RAY ROBERTS

PROJECT NO.: DG-16-10188	DRAWING NO.: PLATE 3

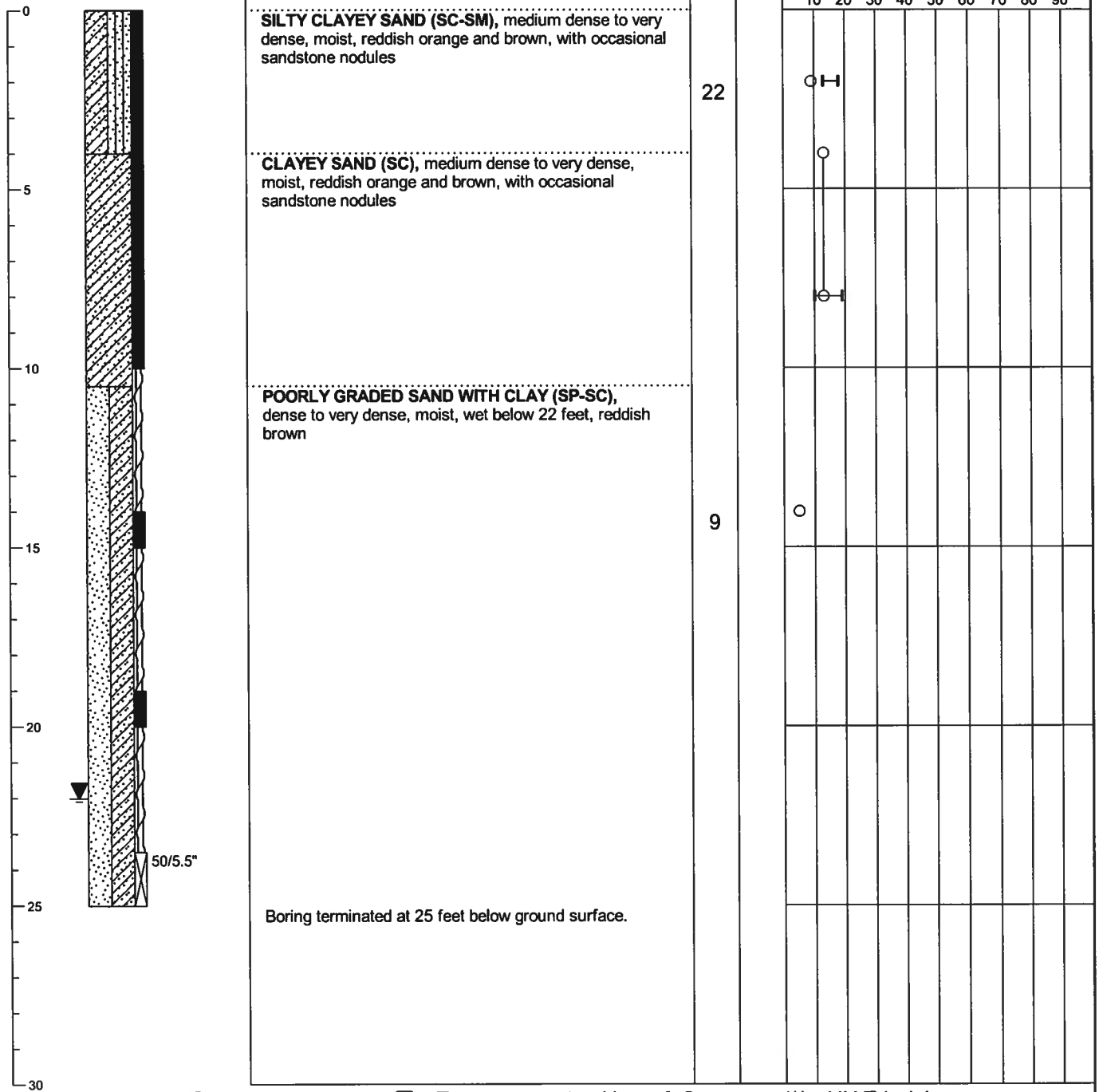
LOG OF BORING

Project: Flood Repairs at Lake Ray Roberts
Boring No.: B-1
Groundwater during drilling: 22 feet
Groundwater after drilling: N/A

Date: 6/26/2017
Northing: --
Easting: --

Project No.: DG-16-10188
Elevation:
Station: --
Offset: --

ELEV. DEPTH, FEET	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	SOIL/ROCK CLASSIFICATION	% PASSING NO. 200 SIEVE	DRY DENSITY PCF
0		**SILTY CLAYEY SAND (SC-SM),** medium dense to very dense, moist, reddish orange and brown, with occasional sandstone nodules	22	
5		**CLAYEY SAND (SC),** medium dense to very dense, moist, reddish orange and brown, with occasional sandstone nodules		
10		**POORLY GRADED SAND WITH CLAY (SP-SC),** dense to very dense, moist, wet below 22 feet, reddish brown	9	
15				
20				
25	50/5.5"	Boring terminated at 25 feet below ground surface.		
30				



Shear Types: ● = Hand Penet. ■ = Torvane ▲ = Unconf. Comp. ✳ = UU Triaxial

See Plate 3 for boring location.

PLATE 4

HVJ ASSOCIATES

LOG OF SOIL BORING LAKE RAY ROBERTS.GPJ HVJ.GDT 8/14/17

LOG OF BORING

Project: Flood Repairs at Lake Ray Roberts
Boring No.: B-2
Groundwater during drilling: 25 feet
Groundwater after drilling: N/A

Date: 6/26/2017
Northing: --
Easting: --

Project No.: DG-16-10188
Elevation:
Station: --
Offset: --

ELEV. DEPTH, FEET	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	SOIL/ROCK CLASSIFICATION	% PASSING NO. 200 SIEVE	DRY DENSITY PCF
0		**CLAYEY SAND (SC),** medium dense to very dense, moist, reddish brown and gray	15	
5			26	
10				
15	24-36-27			
20		**FAT CLAY (CH),** very stiff, moist, brown and gray, trace sand		
25		**CLAYEY SAND (SC),** wet, brown and gray, with lignite	29	
30		Boring terminated at 27 feet below ground surface.		

SHEAR STRENGTH, TSF
0.5 1.0 1.5 2.0
MOISTURE O CONTENT, %
PLASTIC LIMIT — LIQUID LIMIT
10 20 30 40 50 60 70 80 90

Shear Types: ● = Hand Penet. ■ = Torvane ▲ = Unconf. Comp. ✳ = UU Triaxial

See Plate 3 for boring location.

PLATE 5

HVJ ASSOCIATES

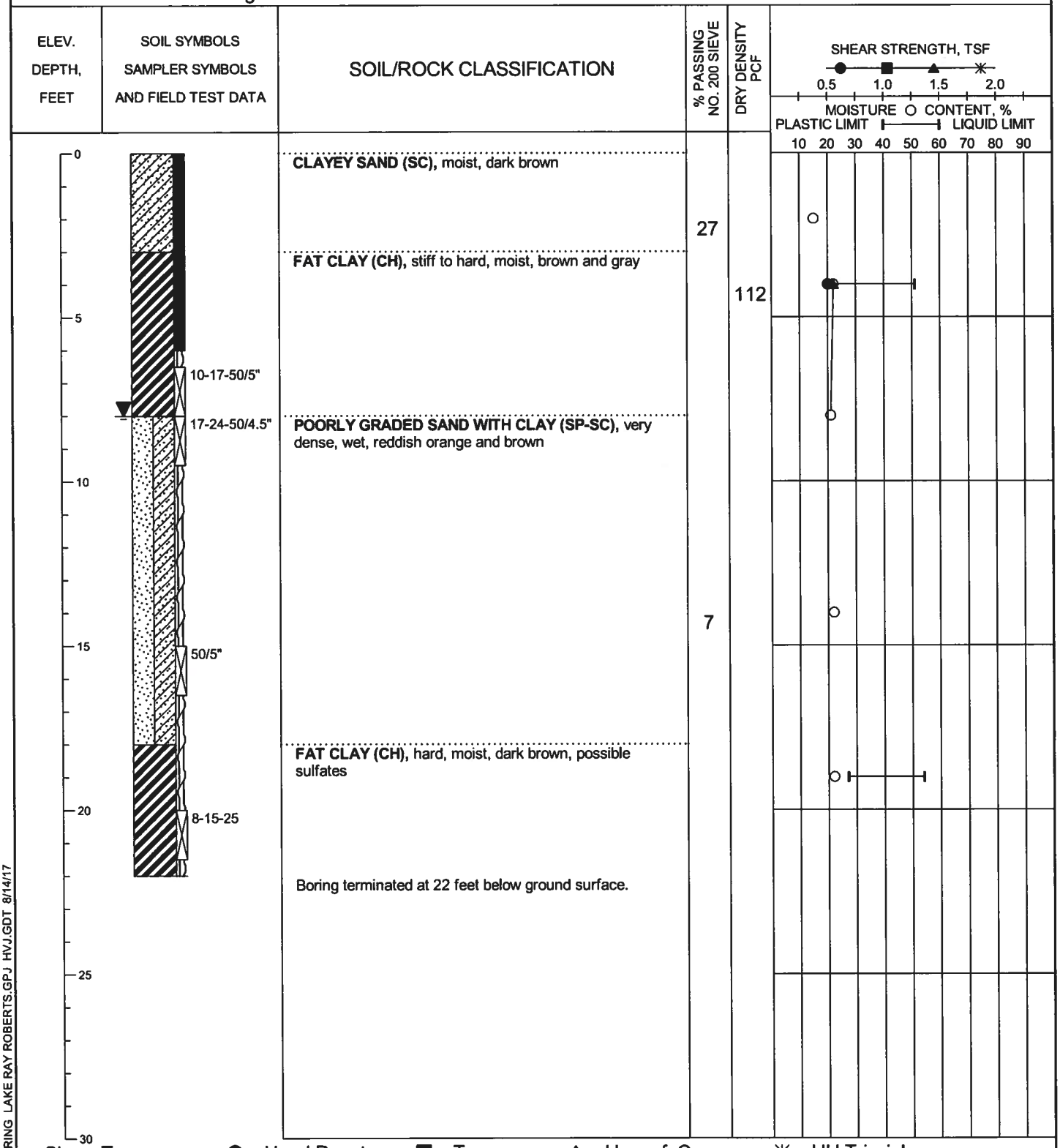
LOG OF SOIL BORING LAKE RAY ROBERTS.GPJ HVJ.GDT 8/14/17

LOG OF BORING

Project: Flood Repairs at Lake Ray Roberts
Boring No.: B-3
Groundwater during drilling: 8 feet
Groundwater after drilling: N/A

Date: 6/26/2017
Northing: --
Easting: --

Project No.: DG-16-10188
Elevation:
Station: --
Offset: --



Shear Types: ● = Hand Penet. ■ = Torvane ▲ = Unconf. Comp. ✳ = UU Triaxial

See Plate 3 for boring location.

PLATE 6

HVJ ASSOCIATES

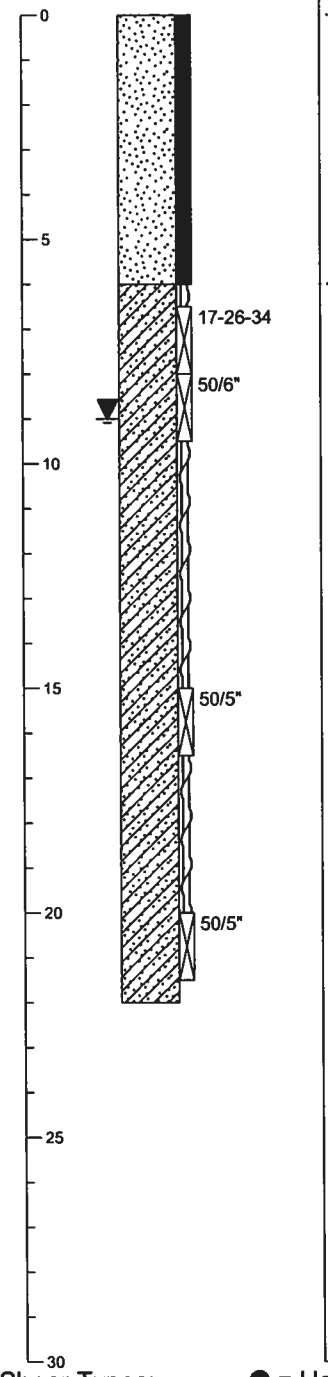
LOG OF SOIL BORING LAKE RAY ROBERTS.GPJ HVJ.GDT 8/14/17

LOG OF BORING

Project: Flood Repairs at Lake Ray Roberts
Boring No.: B-4
Groundwater during drilling: 9 feet
Groundwater after drilling: N/A

Date: 6/26/2017
Northing: --
Easting: --

Project No.: DG-16-10188
Elevation:
Station: --
Offset: --



ELEV. DEPTH, FEET	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	SOIL/ROCK CLASSIFICATION	% PASSING NO. 200 SIEVE	DRY DENSITY PCF
		POORLY GRADED SAND (SP), moist, reddish brown	5	
		CLAYEY SAND (SC), dense to very dense, wet, reddish brown	29	
		Boring terminated at 22 feet below ground surface.		

SHEAR STRENGTH, TSF
0.5 1.0 1.5 2.0
MOISTURE CONTENT, %
PLASTIC LIMIT — LIQUID LIMIT
10 20 30 40 50 60 70 80 90

Shear Types: ● = Hand Penet. ■ = Torvane ▲ = Unconf. Comp. ✳ = UU Triaxial

See Plate 3 for boring location.

PLATE 7

HVJ ASSOCIATES

LOG OF SOIL BORING LAKE RAY ROBERTS.GPJ HVJ.GDT 8/14/17

SOIL SYMBOLS

Soil Types


Clay


Silt


Sand


Gravel

Modifiers


Clayey


Silty


Sandy


Fill

Construction Materials


Asphaltic Concrete


Stabilized Base


Asphalt


Portland Cement Concrete

SAMPLER TYPES


Thin Walled Shelby Tube


No Recovery


Split Barrel


Auger


THD Cone Penetration Test


Jar Sample

WATER LEVEL SYMBOLS


Groundwater measured after drilling operations


Groundwater measured during drilling operations

SOIL GRAIN SIZE

Classification	Particle Size	Particle Size or Sieve No. (U.S. Standard)
Clay	< 0.002 mm	< 0.002 mm
Silt	0.002 - 0.075 mm	0.002 mm - #200 sieve
Sand	0.075 - 4.75 mm	#200 sieve - #4 sieve
Gravel	4.75 - 75 mm	#4 sieve - 3 in.
Cobble	75 - 200 mm	3 in. - 8 in.
Boulder	> 200 mm	> 8 in.

DENSITY OF COHESIONLESS SOILS

Descriptive Term	Penetration Resistance "N" * Blows/Foot
Very Loose	0 - 4
Loose	4 - 10
Medium Dense	10 - 30
Dense	30 - 50
Very Dense	> 50

CONSISTENCY OF COHESIVE SOILS

Consistency	Undrained Shear Strength (tsf)	Penetration Resistance "N" * (Blows/ft)
Very Soft	0 - 0.125	< 2
Soft	0.125 - 0.25	2-4
Firm	0.25 - 0.5	4-8
Stiff	0.5 – 1.0	8-15
Very Stiff	1.0 – 2.0	15-30
Hard	> 2.0	>30

PENETRATION RESISTANCE

#-#-#	Blows required penetrating each of three consecutive 6-inches per ASTM D-1586*
50/4"	If more than 50 blows are required, driving is discontinued and penetration at 50 blows is noted
(4/6")	Texas Cone Penetration blows required penetrating each of two consecutive 6-inches per TEX- 132-E

* The N value is taken as the blows required to penetrate the final 12 inches

TERMS DESCRIBING SOIL STRUCTURE

Slickensided	Fracture planes appear polished or glossy, sometimes striated
Fissured	Breaks along definite planes of fracture with little resistance to fracturing
Inclusion	Small pockets of different soils, such as small lenses of sand scattered through a mass of clay
Parting	Inclusion less than 1/4 inch thick extending through the sample
Seam	Inclusion 1/4 inch to 3 inches thick extending through the sample
Layer	Inclusion greater than 3 inches thick extending through the sample
Laminated	Soil sample composed of alternating partings of different soil type
Stratified	Soil sample composed of alternating seams or layers of different soil type
Intermixed	Soil sample composed of pockets of different soil type and laminated or stratified structure is not evident
Calcareous	Having appreciable quantities of calcium carbonate
Ferrous	Having appreciable quantities of iron
Nodule	A small mass of irregular shape

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KEY TO TERMS AND SYMBOLS USED ON BORING LOGS

PROJECT NO.: DG-16-10188 | DRAWING NO.: Plate 8

APPENDIX A

SUMMARY OF LABORATORY TEST RESULTS

Boring#	Depth	Liquid Limit	Plastic Limit	PI	Percent Finer Than #200 Sieve	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (UC) (tsf)	Shear Strength (Pocket Pen) (tsf)
B-1	2	18	13	5	22	9.1			
B-1	4					13.4			
B-1	8	19	10	9		12.5			
B-1	14				9	5.3			
B-2	2				15	10.5			
B-2	4					11.3			
B-2	6	26	15	11	26	13			
B-2	20	53	17	36		19.4			1.17
B-2	25				29	40.7			
B-3	2				27	15.4			
B-3	4	51	20	31		22.2	112.1	0.55	0.5
B-3	8					20.9			
B-3	14				7	22.3			
B-3	19	54	27	27		21.8			
B-4	2	25	14	11	5	11.4			
B-4	8				29	22.1			
B-4	14					22.7			
Total No. of Tests		**7**	**7**	**7**	**9**	**17**	**1**	**1**	**2**

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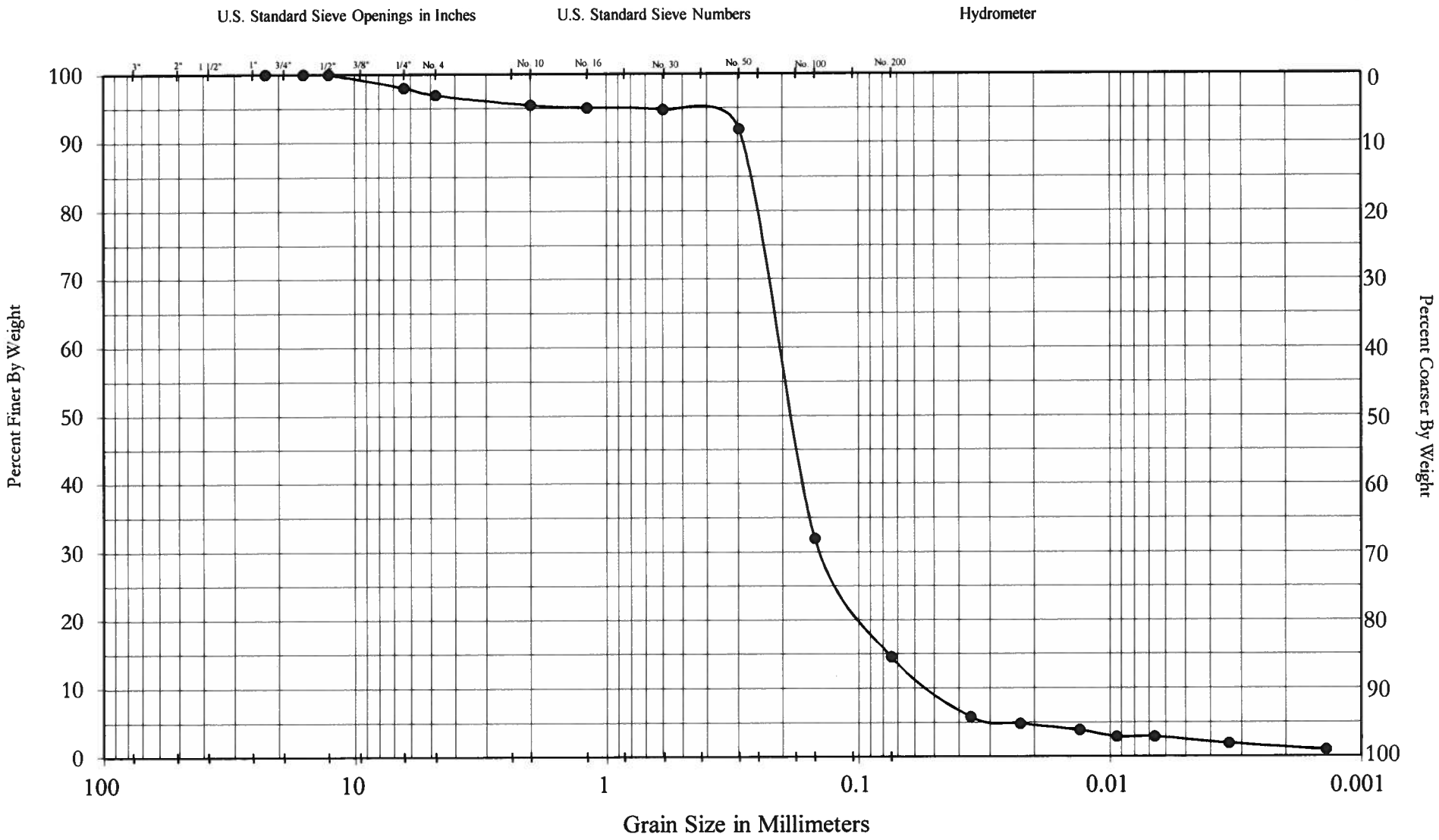
DATE: 7/24/2017 | APPROVED BY: RL | PREPARED BY: RE

SUMMARY OF LAB TEST RESULTS
FLOOD REPAIRS AT LAKE RAY ROBERTS

PROJECT NO.: DG-16-10188 | DRAWING NO.: Plate A-I

APPENDIX B

HYDROMETER AND SIEVE ANALYSIS TEST RESULTS

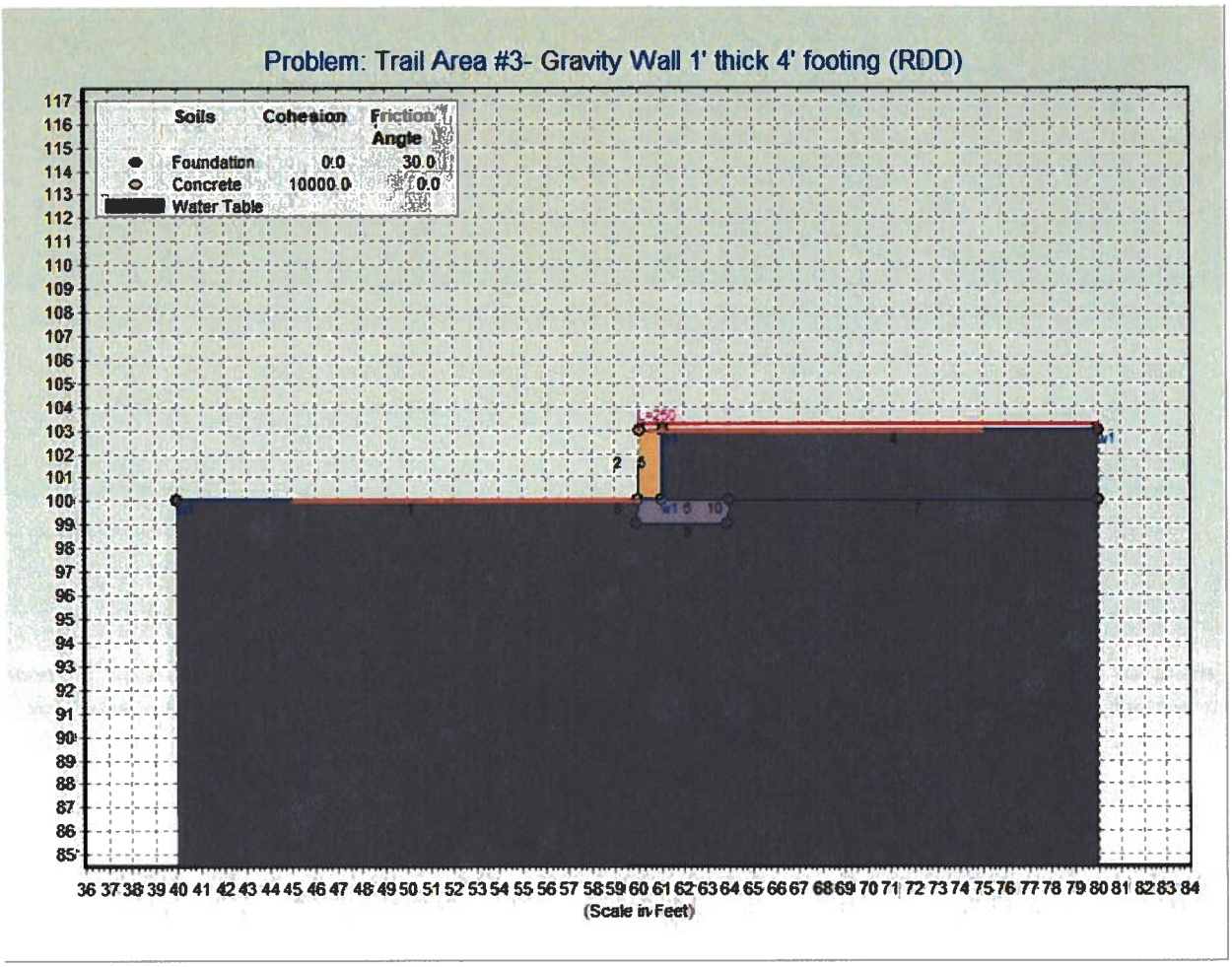


Sample	Classification	Project	
B-2 2-4	Clayey Sand (SC)	DG-16-10188 Flood Repairs at Lake Ray Roberts Lake State Park	D_{50}= 0.19 D_{95}= 1.4

APPENDIX C

TRAIL AREA #3 WALL STABILITY RESULTS

DATA SUMMARY



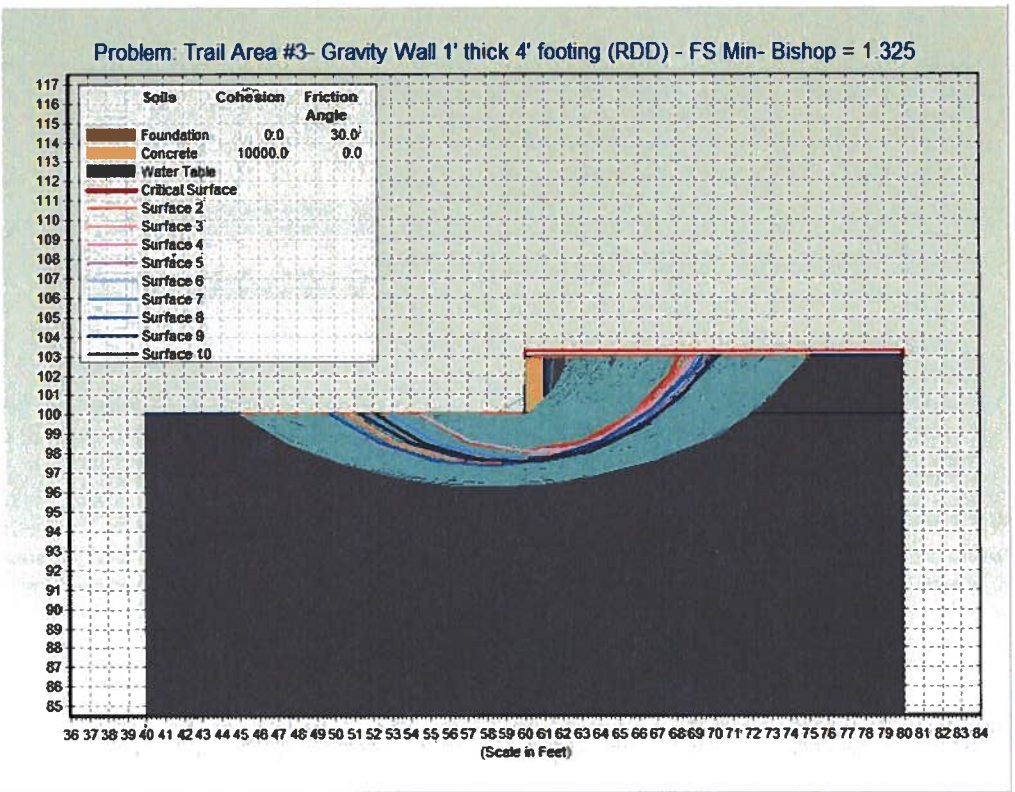
Profile Data

Segment Number	Left Extreme X	Left Extreme Y	Right Extreme X	Right Extreme Y	Soil Under Segment
1	40	100	60	100	1
2	60	100	60.1	103	2
3	60.1	103	61.1	103	2
4	61.1	103	80	103	1
5	61	100	61.1	103	1
6	61	100	64	100	2
7	64	100	80	100	1
8	59.9	99	60	100	2
9	59.9	99	63.9	99	1
10	63.9	99	64	100	1

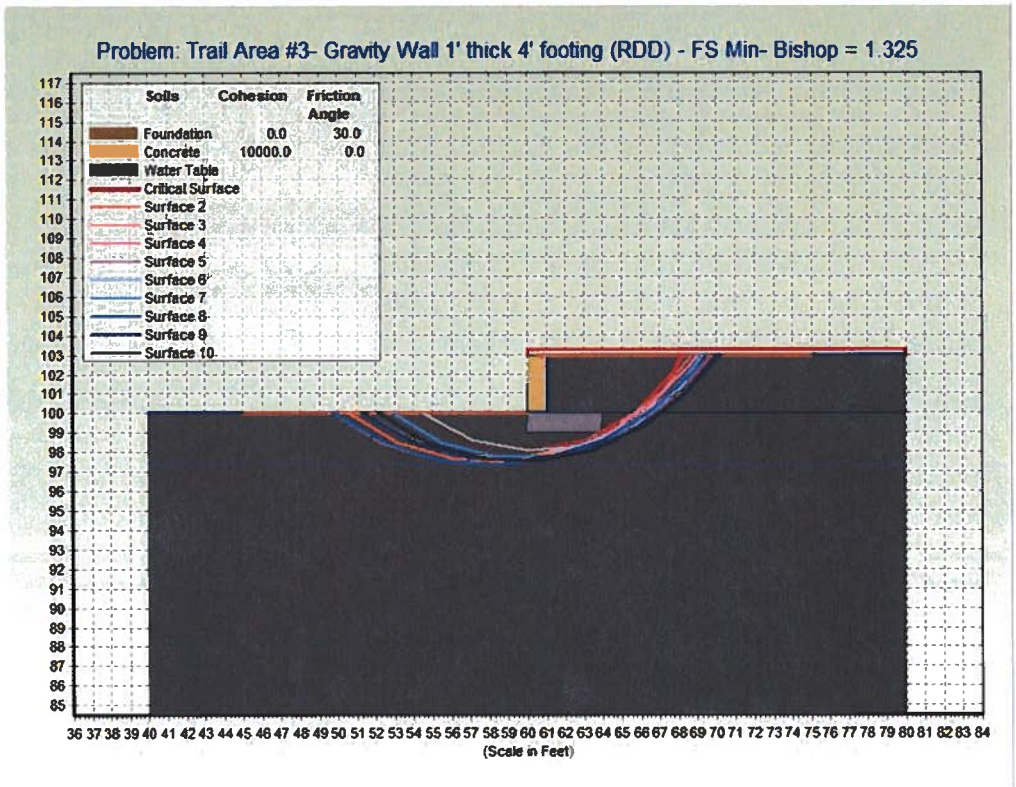
Soil Properties

Soil Number	Wet Unit Weight	Saturated Unit Weight	Cohesive Intercept	Friction Angle	Ru	Pressure Head	Water Table	Soil Name
1	125	125	0	30	0	0	1	Foundation
2	150	150	10000	0	0	0	1	Concrete

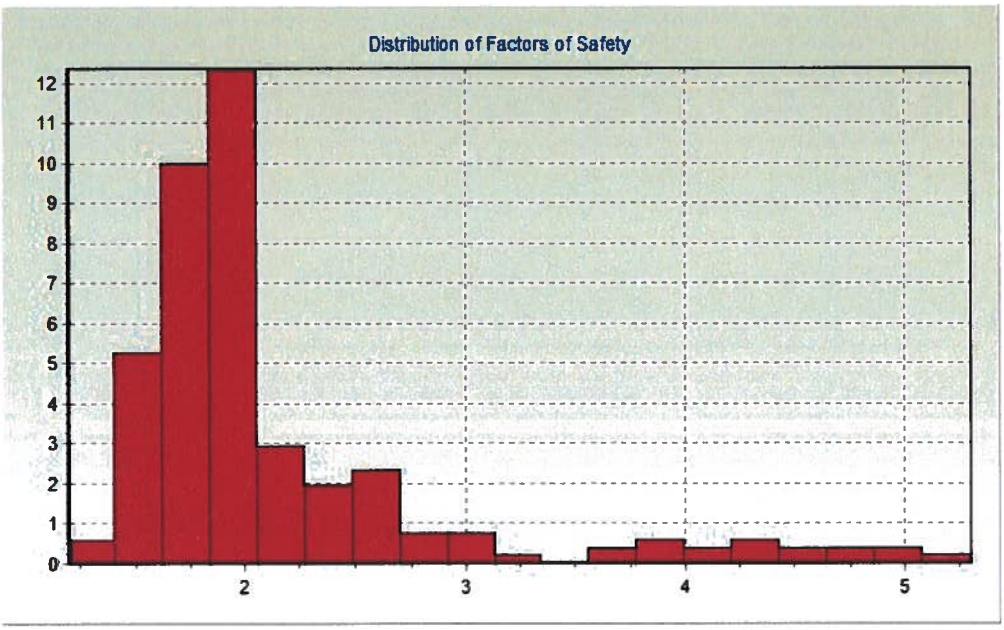
========== All Surfaces Generated ==========



========== 10 Most Critical Surfaces ==========



========== Factor of Safety Histogram ==========



======== Factors of Safety of 10 Most Critical Surfaces ========

Surface Number	Factor of Safety
1	1.325
2	1.386
3	1.395
4	1.424
5	1.434
6	1.452
7	1.453
8	1.461
9	1.476
10	1.495

SECTION 015639 - TREE PROTECTION, REMOVAL, AND PRUNING

PART 1 - GENERAL

1.1 DESCRIPTION

A. Furnish all work and materials, appliances, tools, equipment, facilities, transportation, and services necessary for and incidental to performing all operations in connection with the protection, pruning, care, and removal of trees.

B. The Contractor shall provide protection and care of existing trees or other designated plant material in order to maintain a healthy, vigorous condition.

C. The Contractor shall perform tree removal, stump grinding and pruning as specified, utilizing acceptable horticultural standards as adopted by the Texas Association of Landscape Contractors (TALC) or Texas Nurseryman Association.

D. Such work shall include, but is not limited to, the following:

1. Protection of existing trees and landscape to remain from the following types of damage:
   a. Compaction of root zone by foot, vehicular traffic or material storage.
   b. Trunk and branch damage from equipment operations, material storage, or from nailing or bolting.
   c. Root poisoning from spilled solvents, gasoline, paint, and other noxious materials.
   d. Branch damage due to improper pruning or trimming.
   e. Damage from lack of water due to:
      1) Cutting or altering natural water migration patterns near root zones.
      2) Failure to provide adequate watering.
   f. Damage from alteration of soil pH factor caused by depositing lime, concrete, plaster or other base materials near roots.
   g. Damage to root zone by coverage of soil.
2. Cutting of roots large than one and one-half (1 1/2) inches in diameter and application of sealant.
3. Stump grinding and removal through chipping of trees and other plant vegetation designated for removal as noted on the plans.
4. Removal and pruning of tree branches and roots adjacent to new construction and excavation or where construction access route is to occur to reduce damage to tree canopy and roots.
5. Removal of dead wood and broken or hanging branches from the existing trees.
6. Application of mulch product and root stimulant at trees to be root pruned.
7. Placement of plywood over mulch in areas between tree protection fencing and face of building to allow for building face repair.
8. Watering and maintenance of root pruned trees.
9. Documentation of tree removal, damage and treatment shall be recorded and submitted.

1.2 PROJECT CONDITIONS AND DOCUMENTATION SUBMITTAL

A. Verify and examine site conditions with the Owner's Representative. Proceed when official notice is given to the Contractor that the work site is ready. Proceed with tree protection prior to any site work, demolition or grading.

B. Document the condition of every tree to remain and every tree to be protected by dated photograph submitted to the Owner. Submit six (6) photographs per tree showing the tree, branching, and roots at various angles. Photograph existing trees to remain with Owner's representative present to verify and record tree designation and health at time of commencing site work. Provide one (1) copy of photos to Owner. Contractor to maintain one (1) copy of tree photos and record of tree health in notebook (or pdf file) for entire construction period.

1.3 SEQUENCING

A. Coordinate installation of protection devices and other related units of Work specified in other Sections to ensure that protection of existing trees is complete prior to any site work, demolition or grading.

B. Trees designated for root or branch pruning must be pruned prior to commencing site work or demolition.

1.4 DAMAGES

A. Trees that are designated to remain but, during the course of construction, are removed, severely damaged, in significant decline or have died due to Contractor's work or neglect shall be replaced and/or damages paid by the Contractor to the Owner per the schedule below at the Contractor's expense.

B. For trees four (4) inch caliper or greater, the Owner's representative will assess the following damages for damaged, dead or dying, or removed trees to be paid by the Contractor to the Owner.

Tree size – Diameter/Caliper in Inches	Replacement Tree or Value Each tree
Equal to 4 and up to 6	$1,500.00
Equal to 6 and up to 8	$ 2,000.00
Greater than 8 and up to 12	$ 3,000.00
Greater than 12 and up to 15	$ 4,000.00
Greater than 15 inches	$ 500 per caliper inch

Size will be determined by measuring caliper at twelve (12) inches above grade for trees from four (4) to twelve (12) inch caliper and at six (6) inches above grade for trees from zero (0) to four (4) inch in caliper. Trees that are larger than twelve (12) inch in caliper shall be measured at

four (4) feet above natural ground elevation, or from top of stump, if removed. Multi-trunk trees shall be measured at twelve (12) inches above grade of each trunk. The largest trunk's diameter shall be counted as 100% caliper; the remaining trunks shall be counted at 50% caliper.

C. Slight Damage shall be defined as damage, in the opinion of the Owner that may heal. Examples include but are not limited to; scaring of the trunk into the cambial layer one-half (½) inch to two (2) inches in width but less than one-third (1/3) trunk circumference or breaking of limbs less than two (2) inches in diameter or limbs less than one-third (1/3) trunk caliper, whichever is less. Slight damage shall also include removal or lying down of protective tree fencing prior to end of construction, storing equipment or supplies within the critical root zone (CRZ), or disposing of paint or concrete within the CRZ but not closer to the trunk than 50% radius of the CRZ. Slight damage to trees shall be assessed at a rate of $100.00 for each instance. Each day tree fencing is not properly placed, equipment or supplies are stored within CRZ or fill is stored within the CRZ shall be considered one instance.

D. Moderate damage shall be defined as damage, in the opinion of the Owner, that contributes to the poor health and reduced longevity of the tree, examples include but are not limited to scaring of the trunk into the cambial layer greater than two (2) inches but less than one-third (1/3) the trunk circumference or breaking of limbs more than two (2) inches in diameter but less than one-third (1/3) trunk caliper. Moderate damage shall also include compaction of soil, grading or filling in 20% of the CRZ on one of four sides but outside the 50% radius of the CRZ, disposing of paint or concrete within 50% radius of the CRZ. Moderate damages shall be calculated at a rate of one-half (½) the assessed value of the tree per each instance of damage.

E. Severe damage shall include but is not limited to scaring of the trunk to the cambial layer greater than one-third (1/3) the trunk circumference, uprooting or causing a tree to lean, damage to a scaffolding branch or branch greater than one-third (1/3) of trunk caliper. Severe damage shall also include compaction of soil, grading or filling more than 20% of the CRZ, or within 50% radius of the CRZ or on more than one (1) of four (4) sides. Cutting one-third (1/3) of the buttress roots within three (3) times the distance of the DBH of the trunk, or cutting four (4) roots four (4) inches or greater in diameter within four (4) foot of the trunk shall also be considered severe damage. Severely damaged trees shall be designated by the Owner and shall be scheduled for removal. The Contractor shall pay the Owner penalty as described in the table above.

F. Trees that must be removed due to damage caused by the contractor shall be removed at the Contractor's expense.

G. All damages shall be paid to the Owner. Failure to replace or pay for damaged trees shall result in a breach of contract and the Contractor will be automatically assessed damages. Damages as described herein shall be deducted from payments otherwise due to the Contractor.

1.5 WATER

Potable water is available on site.

PART 2 - PRODUCTS

2.1 WOUND PAINT

For trees within protection fencing area that may need limb pruning/removal, use petroleum or latex base tree wound paint, dark gray, brown or black in color. Spray type paints are acceptable for use on genus Quercus only.

2.2 TREE PROTECTION FENCING

A. Refer to the drawings for the location of proposed tree protection fencing.

B. Fencing: Non-movable chain link fencing.

1. All elements hot dip galvanized and unless otherwise shown.
2. All elements consist of the following:

a. Chain link fencing: Nine (9) gauge, two (2) inch mesh, four (4) foot height.
b. Posts: two and three-eighths (2 3/8) inches outside diameter, minimum, steel driven and set a minimum of two (2) feet into ground. Posts are set maximum eight (8) feet on center.

C. Temporary enclosures and wrapping

1. The Contractor shall protect tree trunks and root zones from damage. If fencing is not possible due to proximity of construction, then the Contractor is obligated to wrap the trunk with material sufficient to protect the trunk from any damage. The Contractor is obligated to protect the root zone from compaction and damage. The Contractor may use 2x4 pieces wired together to protect the trunk to a minimum height of eight (8) feet above grade. Mulch, gravel and plywood boards should be used to cover 100% of the root zone.
2. Miscellaneous materials: burlap, coarsely shredded hardwood mulch, septic (rounded) gravel.
3. The Contractor shall be aware and flag, if necessary, existing overhead canopies of trees to remain. Equipment shall operate with lowered boom or cranes to protect the existing tree canopies from damage.

2.3 MACHINERY AND EQUIPMENT

A. Machinery or tools requirements listed under this Section are NOT intended to be restrictive of specific manufacturers or models, unless so stated. Specific mention of the manufacturers is intended as a guide to illustrate the final product of the maintenance operations desired.

B. All equipment and pruning tools shall be maintained in a safe working condition, and cutting edges shall be sharp at all times.

2.4 MULCH AND COMPOST

A. Mulch – Commercially available coarsely shredded hardwood mulch.

B. Shredded tree mulch - On site shredded tree debris may be used that is twice (2) grounded and placed on top of two (2) inch layer of compost.

C. Compost - commercially available, fully decomposed compost.

2.5 ROOT STIMULANT (FERTILIZER)

A. Liquid fertilizer to stimulate tree root growth.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of Conditions: Verify trees to remain and trees to remove with Owner's representative.

B. Verify health of trees to remain and provide photo documentation prior to commencing demolition or site work.

C. Verify locations of existing utilities in area of tree removal and root grinding. Contractor shall protect all utility lines to remain.

D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the Owner.

3.2 TREE PRESERVATION

A. Protect and preserve trees, shrubs, and plants not to be removed by the use of fencing, temporary enclosures, wrapping or other means. TREE PROTECTION MUST OCCUR PRIOR TO ANY SITE WORK, DEMOLITION OR GRADING.

B. Tree protection must receive approval of the Owner's Representative prior to starting any site work.

C. Protect trees shown with approved fencing as indicated on the drawings and as needed to protect from construction activities.

D. Repair injuries, abrasions and other damage to plants by cleanly removing broken members, loose and torn bark, and shape edges in order to permit drainage of rain water from wounds. Paint wounds with an approved tree wound paint.

E. Where depth of soil over root system of existing plantings is to be modified by final grading, provide the following:

1. Where increase of one (1) foot or more in elevation is shown, spread continuous layer of rock aggregate, graded one quarter (1/4) inch to two (2) inches, six (6) inches deep from trunk to drip line of branches prior to installation of fill.
2. Provide proper aeration by installing within perimeter of spread, a system of four (4) inch clay drain tile. Install vertically flush with soil surface and penetrating into layer of aggregate fill.

F. Install tree guard fencing outside the edge of the tree drip line or as noted on the drawings.

G. Do not install gates in tree guard fencing. Do not stack or store any equipment inside the tree fence.

H. Do not clean construction equipment, dump liquids, nor perform field maintenance on vehicles in the vicinity of the trees to be preserved.

I. Apply four (4) inches of coarsely shredded hardwood mulch over tree root zone within fencing, unless shown otherwise.

J. Install plywood over mulch in areas reflected on plans for access between the tree protection fencing and other structures to be built.

K. Trees inside fencing with native lawn areas to remain: DO NOT install mulch or disturb soils in areas shown without mulch due to in-situ soils ability to percolate and drain.

3.3 TREE, LIMB, AND VEGETATION REMOVAL

A. Receive approval from the Owner's Representative in the field for trees and vegetation to be removed. Trees that have died or have been approved for removal shall be removed by felling with chain saws. Fell trees to avoid injuring protected trees and vegetation or damaging utilities and existing pavement or structures. Use felling methods that comply with OSHA and American Association of Nurserymen.

B. For trees less than 4 inch in caliper: thoroughly grub out stump and roots within 2 foot diameter.

C. For trees 4 inch in caliper and above: Grind stumps to a depth of eighteen (18) inches within a three (3) foot diameter of the trunk in areas where rough grading does not exceed two (2) feet of cut. Remove ground mulch from area and fill hole with select fill or site stockpiled topsoil compacted to 90% proctor density. Trees will not need to have stumps ground that are removed within area of building construction and excavation or where rough grading exceeds two feet of cut.

D. Trees within heavily rooted zones of other trees will have stumps ground to same depth as above, but grind main root laterals out three (3) feet from tree. DO NOT grind over or into other trees root systems.

E. Prune trees to remove limbs and branches that hinder Contractor's work. Remove limbs using three (3) cut process. Owner's representative shall approve any pruning that removes more than ten (10) percent of the tree's canopy.

F. Remove all branches and debris. Legally dispose of vegetation, branches and debris off site. Leave site in a clean and orderly manner.

3.4 ROOT PRUNING

A. Root pruning as indicated on the drawings must occur prior grading or excavation in the root zone.

B. Arborist – Major root pruning (two inch caliper and larger) should be supervised by a certified Arborist where indicated on the plan or if roots are exposed due to grading or excavation. Use sharp instruments that leave a clean cut, with no ragged edges.

C. Cutting guidelines:

1. Do not mechanically trench under trees, Trench using Air Spade Technology offered by Root Flare Services, Dallas, TX (or approved equal), hand dig or bore underneath. If roots greater than one (1) inch are encountered and severed, dig back along the root and find solid root wood, then cut flush and treat with an acceptable root sealant immediately. If the roots cannot be treated immediately, cover with moist burlap to prevent desiccation until they can be treated.
2. Any roots broken and disturbed during construction trenching operations shall be immediately cleanly cut and sprayed with root sealant. Do not leave uncut, frayed roots without immediate treatment. Owner is to inspect any trench before filling occurs.
3. Do not remove more than 33 % of the tree's roots, with no more than 25% from one side.
4. For trees twelve (12) inches in diameter and less, roots should not be removed within four (4) feet of the outer edge of the tree trunk base. Trees other than Post Oaks with diameter more than twelve (12) inches should be allowed an additional twelve (12) inches for every three (3) inches of trunk diameter measured at a point three (3) feet above the ground. Root prune all trees adjacent to proposed pavement locations.
5. Oak trees with diameter more than twelve (12) inches should be allowed an additional twelve (12) inches for every one (1) inch of trunk diameter measured at a point three (3) feet above the ground.
6. Root prune all trees adjacent to proposed pavement and excavation locations with proper pruning technique to provide clean cuts at roots with no ragged edges. Do not cut within five (5) feet of trunk.

D. Backfill the excavation as soon as possible after sealing cuts with root sealant and applying root stimulant to exposed root zone. Water the soil around the roots to avoid leaving air pockets.

E. Arborist will review root pruning prior to backfilling. Backfill the excavation as soon as possible and water the soil around the roots to avoid leaving air pockets. If backfilling won't happen for several days, leave the roots exposed until just before backfilling.

F. Backfill with five (5) parts native topsoil and one (1) part compost.

G. The Arborist must thin the foliar tree canopy to compensate for root loss and to loss of anchorage.

H. The Arborist must receive field approval from Owner's Representative or the Landscape Architect for tree and root pruning not shown in the drawings.

3.5 MAINTENANCE OF EXISTING TREES

A. The Contractor shall maintain protected tree(s) during construction by keeping fencing upright and secure, deep root watering trees once every two weeks during the months of June, July, August, and September. Should drought of more than three (3) weeks occur from October through May, the Contractor shall provide additional deep root watering of protected tree(s) as needed to keep tree(s) in healthy, growing condition. A dripping hose or gator bag or other means may be used to deep root water the trees. Soil should be saturated within the drip line after deep root watering.

B. The Contractor shall maintain a two (2) inch cover of mulch on the tree root zone though out

construction on individual trees. Mulch shall be refreshed to specified depth in January and July.

3.6 DISPOSAL

A. Haul off and legally dispose of any debris from the work of this section.

B. Dispose of debris off the Site only with permission of property owner where such debris is to be deposited and in accordance with codes and regulations of the jurisdictional authorities.

C. Burning and burying debris on the Worksite is prohibited.

3.7 CLEAN-UP

Remove and dispose of any debris, protective materials, enclosures and fencing upon completion of the Work.

3.8 FINAL ACCEPTANCE

A. Receive approval from the Owner's Representative for the work of this section when adjacent construction is completed.

END OF SECTION 015639

SECTION 024119 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Demolition and removal of selected portions of building or structure.
2. Demolition and removal of selected site elements.
3. Salvage of existing items to be reused or recycled.

1.2 MATERIALS OWNERSHIP

A. Unless otherwise indicated, demolition waste becomes property of Contractor.

B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.

1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.3 PREINSTALLATION MEETINGS

A. Predemolition Conference: Conduct conference at Project site.

1.4 FIELD CONDITIONS

A. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

B. Notify Engineer of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

C. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.

1. If suspected hazardous materials are encountered, do not disturb; immediately notify Engineer and Owner. Hazardous materials will be removed by Owner under a separate contract.

D. Storage or sale of removed items or materials on-site is not permitted.

E. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

1. Maintain fire-protection facilities in service during selective demolition operations.

F. Arrange selective demolition schedule so as not to interfere with Owner's operations.

1.5 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials and using approved contractors so as not to void existing warranties.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Standards: Comply with ASSE A10.6 and NFPA 241.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped before starting selective demolition operations.

B. Perform an engineering survey of condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective building demolition operations.

C. Inventory and record the condition of items to be removed and salvaged.

3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.

B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off utility services and mechanical/electrical systems serving areas to be selectively demolished.

1. Owner will arrange to shut off indicated services/systems when requested by Contractor.
2. Arrange to shut off utilities with utility companies.
3. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
4. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated on Drawings to be removed.

    a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
    b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material and leave in place.
    c. Equipment to Be Removed: Disconnect and cap services and remove equipment.
    d. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
    e. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.

3.3 PROTECTION

A. Temporary Protection: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.

B. Temporary Shoring: Design, provide, and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.

C. Remove temporary barricades and protections where hazards no longer exist.

3.4 SELECTIVE DEMOLITION

A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.
2. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
3. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.

4. Maintain fire watch during and for at least 2 hours after flame-cutting operations.
5. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
6. Dispose of demolished items and materials promptly.

B. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

C. Removed and Salvaged Items:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until delivery to Owner.
4. Transport items to Owner's storage area designated by Owner.
5. Protect items from damage during transport and storage.

D. Removed and Reinstalled Items:

1. Clean and repair items to functional condition adequate for intended reuse.
2. Pack or crate items after cleaning and repairing. Identify contents of containers.
3. Protect items from damage during transport and storage.
4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

E. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Owner, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

3.5 CLEANING

A. Remove demolition waste materials from Project site and dispose of them in an EPA-approved construction and demolition waste landfill acceptable to authorities having jurisdiction.

1. Do not allow demolished materials to accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Burning: Do not burn demolished materials.

C. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION 024119

SECTION 033000 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Design Mixtures: For each concrete mixture.

C. Steel Reinforcement Shop Drawings: Placing Drawings that detail fabrication, bending, and placement.

1.3 INFORMATIONAL SUBMITTALS

A. Material certificates.

B. Material test reports.

C. Formwork Shop Drawings: Prepared by or under the supervision of a qualified professional engineer, detailing fabrication, assembly, and support of formwork.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94/C94M requirements for production facilities and equipment.

1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

B. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C1077 and ASTM E329 for testing indicated.

1.5 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction testing on concrete mixtures.

1.6 FIELD CONDITIONS

A. Cold-Weather Placement: Comply with ACI 306.1.

1. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

B. Hot-Weather Placement: Comply with ACI 301 and ACI 305.1.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

A. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:

1. ACI 301.
2. ACI 117.

2.2 FORM-FACING MATERIALS

A. Smooth-Formed Finished Concrete: Form-facing panels that provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.

B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

2.3 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A615/A615M, Grade 60, deformed.

B. Low-Alloy-Steel Reinforcing Bars: ASTM A706/A706M, deformed.

C. Galvanized Reinforcing Bars: ASTM A615/A615M, Grade 60 deformed bars, ASTM A767/A767M, Class I zinc coated after fabrication and bending.

D. Epoxy-Coated Reinforcing Bars: ASTM A615/A615M, Grade 60 deformed bars, ASTM A775/A775M epoxy coated, with less than 2 percent damaged coating in each 12-inch bar length.

E. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice."

2.4 CONCRETE MATERIALS

A. Cementitious Materials:

1. Portland Cement: ASTM C150/C150M
2. Fly Ash: ASTM C618.
3. Slag Cement: ASTM C989/C989M, Grade 100 or 120.
4. Blended Hydraulic Cement: ASTM C595/C595M

B. Normal-Weight Aggregates: ASTM C33/C33M, graded.

C. Lightweight Aggregate: ASTM C330/C330M

D. Air-Entraining Admixture: ASTM C260/C260M.

E. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

1. Water-Reducing Admixture: ASTM C494/C494M, Type A.
2. Retarding Admixture: ASTM C494/C494M, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C494/C494M, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type G.
6. Plasticizing and Retarding Admixture: ASTM C1017/C1017M, Type II.

F. Water: ASTM C94/C94M and potable.

2.5 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.

B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.

C. Moisture-Retaining Cover: ASTM C171, polyethylene film or white burlap-polyethylene sheet.

D. Water: Potable.

E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C309, Type 1, Class B, dissipating.

F. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C309, Type 1, Class B, nondissipating, certified by curing compound manufacturer to not interfere with bonding of floor covering.

G. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C309, Type 1, Class B, 18 to 25 percent solids, nondissipating, certified by curing compound manufacturer to not interfere with bonding of floor covering.

H. Clear, Solvent-Borne, Membrane-Forming Curing and Sealing Compound: ASTM C1315, Type 1, Class A.

I. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C1315, Type 1, Class A.

2.6 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.

B. Cementitious Materials: Use fly ash, pozzolan, slag cement, and silica fume as needed to reduce the total amount of portland cement, which would otherwise be used, by not less than 40 percent.

C. Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use water-reducing, high-range water-reducing, or plasticizing admixture in concrete, as required, for placement and workability.
2. Use water-reducing and -retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a w/c ratio below 0.50.

2.7 CONCRETE MIXTURES FOR BUILDING ELEMENTS

A. Normal-Weight Concrete:

1. Minimum Compressive Strength: 3500 psiat 28 days.
2. Maximum W/C Ratio: 0.45
3. Slump Limit: 4 inches, plus or minus 1 inch.
4. Air Content: 5.5 percent, plus or minus 1.5 percent at point of delivery for 1-1/2-inch nominal maximum aggregate size.
5. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 1-inch nominal maximum aggregate size.
6. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.
7. Synthetic Micro-Fiber: Uniformly disperse in concrete mixture at manufacturer's recommended rate, but not less than a rate of 1.0 lb/cu. yd.

2.8 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.9 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C94/C94M, and furnish batch ticket information.

1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 FORMWORK INSTALLATION

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

C. Chamfer exterior corners and edges of permanently exposed concrete.

3.2 EMBEDDED ITEM INSTALLATION

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

3.3 STEEL REINFORCEMENT INSTALLATION

A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

3.4 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.

C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:

1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- wide joints into concrete when cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

3.5 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections are completed.

B. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.

1. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.

3.6 FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces not exposed to public view.

B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces exposed to public view, to receive a rubbed finish, or to be covered with a coating or covering material applied directly to concrete.

C. Rubbed Finish: Apply the following to smooth-formed-finished as-cast concrete where indicated:

1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.
2. Grout-Cleaned Finish: Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix 1 part portland cement to 1-1/2 parts fine sand with a 1:1 mixture of bonding admixture and water. Add white portland cement in amounts determined by trial patches, so color of dry grout matches adjacent surfaces. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap and keep surface damp by fog spray for at least 36 hours.
3. Cork-Floated Finish: Wet concrete surfaces and apply a stiff grout. Mix 1 part portland cement and 1 part fine sand with a 1:1 mixture of bonding agent and water. Add white portland cement in amounts determined by trial patches, so color of dry grout matches adjacent surfaces. Compress grout into voids by grinding surface. In a swirling motion, finish surface with a cork float.

D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.7 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 305.1 for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for remainder of curing period.

D. Cure concrete according to ACI 308.1, by one or a combination of the following methods:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days.
2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period, using cover material and waterproof tape.

3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

    a. Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound does not interfere with bonding of floor covering used on Project.

4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.8 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

3.9 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

END OF SECTION 033000

SECTION 116816 – PLAYGROUND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Provisions established within the General and Supplementary General Conditions of the Contract, Division 1 - General Requirements, and the Drawings are collectively applicable to this Section.

1.2 DESCRIPTION

A. Furnish all work and materials, appliances, tools, equipment, facilities, transportation, and services necessary for and incidental to performing all operations in connection with the installation of the play equipment.

B. Conform to the requirements of the general conditions of the contract.

1.3 SCOPE

A. Work include: the work includes, but is not necessarily limited to:

1. Furnish and install play structures.
2. Furnish and install play structure elements.
3. Furnish and install playground safety surfacing.
4. Furnish and install grill with footing.
5. Warranty and replacements.
6. Provide touch-up paint for play equipment.

1.4 RELATED WORK SPECIFIED ELSEWHERE

A. Concrete Paving at Playground – Section 321314.

B. Landscape Drainage System at Playground – Section 334114.13.

C. Playground Inspection – Section 116816.13.

1.5 REFERENCES

A. Requirements of Regulatory Agencies:

1. Perform work in accordance with all applicable laws, codes and regulations required.

1.6 QUALITY ASSURANCE

A. Play surface installer qualifications: minimum of five (5) years experience in installation of poured-in-place play surfacing.

B. Play equipment installer qualifications: minimum of five (5) years experience in installation of the play equipment brand selected for this project.

C. Play equipment installer to be a Certified Installer by the manufacture of the play equipment selected for this project.

D. Contractor to provide proof of play equipment installation experience and copy of Certificate authenticating completion of Certified Installer program by the manufacturer of the play equipment selected for the project.

E. Play equipment must be IPEMA Certified.

F. "REFERENCE CODES AND STANDARDS"

1. ASTM:

   a. F1292-09 - Standard Specification for Impact Attenuation of Surfacing Materials within the Use Zone of Playground Equipment
   b. F1487-11 – Standard Consumer Safety Performance Specification for Playground Equipment for Public Use
   c. F1951-09b – Standard Specification for Determination of Accessibility of Surface Systems Under and Around Playground Equipment
   d. F2049 – Standard Guide for Fences / Barriers for Public, Commercial, and Multi-Family Residential Use Play Areas.
   e. F2075 – Standard Specifications for Engineered Wood Fiber for Use as a Playground Safety Surfacing Under and Around Play Equipment
   f. F2223 – Standard Guide for ASTM Standards on Playground Surfacing
   g. F2479-07 – Standard Guide for Specification, Purchase, Installation, and Maintenance of Poured-In-Place Playground Surfacing

2. CPSC:

   a. CPSC 3200 – Burn Safety Awareness on Playgrounds
   b. CPSC 5065 – Strangulation Hazard with Playground Cargo Nets

3. USCPSC:

   a. Publication 325 - Public Playground Safety Handbook

4. ADA:

   a. ADA Accessibility Guidelines for Play Areas – 36 CFR Part 1191
   b. 2012 TAS

1.7 SUBMITTALS

A. Submit manufacturer's product data and warranty for each type of play structure or play element specified, including finish and color indicated.

B. Shop Drawings: Submit manufacturer's shop drawings, indicating layout, materials, components, accessories, footing details and dimensions.

C. Submit footing detail as recommended by the manufacturer for each type of play structure and play equipment.

D. Submit manufacturer's installation instructions including footing layout plan as installed within the footprint of the play area.

E. Samples:

1. Submit two (2) samples at 2 x 2-inch size in size illustrating finish material and color for substitutions.
2. Submit one (1) pound sample of safety surfacing specified with manufacturer's literature including alternates.

F. Submit laboratory test findings for impact attenuation for safety surfacing to be installed.

G. Submit laboratory test findings for accessibility for safety surfacing to be installed.

H. Submit IPMEA certification and compliance for all play equipment and safety surfacing to be installed.

I. Anti-Graffiti coat: Submit manufacturer's literature.

J. Warranty: Submit manufacturer's standard warranty for play equipment and safety surfacing. Warranty should address inundation.

K. Maintenance: Submit manufacturer's instructions for maintenance of play equipment and safety surfacing for normal usage and after inundation.

L. Grill: Submit manufacturer's product information and footing design for grill.

M. Submittals to be submitted to the Landscape Architect or Owner's Authorized Representative for review and approval no less than sixty (60) days prior to installation.

1.8 DELIVERY, STORAGE AND HANDLING

A. Labeling: Furnish all materials in manufacturer's unopened, original containers, bearing original labels showing quantity, description and name of manufacturer.

B. Deliver and unload at the site on pallets and bound in such a manner that no damage occurs to the product.

C. Store products in a manner which will preclude all damages. Damaged materials will be rejected. Remove all damaged materials from the job site immediately and replace at no cost to the Owner.

D. Furnish suitable equipment to locate all play equipment materials carefully and efficiently. Lift materials using lifting inserts provided by the manufacturer where applicable.

E. Protect play equipment and accessories from damage until final acceptance. Owner reserves right to reject equipment damaged prior to and during and after installation.

PART 2 - MATERIALS

2.1 MANUFACTURERS OF EQUIPMENT AND ACCESSORIES

A. Acceptable Manufacturers are listed on the drawings.

B. Substitutions: Equivalent as approved by Owner's Authorized Representative. Submit full design, layout, specifications, 3D images, color and material samples, written warranty, and installation drawings for review.

2.2 CONCRETE

A. ASTM C94 ready mix concrete, minimum of twenty-eight (28) day compressive strength of 3,500 psi, air-entrained 2% to 45%.

2.3 FINISHES

A. Specified on the drawings.

2.4 POURED-IN-PLACE PLAY (SAFETY) SURFACE

A. Provide and install poured-in-place surface as specified on the drawing according to the manufacturer's recommendations with subsurface drainage system.

2.5 ANTI-GRAFFITI COAT

A. Acceptable Manufacturer: Acrylithane QuickClean HS Clear (99975) Catalyst by Jones-Blair Industrial Coatings, 2728 Empire Central, Dallas, TX 75235-7624, www.jones-blair.com, 214.353.1600 – contact: Catherine Clark at Mantek, 469.867.9821.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine final grades and installation conditions. Do not proceed with work until unsatisfactory conditions are corrected.

B. Beginning of installation means acceptance of existing conditions.

3.2 PREPARATION

A. Remove foreign substances from surfaces to receive metal items.

B. Locate and layout all play equipment and site accessories for review by Owner's Authorized Representative's or Landscape Architect's prior to installation.

C. Verify play equipment safety zones with Manufacturer's Representative.

D. Coordinate setting drawings, diagrams, templates, instructions and directions for the installation of items having integral anchors which are to be embedded in concrete construction. Coordinate delivery of such items with concrete work.

E. Restore protective coverings that have been damaged in shipment or in the installation of the item. Remove protective covering from surfaces only when there is no possibility of damage from work yet to be performed after installation. Retain covering on all similarly finished items and remove only when all are in place, to preclude non-uniform oxidation and discoloration.

3.3 INSTALLATION OF PLAY EQUIPMENT

A. All play equipment shall be installed per the manufacturer's instructions. No other specifications shall supersede or be used for installation.

B. Install equipment where and as shown on plans. Contact Landscape Architect in the event of discrepancies with equipment location between Construction Drawing plans and manufacturer plans.

C. Install each item with base assembly and fittings in accordance with manufacturer's instructions. Vertical height of playground equipment should be in accordance with manufacturer's instructions and adjusted for sloping subgrade (play surface depth) and poured-in-place play (safety) surface of varying depth due to slope.

D. Provide concrete footings and/or slab as detailed on the drawings or as required by the manufacturer.

E. Align posts both vertically and laterally. Hold in position during concrete placement and finishing operations.

F. Refer to Section 334114 for drains and piping to be installed in concrete subslab. Coordinate with other work to avoid conflict with play equipment prior to pours.

G. Assemble and install swings, climbers, slides, and play structures and related components in accordance with manufacturer's recommendations and as the drawings require.

H. Set all play equipment level and plumb.

3.4 TOLERANCES

A. Maximum Variation from Plumb: 1/16 inch per foot.

3.5 PLAY (SAFETY) SURFACE

A. Provide positive drainage of subslab surface per Drawings.

B. Install poured-in-place play safety surface and interior drainage system for positive drainage.

C. Install all poured-in-place safety surfacing in accordance with manufacturer's recommendations and as the drawings require.

3.6 PICNIC GRILL

Install picnic grill at locations shown with concrete footing per manufacturer's recommendations. Grill will be installed in turfgrass area.

3.7 CLEANING AND TOUCH-UP

A. Perform cleaning during installation of the work and upon completion of the work. Maintain clean surfaces until final acceptance.

B. As Work proceeds, promptly remove concrete where spilled, splashed, or splattered onto play equipment.

C. During process of Work, maintain premises free of unnecessary accumulation of tools, equipment, surplus materials, packaging, and debris.

D. Remove from site all debris and equipment.

E. Repair all damage resulting from playground equipment installation.

F. Replace damaged equipment as requested by the Owner, Owner's Authorized Representative, or the Landscape Architect.

G. Apply anti-graffiti coat on clean equipment after complete installation.

3.8 PLAYGROUND INSPECTION

A. Employ the services of a playground inspector to inspect completely installed playground as described in Section 116816.13. Playground must pass inspection and testing to receive Final Acceptance.

END OF SECTION 116816

SECTION 116816.13 – PLAYGROUND INSPECTION

PART 1 - GENERAL

1.1 DESCRIPTION

A. Independent safety audit at the completion of playground construction.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Concrete Paving at Playground – Section 321314.

B. Landscape Drainage System at Playground – Section 334114.

C. Playground Equipment – Section 116816.

1.3 DEFINITIONS

A. Certified Playground Safety Inspector (CPSI) – an individual who has completed program requirements as a certified Playground Safety Inspector as specified in Section 2.6.

B. U.S. Consumer Product Safety Commission (CPSC).

C. Playground – an improved outdoor area designed, equipped, and set aside for children's play that is not intended for use as an athletic playing field or athletic court, and shall include all playground equipment, surfacing, fencing, signs, internal pathways, internal land forms, vegetation, and related structures.

D. Play Equipment – a fabricated structure intended primarily for play by children located at a playground which has at least one surface designated and which is anchored to or built into the ground and not intended to be removed or relocated.

E. Playground Inspection Certification Summary – an inspection report indicating compliance or non-compliance of the playground and its associated play equipment with the local, state and federal regulations as prepared by a Certified Playground Safety Inspector (CPSI).

PART 2 - PRODUCTS

2.1 GENERAL: The Contractor shall employ services of a Certified Playground Safety Inspector to perform an on-site playground facility audit utilizing any/all of the current local, state, federal, and national playground guidelines, regulations, codes, and standards as evaluation criteria.

2.2 QUALITY ASSURANCE: The design, playground equipment, and surfacing materials shall meet all standard local, state, and federal regulations, and comply with the following guidelines:

A. IPEMA Certification

B. US CPSC Handbook Publication 325 – Public Playground Safety Handbook

C. ASTM F 1292-17a – Standard Specification for Impact Attenuation of Surfacing Materials Within the Use Zone of Playground Equipment

D. ASTM F 1487-17 – Standard Consumer Safety Performance Specification for Playground Equipment for Public Use

E. ASTM F 1951-14 – Standard Specification for Determination of Accessibility of Surface Systems Under and Around Playground Equipment

F. ASTM F 2049-11 (2017) – Standard Guide for Fences / Barriers for Public, Commercial, and Multi-Family Residential Use Outdoor Play Areas

G. ASTM F 2075-15 – Standard Specification for Engineered Wood Fiber for Use as a Playground Safety Surface Under and Around Playground Equipment

H. ASTM F 2223-15 – Standard Guide for ASTM Standards on Playground Surfacing

I. ASTM F 2479-17 – Standard Guide for Specification, Purchase, Installation and Maintenance of Poured-In-Place Playground Surfacing

2.3 CERTIFIED PLAYGROUND SAFETY INSPECTOR QUALIFICATIONS

A. A Certified Playground Safety Inspector shall possess a current Certified Playground Safety Inspector Certificate issued by the National Playground Safety Institute (c/o National Parks and Recreation Association, 22377 Belmont Ridge Road, Ashburn, VA 20148-4501, (800-626-6772) or e-mail at consumerservice@npra.org.

B. The inspector shall be required to provide Proof of Insurance (ACCORD Certificate) with coverage minimums as follows:

General Liability per Occurrence	$ 100,000.00
Aggregate	$ 2,000,000.00
Errors and Omissions Liability	$ 1,000,000.00
Property Damage per Occurrence	$ 100,000.00

C. The inspector shall be qualified, approved and certified for the operation of the test instrumentation – Triax 2015 or updated instrumentation as required for testing to provide report documentation.

PART 3 - EXECUTION

3.1 INSPECTION

A. The safety audit shall consist of a minimum of two (2) site visits by the CPSI.

1. Site Visit # 1: At the completion of construction, the playground access, playground equipment, and safety surfacing shall be inspected by an independent Certified Playground Safety Inspector (CPSI) and a Playground Inspection Certification Summary provided in a format acceptable to the city of Plano Park & Recreation Department.

   The Playground Inspection Certification Summary shall list, but not be limited to, the following information:

   a. Project name and address
   b. CPSI firm name, address, telephone and fax numbers, e-mail address of inspector
   c. Inspector's name, certification number, certifying organization, certification expiration date
   d. Date of inspection and weather conditions
   e. Name of play equipment manufacturer
   f. Listing of play equipment including indicating the manufacturer's approved age
   g. Safety surfacing material type including test results from the impact attenuation field test
   h. Type of access into play area
   i. Compliance or non-compliance of the play equipment, safety surfacing, and access method
   j. Documentation of compliance or non-compliance of the play equipment based on the Five-Level Safety Concern Priority Rating System indicating priority rating of each play condition evaluated
   k. Recommendations for correction of items found to be deficient / non-compliant
   l. Elements within the playground which were not inspected during the audit must be listed with the reason for non-inspection
   m. A narrative report, photographs, diagrams, and additional support information should accompany the inspection summary

2. Site visit #2 shall be performed to verify modifications made to equipment, safety surfacing, or playground access for the repair or correction of non-compliance items noted in initial Safety Audit. The necessary modifications must be made to the playground and then it must be re-inspected and certified by the same Safety Inspector at the expense of the Contractor.

B. The Certified Playground Safety Inspector shall provide a copy of the Playground Inspection Certification Summary to Owner, Contractor, Playground Vendor, and Landscape Architect. Contractor and Playground Manufacturer are responsible for compliance at no additional cost to the Owner.

C. If any part of the new playground equipment or surfacing fails the Safety Audit, the Contractor shall be responsible for any and all modifications needed to bring the playground into full compliance with Texas State Law and Federal Law requirements which are compliant with all applicable ASTM Standards including but not limited to ASTM 1487-17ae1, ASTM F1292-17a, F1951-14, and ASTM F2075-15e1.

D. The Contractor must provide a Warranty statement from the play equipment manufacturer for any modifications made to the play equipment based on the findings of the Safety Audit. All play equipment manufacturer warranties must remain valid.

E. Bidders are advised of the mandated compliance with ALL the reference Standards as a condition of final acceptance of the project. The Contractor's final payment and retainage will not be released until final certification is obtained.

3.2 TESTING FOR IMPACT ATTENUATION OF SAFETY SURFACE MATERIAL

A. Laboratory testing for the safety surfacing material shall be submitted for review. Laboratory testing shall include gMax and HIC calculations.

B. The safety audit shall include a field test of the safety surface material and shall be performed using a Triax2015 Surface Impact Tester.

C. A field test of impact attenuation shall be completed using a Triax2015 Surface Impact Tester which shall be provided by Certified Playground Safety Inspector. Results and recommended GMAZ and HIC values shall be recorded and findings shall be reported to Owner, Contractor, and Landscape Architect as part of the Playground Inspection Certification Summary.

3.3 PLAYGROUND MAINTENANCE

A. Owner is responsible for maintenance after acceptance of project.

END OF SECTION 116816.13

SECTION 121426 - STONE BLOCKS FOR BENCH

PART 1 - GENERAL

1.1 RELATED DOCUMENTS: The Drawings, Division 0 and Division 1 apply to Work under this Section.

1.2 DESCRIPTION OF THE WORK

A. Work Included:

1. Stone block cutting and finishing.
2. Submittals of photos and shop drawings.
3. Protection and handling.
4. Leveling and setting with epoxy mortar grout to secure to concrete pavement.

1.3 SUBMITTALS

A. Submit shop drawings with complete illustrations and / or descriptions for the following:

1. Stone: Source, color, finishes and general character and sizes.

B. Samples: Approved samples shall be the standards for stone.

1.4 DELIVERY, STORAGE AND HANDLING: Store materials well protected from inclement weather, and admixture of foreign material.

PART 2 - MATERIALS

2.1 LIMESTONE BLOCKS

A. Stone shall be "Lueder Limestone Blocks," as supplied by Custom Stone Supply, Dallas, TX or equivalent source as approved by the Landscape Architect.

B. Photos of the rough blocks shall be submitted by the supplier to the Landscape Architect for approval prior to cutting and finishing.

C. Top and Bottom face of stone to be sawn cut.

D. Finish of top face to be hand sanded to remove saw cut marks and provide slope for surface drainage.

E. Sides shall have a chisel finish. Samples shall be submitted for approval by Landscape Architect prior to finishing.

F. Refer to drawings for stone dimensional sizes and quantities.

PART 3 - EXECUTION

3.1 LAYOUT: Layout all locations for stone installation. Proceed no further without approval of the Owner's Authorized Representative of the Landscape Architect.

3.2 PLACEMENT

A. Limestone Block stone shall be installed per details with a cross slope for drainage of top surface and set on epoxy mortar setting bed to secure location.

B. All necessary leveling and adjustments shall be a part of this work.

C. Installation shall be done by a stone mason with a minimum of 15 years experience heavy boulder construction. The general contractor shall submit a list of stone masons to the Owner for review prior to beginning work.

D. Do not clean limestone blocks.

3.3 CLEAN-UP: At completion, remove from the project site all excess materials, debris, rubbish, etc., resulting from the operations of this section.

END OF SECTION 121416

SECTION 221113 - FACILITY WATER DISTRIBUTION PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes water-distribution piping and related components outside the building for combined water service and fire-service mains.

1.2 ACTION SUBMITTALS

A. Prior to construction, the following product data is required from the pipe supplier identifying or verifying following items:

1. Name of pipe manufacturer
2. Pipe diameter
3. Dimension Ratio (DR) of 14 or as per plans
4. Pressure Class per applicable standards
5. Color
6. Confirmation/ Recommended minimum bending radius
7. Confirmation/ Recommended maximum safe pull force

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control test reports.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements:

1. Comply with requirements of utility company supplying water. Include tapping of water mains and backflow prevention.
2. Comply with standards of authorities having jurisdiction for potable-water-service piping, including materials, installation, testing, and disinfection.
3. Comply with standards of authorities having jurisdiction for fire-suppression water-service piping, including materials, hose threads, installation, and testing.

B. Piping materials shall bear label, stamp, or other markings of specified testing agency.

C. Comply with ASTM F645 for selection, design, and installation of thermoplastic water piping.

D. NFPA Compliance: Comply with NFPA 24 for materials, installations, tests, flushing, and valve and hydrant supervision for fire-service-main piping for fire suppression.

E. NSF Compliance:

1. Comply with NSF 14 for plastic potable-water-service piping. Include marking "NSF-pw" on piping.
2. Comply with NSF 61 Annex G for materials for water-service piping and specialties for domestic water.

1.6 PROJECT CONDITIONS

A. Interruption of Existing Water-Distribution Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water-distribution service according to requirements indicated:

1. Notify Owner no fewer than two days in advance of proposed interruption of service.
2. Do not proceed with interruption of water-distribution service without Owner's written permission.

1.7 COORDINATION

A. Coordinate connection to water main with utility company.

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS

A. PVC, AWWA Pipe: AWWA C900, Class 150 with bell end with gasket, and with spigot end.

1. Comply with UL 1285 for fire-service mains if indicated.
2. PVC Fabricated Fittings: AWWA C900, Class 150, with bell-and-spigot or double-bell ends. Include elastomeric gasket in each bell.
3. Pipe and couplings shall be made from unplasticized PVC compounds having a minimum cell classification of 12454, as defined in ASTM D 1784. The compound shall qualify for a Hydrostatic Design Basis (HDB) of 4000 psi for water at 73.4 degrees F, in accordance with the requirements of ASTM D 2837. Restrained joint water pipe shall carry the UL1285 listing.

2.2 JOINING MATERIALS

A. Refer to Section 330500 "Common Work Results for Utilities" for commonly used joining materials.

B. Plastic Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

C. Pipe shall be joined using non-metallic couplings to form an integral system for maximum reliability and interchangeability. High-strength, flexible thermoplastic splines shall be inserted into mating, precision machined grooves in the pipe and coupling to provide full 360° restraint with evenly distributed loading.

D. Cut exposed splines 3/4" from coupling to reduce soil drag.

E. Couplings shall be beveled as part of the manufacturing process on the leading edges so as to minimize soil friction.

2.3 GATE VALVES

A. AWWA, Cast-Iron Gate Valves:

1. Nonrising-Stem, Resilient-Seated Gate Valves:

a. Description: Gray- or ductile-iron body and bonnet; with bronze or gray- or ductile-iron gate, resilient seats, bronze stem, and stem nut.

1) Standard: AWWA C509.
2) Minimum Pressure Rating: 200 psig.
3) End Connections: Mechanical joint.
4) Interior Coating: Complying with AWWA C550.

2.4 GATE VALVE ACCESSORIES AND SPECIALTIES

A. Tapping-Sleeve Assemblies:
1. Description: Sleeve and valve compatible with drilling machine.

a. Standard: MSS SP-60.
b. Tapping Sleeve: Cast- or ductile-iron or stainless-steel, two-piece bolted sleeve with flanged outlet for new branch connection. Include sleeve matching size and type of pipe material being tapped and with recessed flange for branch valve.
c. Valve: AWWA, cast-iron, nonrising-stem, resilient-seated gate valve with one raised face flange mating tapping-sleeve flange.

B. Valve Boxes: Comply with AWWA M44 for cast-iron valve boxes. Include top section, adjustable extension of length required for depth of burial of valve, plug with lettering

"WATER," and bottom section with base that fits over valve and with a barrel approximately 5 inches in diameter.

1. Operating Wrenches: Steel, tee-handle with one pointed end, stem of length to operate deepest buried valve, and socket matching valve operating nut.

C. Indicator Posts: UL 789, FMG-approved, vertical-type, cast-iron body with operating wrench, extension rod, and adjustable cast-iron barrel of length required for depth of burial of valve.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Refer to Section 312000 "Earth Moving" for excavating, trenching, and backfilling.

3.2 PIPING APPLICATIONS

A. General: Use pipe, fittings, and joining methods for piping systems according to the following applications.

B. Transition couplings and special fittings with pressure ratings at least equal to piping pressure rating may be used, unless otherwise indicated.

C. Do not use flanges or unions for underground piping.

D. Underground water-service piping NPS 4 and NPS 6 shall be the following:

1. PVC, AWWA Class 150 pipe; PVC, AWWA Class 150 molded fittings; and gasketed joints.

E. Underground Fire-Service-Main Piping NPS 4 to NPS 8 shall be the following:

1. PVC, AWWA Class 150 pipe listed for fire-protection service; PVC Class 150 fabricated or molded fittings; and gasketed joints.

F. Underground Combined Water-Service and Fire-Service-Main Piping NPS 6 to NPS 10 shall be the following:

1. PVC, AWWA Class 150 pipe listed for fire-protection service; PVC fabricated or molded fittings of same class as pipe; and gasketed joints.

3.3 VALVE APPLICATIONS

A. General Application: Use mechanical-joint-end valves for NPS 3 and larger underground installation.

B. Where specific valve types are not indicated, the following requirements apply:

1. Underground Valves, NPS 3 and Larger: AWWA, cast-iron, nonrising-stem, resilient-seated gate valves with valve box.

3.4 PIPING SYSTEMS - COMMON REQUIREMENTS

A. See Section 330500 "Common Work Results for Utilities" for piping-system common requirements.

3.5 PIPING INSTALLATION

A. Water-Main Connection: Arrange with utility company for tap of size and in location indicated in water main.

B. Water-Main Connection: Tap water main according to requirements of water utility company and of size and in location indicated.

C. Make connections larger than NPS 2 with tapping machine according to the following:

1. Install tapping sleeve and tapping valve according to MSS SP-60.
2. Install tapping sleeve on pipe to be tapped. Position flanged outlet for gate valve.
3. Use tapping machine compatible with valve and tapping sleeve; cut hole in main. Remove tapping machine and connect water-service piping.
4. Install gate valve onto tapping sleeve. Comply with MSS SP-60. Install valve with stem pointing up and with valve box.

D. Comply with NFPA 24 for fire-service-main piping materials and installation.

1. Install copper tube and fittings according to CDA's "Copper Tube Handbook."

E. Install PVC, AWWA pipe according to ASTM F645 and AWWA M23.

F. Bury piping with depth of cover over top at least 48 inches, with top at least 12 inches below level of maximum frost penetration.

G. Install underground piping with restrained joints at horizontal and vertical changes in direction. Use restrained-joint piping, thrust blocks, anchors, tie-rods and clamps, and other supports.

3.6 JOINT CONSTRUCTION

A. See Section 330500 "Common Work Results for Utilities" for basic piping joint construction.

B. Make pipe joints according to the following:

1. PVC Piping Gasketed Joints: Use joining materials according to AWWA C900. Construct joints with elastomeric seals and lubricant according to ASTM D2774 or ASTM D3139 and pipe manufacturer's written instructions.

3.7 ANCHORAGE INSTALLATION

A. Anchorage, General: Install water-distribution piping with restrained joints. Anchorages and restrained-joint types that may be used include the following:

1. Concrete thrust blocks.
2. Locking mechanical joints.
3. Set-screw mechanical retainer glands.
4. Bolted flanged joints.
5. Heat-fused joints.
6. Pipe clamps and tie rods.

B. Install anchorages for tees, plugs and caps, bends, crosses, valves, and hydrant branches. Include anchorages for the following piping systems:

1. Gasketed-Joint, PVC Water-Service Piping: According to AWWA M23.
2. Fire-Service-Main Piping: According to NFPA 24.

C. Apply full coat of asphalt or other acceptable corrosion-resistant material to surfaces of installed ferrous anchorage devices.

3.8 VALVE INSTALLATION

A. AWWA Gate Valves: Comply with AWWA C600 and AWWA M44. Install each underground valve with stem pointing up and with valve box.

3.9 CONNECTIONS

A. See Section 330500 "Common Work Results for Utilities" for piping connections to valves and equipment.

B. Connect water-distribution piping to existing water main using tapping sleeve and tapping valve.

3.10 FIELD QUALITY CONTROL

A. Piping Tests: Conduct piping tests before joints are covered and after concrete thrust blocks have hardened sufficiently. Fill pipeline 24 hours before testing and apply test pressure to stabilize system. Use only potable water.

B. Hydrostatic Tests: Test at not less than one-and-one-half times working pressure for two hours.

1. Pipe and machined couplings must pass AWWA C900 hydrostatic proof test requirements. Test frequency to be in accordance with C900 and/or UL requirements.
2. Increase pressure in 50-psig increments and inspect each joint between increments. Hold at test pressure for 1 hour; decrease to 0 psig. Slowly increase again to test pressure and hold for 1 more hour. Maximum allowable leakage is 2 quarts per hour per 100 joints. Remake leaking joints with new materials and repeat test until leakage is within allowed limits.

C. Prepare reports of testing activities.

3.11 IDENTIFICATION

A. Install continuous underground detectable warning tape during backfilling of trench for underground water-distribution piping. Locate below finished grade, directly over piping. Underground warning tapes are specified in Section 312000 "Earth Moving."

B. Permanently attach equipment nameplate or marker indicating plastic water-service piping, on main electrical meter panel. See Section 330500 "Common Work Results for Utilities" for identifying devices.

3.12 CLEANING

A. Clean and disinfect water-distribution piping as follows:

1. Purge new water-distribution piping systems and parts of existing systems that have been altered, extended, or repaired before use.
2. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in AWWA C651 or do as follows:

    a. Fill system or part of system with water/chlorine solution containing at least 50 ppm of chlorine; isolate and allow to stand for 24 hours.
    b. Drain system or part of system of previous solution and refill with water/chlorine solution containing at least 200 ppm of chlorine; isolate and allow to stand for 3 hours.
    c. After standing time, flush system with clean, potable water until no chlorine remains in water coming from system.
    d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedure if biological examination shows evidence of contamination.

B. Prepare reports of purging and disinfecting activities.

END OF SECTION 221113

SECTION 311000 - SITE CLEARING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Protecting existing vegetation to remain.
2. Removing existing vegetation.
3. Clearing and grubbing.
4. Stripping and stockpiling topsoil.
5. Removing above- and below-grade site improvements.
6. Disconnecting, capping, or sealing site utilities.
7. Temporary erosion and sedimentation control.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 MATERIAL OWNERSHIP

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

1.4 FIELD 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 trafficways if required by Owner or authorities having jurisdiction.

B. Salvageable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises.

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 and plant-protection measures are in place.

E. Tree- and Plant-Protection Zones: Protect according to requirements in Section 015639 "Temporary Tree and Plant Protection."

PART 2 - PRODUCTS

2.1 MATERIALS

A. Satisfactory Soil Material: Requirements for satisfactory soil material are specified in Section 312000 "Earth Moving."

1. Obtain approved borrow soil material off-site when satisfactory soil material is not available on-site.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect and maintain benchmarks and survey control points from disturbance during construction.

B. Verify that trees, shrubs, and other vegetation to remain or to be relocated have been flagged and that protection zones have been identified and enclosed according to requirements in Section 015639 "Temporary Tree and Plant Protection."

C. Protect existing site improvements to remain from damage during construction.

1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.2 TEMPORARY EROSION AND SEDIMENTATION CONTROL

A. Provide temporary erosion- and sedimentation-control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to erosion- and sedimentation-control Drawings and requirements of authorities having jurisdiction.

B. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.

C. Inspect, maintain, and repair erosion- and sedimentation-control measures during construction until permanent vegetation has been established.

D. Remove erosion and sedimentation controls, and restore and stabilize areas disturbed during removal.

3.3 TREE AND PLANT PROTECTION

A. Protect trees and plants remaining on-site according to requirements in Section 015639 "Temporary Tree and Plant Protection."

B. Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations according to requirements in Section 015639 "Temporary Tree and Plant Protection."

3.4 EXISTING UTILITIES

A. Locate, identify, disconnect, and seal or cap utilities indicated to be removed or abandoned in place.

1. Arrange with utility companies to shut off indicated utilities.

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

C. Removal of underground utilities is included in earthwork sections; in applicable fire suppression, plumbing, HVAC, electrical, communications, electronic safety and security, and utilities sections; and in Section 024119 "Selective Demolition."

3.5 CLEARING AND GRUBBING

A. Remove obstructions, trees, shrubs, and other vegetation to permit installation of new construction.

1. Grind down stumps and remove roots larger than 3 inches in diameter, obstructions, and debris to a depth of 18 inches below exposed subgrade.
2. Use only hand methods or air spade for grubbing within protection zones.

B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.

1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches, and compact each layer to a density equal to adjacent original ground.

3.6 TOPSOIL STRIPPING

A. Remove sod and grass before stripping topsoil.

B. Strip topsoil to depth of 6 inches in a manner to prevent intermingling with underlying subsoil or other waste materials.

C. Stockpile topsoil away from edge of excavations without intermixing with subsoil or other materials. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust and erosion by water.

3.7 SITE IMPROVEMENTS

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

3.8 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. 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.

B. 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. Do not interfere with other Project work.

END OF SECTION 311000

SECTION 312000 - EARTH MOVING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Excavating and filling for rough grading the Site.
2. Preparing subgrades for slabs-on-grade, walks, pavements, turf and grasses, and plants.
3. Excavating and backfilling for structures.
4. Subbase course for concrete walks and pavements.
5. Excavating and backfilling trenches for utilities and pits for buried utility structures.

1.2 DEFINITIONS

A. Backfill: Soil material used to fill an excavation.

1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Base Course: Aggregate layer placed between the subbase course and hot-mix asphalt paving.

C. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.

D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

E. Drainage Course: Aggregate layer supporting the slab-on-grade that also minimizes upward capillary flow of pore water.

F. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.

1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Engineer. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
2. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Engineer. Unauthorized excavation, as well as remedial work directed by Engineer, shall be without additional compensation.

G. Fill: Soil materials used to raise existing grades.

H. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

I. Subbase Course: Aggregate layer placed between the subgrade and base course for hot-mix asphalt pavement, or aggregate layer placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.

J. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.

K. Utilities: On-site underground pipes, conduits, ducts, and cables as well as underground services within buildings.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct preexcavation conference at Project site.

1.4 INFORMATIONAL SUBMITTALS

A. Material test reports.

1.5 FIELD CONDITIONS

A. Utility Locator Service: Notify utility locator service for area where Project is located before beginning earth-moving operations.

B. Do not commence earth-moving operations until plant-protection measures specified in Section 015639 "Temporary Tree and Plant Protection" are in place.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

B. Satisfactory Soils: Soil Classification Groups GW, GP, GM, SW, SP, and SM according to ASTM D 2487, or a combination of these groups; free of rock or gravel larger than 3 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.

1. Liquid Limit: 40 max.
2. Plasticity Index: 10 max.

C. Unsatisfactory Soils: Soil Classification Groups GC, SC, CL, ML, OL, CH, MH, OH, and PT according to ASTM D 2487, or a combination of these groups.

1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.

D. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940/D 2940M; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.

E. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 294/D 2940M 0; with at least 95 percent passing a 1-1/2-inch sieve and not more than 8 percent passing a No. 200 sieve.

F. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940/D 2940M; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.

G. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940/D 2940M; except with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve.

H. Drainage Course: Narrowly graded mixture of washed crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch sieve and zero to 5 percent passing a No. 8 sieve.

2.2 ACCESSORIES

A. Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility; colored to comply with local practice or requirements of authorities having jurisdiction.

B. Detectable Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored to comply with local practice or requirements of authorities having jurisdiction.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth-moving operations.

B. Protect and maintain erosion and sedimentation controls during earth-moving operations.

C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

3.2 EXCAVATION, GENERAL

A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.

1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.

3.3 EXCAVATION FOR STRUCTURES

A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.

1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.

B. Excavations at Edges of Tree- and Plant-Protection Zones:

1. Excavate by hand or with an air spade to indicated lines, cross sections, elevations, and subgrades. If excavating by hand, use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.
2. Cut and protect roots according to requirements in Section 015639 "Temporary Tree and Plant Protection."

3.4 EXCAVATION FOR WALKS AND PAVEMENTS

A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

3.5 EXCAVATION FOR UTILITY TRENCHES

A. Excavate trenches to allow for a minimum 4' cover for all new water lines.

B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit unless otherwise indicated.

1. Clearance: 12 inches each side of pipe or conduit.

C. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.

1. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

D. Trenches in Tree- and Plant-Protection Zones:

1. Hand-excavate to indicated lines, cross sections, elevations, and subgrades. Use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.
2. Do not cut main lateral roots or taproots; cut only smaller roots that interfere with installation of utilities.
3. Cut and protect roots according to requirements in Section 015639 "Temporary Tree and Plant Protection."

3.6 SUBGRADE INSPECTION

A. Proof-roll subgrade below pavements with a pneumatic-tired dump truck to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

B. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Engineer, without additional compensation.

3.7 UNAUTHORIZED EXCAVATION

A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean

concrete fill, with 28-day compressive strength of 2500 psi, may be used when approved by Engineer.

1. Fill unauthorized excavations under other construction, pipe, or conduit as directed by Engineer.

3.8 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.9 UTILITY TRENCH BACKFILL

A. Place backfill on subgrades free of mud, frost, snow, or ice.

B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

C. Initial Backfill: Place and compact initial backfill of satisfactory soil, free of particles larger than 1 inch in any dimension, to a height of 12 inches over the pipe or conduit.

1. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.

D. Final Backfill: Place and compact final backfill of satisfactory soil to final subgrade elevation.

E. Warning Tape: Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.10 SOIL FILL

A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

B. Place and compact fill material in layers to required elevations as follows:

1. Under grass and planted areas, use satisfactory soil material.
2. Under walks and pavements, use satisfactory soil material.
3. Under steps and ramps, use engineered fill.
4. Under building slabs, use engineered fill.

3.11 SOIL MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.

1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
2. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.12 COMPACTION OF SOIL BACKFILLS AND FILLS

A. Place backfill and fill soil materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

B. Place backfill and fill soil materials evenly on all sides of structures to required elevations and uniformly along the full length of each structure.

C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 698:

1. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill soil material at 95 percent.
2. Under walkways, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 95 percent.
3. Under turf or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 85 percent.
4. For utility trenches, compact each layer of initial and final backfill soil material at 85 percent.

3.13 GRADING

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

B. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to elevations required to achieve indicated finish elevations, within the following subgrade tolerances:

1. Turf or Unpaved Areas: Plus or minus 1 inch.
2. Walks: Plus or minus 1 inch.
3. Pavements: Plus or minus 1/2 inch.

3.14 SUBBASE AND BASE COURSES UNDER PAVEMENTS AND WALKS

A. Place subbase course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place subbase course under pavements and walks as follows:

1. Shape subbase course to required crown elevations and cross-slope grades.
2. Place subbase course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
3. Compact subbase course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than percent of maximum dry unit weight according to ASTM D 698.

3.15 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform inspections:

B. Testing Agency: Owner will engage a qualified geotechnical engineering testing agency to perform tests and inspections.

C. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.

D. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Engineer.

E. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.

3.16 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.17 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

END OF SECTION 312000

Ray Roberts Lake State Park
Isle Du Bois – Flood Damage Repairs
Texas Parks and Wildlife
Project Number 128302

SECTION 312001 - RIPRAP

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Rock riprap with geotextile filter fabric.

1.2 PRODUCT & EXECUTION

A. Rock riprap shall be Type "A" as per NCTCOG item 803.3 (Slope and Channel Protection, Riprap).

B. Rock for riprap shall be durable and of a quality to insure permanence in the structure. It shall be free from cracks, seams and other defects that would tend to increase deterioration. Rock shall be reasonably well-graded between the following prescribed limits; thickness shall be as specified by the engineer:

12" Rock Riprap – 12" Thick
Sieve Size – Square Mesh % Passing
15" 100%
12" 70-100%
8" 45-75%
3" 10-30%
1½" 0-10%

Bedding
Sieve Size – Square Mesh % Passing
3" 100%
1½" 55-100%
3/4" 25-60%
3/8" 5-30%
No. 4 0-10%

C. The weight of rock shall be 155-lbs per solid cubic foot (minimum) calculated from the bulk specific gravity (saturated surface dry).

D. Rock for riprap shall be placed on the geotextile in such a manner as to produce a reasonably well-graded mass of rock with the minimum percentage of voids and shall be constructed within the specified tolerance to the lines and grades shown on the drawings. The intent of these specifications is to require the placement of riprap to the thickness shown and to allow isolated stones to extend as much as six (6) inches above grade. Riprap shall be placed to its full course thickness at one operation and in such a manner as to avoid displacing the geo-textile. The larger rocks shall be well distributed and the entire mass of rocks in their final position shall conform to the

gradation specified hereinbefore. The finished riprap shall be free from objectionable pockets of small rocks and clusters of larger rocks. The desired distribution of the various sizes of rocks throughout the mass shall be obtained by successive loading of the material at the quarry or other source, by controlled dumping of successive loads during final placing, or by methods of placement that will produce the specified results. Rearranging of individual rocks by mechanical equipment and by hand is necessary to obtain a reasonably well-graded mass with minimum voids. The Contractor shall maintain the riprap protection until the Owner accepts the project. Any material displaced by any cause, including erosion, shall be replaced to the lines and grades shown on the drawings.

E. Geotextile for use beneath the riprap shall meet the requirements of NCTCOG Item 803.4 (Geotextiles Used in Drainage and Stabilization Applications) for drainage conditions, unprotected applications, and EOS greater than a #50 sieves and permeability equal to soil (normal application).

F. The geotextile shall be placed in such a manner and at the locations shown on the drawings. At the time of installation, the geo-textile shall be rejected if it has defects, rips, holes, flaws, deterioration or damage incurred during manufacture, transportation or storage. The surface to receive the geo-textile shall be prepared to a relatively smooth condition free of obstructions, depressions, debris and soft or low density pockets of material. Erosion features such as rills, gullies, etc. must be graded out of the surface before geo-textile placement. The geo-textile shall be placed with the long dimension perpendicular to the centerline of the channel and laid smooth and free of tension, stress, folds, wrinkles, or creases. The strips shall be placed to provide a minimum width of 24-inches of overlap for each joint. Temporary pinning of the geo-textile will be required to help hold it in place until the rock riprap is placed. The temporary pins shall be removed as the riprap is placed to relieve high tensile stress that may occur during placement of material on the geo-textile. The specified placement procedure requires that the length of the geo-textile be greater than the actual slope length. The Contractor shall adjust the actual length of the geo-textile used based on initial installation experience. The geo-textile shall be protected at all times during construction from contamination by surface runoff and any geo-textile so contaminated shall be removed and replaced with uncontaminated geo-textile. Any geo-textile damaged during installation or during placement of riprap shall be replaced by the Contractor at no cost to the Owner. The work shall be scheduled so that the covering of the geo-textile with a layer of the specified material is accomplished within seven (7) calendar days after placement of the geo-textile. Failure to comply shall require replacement of geo-textile. The geo-textile shall be protected from damage prior to and during placement of the rock riprap. Before placement of rock, the Contractor shall demonstrate that the placement technique will prevent damage to the geo-textile. In no case shall any type of equipment be allowed on the unprotected geotextile.

G. Excavation, geotextile, and grout are included in the cost of rock riprap.

SECTION 312002 – CRUSHED LIMESTONE SURFACING – TOP COURSE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Supplying and placing crushed limestone surfacing over a prepared base course as shown on the drawings or as directed by a Parks Representative.

1.2 INFORMATIONAL SUBMITTALS

A. Material test reports and sieve analysis to be submitted prior to pre-installation meeting.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Crushed limestone surfacing shall consist of ¼" minus crushed limestone with cement stabilization to a compacted depth of 4".

B. Crushed limestone surfacing shall be "dense grade" limestone. The material shall be uniform in quality and substantially free from extraneous material.

C. Grouted Crushed Limestone Low Water Crossings shall consist of ¼" minus crushed limestone with sand-portland cement grout, composed of white or gray cement, unfading mineral pigments, and white or colored sand to match existing color.

PART 3 - EXECUTION

3.1 PLACEMENT

A. All areas shall be graded to within 0.1 foot, plus or minus of the proposed elevations. In addition, Contractor shall meet all specified cross slopes, running slopes, and positive drainage requirements as shown in the plans.

B. Limestone shall be placed with a method that provides a finished surface of evenly mixed material free from large pockets of separated rock. Large pockets are defined as areas with loose rock lacking fines (any surface thickness) in areas larger than 2 square feet measured at the trail surface. The frequency of such pockets of loose aggregates shall not exceed 10% of any

given 100-foot segment of new trail section selected by the owner. Loose top course shall be removed in its entirety and replaced by the contractor at no additional cost to the owner.

C. Optimal moisture content shall range between 5% and 7% before limestone is placed. The remedy for dry limestone placed at a moisture content less than specified shall be as follows:

1. Loosen compacted limestone.
2. Apply water until limestone is saturated.
3. Back-blade surface smooth
4. Ensure limestone layer is consistently moist, full depth. Add water to dry sections as directed.
5. Compact to 95% Standard Proctor.
6. Loose rock shall be remedied as specified in this section.
7. These tasks shall be incidental to the bid price. No additional compensation shall be permitted. Any task completed to achieve optimum moisture content is at the sole responsibility of the contractor and shall be provided at no additional cost to the owner.

D. Limestone surfacing shall be compacted after final grading as directed by a Parks Representative.

E. Limestone shall be compacted by mechanical methods to 95% density.

1. Trail shoulders shall be compacted to 95% density.

3.2 FIELD QUALITY CONTROL

A. The Contractor will be required to submit a sieve analysis from the manufacturer that is dated no more than one year prior to the contract award date for all material.

B. At the owner’s option, the owner may order a sieve analysis of the material stock piled on the site at any time to ensure that it is in compliance with specifications.

C. At the owner’s option, the Contractor may be required to build a test trail to show the level of quality of acceptable trail work before proceeding with the actual trail. The size and location of the test trail shall be determined at the pre-construction meeting. The Contractor shall not proceed with work until the owner has approved the test trail.

D. The Owner expects that the Work shall be executed in a way to match the existing trail example or test panel.

E. Contractor shall clean base course, or other specified base of debris, organic or deleterious material before placement of limestone

F. The Contractor shall place the crushed limestone surfacing immediately at optimum moisture content.

G. The Contractor shall compact placed material to specified density immediately after placement.

NEW PER ADDENDUM 4

H. The Contractor shall take special care to not disaggregate the Crushed Limestone Surfacing mixture.

I. Contractor shall obtain Owner's approval to stock pile Crushed Limestone Surfacing before it is brought to the site. Stockpiled material shall not be contaminated at the site so as to change the moisture content or gradation. Stock piled material shall not be allowed to dry out. The Contractor shall cover all stock piled material to maintain the material's moisture content. Material shall not be stock piled at the project site for an extended period of time, as determined by the Owner.

3.3 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Contractor shall remove surplus soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Park's property.

END OF SECTION 312002

Ray Roberts Lake State Park
Isle Du Bois – Flood Damage Repairs
Texas Parks and Wildlife
Project Number 128302

SECTION 312002 – CRUSHED LIMESTONE SURFACING – TOP COURSE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Supplying and placing crushed limestone surfacing over a prepared base course as shown on the drawings or as directed by a Parks Representative.

1.2 INFORMATIONAL SUBMITTALS

A. Material test reports and sieve analysis to be submitted prior to pre-installation meeting.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Crushed limestone surfacing shall consist of ¼" minus crushed limestone with cement stabilization to a compacted depth of 4".

B. Crushed limestone surfacing shall be "dense grade" limestone. The material shall be uniform in quality and substantially free from extraneous material.

PART 3 - EXECUTION

3.1 PLACEMENT

A. All areas shall be graded to within 0.1 foot, plus or minus of the proposed elevations. In addition, Contractor shall meet all specified cross slopes, running slopes, and positive drainage requirements as shown in the plans.

B. Limestone shall be placed with a method that provides a finished surface of evenly mixed material free from large pockets of separated rock. Large pockets are defined as areas with loose rock lacking fines (any surface thickness) in areas larger than 2 square feet measured at the trail surface. The frequency of such pockets of loose aggregates shall not exceed 10% of any given 100-foot segment of new trail section selected by the owner. Loose top course shall be removed in its entirety and replaced by the contractor at no additional cost to the owner.

C. Optimal moisture content shall range between 5% and 7% before limestone is placed. The remedy for dry limestone placed at a moisture content less than specified shall be as follows:

1. Loosen compacted limestone.
2. Apply water until limestone is saturated.
3. Back-blade surface smooth
4. Ensure limestone layer is consistently moist, full depth. Add water to dry sections as directed.
5. Compact to 95% Standard Proctor.
6. Loose rock shall be remedied as specified in this section.
7. These tasks shall be incidental to the bid price. No additional compensation shall be permitted. Any task completed to achieve optimum moisture content is at the sole responsibility of the contractor and shall be provided at no additional cost to the owner.

D. Limestone surfacing shall be compacted after final grading as directed by a Parks Representative.

E. Limestone shall be compacted by mechanical methods to 95% density.

1. Trail shoulders shall be compacted to 95% density.

3.2 FIELD QUALITY CONTROL

A. The Contractor will be required to submit a sieve analysis from the manufacturer that is dated no more than one year prior to the contract award date for all material.

B. At the owner's option, the owner may order a sieve analysis of the material stock piled on the site at any time to ensure that it is in compliance with specifications.

C. At the owner's option, the Contractor may be required to build a test trail to show the level of quality of acceptable trail work before proceeding with the actual trail. The size and location of the test trail shall be determined at the pre-construction meeting. The Contractor shall not proceed with work until the owner has approved the test trail.

D. The Owner expects that the Work shall be executed in a way to match the existing trail example or test panel.

E. Contractor shall clean base course, or other specified base of debris, organic or deleterious material before placement of limestone

F. The Contractor shall place the crushed limestone surfacing immediately at optimum moisture content.

G. The Contractor shall compact placed material to specified density immediately after placement.

H. The Contractor shall take special care to not disaggregate the Crushed Limestone Surfacing mixture.

I. Contractor shall obtain Owner's approval to stock pile Crushed Limestone Surfacing before it is brought to the site. Stockpiled material shall not be contaminated at the site so as to change the moisture content or gradation. Stock piled material shall not be allowed to dry out. The Contractor shall cover all stock piled material to maintain the material's moisture content. Material shall not be stock piled at the project site for an extended period of time, as determined by the Owner.

3.3 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Contractor shall remove surplus soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Park's property.

END OF SECTION 312002

SECTION 320130 - LANDSCAPE -MAINTENANCE OF SITE IMPROVEMENTS – ONE (1) YEAR

PART 1 - GENERAL

1.1 SCOPE

A. Furnish all work and materials, appliances, tools, equipment, facilities, transportation, and services necessary for and incidental to performing all work as listed in 1.4 and in Part 3, as shown on drawings and/or specified herein.

1.2 REQUIREMENTS OF REGULATORY AGENCIES

A. Perform work in accordance with all applicable laws, codes, and regulations required by authorities having jurisdiction over such work and provide for all permits required by local authorities.

1.3 QUALITY ASSURANCE

A. Qualifications:

1. The contractor shall have a minimum of five (5) years successful experience in the practice of landscape maintenance.

1.4 CONTRACTOR RESPONSIBILITIES

A. The Contractor shall provide maintenance services (Refer to individual specifications) after any portion of the sprinkler irrigation or landscape installation is complete

B. The Contractor's Maintenance Period shall be for one (1) year commencing upon a Letter of Final Acceptance of the construction issued by the Owner.

1. Temporary Irrigation: The Contractor shall continue to provide watering to maintain the health and growth of seed, sod and planted areas. The Contractor may provide manual watering or a temporary irrigation system. Contractor's maintenance of the temporary sprinkler irrigation system shall consist of monitoring and adjustment of the duration and frequency of the watering schedule, adjustment of heads for coverage and elevation, replacing damaged or removed heads or valves, repair of leaks in both mains and lateral lines and all other work required to establish a complete working sprinkler irrigation system.
2. Trees: The Contractor's maintenance of new planting shall consist of watering, cultivating, weeding, mulching, re-staple pinning, resetting plants to proper grades or upright position, pruning any dead or diseased wood, pruning any rangy growth, and furnishing and applying such sprays and invigorants as are necessary to keep the plantings free of insects and disease and in thriving condition. Irrigation should apply water infrequently, yet thoroughly for the first year. In times of drought, trees benefit from once-a-month thorough watering during the growing season.
3. Shrubs, Perennials and Ornamental Grasses: The Contractor's maintenance of new plants shall consist of watering, weeding, dead-heading, cutting back ornamental grasses, hand

pick pruning, fertilizing, pre-emergent, post-emergent, insecticide and fungicide applications, and top dress mulching.

4. Turf Grasses: The Contractor's maintenance of new Bermuda grass shall consist of watering, mowing, edging, trimming, keeping grass and grass cuttings out of planting beds and off playground surfacing, organic fertilizing, organic herbicides, organic insecticides and organic fungicide applications. Maintenance of lawns shall be as per Section 3.6 and 3.7 and per frequency as shown in Appendix A at end of this section.
5. Drainage Structure Inspection and Cleaning as required per guidelines set forth in these documents.
6. Paving and Playground Surface Area: Clean up paving surfaces from mowing, mulching, and other landscape related applications, treatments or cultivation.

C. Maintenance of project site shall be per Section 3 - Execution and per frequency as shown in Appendix A at end of this section.

1.5 MONTHLY SITE VISIT REPORT SUBMITTAL

A. The Contractor is responsible for documenting all phases of maintenance with site visit reports and date stamped photographs taken at a minimum of five (5) predetermined and designated locations in the site throughout the one (1) year of maintenance.

B. The site visit report and photo documents shall be submitted for each type of action regarding maintenance per Appendix A to show proof of maintenance action and for submittal to Owner at time of pay applications and copied to the Landscape Architect for record. Photos shall be submitted in an electronic Doc, Docx or PDF format, sent via email.

C. An overall site plan image will accompany each monthly submittal with the five (5) recorded locations marked for Owner site confirmation of work items. Additional locations may be marked or noted for items of special interest or warranty work replacement. The Site visit report shall include a listing of tasks completed and products used including product name, manufacturer's product information, and quantity applied.

D. If requested by the Owner, Texas Parks and Wildlife, the Contractor shall produce invoices for products used by the Contractor during the maintenance period.

E. This submittal provides proof of work for Texas Parks and Wildlife records for the project and will help document issues on the site for replacement requirements for items under warranty, items that have been vandalized, or items that need Texas Parks and Wildlife attention such as light outages or other damages to the site by others.

1.6 WARRANTIES AND REPLACEMENTS: Refer to Sections 328424 and 329300.

1.7 MAINTENANCE INSTRUCTIONS: At the completion of the maintenance period, furnish two (2) copies of written maintenance instructions,

PART 2 - MATERIALS

2.1 MATERIALS

A. Materials required for installed items shall match those already in use.

B. Samples of all materials not specified under other Sections of the Specifications shall be submitted for review by the Owner's Authorized Representative prior to use.

C. The use of any insecticides or herbicides will be permitted only with prior written approval of Texas Parks and Wildlife.

2.2 ORGANIC BIOLOGICAL FERTILIZER: to build soil structure within urban environment. Synthetic fertilizers will not be used due to runoff issues and per iSWM (Integrated Storm Water Management) best practices.

A. Homogenous, granulated all organic biological fertilizer containing soil microbes, endo & ecto mycorrhizal fungi, vitamins, minerals, plant hormones, stimulators, essential carbon and protein: MicroLife Multi-Purpose 6-2-4 All Organic Biological Fertilizer, as supplied by San Jacinto Environmental Supplies, Houston, TX (713) 957-0909 or equivalent as determined by the Owner's Authorized Representative. See 3.2 F., 3.5 A. 13. And 3.5 B. 14. for application rate to amended soils.

B. Locally Available:

1. Re-wholesaler: AG Organics, 450 Business Park Drive, Suites 100, Prosper, TX 75078, (972) 347-3330.
2. Wholesale: Southwest Wholesale Nursery, 2220 Sandy Lake Road, Carrollton, TX 75006, (972) 245-4557.
3. If quantity dictates, direct purchase from manufacturer.

C. Organic Fertilizer: To build soil structure within urban environment. Synthetic fertilizers will not be used due to runoff issues and design of Rain garden systems for iSWM (Integrated Storm Water Management).

2.3 PRE-EMERGENCE AND POST-EMERGENCE FOR WEED REMOVAL - ORGANIC HERBICIDE AND HAND PULLING

A. Chemical Herbicides will not be used due to detrimental effects on the soils and due to runoff effects.

B. For site bed treatments: initial during bed preparation, prior to planting, and for spot treatment with a wick after planting.

C. Nonselective organic herbicide such as: Mirimichi Green Pro Weed Control, EPA approved and OMRI listed, as manufactured by Mirimichi Green Express, 418 Hermitage Road, Castle Hayne, NC 28429, (910-602-1681); as supplied by San Jacinto Environmental Supplies, Houston, TX (713-957-0909), local representative: Lanse Fullinwider, cell: (214-534-2317), or other suppliers.

D. Nonselective organic herbicide, such as Agricultural grade (20%) vinegar. Vinegar can be mixed with citrus oil.

E. Hand weeding or plant specific application of organic herbicide shall be used to control weeds during plant establishment.

2.4 TOPDRESSING/ MULCH

A. Mulch for Planting Areas and Trees: Fine Cut Hardwood Mulch - hammer mill processed, decomposed - heat sterilized two (2) times to remove latent weed seeds, aged for minimum two (2) months, native hardwood mulch with frayed edges, screened to remove fines. No soft green or unprocessed materials allowed. 99.8% of material will not exceed four (4) inches in length. shall have no pungent odors but will have an earthy smell. As processed and supplied by Soil Building Systems, 2101 Walnut Hill Lane, Dallas, Texas 75229, (972-831-8181), attention: Baron Ablon, or equivalent as approved by the Owner's Representative.

2.5 ORGANIC FUNGICIDES

A. As needed for specific conditions.

B. No chemical fungicides shall be used.

C. MicroGro Granular Root Protector - Biological Fungicide as supplied by San Jacinto Environmental Supplies, Houston, TX (713) 957-0909, or equivalent product as approved by the Owner's Authorized Representative or Landscape Architect.

D. Contractor shall recommend products for submittal and approval by the Owner's Representative or Landscape Architect depending on final plant selections and their susceptibility to certain fungi.

2.6 ORGANIC INSECTICIDE

A. Soft Bodied Insects (aphids, mites, thrips, white flies, lace bugs, etc.):

1. EcoSMART® Organic Insecticides as manufactured by a division of the Kittrich® Corporation, Atlanta, GA 30336, (714-736-1011), or equivalent product as approved by the Owner's Authorized Representative or Landscape Architect.
2. Neem Oil.

B. Scale: Use 2 ounces of Orange Oil mixed with 1 ounce of Neem Oil to a gallon of water. Spray weekly for 3 weeks.

C. Caterpillars, Army Worms, Sod Webworms: Use Bacillus Thuringiensis (BT) biological agent.

D. Chinch Bugs:

1. EcoSMART® Granular, as manufactured by a division of the Kittrich® Corporation, Atlanta, GA 30336, (714-736-1011), or equivalent product as approved by the Owner's Authorized Representative or Landscape Architect.

2.7 ORGANIC INSECTICIDE - FIRE ANTS

A. Fire Ant Bait:

1. PayBack® Fire Ant Bait with Conserve® Insecticide (spinosad 0.015%) granular form as manufactured by Southern Agricultural Insecticides, Inc., Palmetto, FL 34220, (941-722-3285).
2. Ferti-lome Come and Get It! Fire Ant Killer with Conserve® Insecticide (spinosad 0.015%) granular form as manufactured by Ferti-lome – Voluntary Purchasing Groups, Inc., 230 FM 87, Bonham, TX 75418.

B. Dusting Powder: Perma-Guard® Commercial Insecticide D-20 (pyrethrins 0.02%, technical piperonyl butoxide 1.0%, silicon dioxide from diatomaceous earth 88.0%) as manufactured by Perma-Guard, Inc., Albuquerque, NM 87102, (505-243-1460), or equivalent product as approved by the Owner's Authorized Representative or Landscape Architect.

2.8 WOUND PAINT: Not used.

2.9 MACHINERY AND EQUIPMENT: Machinery requirements listed under this Section are NOT intended to be restriction of specific manufacturers or models, unless so stated. Specific mention of the manufacturers in intended as a guide to illustrate the final product of the maintenance operations desired. All equipment used shall be and maintained in top working condition at all times.

A. Lawn mowers shall be of the rotary or reel type, in good working order, finely tuned to protect the grass from excessive exhaust fumes. Mower blades shall be sharp at all times to reduce the tearing of the turf and shredding of the cut grass blades. Mowers shall be kept in balance with no bent blades. Lawn mowers shall be in a safe working condition at all times.

B. Edgers shall be hard blade grass edgers. Edger's shall be maintained in safe, working condition, cutting edges shall be sharp at all times.

C. String trimmers shall be maintained in safe and working condition.

D. Pruning tools shall be maintained in safe, working condition, cutting edges shall be sharp at all times.

E. Fertilizer and insecticide spreaders shall be of the hand-held or cyclone type. The Contractor shall be responsible for any grade, plant material (trees, etc.), or hardscape amenity damage caused by the spreader and the application process. Spreaders shall be in a safe working condition at all times.

F. Insecticide and fungicide sprayers shall be of the hand-held or backpack type. The Contractor shall be responsible for any grade, plant material (trees, etc.), or hardscape amenity damage caused by the sprayer and the application process. Sprayers shall be in a safe working condition at all times.

G. Deep root zone tree fertilizing shall be done with a hydraulic spray rig capable of producing fifteen (15) gallons of fertilizer solution per minute at 150 - 200 p.s.i.

H. All carts, wheelbarrows, and similar wheeled conveyances used in or on any portion of the existing landscape or amenities shall be equipped with pneumatic tires.

PART 3 - EXECUTION

3.1 WATERING

A. General:

1. Maintenance procedures should assure the operation of the temporary irrigation system if one is present. The irrigation system components (valves, nozzles and controller) should be inspected, cleaned, repaired and adjusted weekly.
2. Adjust the temporary system's timing in accordance with the general weather conditions. Improper watering procedures causing the decline of the permanent good health and appearance of the tree shall be replaced with the same tree of equal size and form at the cost of the Contractor.
3. Promptly repair any damage to the temporary irrigation system caused by the maintenance operations, vandalism, excavation by other resulting in broken heads, risers, pipe or other similar damage; replace with the same part and manufacture.

B. Deep root water all newly planted trees once (1) every week during the first summer and once a month during the first winter. This should be adjusted to the amount of rain. However, unless it has rained at least one-half (1/2) inch since the last watering, continue to deep root water. Complete deep root watering by filling each tree planter area three (3) times and letting it percolate dry. Use watering bags to provide supplement watering as necessary.

C. Be alert to over watering and discontinue watering as required. In general, a drainage problem area can be identified when water consistently remains for twelve to twenty-four (12-24) hours after either sprinkler system use or heavy rains.

D. Be especially careful to avoid over-watering the trees.

3.2 ORGANIC BIOLOGICAL FERTILIZER

A. MicroLife Multi-Purpose 6-2-4 All Organic Biological Fertilizer, as supplied by San Jacinto Environmental Supplies, (713) 957-0909.

B. Applied in: planting beds, trees in turf areas, and turf areas.

C. Rate: Twenty (20) pounds per one thousand (1,000) square feet.

D. Application:

1. March.
2. June.
3. October.

3.3 TREES

A. Trees shall be continuously and routinely inspected for vertical alignment. Adjust the tree staple pinning and check backfill against root ball to keep trees plumb.

B. Any Fire Ant mounds around or on top of a tree root zone shall be treated immediately and the mound removed physically. Do not allow the mound to build on the tree trunk as this will cover the tree root flare and possibly cause injury or death. Insure that any chemical application to the Fire Ant mound is safe for application atop tree root zones.

C. Trees: DO NOT CUT BACK, TOP OFF, SHEAR OFF OR TIP BRANCHES OF THE CRAPEMYRTLE. Remove seed heads by hand only if desired. Experienced pruning personnel shall carry out pruning.

D. Trees: Prune annually in the correct season for the species; non-flowering trees will be pruned in mid-winter. Experienced pruning personnel shall carry out pruning.

1. Prune to encourage positive growth; remove crossing branches; and maintain the natural shape of each species.
2. Remove sucker growth as needed.
3. Prune to eliminate dead wood and diseased or damaged growth.
4. Sterilize pruning tools with alcohol or hydrogen peroxide between individual plants, especially in the genus Quercus. Paint all wounds on plants of the genus Quercus with wound paint as soon as possible. Wounds shall be painted within I hour of pruning. Paint accidental wounds (storm or equipment damage or vandalism) as soon as they are observed.
5. Raising branching height to an acceptable height as approved by Owner's Authorized Representative.
6. No weed-eaters or edger's are to be used within fifteen (15) inches of any tree. Should the need for trimming be necessary within fifteen (15) inches of any tree, it shall be done so by hand trimming only.

E. If branches must be removed then, if possible, remove without disfiguring the natural shape of the tree. Wipe blade with alcohol or hydrogen peroxide between cuts. Do not leave branch stumps sticking out where someone could injure or poke eyes. Cut branches per arborilogical practices.

F. Damaged Trees: The Owner's Authorized Representative shall be notified of damaged plant materials resulting from mechanical injury or storm damage. The Contractor will be responsible for repairs or replacements on all plant material damaged during warranty care period and shall be responsible for replacement of all trees and groundcovers destroyed for any reason. The Owner's Authorized Representative will determine the degree of damage.

3.4 SHRUBS, ORNAMENTAL GRASSES AND PERENNIALS (GROUNDCOVERS)

A. Thin to remove dead wood when necessary. Remove dead wood and freeze damaged leaves in the spring.

B. In no case should any shrub or perennial be sheared. Shrubs shall be selectively pruned.

C. All water sprout and sucker type growth shall be pruned and trimmed continuously. Pruning and trimming of any shrub shall be done so in a manner as to retain the natural character and habit of the plant. All shrubs shall be pruned to create a uniformly dense plant. Selectively thin and tip

back annually, or as needed. Do not change the natural shape of the shrub by pruning unless so directed by the Owner.

D. All shrub, ornamental grass and perennial beds shall be weeded and cultivated in accordance with the Schedule.

E. Cultivate the beds (break soil and loosen to incorporate amendment) when adding fertilizer.

F. Always prune out dead, broken, and diseased wood. All cuts shall be flush cuts. Refer to the Schedule for pruning and trimming times.

G. As planting beds mature, discontinue cultivation.

H. All damaged, dead, or thin areas in shrub/ornamental grass/perennial beds shall be replanted at the direction of the Owner's Representative. Replacement of plant material not due to the Contractor's negligence will be at the Owner's expense, upon receipt of written authorization to proceed.

I. All pruning debris and limbs shall be removed completely and immediately from site, or to an approved location on-site.

J. Re-mulch non-depressed planter beds with compost and mulch topping as necessary to maintain three (3) inch depth. Re-mulch Rain garden (depressed) beds with rustic mulch topping as necessary to maintain three (3) inch depth. Refer to 3.12 Topdressing/Mulching.

3.5 NATIVE AND ORNAMENTAL GRASS

A. The ornamental grass used in the project is an herbaceous perennial, dormant in winter. The foliage, flowers and seed plumes die with onset of freezing weather but persist throughout the winter. The dead but standing foliage retains its form and is one of the main aesthetic values of these plants. Maintenance activities in or around these plants must be performed carefully during the fall and winter to avoid damage to the standing foliage. If damaged, the foliage will not completely regenerate until the following summer.

B. The ornamental grass is sensitive to over-fertilization and to over-watering. Over-fertilization and over-watering causes the plants to become "top-heavy", resulting in foliage and flowers that do not stand upright, but fall over in wind or rain. This destroys the fall and winter value of the plants and may cause decreased cold-hardiness.

C. Do not trim or shear ornamental grasses, due to seasonal change aesthetic value and possible damage to the living crown. In early to mid-Spring, use rubber gloves and run fingers and hands over grasses, like combing hair, and gently pulling out the spent blades. Not all the spent blades may come out but removing some will trigger the grass to refresh itself.

If the warm season grasses have wind or winter damage, then cutting back the top of the grasses in early Spring (late February), before new foliage emerges, may be required by removing no more than two-thirds (2/3) of the top of the plant leaving one-third (1/3) of the plant to protect the living crown. Cutting grasses back too much will allow moisture to gather on their crowns, which can cause rot. Pruning should only occur every two (2) years if required

1. Native Grass:

   a. Inland Sea Oats

3.6 MOWING AND EDGING OF 419 TIFWAY BERMUDA GRASS

A. Mow and edge grass areas as shown on attached Appendix "A".

B. Bag clippings in all lawn areas adjacent to playground surfacing area. Do NOT allow any clippings to be thrown, blown, washed or enter onto the playground surfacing as these will clog up and choke the surface of this area.

C. Do not scalp the grass or cut more than one-third (1/3) the existing top growth in one (1) mowing. If more than that is cut, remove or catch the clippings. Clippings shall not remain on the turf surface for more than four (4) hours.

D. When edging, use sharp blades to give a crisp appearance along walks, curbs, edge of pavement (street, walks), permanent structures, etc.

E. When trimming, use string trimmers around non-living structures and objects. Do not allow turf to be trimmed shorter with a string trimmer than other turf areas mowed by mowers the same day.

F. When trimming, do not allow the turf to be scalped around irrigations sprinkler heads and valve boxes creating a "doughnut" appearance.

G. When trimming, never use string trimmers around tree and shrub trunks where girdling trunk damage is possible.

H. Hand trim around irrigation heads, signs, valve boxes, trees and shrubs.

I. The edge of road pavements and back of curbs shall be mechanically edged.

J. No weed-eaters or edger's are to be used within fifteen (15) inches of any tree. Should the need for trimming be necessary within fifteen (15) inches of any tree, it shall be done so by hand trimming only.

K. All irrigation heads, signs, utility poles, fire hydrants, etc., shall be mechanically trimmed; chemical control not acceptable. Use extreme caution when trimming around new or existing trees to prevent damage.

L. Mulching mowers may be used on all turf areas separate and not adjacent to Playground surfacing areas. Do not bag clippings.

M. Turf Mowing:

1. During periods of cool weather:

   Mow Bermuda Grass turf at 1-1/2" height.

2. During periods of warm and hot weather:

Mow Bermuda Grass turf at 2" height.

3.7 BROWN PATCH

A. MicroLife Brown Patch 5-1-3 All Organic Biological Fertilizer, as supplied by San Jacinto Environmental Supplies, (713) 957-0909.

B. Rate: Per manufacturer's recommendations.

3.8 ORGANIC INSECTICIDE - ANT CONTROL

A. Granular Bait:

1. PayBack® Fire Ant Bait with Conserve® Insecticide or
2. Ferti-lome Come and Get It! Fire Ant Killer with Conserve® Insecticide.

B. Dusting powder – Perma-Guard® Commercial Insecticide D-20.

C. Treatment and Rate: Per manufacturer's recommendations.

3.9 ORGANIC INSECTICIDES AND ORGANIC FUNGICIDES: As required for safe control of the particular insects or diseases.

A. Assess level of damage caused by insects and diseases regularly. Minor, visually unimportant damage does not need to be treated, as long as the long-term health of the planting is not affected.

B. Carefully identify any pest that causes significant damage. Do not attempt control until the pest organism has been identified.

C. After identification, treat with organic biological and insect-specific control measures. Read and observe all label precautions. If the least hazardous control measure is not effective, use the next least hazardous measure. In pest outbreaks, review cultural practices to determine the underlying cause, and correct.

D. Only experienced personnel should handle and apply the organic insecticides.

E. Drenching Materials for Control of Root Disease - Treat all root diseases on trees with MicroGro Granular Root Protector - Biological Fungicide as recommended by the manufacturer.

3.10 TEMPORARY IRRIGTION

A. The Contractor shall continue to water: the seeded areas to promote germination and growth of newly seeded areas; promote growth of newly sodded areas; and promote growth of newly planted areas with shrubs, perennials, native grass and trees. The Contractor may rely on manual watering, "gator" bags, soaker hoses or other means for the plant material to be fully established at the end of the one-year maintenance.

B. Temporary Landscape Irrigation System: If desired and approved by the Owner, the Contractor, may install a temporary irrigation system. If so, the Contractor shall be totally responsible for the operation of the temporary irrigation system, as well as programming the automatic

controlling devices to produce optimum moisture levels in all tree planter areas. It shall be the Contractor's sole responsibility to keep plants watered properly (to the extent of supplemental watering when necessary to provide the need/s, beyond that provided by irrigation systems). If there are problems with the irrigation system that prevent proper watering procedures, Contractor shall effectuate all repairs, so as to prevent any vegetation and/or tree loss.

1. If possible, except as dictated by extenuating circumstances (when unusual circumstances occur as necessitated by special events, location, etc.) irrigation cycles shall be set to take place during night-time hours, but in all instances prior to beginning of morning hours.
2. During periods of high rainfall, set controllers to the manual or rain mode, until irrigation is needed.
3. Operation of irrigation system shall be monitored by contractor on a weekly basis (in conjunction with service cycle); to insure proper coverage of areas and operation of system - for example, proper running of controller, the setting of groundcover/perennial heads at the proper height, bubbler head adjustment to cover trees root balls, the covering and staking of drip line, and to reset drip line.
4. During cold weather, the Contractor shall be responsible to monitor the irrigation system to prevent the icing of sidewalks, playground, and any associated damage to plants. When weather conditions dictate, the Contractor shall drain the irrigation system so that minimum freeze damage occurs to the system.
5. Any damage caused by the Contractor (bubblers, valves, wiring etc.), during the servicing of facilities; shall be repaired at no cost to the Owner. Replacement equipment shall be of the same type, model and manufacturer to keep the warranty coverage the same. No substitutions shall be accepted unless a particular replacement part is out of production.
6. The Contractor shall be responsible for the supply and/or replacement of all sprinkler nozzles "blown-off," (including parts) broken, missing, or otherwise damaged during routine scheduled service and/or vandalism of property. Contractor should be prepared to respond immediately to reports of irrigation problems occurring.

B. Make adjustments and settings of automatic controllers to establish frequency and length of watering periods.

C. Check systems for continuous trouble-free operation.

1. Adjust all bubblers to maintain proper coverage.
2. Immediately repair and replace any equipment damaged as a result of maintenance operations, at the Contractor's expense and directed by the Owner's Authorized Representative.
3. Accidental damage not resulting from Contractor's negligence will be reported promptly to the Owner's Authorized Representative with estimate of cost for correction for the Owner's Authorized Representative's approval.
4. The Owner's Authorized Representative shall be notified, within twenty-four (24) hours, of any damage caused by accident, vandalism, theft, acts of God, or mysterious causes.
5. During the start and throughout the year of maintenance, the Contractor shall adjust the watering of the plants to promote deep drought tolerant root systems by not over watering the plants, but watering deep and less frequently per xeric and sustainable practices. Newly

planted replacement trees shall be provided with supplemental truck watering at the Contractor's expense to establish the tree prior to the end of the Contract period.

D. At the end of the Contract, the Contractor shall remove all temporary irrigation system.

E. Contractor shall leave gator watering bags in place for the Owner.

3.11 TOPDRESSING/MULCHING

A. Tree Mulch Planter Bed and Tree Planters: Apply one (1) inch layer of finely shredded hardwood mulch over tree mulch bed and at base of trees in turf areas twice (2 times) a year to maintain full three (3) inch depth. Hold mulch back from root flare of tree to keep flares fully exposed.

3.12 WEED REMOVAL: Remove weeds weekly during growing season and as required for safe control and elimination of the weeds and to prevent reseeding and spreading of noxious and aggressive weeds. Contractor shall familiarize himself with the plants that are to be maintained.

A. Weeds in shrub, groundcover, ornamental grass, and perennial beds – hand pull on a regular basis and individually treat with organic herbicide. Do not overspray or wick onto permanent plantings.

B. Weeds in paving – apply organic herbicide on regular basis.

3.13 LITTER REMOVAL: Maintain all planting beds and play surfacing areas as required to be free of litter and debris, including cigarette butts, gum, and other small materials. The frequency is shown on the Appendix "A". Litter control will be performed weekly on all portions of areas involved in this contract. Extremely high visitation, i.e. special event, may increase intensity. Pick up all litter and debris and deposit in trash receptacles provided by the Owner. If none are provided, it is the Contractor's responsibility to haul away and dispose of in an appropriate manner.

3.14 HAZARD REMOVAL: Pick up and remove all broken glass from planters, turf, and playground surfacing as necessary, but at least once (1) per week. Any hazardous conditions shall be reported to the Owner or its authorized representative immediately upon discovery. Hazardous conditions will be defined as any natural or man-made feature within the physical boundaries of the contracted property (plant, structure, item of equipment, site furniture, or any real property) which is in such a condition that it may not be utilized as it's original or designated use.

3.15 PLAYGROUND EQUIPMENT AND STONE BLOCK BENCH: Damaged furnishings shall be reported to Texas Parks and Wildlife or the Owner's Authorized Representative immediately upon discovery.

3.16 SUBDRAINAGE LINES, DRAIN GRATE COVERS/CATCH BASINS AND CLEAN-OUTS

A. All surface and subdrainage lines shall be kept clear, clean, and free of any and all debris, mulch and sediments, at all times.

B. If standing water is found, provide inspection of lines, via cleanouts and drain structures, to ensure water drains out.

C. The Contractor shall make routine monthly inspection of all drainage clean-outs to ensure that flow lines are free of obstructions.

3.17 HARDSCAPE MAINTENANCE: shall be performed to remove debris or materials left by Contractor during maintenance of project.

A. Hardscape cleaning is primarily performed with electric power sweepers or blowers to maintain the walkways, pavement, playground surface, and other hardscapes. Capture debris and dispose of in waste receptacles or dispose of in an appropriate manner.

3.18 MAINTENANCE SCHEDULE

Refer to Appendix "A" for summary of maintenance activities.

PART 4 – EXPLANATION OF LANDSCAPE MAINTENANCE (WARRANTY) AND CONTRACTOR CARE REQUIREMENTS

4.1 REQUIREMENTS: The following are requirements for one (1) year Landscape Maintenance Warranty Period to be performed by the Contractor. The intent of this is to accomplish the following in the manner herein described.

A. The Contractor is to be completely responsible to maintain plant materials he/she is warranting. This is accomplished by giving him/her control over the area he/she has just finished constructing.

B. The Contractor maintains control by setting the standard for which this area will be maintained. This standard will be as described below.

1. The Contractor shall determine his/her costs for maintaining this standard of warranty and add these costs into the entire items bid on the project in the same way costs for maintaining an office or construction equipment for carrying on normal day-to-day business is done.
2. The Contractor shall tell the Owner's Authorized Representative in writing what those costs are in an itemized statement prior to the award of the contract. This amount will be retained after the construction for final acceptance and paid to the Contractor on a quarterly basis for the period of the warranty set forth above. If in the opinion of the Owner's Authorized Representative the Contractor's costs are too low, Owner staff will determine a figure and this amount will be retained after the construction final acceptance and paid out to the Contractor quarterly as stated above. If certain work is not done, payment will not be made for that particular item.
3. Upon final payment to the Contractor, the contract is considered as terminated with certain exceptions as described on the following pages.

PART 5 – SPECIFICATION REQUIREMENTS FOR LANDSCAPE MAINTENANCE WARRANTY PERIOD

5.1 TERM: The term of any contract for performance of Landscape Maintenance Warranty Care described in these specifications shall begin on the day of Final Acceptance of general contract and continue for one (1) year.

5.2 THE AGREEMENT: The agreement may be altered or terminated at the election of the Owner or its Authorized Representative, should it be found that to maintain the public interest (which shall be so construed to include the appearance of the segments of public property herein, and subsequently described, and warranted), safety, health, comfort and/or welfare would require such action. In such event, the decision of the Owner's Authorized Representative shall be final and binding.

5.3 LIABILITY: The Owner will not be liable for any loss or damage sustained by the contractor. The contractor shall save the Owner whole and harmless from any and all claims for damage of whatsoever nature and kind, suffered or asserted to have been suffered by the person or property of any person whomsoever growing out of or resulting from or in any way connected with the exercise of the privilege herein granted. Contractor will exercise every necessary precaution for the safety of the Owner's property and the protection of any and all persons and/or property located adjacent to or making passage through said property.

5.4 AREA TO BE MAINTAINED: The Owner's Authorized Representative shall determine the exact location of land to be maintained. The area to be maintained subject to the provisions of these specifications is described below. The Owner's Authorized Representative in supervising the agreement outlined herein is, the Project Manager, who may specifically designate others to be responsible for the on-site inspection.

The areas to be maintained are the playground and adjacent seeded, sodded and planted areas and any pavements and site furniture installed under the contract.

5.5 CONTACT: Contractor shall furnish all of the material and perform all of the work to be undertaken as the contractor's obligations under this contract. Contractor must provide a valid phone number and address at all times to the Owner's Authorized Representative. The telephone must be answered during normal working hours at least to take a message. Contractor must also provide a phone number he/she can be reached after hours and weekends. A pager or cell phone is strongly recommended.

5.6 EQUIPMENT: All materials, tools, and equipment used in performing the conditions outlined will be provided by the successful bidder and must be removed from the jobsite at the end of each working day or upon the request of the Owner's Authorized Representative at any time.

5.7 ASSIGNMENT OF THE AGREEMENT: The Contractor shall not sell, sublet, or assign the agreement or any portion thereof to any other person or persons, except upon the written approval of the Owner's Authorized Representative.

5.8 NOTIFICATION: The Contractor shall notify the Owner's Authorized Representative at least forty-eight (48) hours prior to beginning the seasonal commencement of the Landscape Maintenance Warranty Care Period.

A. The Owner's Authorized Representative shall be present at the initial start of the project and will spot check the progress of the contract work until completed. If at any time it is determined by

the Owner's Authorized Representative that the terms of the contract are not being followed, said representative shall stop the work until the corrections are initiated.

B. Failure to correct contract violations (within 48 hours after notification) may result in contractor's quarterly payment being withheld until and understanding between the Owner's Authorized Representative and Contractor can be reached.

5.9 SUBCONTRACTOR APPROVAL: The Owner's Authorized Representative reserves the right to examine contractor's subcontractor for warranty care period and approve/disapprove same. Items to be examined will be performance history, experience and equipment inventory and will therefore require the submission of a business experience portfolio from subcontractor. Said portfolio shall contain the following information:

A. History and experience – Trace the Contractor's professional experience giving particular attention to past and present operations.

B. Equipment and Personnel – A list of equipment and personnel to be used in the Landscape Maintenance Warranty Care Management Program shall be provided. An on-site inspection of subcontractor's equipment will be required prior to subcontractor's approval for Landscape Maintenance Warranty Care.

C. Contractor shall submit a complete list of projected costs for all work to be performed prior to commencement of the Landscape Maintenance Warranty Care Period.

D. The foregoing information may be used at the Owner's Authorized Representative's discretion to disapprove a Contractor when in the estimation of the Owner's Authorized Representative the Contractor is incapable of performing said contract.

E. The Owner's Authorized Representative reserves the right to defer the approval of the Contractor until after an interview with the principal parties involved in the company being considered to do Landscape Maintenance Warranty Care. Said interview may or may not be required and may be conducted by the Owner's Authorized Representative.

5.10 COMPLIANCE: Contractor shall comply with all applicable governmental laws and regulations.

5.11 FAILURE TO PERFORM SATISFACTORILY

A. It is agreed and understood that in the short run, if the Contractor fails to perform the work satisfactorily as specified herein, the Owner's Authorized Representative will only pay the amount of retainage for the amount of service received, as determined by the Owner's Authorized Representative with an appropriate downward adjustment in contract price. Such adjustments will be the estimated cost for performance by the Owner's Authorized Representative.

B. Those discrepancies and deficiencies in the work that remain uncorrected may be grounds for termination of the Contractor, by the Owner's Authorized Representative. The contractor will then be required to obtain the services of another subcontractor that is acceptable to the Owner's Authorized Representative.

5.12 RETURN OF RETAINAGE PAYMENTS WITHHELD: The Owner's Authorized Representative may withhold retainage payment to such extent as may be necessary to protect the Owner from loss due to:

A. Work required in the specifications which is defective, incomplete or not performed.

B. Claims filed or reasonable evidence indicating probable filing claims.

PART 6 – PUBLIC ENTITY INSURANCE

6.1 REQUIREMENTS: The Contractor, one (1) week prior to the time that the Landscape Maintenance Warranty Care Period begins, shall provide at his own cost and expense, the following insurance to the Public Entity by insurance companies licensed in the State of Texas. All required insurance shall be evidenced by certificates and/or policies as determined by the Public Entity.

TYPE OF COVERAGE	LIMITS OF LIABILITY
I. Workmen's compensation	Statutory
II. Comprehensive General Liability	
Bodily Injury	$300,000 per occurrence
Property Damage	$50,000 per occurrence
III. Comprehensive Automobile	
Liability	(with a minimum limit of $100,000 per person)
Bodily Injury	$300,000 per occurrence
Property Damage	$50,000 per occurrence

A. Additional coverages and limits may be required based upon the particular function contracted. If such additional coverage and limits are required, they will be described in the special conditions of the specifications.

B. Each certificate and/or policy of insurance shall require that thirty (30) days prior to the cancellation or material change in policies, notice thereof shall be given to the Public Entity by registered mail.

C. Any and all deductibles in the above-described policies shall be assumed by, and before, the account of and at the sole risk of the contractor.

D. The Public Entity shall be named as an additional insured and that the term "owner" of "Public Entity" shall include all authorities, Boards, Bureaus, Commission, Divisions, Departments, and offices of the Public Entity and the individual members, employees, and agents thereof, in their official capacities and/or while acting on behalf of the Public Entity.

E. Proof of Insurance must be provided to the Owner's Authorized Representative one (1) week prior to starting any contract work.

Appendix A – Schedule

Activity	Frequency Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec	Total Visits
Cultivate beds		1				1			1				3
Hand weed beds	1	1	2	4	4	5	4	4	5	4	2	1	37
Tree pruning & maintenance	*	*	*	*	*	*	*	*	*	*	*	*	*
Trim warm season ornamental grasses (ref. 3.5) – 1 time every 2 years		*											*
Dead head perennials	*	*	*	*	*	*	*	*	*	*	*	*	*
Remove all debris, trimmings, fallen branches and thatch from playground surface areas to prevent clogging of system	*	*	*	*	*	*	*	*	*	*	*	*	*
Organic Insecticide - Ant control	*	*	*	*	*	*	*	*	*	*	*	*	*
Applications & treatment with organic: insecticides, herbicides, fungicides & for brown patch	*	*	*	*	*	*	*	*	*	*	*	*	*
Apply organic biological fertilizer to planting beds, tree planters & turf			1			1				1			3
Apply fine mulch over existing mulch areas (planters & trees)			1							1			2
Mowing - refer to Section 329200 for frequency & 3.6	*	1	2	2	2	*	*	*	*	*	1	1	*
Litter and leaf removal	5	4	4	4	5	4	5	4	5	4	4	4	52
Site furniture - maintenance	*	*	*	*	*	*	*	*	*	*	*	*	*
Removal of hazardous materials	*	*	*	*	*	*	*	*	*	*	*	*	*
Irrigation check, water bag filling, coverage and rate	5	4	4	4	5	4	5	4	5	4	4	4	52
Subdrainage system check & cleanout inspect	1		1		1		1		1		1		6
Visit w/ Contracting Officer	1	1	1	1	1	1	1	1	1	1	1	1	12

NOTE: This table is not comprehensive and is intended as a guideline.
Refer to Sections 329300 and 328424 for additional maintenance requirements.
* as needed

END OF SECTION 320130

SECTION 321313 - CONCRETE PAVING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes Concrete Paving. Including the Following:

1. Walks.
2. Pads.
3. Low Water Crossings

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each type of product, ingredient, or admixture requiring color selection.

C. Design Mixtures: For each concrete paving mixture. Include alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

1.3 QUALITY ASSURANCE

A. Ready-Mix-Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities" (Quality Control Manual - Section 3, "Plant Certification Checklist").

1.4 TESTING

A. Testing Service: Texas Parks and Wildlife will engage a qualified independent testing agency to perform on-site testing on concrete paving mixtures.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

A. ACI Publications: Comply with ACI 301 unless otherwise indicated.

2.2 STEEL REINFORCEMENT

A. Plain-Steel Welded-Wire Reinforcement: ASTM A 1064/A 1064M, fabricated from as-drawn steel wire into flat sheets.

B. Deformed-Steel Welded-Wire Reinforcement: ASTM A 1064/A 1064M, flat sheet.

C. Reinforcing Bars: ASTM A 615/A 615M, Grade 60; deformed.

D. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60 plain-steel bars; zinc coated (galvanized) after fabrication according to ASTM A 767/A 767M, Class I coating. Cut bars true to length with ends square and free of burrs.

E. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars, welded-wire reinforcement, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete of greater compressive strength than concrete specified.

2.3 CONCRETE MATERIALS

A. Cementitious Materials: Use the following cementitious materials, of same type, brand, and source throughout Project:

1. Portland Cement: ASTM C 150/C 150M, gray portland cement Type I

B. Normal-Weight Aggregates: ASTM C 33/C 33M, Class 4S, uniformly graded. Provide aggregates from a single source.

C. Air-Entraining Admixture: ASTM C 260/C 260M.

D. Chemical Admixtures: Admixtures certified by manufacturer to be compatible with other admixtures and to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material.

E. Water: Potable and complying with ASTM C 94/C 94M.

2.4 CURING MATERIALS

A. Absorptive Cover: AASHTO M 182, Class 3, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. dry or cotton mats.

B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

C. Water: Potable.

D. Evaporation Retarder: Waterborne, monomolecular, film forming, manufactured for application to fresh concrete.

E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.

F. White, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 2, Class B, dissipating.

2.5 RELATED MATERIALS

A. Joint Fillers: ASTM D 1751, asphalt-saturated cellulosic fiber or ASTM D 1752, cork or self-expanding cork in preformed strips.

B. Slip-Resistive Aggregate Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive aggregate of fused aluminum-oxide granules or crushed emery aggregate containing not less than 50 percent aluminum oxide and not less than 20 percent ferric oxide; unaffected by freezing, moisture, and cleaning materials.

2.6 CONCRETE MIXTURES

A. Prepare design mixtures, proportioned according to ACI 301, for each type and strength of normal-weight concrete, and as determined by either laboratory trial mixtures or field experience.

B. Cementitious Materials: Use fly ash, pozzolan, slag cement, and silica fume as needed to reduce the total amount of portland cement, which would otherwise be used, by not less than 40 percent.

C. Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement having an air content as follows:

1. Air Content: 4-1/2 percent plus or minus 1-1/2 percent.

D. Chemical Admixtures: Use admixtures according to manufacturer's written instructions.

E. Concrete Mixtures: Normal-weight concrete.

1. Compressive Strength (28 Days): 3500 psi.
2. Maximum W/C Ratio at Point of Placement: 0.45
3. Slump Limit: 4 inches plus or minus 1 inch.

2.7 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Furnish batch certificates for each batch discharged and used in the Work.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Proof-roll prepared subbase surface below concrete paving to identify soft pockets and areas of excess yielding.

3.2 PREPARATION

A. Remove loose material from compacted subbase surface immediately before placing concrete.

3.3 EDGE FORMS AND SCREED CONSTRUCTION

A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.

B. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

3.4 STEEL REINFORCEMENT INSTALLATION

A. Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

3.5 JOINTS

A. General: Form construction, isolation, and contraction joints and tool edges true to line, with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline unless otherwise indicated.

B. Construction Joints: Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than one-half hour unless paving terminates at isolation joints.

C. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, other fixed objects, and where indicated.

D. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness.

E. Edging: After initial floating, tool edges of paving, gutters, curbs, and joints in concrete with an edging tool to a 1/4-inch radius. Repeat tooling of edges after applying surface finishes. Eliminate edging-tool marks on concrete surfaces.

3.6 CONCRETE PLACEMENT

A. Moisten subbase to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.

B. Comply with ACI 301 requirements for measuring, mixing, transporting, and placing concrete.

C. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.

D. Screed paving surface with a straightedge and strike off.

E. Commence initial floating using bull floats or darbies to impart an open-textured and uniform surface plane before excess moisture or bleedwater appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.

3.7 FLOAT FINISHING

A. General: Do not add water to concrete surfaces during finishing operations.

B. Float Finish: Begin the second floating operation when bleedwater sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.

1. Burlap Finish: Drag a seamless strip of damp burlap across float-finished concrete, perpendicular to line of traffic, to provide a uniform, gritty texture.
2. Medium-to-Fine-Textured Broom Finish: Draw a soft-bristle broom across float-finished concrete surface, perpendicular to line of traffic, to provide a uniform, fine-line texture.
3. Medium-to-Coarse-Textured Broom Finish: Provide a coarse finish by striating float-finished concrete surface 1/16 to 1/8 inch deep with a stiff-bristled broom, perpendicular to line of traffic.

C. Slip-Resistive Aggregate Finish: Before final floating, spread slip-resistive aggregate finish on paving surface according to manufacturer's written instructions.

1. Cure concrete with curing compound recommended by slip-resistive aggregate manufacturer. Apply curing compound immediately after final finishing.
2. After curing, lightly work surface with a steel-wire brush or abrasive stone and water to expose nonslip aggregate.

3.8 CONCRETE PROTECTION AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

B. Comply with ACI 306.1 for cold-weather protection.

C. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete but before float finishing.

D. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

E. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing, curing compound, or a combination of these.

3.9 PAVING TOLERANCES

A. Comply with tolerances in ACI 117 and as follows:

1. Elevation: 3/4 inch.
2. Thickness: Plus 3/8 inch, minus 1/4 inch.
3. Surface: Gap below 10-feet- long; unleveled straightedge not to exceed 1/2 inch.
4. Joint Spacing: 3 inches.
5. Contraction Joint Depth: Plus 1/4 inch, no minus.
6. Joint Width: Plus 1/8 inch, no minus.

3.10 REPAIR AND PROTECTION

A. Remove and replace concrete paving that is broken, damaged, or defective or that does not comply with requirements in this Section. Remove work in complete sections from joint to joint unless otherwise approved by Architect.

B. Protect concrete paving from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.

C. Maintain concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep paving not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION 321313

SECTION 321314 – CONCRETE PAVING AT PLAYGROUND – ARCHITECTURAL JOINTS & FINISH

PART 1 - GENERAL

1.1 DESCRIPTION

A. Furnish all work and materials, appliances, tools, equipment, facilities, transportation, and services necessary for and incidental to performing all operations in connection with the concrete pavement finishing and jointing and for all vertical concrete work for pavements adjacent to the playground area.

B. Conform to the requirements of the general conditions of the contract.

1.2 SUMMARY

A. Work Included: The work includes, but is not necessarily limited to:

1. Standard pedestrian pavement finishes.
2. Expansion, saw-cut and control joints and expansion joint materials.
3. Placement of jointing per plans and details.
4. Placement of rebar per details for depth from top or sides of finished concrete.
5. Finishing of pavements.
6. Curing of pavements.
7. Sealer.
8. Non-shrink grout.
9. These documents and details for the sidewalk and accessible drive jointing provide for compliance with ADA 2012 and TAS 2012 for accessible expansion joints in walk areas and for staggered pours with saw-cuts to reduce contraction from pour to pour. Per ADA - joint width not to exceed 1/2" width in direction of travel.
10. Traffic control/barricading with daily maintenance and documentation of devices (if required).

B. Related Work Specified Elsewhere:

1. Concrete Paving – Section 321313 – for walks (trails not adjacent to playground).
2. Landscape Drainage System at Playground – Section 334114.
3. Playground Equipment – Section 116816.

1.3 REFERENCES

A. Requirements of Regulatory Agencies:

1. Perform work in accordance with all applicable laws, codes and regulations.

2. Perform work in compliance with Texas Department of Licensing and Regulations per the Architectural Barriers Texas Accessibility Standards (TAS).
3. Products shall comply with the United States Clean Air Act for minimum Volatile Organic Compound (VOC) content as specified in 2.00 of this section.

B. Reference Standards:

1. American Concrete Institute (ACI): ACI 303.1 "Standard Specification for Cast-In-Place Architectural Concrete".
2. ACI 304 "Recommended Practice for Measuring, Mixing, Transporting and Placing of Concrete."
3. ACI 305R "Recommended Practice for Hot Weather Concreting."
4. American Society for Testing and Materials (ASTM):
   D1751-73 Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Non-extruding and resilient Bitumens Type)
5. American Society for Testing and Materials (ASTM):
   C309 "Standard Specifications for Liquid Membrane-Forming Compounds for Curing Concrete."
6. American Society for Testing and Materials (ASTM):
   C494 "Standard Specification for Chemical Admixtures for Concrete."
7. Concrete Reinforcing Steel Institute (CRSI):
   Manual of Standard Practice.

C. Coordination:

1. Coordinate all items of other trades to be furnished and set in place.
2. Insure that such portions of their work are all or in part embedded, built-in, attached to, supported by or covered over by the concrete work are executed by them in ample time that progress of the work is not delayed.
3. Do all cutting or patching made necessary to comply with above injunction.

1.4 SUBMITTALS: Submit samples and manufacturers' latest catalog cuts and specifications as required for each of the following materials for approval:

A. Product Data: submit manufacturer's data including product compliance for the following:

1. Admixtures
2. Curing compound
3. Sealing compound
4. Non-shrink grout
5. Backer rod
6. Color samples: Expansion Joint Compounds and Sealants for concrete walks
7. Expansion joint material

8. Joint dowel alignment sleeves
9. Bond breaker tape

B. Material Certifications: submit certifications showing compliance for the following:

1. Fly ash
2. Sieve analysis for structural concrete aggregates:

   a. Coarse aggregate
   b. Fine aggregate

C. Structural Concrete Mix Designs for each class of concrete.

D. Concrete Delivery Tickets: Submit sample ready-mixed concrete delivery tickets in accordance with ASTM C94 for each class of concrete.

1.5 QUALITY ASSURANCE

A. Concrete Contractor shall have a minimum of five (5) years of experience in placing and finishing concrete of similar scope and finish quality required of this project.

B. Manufacturer Qualifications: Manufacturer of sealer products shall have minimum ten (10) years of experience in the production of the specified products.

C. Substitutions: The use of any products other than those specified shall be considered providing that the Contractor requests its use in writing. This request shall be accompanied by:

1. A certificate of compliance from the material manufacturer stating that the proposed products meet or exceed the requirements specified.
2. Documented proof that the proposed material has a ten (10) year proven record of performance for surfacing or coloring concrete, confirmed by at least five (5) local projects that the Owner' can examine.
3. Approval for the substitution is at the Owner's discretion.

D. Regulatory Requirements:

1. Products shall comply with the United States Clean Air Act for maximum Volatile Organic Compound (VOC) content as specified in Part 2 of this section.

E. Source Limitations: Obtain each specified material from same source and maintain high degree of consistency in workmanship throughout Project.

F. Cast-in-Place Concrete Sample(s):

1. Flatwork

a. Construct using same ratio of components to be used by the batch plant to provide for pour color consistency.

b. Jobsite mock-up sample(s): Cast one (1) each 6-foot square x 4-inch-thick sample for type of texture. Provide formed and detailed expansion joint for mockup up within panel. Include required joints and surface treatment. The contractors selected concrete batch plant is to provide materials for all jobsite mock-ups, the components provided shall include all matrix items including admixtures approved in preliminary mix-design submittals. The mock-up will simulate job conditions as closely as possible. Materials for mock-ups that do not comply with batch plant supplier requirements and/or mix designs will be rejected.

c. Joint and surface of mockup samples to include: Expansion Joint Material, Joint Sealant, and Sealer.

2. Playground Edge

a. Construct using same ratio of components to be used by the batch plant to provide for pour color consistency.

b. Jobsite mock-up sample(s): Cast one (1) eight (8) foot long sample for shape, edges and type of texture. Provide formed and detailed expansion joint for mockup up within edging. Include required joints and surface treatment. The contractors selected concrete batch plant is to provide materials for all jobsite mock-ups, the components provided shall include all matrix items including admixtures approved in preliminary mix-design submittals. The mock-up will simulate job conditions as closely as possible. Materials for mock-ups that do not comply with batch plant supplier requirements and/or mix designs will be rejected.

c. Joint and surface of mockup samples to include: Expansion Joint Material, Joint Sealant, and Sealer.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Transporting: Ready-mixed concrete supplier shall have sufficient capacity and adequate facilities to provide continuous delivery at the rate required for continuous placement throughout any sequence of placement.

B. Storage of Materials:

1. Store cement in weather tight buildings or bins which prevent intrusion of moisture or contaminates. Store different types of cement in separate facilities.
2. Stockpile aggregates to prevent segregation and contamination with other materials. Thaw frozen aggregates before use.
3. Sand shall be drained to a uniform moisture content before use.
4. Store admixtures securely to prevent contamination, evaporation, damage or temperature variation in excess of the range recommended by the manufacturer.

C. Delivery: Truck mixers, agitators and non-agitating units shall conform to the applicable requirements of ASTM C94, "Specification for Ready-Mixed Concrete".

D. Deliver the specified products in original, unopened containers with legible manufacturer's identification and information.

E. Store specified products in conditions recommended by the manufacturer.

1.7 PROJECT CONDITIONS

A. Environmental Conditions: Maintain an ambient temperature of between 50° and 90° F during application and at least forty-eight (48) hours after application.

B. Protection: Precautions shall be taken to avoid damage or contamination of any surfaces near the work zone. Protect completed stain work from moisture, damage or contamination.

1.8 GENERAL REQUIREMENTS

A. All concrete work shall be true to line and grade as indicated on the drawings. The Contractor shall be responsible for proper drainage, without birdbaths, on all concrete paving surfaces. Any discrepancies or omissions on drawings, or conditions on the site, which prevent this Contractor from providing proper drainage shall be brought to the attention of the Owner in writing for correction or relief before work proceeds

1.9 FINAL ACCEPTANCE

A. Review Date: Make a written request for review for Final Acceptance at least five (5) working days in advance.

B. Completion: Work will be accepted upon satisfactory completion of all site concrete work.

C. Responsibility: Upon Final Acceptance, Owner will assume responsibility for maintenance of the work.

PART 2 - MATERIALS

2.1 GENERAL FINISHES: See finish schedule on drawings and on details.

2.2 WATER: Provide clean, potable, concrete mixing water free from injurious amounts of salts, oils, acids, alkalis, organic materials or other deleterious matter.

2.3 EXPANSION JOINT MATERIALS FOR PEDESTRIAN ACCESSIBLE PAVEMENTS (these details allow for compliance with TAS requirements for accessible joint widths less than ½" width)

A. Expansion Joint: flexible, lightweight, non-staining, polyethylene, closed-cell expansion joint filler. Chemical-resistant, ultraviolet stable, non-absorbent, low-density, compressible foam per ASTM D4819. Thickness: 1/4 inch with 1/2-inch tear-off strip at top.

1. Acceptable Products/Manufacturers:

a. Ceramar Deck-O-Foam as manufactured by W.R. Meadows, Inc., P.O. Box 338, Hampshire, IL 60140-0338, (800-342-5976), www.wrmeadows.com.

b. BoMetals Non-Cross-Linked Foam as manufactured by BoMetals, Inc., 141 Hammond Street, Carrollton, GA 30117, (800-862-4835), www.bometals.com.

c. Equivalent as approved by the Owner's Representative.

B. Backer Rod (if required): Closed cell foam backer rod of the size recommended by the Manufacturer for the joint sealant.

C. Joint Sealant: Gun-grade, multi-component, self-leveling polyurethane sealant with a Shore 'A' hardness of not less than 40 after 72 hours per ASTM C661.

1. Acceptable Products/Manufacturers:

a. MasterSeal® SL2™ as manufactured by BASF Corporation, Construction Systems, 889 Valley Park Drive, Shakopee, MN 55379, (800-433-9517), www.master-builder-solutions.basf.us.

b. Vulkem® 445SSL as manufactured by Tremco Commercial Sealants and Waterproofing, 3735 Green Road, Beachwood, OH 44122, (800-321-7906), www.tremcosealants.com.

D. Joint Dowel Alignment Sleeves: Polypropylene plastic sleeve dowel to ensure proper alignment of steel dowels.

1. Acceptable Manufacturers:

a. Sika GreenStreak Speed Dowel System as manufactured by Sika U.S., Sika Corporation, 3400 Tree Court Industrial Blvd., St. Louis, MO 63122, (800-325-9504), usa.sika.com.

b. BoMetals QuicLoad Round Dowel System as manufactured by BoMetals, Inc., 141 Hammond Street, Carrollton, GA 30117, (800-862-4835), www.bometals.com.

E. Bond breaker tape to be as recommended by sealant manufacturer.

1. Color: To match adjacent concrete surfaces.

2.4 CHALK LINE MARKING OF CONCRETE FOR SAWCUT JOINTS: Use blue chalk only. NO RED chalk shall be used.

2.5 WEAKENED PLANE (TOOLED) JOINTS: Hand tooled joint - 3/8" tool width including 1/8-inch gap by 1/5 slab thickness inch, with 1/8-inch radius.

2.6 SAWCUT JOINTS (if used): Concrete saw joint, 1/5 slab thickness x 1/8-inch width, accurately constructed true to alignment and location. Extend all saw cuts to the end of each concrete panel to control cracks. Pull up radial cuts prior to curbs or other pavements. Provide specialty hand cutting tools to extend full depth of cut to edge of adjacent pavements with no overcut. Do not overlap cuts into adjacent concrete panels or onto curbs. Refer to drawings for locations.

2.7 CONSTRUCTION JOINTS: Concrete joint shall be formed to provide a recess for sealant application, per details, to prevent moisture access from the surface.

2.8 BROOM FINISH FOR PEDESTRIAN ACCESSIBLE SIDEWALKS, RAMPS AND PLAYGROUND EDGE: Medium broom finish – approved sample shall set compliance standard for project walks.

2.9 TROWEL FINISH FOR PLAYGROUND SUBSLAB/SURFACING BASE: Smooth trowel finish – approved sample shall set compliance standard for subslab.

2.10 EPOXY GROUT: To be Sika, Sikadur 32 or approved equal. Minimum compressive strength value of 8500 psi. Provide colors per drawings and specifications to match adjacent pavement colors.

PART 3 - EXECUTION

3.1 FINISHES

A. Broom Finish:

1. Shall be obtained by drawing a stiff bristled broom across a floated finish.
2. Direction of brooming to be perpendicular to direction of walk or as otherwise shown on Drawings.
3. Direction of brooming on playground edge to be perpendicular to the linear length of the edging.
4. Depth of Finish: Use brooms of the required graduation and depth to finish the paving surface to achieve specified depth:

a. Medium Broom Finish: Approximately one-sixteenth (1/16) to one-eighth (1/8) inch depth.
b. Heavy Broom Finish: Approximately one-eighth (1/8) to three-sixteenth (3/16) inch depth.

B. Trowel Finish:

1. Shall be obtained by using a trowel to provide a firm smooth surface without surface voids or pockets to a floated finish.

3.2 JOINTS

A. Tooled Score Joints:

1. Score joints shall be formed in the fresh concrete using a jointer to cut the TAS/ADA compliant groove so that a smooth uniform impression is obtained.
2. All joints shall be struck before and after brooming or applying reconstructed stone.

3. Tool marks at edges shall not be visible.
4. Perform in a continuous manner, avoiding misalignment. Redo all crooked or misaligned joints at no cost to Owner.

B. Sawcut Joints: (if applicable)

1. Restrictions: Do not sawcut until after initial cure of slab.
2. Layout all locations of joints as indicated on the drawings and receive approval from Owner's Representative prior to commencement of cutting.
3. Cutting: Using accepted mechanical concrete saw. Employ only experienced personnel. Perform all cuts cleanly and smoothly, to a constant and equal depth per drawings. Perform in as continuous an operation as possible to avoid misalignment of joints. Use forms or templates as required to achieve consistent lines.
4. Controls: Accurately align joints with all adjacent improvements.
5. Protection: Protect all existing and adjacent site improvements during construction of this work. Repair all damage to the satisfaction of the Owner's Representative and at no additional cost to the Owner.

C. Expansion Joints and Edging:

1. Locations: Provide joints at locations and intervals as shown on the Drawings, and at all locations where concrete paving abuts buildings, curbs, or other structures.
2. Provide for staggered pours to provide for tight joints and abutted pours to hold expansion materials in place without gaps or pulling away due to concrete expansion.
3. Placement: Approved joint material shall be placed with top edge one-quarter (1/4) inch below the paved surface and shall be securely held in place to prevent movement.
4. Forming: Form joints and other edges in the fresh concrete using an edging tool to provide a smooth uniform impression. Strike all edges before and after brooming.
5. Sealing: After the curing period, carefully clean expansion joint and fill with approved joint compound to one-quarter (1/4) inch below paved surface. Avoid spilling on paved surfaces or overflow from joint.

D. Bonding Concrete at Construction Joints:

1. In order to secure full bond at construction joints, the surface of the concrete previously placed (including vertical, inclined, and substantially horizontal areas) shall be thoroughly cleaned of foreign materials and latence, if any, and then roughened so that the aggregate will be slightly exposed over ninety (90%) percent of each two (2") inch square area. Such cleaning and roughening shall be done by the use of suitable tools and methods, such as picks, wire brushes, wet sandblasting, etc., and shall be followed by re-cleaning by means of a stream of clean water of compressed air.
2. The previously placed concrete at the joint shall be saturated with clean water and kept thoroughly wet overnight, after which all pools shall be removed by an air jet. After free

or glistening water disappears, the concrete shall be given a thorough coating of neat cement mixed to a suitable consistency. The coating shall be one-eighth (1/8") inch thick on vertical surfaces and one-quarter (1/4") inch thick on horizontal surfaces, and shall be well scrubbed in by means of stiff bristle brushes wherever possible. New concrete shall be deposited before the neat cement dries.

3.3 EPOXY GROUT

A. Mix, install and cure epoxy grout in strict accordance with manufacturers written instructions.

B. Holes for insertion of dowels shall be drilled to the diameter and depth as indicated on the drawings. All holes shall be cleaned by brushing and blasting out with compressed air. Do not drill the hole greater than one-quarter (1/4") inch larger than the diameter of the insert.

3.4 PROTECTION AND CURING

A. Protection:

1. Protect concrete work against rapid drying and damage by rain.
2. Keep concrete moist for at least seven (7) days. Protect with wet burlap, canvas covering or liquid-curing compound. Use a covering that will not stain or discolor finished concrete surfaces. Secure acceptance of proposed method. During curing period, maintain concrete above 70 degrees F, for at least three (3) days or above 50 degrees F, for at least five (5) days.

B. Spraying: Spray concrete during the curing period as frequently as drying conditions may require.

C. Curing: Cure concrete in accordance with the ACI Manual of Concrete Practice.

D. Damage and Defacement: Protect all concrete work against damage and defacement during subsequent construction operations until Final Acceptance.

3.5 CLEANING AND PATCHING

A. All projecting fins, bolts, wire, nails, etc., not necessary for the work shall be removed or cut back one (1) inch from the surface and patched in an inconspicuous manner.

B. All defects in concrete work shall be corrected, voids shall be chipped to a depth of at least one (1) inch with the edges perpendicular to the surface and parallel to form markings. Voids, surface irregularities, or honeycombing shall be filled by patching or rubbings as directed by the Owner's Authorized Representative and shall be done at the Contractor's expense. Concrete surfaces so repaired shall duplicate the appearance of the unpatched work. Thoroughly remove residual curing membrane before any patchwork is started.

C. Any defective concrete work, which after corrective patching, rubbings, etc., fails to duplicate the appearance of unpatched work and/or conform to the standards set forth in these specifications shall be removed in its entirety and replaced at no additional cost to the Contract.

3.6 JOINT SEALANT

A. Clean, point and prepare all joints per manufacturer's recommendations to depth for full contact of expansion joint sealant with concrete.

B. Remove all debris from joints and site project prior to installation of sealant to prevent blowing of debris back across sealant.

C. Protect all areas from foot traffic during installation and curing to prevent damage to sealant and adjacent concrete surfaces.

D. Install sealant into joints per manufacturer's directions and in temperature conditions that are recommended to ensure that the sealant does not run out of the joint.

E. Joints shall be flush with adjacent surfaces at faces of buildings to prevent ponding or holding of water.

F. Joints in all paving and banding shall be installed per depth as compliant with American with Disabilities Act (ADA) and Texas Accessibility Standards (TAS) such that they shall be less than one-quarter (1/4) inch in depth.

G. Joints that do not comply with the above requirements will be replaced at no cost to the Owner.

3.7 CLEAN-UP

A. General: All areas shall be maintained in a clean and orderly manner at all times. Debris, excess product and other rubbish shall be removed daily.

B. Clean up all sealant from adjacent surfaces per manufacturer's directions.

C. Upon completion of work, immediately remove from the premises all surplus materials, tools, equipment, rubbish and debris resulting from the work.

END OF SECTION 321314

SECTION 321373 - CONCRETE PAVING JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Cold-applied joint sealants.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project Site

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each kind and color of joint sealant required.

1.4 INFORMATIONAL SUBMITTALS

A. Product certificates.

B. Product test reports.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backing materials, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.

2.2 COLD-APPLIED JOINT SEALANTS

A. Single-Component, Self-Leveling, Silicone Joint Sealant: ASTM D5893/D5893M, Type SL.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following

a. Crafco Inc., an ERGON Company, Rodsaver Silicone SL
b. Dow Corning Corporation: 890-SL
c. Pecora Corporation: 300 SL

2.3 JOINT-SEALANT BACKER MATERIALS

A. Round Backer Rods for Cold- and Hot-Applied Joint Sealants: ASTM D5249, Type 1, of diameter and density required to control sealant depth and prevent bottom-side adhesion of sealant.

PART 3 - EXECUTION

3.1 INSTALLATION OF JOINT SEALANTS

A. Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated unless more stringent requirements apply.

B. Cleaning of Joints: Clean out joints immediately to comply with joint-sealant manufacturer's written instructions.

C. Joint-Sealant Installation Standard: Comply with recommendations in ASTM C1193 for use of joint sealants as applicable to materials, applications, and conditions.

D. Install joint-sealant backings to support joint sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of joint-sealant backings.
2. Do not stretch, twist, puncture, or tear joint-sealant backings.
3. Remove absorbent joint-sealant backings that have become wet before sealant application and replace them with dry materials.

E. Install joint sealants immediately following backing installation, using proven techniques that comply with the following:

1. Place joint sealants so they fully contact joint substrates.
2. Completely fill recesses in each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

F. Provide joint configuration to comply with joint-sealant manufacturer's written instructions unless otherwise indicated.

G. Clean off excess joint sealant as the Work progresses, by methods and with cleaning materials approved in writing by joint-sealant manufacturers.

END OF SECTION 321373

SECTION 323119 - DECORATIVE METAL FENCES AND GATES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Decorative metallic-coated-steel tubular picket fences.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project Site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For fencing and gates.

1. Include plans, elevations, sections, and attachment details.
2. Include diagrams for power, signal, and control wiring.

C. Samples: For each fence material and for each color specified.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

B. Product test reports.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Wind Loading: Comply with ASCE/SEI 7 requirements for fence height, wind exposure, design wind speed, and design wind pressure.

B. Lightning-Protection System: Maximum grounding-resistance value of 25 ohms under normal dry conditions.

2.2 DECORATIVE METALLIC-COATED-STEEL TUBULAR PICKET FENCES

A. Decorative Metallic-Coated-Steel Tubular Picket Fences: Comply with ASTM F2408 for residential application (class) unless otherwise indicated.

B. Post Caps: Formed from steel sheet and hot-dip galvanized after forming

C. Pickets: Square tubes.

1. Terminate tops of pickets at top rail for flush top appearance, as seen in plans.
2. Picket Spacing: 4 inches clear, maximum.

D. Metallic-Coated Steel Sheet: Galvanized-steel sheet or aluminum-zinc, alloy-coated steel sheet.

E. Finish: Hot-Dip Galvanized after fabrication in accordance with ASTM A 123.

2.3 STEEL AND IRON

A. Plates, Shapes, and Bars: ASTM A36/A36M.

B. Bars (Pickets): Hot-rolled, carbon steel complying with ASTM A29/A29M, Grade 1010.

C. Tubing: ASTM A500/A500M, cold-formed steel tubing.

D. Bar Grating: NAAMM MBG 531.

E. Galvanized-Steel Sheet: ASTM A653/A653M, structural quality, Grade 50, with G90 or G60 coating.

2.4 STEEL FINISHES

A. Surface Preparation: Clean surfaces according to SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning." After cleaning, apply a conversion coating compatible with the organic coating to be applied over it.

B. Powder Coating: Immediately after cleaning, apply manufacturer's standard two-coat finish consisting of epoxy primer and TGIC polyester topcoat to a minimum total dry film thickness of not less than 8 mils. Comply with coating manufacturer's written instructions.

1. Color and Gloss: As indicated by manufacturer's designations

C. Primer Application: Apply zinc-rich epoxy primer immediately after cleaning, to provide a minimum dry film thickness of 2 mils per applied coat, to surfaces that are exposed after assembly and installation, and to concealed surfaces.

D. High-Performance Coating: Apply intermediate and polyurethane topcoats to prime-coated surfaces. Comply with coating manufacturer's written instructions and with requirements in SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting. Apply at spreading rates recommended by coating manufacturer.

1. Match approved Samples for color, texture, and coverage. Remove and refinish, or recoat work that does not comply with specified requirements.

2.5 METALLIC-COATED-STEEL FINISHES

A. Galvanized Finish: Clean welds, mechanical connections, and abraded areas and repair galvanizing to comply with ASTM A 123

B. Surface Preparation: Clean surfaces of oil and other contaminants. Use cleaning methods that do not leave residue. After cleaning, apply a zinc-phosphate conversion coating compatible with the organic coating to be applied over it. Clean welds, mechanical connections, and abraded areas and apply galvanizing repair paint, complying with SSPC-Paint 20, to comply with ASTM A780/A780M.

C. Powder Coating: Immediately after cleaning and pretreating, apply manufacturer's standard TGIC polyester powder-coat finish to a minimum dry film thickness of 2 mils.

1. Color and Gloss: As indicated by manufacturer's designations

D. Powder Coating: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat finish consisting of zinc-rich epoxy prime coat and TGIC polyester topcoat to a minimum dry film thickness of 2 mils. Comply with coating manufacturer's written instructions to achieve a minimum total dry film thickness of 4 mils.

1. Color and Gloss: As indicated by manufacturer's designations

E. High-Performance Coating: Apply epoxy primer, polyurethane intermediate coat, and polyurethane topcoat to prepared surfaces. Comply with coating manufacturer's written instructions and with requirements in SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting. Apply at spreading rates recommended by coating manufacturer.

1. Match approved Samples for color, texture, and coverage. Remove and refinish, or recoat work that does not comply with specified requirements.

PART 3 - EXECUTION

3.1 DECORATIVE FENCE INSTALLATION

A. Install fences according to manufacturer's written instructions.

B. Install fences by setting posts as indicated and fastening rails and infill panels to posts.

C. Post Excavation: Drill holes for posts in concrete trail. Excavate holes to a diameter of not less than 3 inches and a depth of not less than 6 inches.

D. Post Setting: Set posts in epoxy grout at indicated spacing into core drilled holes in concrete.

1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.
2. Space posts uniformly at 5 feet o.c.

3.2 FIELD QUALITY CONTROL

A. Testing Agency: Texas Parks and Wildlife will engage a qualified testing agency to perform tests and inspections.

END OF SECTION 323119

Ray Roberts Lake State Park
Isle Du Bois – Flood Damage Repairs
Texas Parks and Wildlife
Project Number 128302

SECTION 328424 - LANDSCAPE TEMPORARY IRRIGATION

PART 1 – GENERAL

1.1 REFERENCES

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

AMERICAN SOCIETY OF SANITARY ENGINEERING (ASSE)

ASSE Series 5000	(2015) Cross-Connection Control Professional Qualification Standard

FOUNDATION FOR CROSS-CONNECTION CONTROL AND HYDRAULIC RESEARCH (FCCCHR)

FCCCHR List	(continuously updated) List of Approved Backflow Prevention Assemblies

1.2 RELATED REQUIREMENTS

Refer to SECTION 32 92 00 TURFGRASS, 32 93 00 LANDSCAPING and 32 01 30 LANDSCAPE MAINTANCE FOR ONE YEAR for specific watering requirements to establish plant material.

1.3 SCOPE DESCRIPTION AND WATER SOURCES

The Contractor shall supply temporary irrigation to provide full, 100% coverage to the newly seeded and sodded areas and new tree and pocket planting at his discretion and with the Owner's approval. The Contractor may provide watering trucks, manual watering with hoses or a temporary piping system to deliver the water. For temporary piping system, the Contractor shall supply piping, valves, heads, backflow preventer and other materials and equipment to fully irrigate the seeded and sodded areas.

A. POTABLE WATER
The Contractor may utilize potable water on the site where indicated on the plans.

1.4 SUBMITTALS FOR OWNER REVIEW AND APPROVAL

A. Temporary Irrigation

1. Description of means and methods

The Contractor shall submit a description of the means and methods to provide watering during installation until final acceptance and for one-year maintenance. Means and methods shall be described for each type of planted material: seeded areas, sodded areas, planted areas (with container planting), and trees. The Contractor shall identify on a drawing connections to the water sources, rough layout of any hose lines.

2. Irrigation sprinkler system

If desired, the Contractor may provide a temporary above grade irrigation system. If so, the Contractor shall submit a drawing showing the connections the water sources, pump locations, and rough layout of the main line. Drawings with irrigation legend shall be prepared by a licensed Irrigation Designer registered in the state of Texas.

3. Protection of equipment

The Contractor shall provide the necessary fencing and other means to protect temporary irrigation products and equipment and to keep it operational during the plant establishment. Tres will need watering bags for the full year of landscape establishment. The Contractor will replace watering bags and other equipment as needed.

B. Product Data

Submit product data for the following if used as part of the temporary irrigation.

Tree watering bags
Hoses
Backflow Preventers
Automatic or Manual Controller
Water meter
Rain shut-off device
Freeze shut-off device
Soil moisture sensor
Tapping tee
Valve boxes and lids
Drip head accessories

C. Owner Review and Approval

The Owner will review and approve the Contractor's means and methods to water the planting.

1.5 PERMIT AND IMPACT FEES

The Contractor shall incur the costs for any permits, impact fees and water usage fees to provide temporary irrigation.

PART 2 – PRODUCTS

2.1 TEMPORARY IRRIGATION

The Contractor shall provide products at his discretion and risk to provide watering to newly installed grasses and planting.

2.2 WATERING BAG

The Contractor shall supply slow release watering bags for trees that are installed. Use minimum 20 gallon for trees.

PART 3 – EXECUTION

3.1 INSTALLATION

Install temporary irrigation equipment after site grading and topsoil distribution and amendments have been completed.

3.2 FIELD QUALITY CONTROL AND TESTING

The Contractor assumes all risk and responsibility for the effective operation of the temporary irrigation system. Pressure testing will not be required.

Conduct testing of the back-flow preventer as required by the Governing Authority if potable water is used.

3.3 WATERING

A. General Guidelines

Start watering of installed plants and seeded, sodded areas immediately as needed to enhance germination and growth. To achieve a full stand of grass, the seed must be kept moist to germinate. Native grass seeds have thick hulls which take more time to germinate than non-native bermudagrass which is sold with the hulls removed. Frequent watering will increase the speed and success of germination and seedling growth. Solid sod and container plants also require frequent watering to support root growth and prevent root desiccation. Keep tree root balls moist. Refer to specifications for additional watering guidelines: 32 92 00 Turfgrass, 32 93 00 Landscaping and 32 01 30 Landscape Maintenance of Site Improvements – One year.

Irrigation/watering should occur during times when water loss from evaporation is lowest due to winds and temperature, but without potentially creating a disease prone environment.

Irrigation/watering should not occur after a sufficient rain event or when otherwise unnecessary. Use watering regimes that prevent erosion.

B. Water Application Guidelines

The following application rates are guidelines and should be adjusted by the Contractor for site conditions. Apply water at a rate sufficient to insure thorough wetting of soil to a depth of 2-inches without run off for all planted, seeded and sodded areas. During the germination process, seed is to be kept actively growing and not allowed to dry out.

C. Seeded Areas

Seeded areas require the most water since they take the longest to establish from germination to seedling to mature plants. For germination, all newly seeded areas will receive 0.25 inches of water per day for first 2 weeks days to prevent germinating seeds from drying out. Thereafter as young seedlings, a deep watering is needed to maintain soil moisture the next 2 months. This will require about 1-inch irrigation event every week or twice a week under hot dry conditions. During the mature seedling phase, there should be a minimum watering of 1-inch every two weeks as needed to supplement rainfall. The following watering activity is recommended when natural rainfall is not sufficient to keep the seed and root bed moist.

1. Germination period - Water to apply about 0.25 inches per day (or approximately two to three times per day for five minutes) until germination and seedling reaches one to two-inch height. Germination periods vary for the seed mixes as follows:

    a. Bermuda grass - 2 to 3 weeks.

2. Young seedling phase - Reduce watering frequency, but increase the amount of water applied to stimulate root growth. Deep watering is needed to maintain soil moisture to at least 6-inch depth every week for the next two months. This will require about 1-inch irrigation event every week or twice a week under hot dry conditions.

    a. First 2 weeks - Water once or twice per day (depending on evaporation) to keep root zone moist.

    b. Next 2 weeks - Water once per day or once every other day to keep root zone moist.

    c. Continue watering until plants reach four to five inches height.

3. Mature seedling phase (plants that are minimum 4-5" height) - Provide watering as needed when grasses turn pale gray (indicating that soil moisture need to be replenished.) During the growing season, (March - October inclusive for warm season grasses; and October - April inclusive for cool-season grasses) there should be a minimum watering of 1-inch every two weeks. Continue watering until grasses reach ten to twelve-inch height.

D. Solid Sodded areas

Water is only needed from 4 to 6 weeks to achieve a well rooted sod that can survive on rainfall.

1. First two to three weeks: Perform watering daily to keep sod roots continuously moist and to maintain moist topsoil to a depth of at least 4 inches. Water during heat of day to help prevent wilting. Water with frequent, light watering and avoid runoff or puddling. Water may be needed more than once a day depending on weather conditions.
2. Remaining weeks: Perform watering weekly, decreasing frequency and increasing amount per application to encourage deep root growth. Water more frequently as needed during heat to prevent desiccation. Water during heat of day to help prevent wilting.
3. After six weeks, provide additional watering if the grass appears stressed.

E. Plants and Trees

1. Plugs and container plants consist of vibrant plants and roots that need to become well rooted into the soil and able to subsist on rainfall.
2. Plants installed in seeded or sodded areas will receive watering as needed if wilting occurs and provide additional watering as needed for plant growth.
3. Plant establishment: After eight weeks have passed, provide additional watering if the plants appear stressed.
4. Trees: provide watering bags for slow release and provide supplemental watering as needed to promote tree growth. Leave watering bags on site for Owner's use after one-year landscape maintenance. Provide deep root watering throughout the one-year maintenance.

3.4 FINAL ACCEPTANCE AND ONE YEAR MAINTENANCE

A. Watering and One Year Maintenance

Provide continued watering as needed to achieve a mature, dense stand and plants in vigorous condition and for required supplemental seedings. Provide watering to trees, plants, seeding and sodding until plants are established and receive Final Acceptance. Refer to Section 32 92 00 for coverages required for Final Acceptance of seeded and sodded areas. Note that Final Acceptance may occur during or at the end of the One Year Landscape Maintenance period. It is anticipated that watering will continue for one year for the trees and container plants and that tree watering bags will remain on site for the Owner's use after Final Acceptance.

B. Repair

Repair and replace irrigation products and equipment to provide a healthy, vigorous planting at the end of the One Year Landscape Maintenance or as Final Acceptance occurs of seeded areas and sodded areas.

C. Dismantling equipment

Upon Final Acceptance of the seeded and sodded areas, the Contractor shall dismantle any irrigation equipment and remove the equipment from the site. The equipment shall not be removed when the site is moist or muddy to prevent damage to the seeding and sodding. The Contractor shall take care to minimize injury to the seeded/sodded areas when dismantling. The Owner's Representative shall inspect the site after the equipment has been removed, to deem Final Acceptance of the temporary irrigation.

END OF SECTION 328424

SECTION 329200 – TURF GRASS

PART 1 – GENERAL

1.1 SCOPE

A. Furnish all work and materials, appliances, tools, equipment, facilities, transportation, and services necessary for and incidental to performing all operations in connection with the installation of the sod.

B. Conform to the requirements of the general conditions of the contract.

1.2 SUMMARY

A. Section Includes:

1. Soils Test/Analysis Report of existing site soils.
2. Installing stockpiled existing topsoil.
3. Providing organic compost.
4. Initial (1st) removal of weeds and invasive Bermuda grass on site.
5. Spike harrowing/ripping/breaking-up/shattering of compacted site soils.
6. Soil preparation and tilling imported topsoil and compost into existing rough graded subbase soils.
7. Hand or deep-tine aerifier mixing organic compost into existing soil at root zone of existing trees to remain.
8. Fine grading and removal of debris.
9. Germinating weeds and Bermuda grass for second (2nd) eradication prior to sodding.
10. Hand removal or raking away of dead weeds.
11. Sodding and seeding of grass as designated on landscape plans.
12. Establishment of grass.

B. Alternates: Refer to "Alternates" for description of Work in this Section affected by alternates.

1.3 REFERENCES

A. Codes and regulations of the jurisdictional authorities.

B. Reference Codes and Standards

1. AASHTO: M140, M208.
2. ASTM: C33, C51.
3. U.S. Department of Agriculture and Texas Department of Agriculture
4. Federal Seed Act

1.4 QUALITY ASSURANCE

A. Qualifications:

1. Manufacturer: Company specializing in manufacturing Products specified with minimum five (5) years documented experience.
2. Installer: Company specializing in performing the Work of this Section with minimum five (5) years documented experience.

B. Inspections:

1. Make written request for inspection after sodding operations have been completed. Such inspection is for the purpose of establishing the Maintenance Period.
2. Submit written requests for inspections to the Owner's Authorized Representative at least seven (7) days prior to anticipated inspection date.

1.5 SUBMITTALS

A. Submit the following for approval in accordance with contract related submittals in a single package to the Owner's Authorized Representative no less than sixty (60) days prior to installation.

B. All delivery receipts and copies of invoices for materials used for this work shall be subject to checking by the Owner's Authorized Representative. The Contractor shall offer proof of materials' compliance to the specifications to the Owner's Authorized Representative prior to installation. Various samples, certificates, and specifications of sod, and other materials shall be submitted for approval as required by subsequent sections of this specification and Section 32 9300. The Contractor should submit the following certification to the Owner's Authorized Representative prior to installation.

1. Sod: Certified, each delivery bearing a certification tag and label as required by law.
2. Seed: Certified, each delivery bearing a certification tag and label as required by law
3. Mature Organic Compost: Submit a one (1) gallon sample for spreading as specified in Section 2.5. Submit manufacturer's product information regarding composition and pH as specified.
4. Sources: No less than sixty (60) days prior to installation, notify Owner and Owner's Authorized Representative in writing of source of sod required for the project.
5. Organic Fertilizer: Copy of product information labeled with manufacturer's name and address and chemical analysis.
6. Organic Herbicide: Copy of product information labeled with manufacturer's name and address and chemical analysis. Submit manufacturer's information or cut sheets on products.
7. Organic Fungicide: If requested, provided copy of product information labeled with manufacturer's name and address and chemical analysis. Submit manufacturer's information or cut sheets on products.

8. Organic Insecticide(s): If requested, provide copy of product information labeled with manufacturer's name and address and chemical analysis. Submit manufacturer's information or cut sheets on products.

C. Work Schedule: The seeding sodding of grass must occur at stipulated times. Also, time periods are specified to achieve an acceptable stand. Therefore, the Contractor must submit a schedule for the work of this section so that the grass can achieve full coverage as specified by the contract completion date. The schedule must be submitted no less than sixty (60) days prior to installation for review and approval of the Owner's Authorized Representative, Architect and Owner's Authorized Representative. Refer to Subsection 1.11.

D. Submit Maintenance Instructions upon final acceptance. Refer to Subsection 3.8, Paragraph K.

E. Special Warranty: Submit written special warranty registered with manufacturer as specified in this Section.

F. Provide documentation and testing of compost materials as specified in Parts 2 and 3 of this section.

G. Maintenance Instructions: Submit two (2) copies of typewritten instructions showing compliance with Landscape Maintenance Section 320190 for one (1) full year. Submit to Owner's Authorized Representative for approval. Submit two (2) copies of revised instructions prior to expiration of Contractor's maintenance period(s) required under the contract.

1.6 SELECTION AND ORDERING OF PLANTING MATERIALS

A. Documentation: Submit documentation no less than sixty (60) days prior to installation that all materials have been ordered.

B. Unavailable Materials: If proof is submitted that any of the materials specified is not obtainable, a proposal will be considered for use of the nearest equivalent variety with corresponding adjustment of Contract price. Substantiate such proof in writing no less than sixty (60) days prior to installation.

C. Special Conditions: The above provisions shall not relieve Contractor of the responsibility for obtaining specified materials in advance if special growing conditions or other arrangements must be made in order to supply specified materials.

1.7 JOB CONDITIONS AND PROVISIONS

A. Carefully maintain all site benchmarks, layout points and other points established by other contractors. If destroyed, replacement will be by this Contractor.

B. Coordinate all work of this Section with other on-site contractors and the Owner. Give advanced notice on sequencing of this work so not to affect the operations of other contractors.

C. All turf grass work shall be performed under the direct supervision of a superintendent and laborers thoroughly experienced with the work of this Section and who shall be at the project site for the duration of the work.

D. No turf grass work shall take place during inclement weather or when the ground conditions are, in the opinion of the Owner's Authorized Representative, not in a condition to be properly worked.

E. No turf grass operations shall occur earlier than April 15th nor later than August 30th. If sod is to be installed from October 15th to March 15th, then provide temporary installation of cereal rye grass for winter establishment. Remove cereal rye grass prior to April 15th and install sod.

F. Erect barricades, snow fencing, hire temporary watchmen or whatever is deemed necessary by the Contractor to totally protect all turf grasses and wildflower areas until one hundred (100%) percent established.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Materials and supplies are subject to inspection and sampling for testing. Allow no seed, fertilizer, straw, or other agronomic materials or supplies on Work site other than those for the Project.

1. Sod:

a. Deliver sod to job within twelve (12) hours after being cut; place sod within twenty (20) hours after being cut. Allow sod only eight (8) hours maximum on site.

b. Prior to and after delivery during wet weather, allow sod to dry to the extent that will prevent tearing during handling and laying. During dry weather, water sod to ensure its vitality and prevent dropping of the soil in handling.

c. Analysis of purity and germination tag.

d. Certification tag.

B. Organic Biological Fertilizer: Labeled with manufacturer's name and address, guaranteed analysis, including nutrient and its derived source, listing of potential acidity, and any toxic materials.

C. Organic Biological Fungicide: Labeled with manufacturer's name and address and analysis, warnings, safety instructions, and application requirements.

D. Organic Herbicide: Labeled with manufacturer's name and address and analysis, warnings, safety instructions, and application requirements.

E. Organic Insecticide: Labeled with manufacturer's name and address and analysis, warnings, safety instructions, and application requirements.

1.9 PROJECT CONDITIONS OR SITE CONDITIONS

A. Verify and examine site conditions with the Owner's Authorized Representative. Proceed when official notice is given to the Contractor that the work site is ready. Proceed with tree protection prior to any site work, demolition or grading.

1.10 SEQUENCING

A. Coordinate grading, soil preparation and other related units of Work specified in other Sections to ensure that grass seed can be supported and installed as indicated.

B. Coordinate with General Contractor for construction sequencing. Site area around detention pond must be stabilized with sod to prevent seed from washing away and to prevent sedimentation.

1.11 SCHEDULING

A. **Submit a proposed work schedule to the Owner for approval no less than sixty (60) days prior to start of installation.** After approval, no modification shall be made to this schedule without written authorization by the Owner. List anticipated start and stop dates for each segment of work up to and including final acceptance.

B. Provide schedule to reflect sequencing issues for stabilization of site prior to sodding and seeding.

C. In general, the work shall proceed as rapidly as the site becomes available, consistent with normal seasonal limitations for turf grass work.

D. Note: The grass must be fully, one hundred (100%) percent established by the contract completion date. The Contractor should allow for a minimum of one hundred (100) days to establish the grasses.

PART 2 – PRODUCTS

2.1 SOD FOR TURF

A. Well-rooted certified sod, at least eighteen (18) months old.

1. '419' Tifway Bermuda Grass (Cynodon dactylon x C. transvaalensis 'Tifway 419 or Tifton 419')

B. Sod and attached soil free from any noxious weeds such as quack grass, garlic, Johnson grass, dallisgrass, nutsedge, Canada thistle, and other turf weeds.

C. Mowed in production field to height of not more than 2-1/2 inches within five (5) days prior to lifting.

D. Machine cut in sections not less than 2-1/2 feet in length nor less than 12-inches in width and to a depth equal to growth of fibrous roots, uniform soil thickness of ¾-inch, plus or minus ¼-inch. Measurement for thickness to exclude top growth and thatch.

E. Cut in sections or strips strong enough to support its' own weight and retain size and shape when suspended vertically from firm grasp on upper ten (10) percent of section. Small, irregular or broken pieces of sod are prohibited.

F. Option: Machine cut for Big Roll and to a depth equal to growth of fibrous roots, uniform soil thickness of 3/4 inch, plus or minus 1/4 inch. Measurement for thickness to exclude top growth and thatch.

G. Option: Cut in Big Roll strips strong enough to support its own weight and retain size and shape when unrolled. Small, irregular or broken pieces of sod are prohibited.

2.2 SEED: Provide State-certified seed of the latest season's crop delivered in original sealed packages, bearing producer's guaranteed analysis for percentages of mixtures, purity, germination, weed seed content, and inert material. Label in conformance with AMS Seed Act and applicable state seed laws. Wet, moldy, or otherwise damaged seed will be rejected.

A. Seed Purity

Compute percent pure live seed (%PLS) by adding percent germination to percent firm or hard seed. Divide the sum by 100. Multiply this product by the percent purity.

$$\text{Percent PLS} = \frac{(\text{Percent Germ.} + \text{Percent Firm or Hard Seed}) \times \text{Percent Purity}}{100}$$

Minimum PLS requirements are shown below:

Common Name	Minimum PLS (Percent)	Coverage Lbs./1000 SF
Bermudagrass, Common	85	2.0
Temporary Seeding (Cover crop)		
Rye Grain, Cereal (Secale cereale)		2.3

In addition, all grass seed will meet minimum of 98 percent purity and 85 percent germination, as indicated on the labels. Weed seed shall not exceed 0.5 percent by weight of the total of pure live seed and other material in the mixture.

2.1 ORGANIC BIOLOGICAL FERTILIZER: to build soil structure within developed environment. Synthetic fertilizers will not be used due to runoff issues and per iSWM (Integrated Storm Water Management) best practices.

A. Homogenous, granulated all organic biological fertilizer containing soil microbes, endo & ecto mycorrhizal fungi, vitamins, minerals, plant hormones, stimulators, essential carbon and protein: MicroLife Multi-Purpose 6-2-4 All Organic Biological Fertilizer, as supplied by San Jacinto Environmental Supplies, (713) 957-0909, local representative: Lanse Fullinwider, cell: (214-534-2317), or equivalent product as approved by the Owner's Authorized Representative or Landscape Architect.

B. See 3.4 H. for application rate to amended soils.

2.2 STOCKPILED TOPSOIL – available on site.

After being stockpiled, topsoil will be depleted of organics due to excessive heat within the core of the pile. Test and amend the topsoil to have between 5 and 15 percent of total dry weight. Topsoil may be amended with compost meeting requirements of 2.5 below to meet organic percent or increase compost application to bed preparation to provide the additional percent.

2.3 IMPORTED TOPSOIL (IF NEEDED)

A. Sandy Loam (Imported topsoil): sandy loam topsoil which is friable, fertile, dark loamy soil, free of clay lumps, subsoil, stones and other extraneous material and free of weeds and foreign grasses. Loam containing dallisgrass and nutgrass (nutsedge) will be rejected. Physical properties as follows:

1. Clay: between 10 and 20 percent
2. Silt: between 20 and 30 percent
3. Sand: approximately 60 percent
4. Organic matter: between 5 and 15 percent of total dry weight. Imported topsoil may be amended with compost meeting requirements of 2.6 below to meet organic percent.

2.4 COMPOST - Professional Compost or Mature Organic Compost – 100% plant based

A. Compost: shall be compost for mix above that is fully finished compost that has been produced by aerobic (biological) decomposition of organic matter and meets or exceeds the requirements set forth by the United States Department of Agriculture, the United States Composting Council (USCC), and State composting requirements. Compost feedstock shall include fully composted cotton burrs, local grass trimmings, leaves, brush and processed wood fiber and shall add an average of 1.1 lbs. N^1, 0.13 lbs. P^1, and 0.8 lbs. K^1 of pure consumable organic nutrients per one (100) square feet for each inch depth added plus minerals and trace elements.

B. Compost shall not include food waste, stable waste, treated lumber, pallets, pine bark, raw manure or mushroom compost waste. Compost shall not include any man-made materials or chemicals. Do not use mixed municipal solid waste compost since it varies from season to season. Ensure compost does not contain any visible inorganic refuse, other physical contaminants, or any substance considered to be harmful to plant growth. It must be turned a minimum of five (5) times and not achieve a temperature greater than 160 degrees Fahrenheit. Each turning cycle should not be shorter than fourteen (14) days minimum. Compost shall be completely composted for a minimum of six to twelve (6 - 12) months. Particle Sizes 97% will pass through a one-half (1/2) inch screen, 99%+ will pass through a three-quarter (3/4) inch screen. Compost material shall have no pungent smell, but rather an earthy smell.

C. Supporting documentation should be made available upon request. The contractor is obligated to provide testing of the compost at the supplier's yard and at the job site for quality assurance.

Acceptable Professional compost is as supplied by Soil Building Systems, 2101 Walnut Hill Lane, Dallas, Texas 75229, (972-831-8181), attention: Baron Ablon, or equivalent as determined by the Owner's Authorized Representative.

Table 1

Physical Requirements for Compost

pH: 7.9 – 8.9
Maturity: germination and vigor greater than 90% in accordance with TMECC 05.05-A, "Germination and Vigor"
Solvita® Compost Maturity Index: value of 7 or higher

D. The contractor is obligated to provide testing of the compost at the supplier's yard and at the job site for quality assurance.

E. TESTING OF THE COMPOST AT THE JOB SITE

NOTE: Contractor is advised to test the designated compost stockpile at the supplier's yard prior to loading to ensure the designated pile passes the compost maturity test. If the compost does not pass the test at the jobsite, it will be rejected.

1. Use Solvita® Compost Maturity Test Kit or approved equal. Solvita® test kit shall be recently purchased and shall be stored in a refrigerator protected from heat until use at the site. (The two parameters which Solvita® measures (CO_2 / NH_3) are the mostly frequently cited factors that correlate closely with maturity and potential phytotoxicity. Ammonia is also an odorous aerosol toxicant and is a potential worker hazard at agricultural and compost facilities.) Provide Compost maturity test results to measure both carbon-dioxide (CO_2) and ammonia (NH_3) evolution and provide a Maturity Index value, useful or compost quality evaluation. Compost maturity test is TMECC Test #05-08A.
2. Provide results to Owner's Authorized Representative at the job site.
3. Physical inspection of the material shall be performed at the same time by the Owner's Authorized Representative.
4. Owner's Authorized Representative has the right to reject the material if it does not meet the above parameters.

2.5 PRE-EMERGENCE - ORGANIC HERBICIDE OR SOIL-SOLARIZATION – for initial weed eradication on site prior to sod installation

A. Chemical Herbicides will not be used due to detrimental effects on the soils and iSWM/LID due to runoff effects.

B. Organic herbicide will be used to remove weeds prior to turf grass installation.

C. Use of any herbicide is to be of limited nature because of the potential to damage the viability of the soil and therefore the retardation of future plant growth.

D. Nonselective organic herbicide such as: Mirimichi Green Pro Weed Control, EPA approved and OMRI listed, as manufactured by Mirimichi Green Express, 418 Hermitage Road, Castle Hayne, NC 28429, (910-602-1681); as supplied by San Jacinto Environmental Supplies, Houston, TX

(713-957-0909), local representative: Lanse Fullinwider, cell: (214-534-2317), or other suppliers.

E. Nonselective organic herbicide, such as Agricultural grade (20%) vinegar or 20% vinegar-based product mixed with citrus oil.

F. Alternate: Soil-solarization – clear sheet roll plastic of at least one and one-half (1 1/2) to two (2) mils thickness treated with ultraviolet (UV) inhibitor in size to cover entire bed area.

2.6 ORGANIC FUNGICIDES

A. As needed for specific conditions.

B. No chemical fungicides shall be used.

C. MicroGro Granular Root Protector - Biological Fungicide as supplied by San Jacinto Environmental Supplies, Houston, TX (713) 957-0909, local representative: Lanse Fullinwider, cell: (214-534-2317), or available locally at Southwest Wholesale Nursery, Lewisville, TX, or equivalent product as approved by the Owner's Authorized Representative or Landscape Architect.

D. Contractor shall recommend products for submittal and approval by the Owner's Authorized Representative or Landscape Architect depending on final plant selections and their susceptibility to certain fungi.

2.7 ORGANIC INSECTICIDE - FIRE ANTS

A. Fire Ant Bait:

1. PayBack® Fire Ant Bait with Conserve® Insecticide (spinosad 0.015%) granular form as manufactured by Southern Agricultural Insecticides, Inc., Palmetto, FL 34220, (941-722-3285).
2. Ferti-lome Come and Get It! Fire Ant Killer with Conserve® Insecticide (spinosad 0.015%) granular form as manufactured by Ferti-lome – Voluntary Purchasing Groups, Inc., 230 FM 87, Bonham, TX 75418.

B. Dusting Powder: Perma-Guard® Commercial Insecticide D-20 (pyrethrins 0.02%, technical piperonyl butoxide 1.0%, silicon dioxide from diatomaceous earth 88.0%) as manufactured by Perma-Guard, Inc., Albuquerque, NM 87102, (505-243-1460), or equivalent product as approved by the Owner's Authorized Representative or Landscape Architect.

2.8 WATER

A. Potable. Available on site. Refer to the irrigation specifications and plans. Truck or other means of watering shall be required to establish turf areas behind the sidewalks where no existing or temporary irrigation system exists.

B. Applied and monitored by Contractor to establish seed and sod areas.

C. Keep sod moist with watering schedules to promote deep roots and to prevent runoff. Overwatering of planting areas should not occur. Refer to irrigation plans.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.

1. Verify that all areas to receive turf grasses are clear of stones larger than one (1) inch diameter, weeds, debris and other extraneous materials.
2. Verify that grades are within one (1) inch plus or minus of the required finished grades. Report all variations in writing.

B. Soil Moisture:

Inadequate Moisture: Do not commence work of this section when soil moisture content is so great that excessive compaction will occur, nor when it is so dry that dust will form in air or that clods will not break readily. Apply water, as necessary, to bring soil to an optimum moisture content for planting.

C. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the owner.

3.2 PREPARATION

A. Examine rough grade, verify elevations noted on the Drawings, observe the conditions under which work is to be performed, and notify Owner's Authorized Representative of unsatisfactory conditions. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Owner's Authorized Representative. Beginning of installation means acceptance of existing site conditions.

B. Thoroughly rip/disrupt/break-up/shatter the soil to a minimum depth of eight (8) inches, preferably deeper due to typical construction site compaction. Re-compact to industry standards using a standard gill or comparable piece of equipment. Remove non-soil materials and construction debris such as wood, rock, brick, cement, pipe, sheetrock, metal, paint, plastic, glass, etc. and unacceptable clays, then re-grade subsoil to established grades for proper drainage.

C. Ripping/disrupting/breaking-up/shattering of the soils should occur prior to irrigation line installation. If the turf grass sprinkler system has already been installed, then it will be necessary to stake heads and to take necessary measures to prevent damage to the system.

D. Remove foreign materials and undesirable plants and their roots. Do not bury foreign material beneath areas to be seeded. Remove contaminated subsoil.

E. Insure positive drainage away from all planting areas adjacent to the playground. Insure positive drainage at all turf grass areas. Maintain lines, levels, profiles and contours. Make changes in grade gradual. Blend slopes into level areas.

F. Unless it has rained at least one (1) inch within twenty-four (24) hours prior to planting, water turf grass areas thoroughly to provide a moist, not wet, bed before planting.

3.3 AREAS OF APPROVAL

A. Delineate the area scheduled for seeding or sodding on the site using the drawing to scale the shape and size of the planting area.

B. The Owner's Authorized Representative shall approve the area delineated to receive sod prior to planting.

3.4 PREPARING SOIL & FINE GRADING FOR SODDED AREAS

A. Note: During hauling operations, keep walkway and roadway surfaces clean. Promptly remove compost or other material.

B. Per the soil analysis report, determine if additional organic amendments are to be integrated into the soil preparation for plant health and horticultural suitability. Coordinate addition of amendments with the soil preparation as noted below. If no further soil amendments are required, then soil preparation shall be as noted below.

C. Initial (1st) weed and grass removal:

1. If site has been freshly graded, compacted or disturbed due to construction efforts and placement of stockpiled topsoil, or imported topsoil, water site for minimum two (2) weeks to encourage weed germination and growth. (If site was graded more than two (2) weeks prior, watering is not needed to encourage weed growth.)
2. Areas scheduled for native seeded/sodded grass: Totally remove all grasses and weeds, unless directed otherwise by Owner's Authorized Representative. Apply organic herbicide to thoroughly exterminate existing grasses, weeds, or other vegetation (unless noted on the drawing or in the field by the Owner's Authorized Representative for protection) from areas.
3. Clear and remove/grub these existing weeds and Bermuda grass upon organic herbicide's completed action or after soil-solarization, refer to 2.6, by grubbing off all plant parts and roots to at least one and one-half (1.5) inch below the surface of the soil.
4. In area adjacent to existing trees to remain lightly scarify the soil to remove seedlings and other ground vegetation to a depth not to exceed two (2) inches. Keep all scarification a

minimum of eight (8) feet from the base of all existing trees. If exposed roots are on the surface of the soil DO NOT SCARIFY.

D. Remove branches, roots, weeds, rocks, trash and other material foreign in nature from the existing stockpiled topsoil prior to placing topsoil or use imported topsoil if no suitable stockpiled topsoil material is available. If pulling from a stockpile, push weed growth off top and pull from the lower inside portion of the pile where weed seeds have been heated and are less likely to germinate.

E. Once subsoil is lightly but firmly re-compacted, spread topsoil over areas to be sodded to a depth which will produce a two (2) inch depth minimum after natural settlement and will conform to finish lines, grades and elevations. Add this soil from the outside of the site in, so the subsoil and topsoil create an interface (mingled) layer instead of two distinct layers with the possibility of a pan layer being generated.

F. Do not drive over re-graded/scarified subsoil clays - dump topsoil on the outside of the site and with a tractor/dozer push topsoil onto scarified clays. Make equipment ride on top of topsoil as this will allow topsoil to partially mix with subsoil clays creating an interface layer instead of a compacted pan layer.

G. Fine grade, level and scarify with a weighted spike harrow, spike float drag, or by hand raking. Leave no depressions, ruts, soft spots or humps. Finish to lines or elevations shown and parallel to proposed finished grade, as approved. Maintain positive drainage on site. Remove rocks, clods, weeds, trash or debris from area to be sodded. Remove rocks and other foreign materials one (1) inch or greater in any dimension. Legally dispose debris off site.

H. Place and spread compost over topsoil to depth which will produce a one (1) inch depth after natural settlement and will conform to finish lines, grades and elevations. Spread organic biological fertilizer at rate of twenty (20) pounds per one thousand (1,000) square feet over top of spread compost.

I. Till or disk topsoil and compost with organic biological fertilizer to five (5) inch minimum depth into existing subsoil to eliminate slip-plane between the three (3) materials and to prepare an acceptable bed for sod. Make a minimum of one pass to break up clods and integrate compost evenly into the existing soil. Penetration of soil to a depth of five (5) inches is desired to encourage dormant seed grass and weed growth. Do not till if soil is wet.

J. Under adjacent existing tree(s), place and spread compost over area to depth which will produce a one and one half (1.5) inch depth after natural settlement and will conform to finish lines, grades and elevations. Hand rake mix compost into native soil to three (3) inch depth to eliminate slip-plane between the materials and to prepare an acceptable bed for seed. Make a minimum of one (1) pass to break up clods and integrate compost evenly into the existing soil.

K. If soil or weather conditions are unsuitable, cease compost operations. Resume compost operations when proper conditions prevail.

L. Second (2^{nd}) weed and grass removal in areas scheduled for seeded and sodded grass:

1. Water the tilled and fine graded areas to receive grass three (3) weeks prior to sodding to encourage additional disturbed weed and native grass germination and growth.
2. Apply an organic herbicide to thoroughly exterminate existing grasses, weeds, or other vegetation (unless noted on the drawing or in the field by the Owner's Authorized Representative for protection) in areas scheduled to receive sodded grasses.
3. Totally remove all grasses and weeds, unless directed otherwise by Owner's Authorized Representative.

M. If weeds should germinate prior to sodding, hand pull or re-apply organic herbicide by wick method to eradicate weeds, but do not injure grass.

3.5 SODDING OF BERMUDAGRASS

After soil preparation (Section 3.4) is approved by the Owner's Authorized Representative, commence with sodding.

A. Scope of work: Refer to the plans for the location of areas to receive sod. Sod will also be required in areas designated for turf grass seeding that exceed 4:1 slope, unless noted otherwise on the drawings. Delineate areas to receive sod and receive approval for area by Owner's Authorized Representative prior to planting.

B. Laying Sod:

1. Time frame for laying sod is from April 15 to October 15.
2. Extend or reduce specified period for laying sod as approved and as necessitated by weather and soil conditions.
3. Final selection of sod: As approved.
4. Do not lay sod when sodding area is muddy or frozen nor when sod is frozen. When soil surface is hot or dry, wet soil to a depth of two (2) inches, six (6) to eight (8) hours prior to sodding.
5. Lift sod from trucks or storage piles and place by hand with close joints and no overlapping. When Beck Roll of sod is used, lay as specified and in accordance with the supplier's instructions.
6. Lay first row of sod in straight line. Place subsequent rows parallel to and tightly against each other. Stagger lateral joints to promote more uniform growth and strength. Do not stretch sod. On slopes, lay sod parallel to contours of slope.
7. Water sod immediately to prevent excessive drying during progress of work. Sod which dries out will be rejected.
8. Roll entire area as sodding is completed in one section so that sod is without surface irregularities, such as depressions and high spots.
9. Sod strips for preventing erosion at edges of hydroseeded (hydromulched) grasses to be installed after installation of hydroseeding.
10. Irrigate immediately after rolling to wet underside of sod and one (1) inch of soil immediately below.

3.6 SEEDING OF BERMUDAGRASS - BROADCAST

Seed shall be uniformly broadcast at the rate specified on all disturbed areas not receiving sod or planting. Use broadcast or drop seeders. Sow one-half the seed in one direction, and sow remainder at right angles to the first sowing. Cover seed uniformly to a maximum depth of ½-inch in sandy soils by means of drum roller, spike-tooth harrow, cultipacker, raking or other approved devices.

Immediately after seeding, firm entire area except for slopes in excess of 3 to 1 with a roller not exceeding 90 pounds for each foot of roller width. If seeding is performed with cultipacker-type seeder or by hydroseeding, rolling may be eliminated.

3.7 EROSION CONTROL OF SEEDED AREAS

The Contractor shall provide erosion control material for the seeded areas which may include hydromulch, hay or straw mulch. Hay or straw mulch shall be spread uniformly at the rate of 1 pound per 1000 square feet. Mulch shall be spread by hand, blower-type mulch spreader, or other approved method. Mulching shall be started on the windward side of relatively flat areas or on the upper part of steep slopes and continued uniformly until the area is covered. The mulch shall not be bunched or clumped. Sunlight shall not be completely excluded from penetrating to the ground surface. All areas installed with seed shall be mulched on the same day as the seeding. Mulch shall be anchored immediately following spreading.

3.8 ESTABLISHMENT PERIOD AND REPLACEMENT

A. The establishment period for sodding of grasses shall commence at installation and continue throughout the construction period until final acceptance by the Owner's Authorized Representative.

B. Maintain seeding, sodding and incidental work by performing the following and other operations of care necessary for promotion of growth so that work is in an approved condition throughout establishment period; uniform in color, quality, and coverage; and free of weeds, insects, diseases, surface damage, and other imperfections.

1. Watering: Provide labor and materials for establishment watering. Refer to Section 32 84 00 for watering guidelines for seeded and sodded areas.

C. Eliminate weeds that emerge as soon as they appear, in a timely fashion mechanically and/or with an herbicide to prevent establishment and reseeding. Use an organic herbicide that will not injure the newly sodded grass and apply according to manufacturer's recommendations. The Contractor should allow for a minimum of two (2) herbicide applications of areas scheduled for grasses during the establishment period.

D. Mowing: seeded and sodded grass areas.

1. Mow grass when it reaches a height of three (3) inches. Do not mow until sod is firmly rooted and securely in place. Mow to height of two (2) inches at first cutting. Thereafter, do not remove more than one third (1/3) of grass leaf at any cutting and mow only to enhance root growth.

2. After Tifway 419 Bermudagrass is established, mow every fourteen (14) days until final acceptance.

E. Rolling and reshaping: Roll to maintain uniform surface. Roll to eliminate uneven places in sod. Reshape soil surface to maintain positive drainage. Resod to provide one hundred (100%) percent coverage.

F. Applying organic biological fertilizer:

1. MicroLife Multi-Purpose 6-2-4 All Organic Biological Fertilizer, as supplied by San Jacinto Environmental Supplies, (713) 957-0909.
2. Rate: Twenty (20) pounds per one thousand (1,000) square feet of turf area.
3. Application:

   a. March
   b. June
   c. October

G. For high-use turf grass areas with heavy foot traffic, additionally top dress with one-half (1/2) inch organic compost in the fall plus aeration to open the compacted soils.

H. Applying organic herbicides, organic fungicides and/or organic insecticides:

1. Apply as needed to insure one hundred (100%) percent coverage of turf grass that is weed, disease and pest free.
2. Apply in spray form by certified applicator.

   a. Do not apply when temperature exceeds 80 deg. F. or during periods of drought.
3. Treat fire ant mounds as they appear with approved organic materials.

I. Replacing seeding and sodding:

1. During maintenance period, replace seeded and sodded areas that are dead or are in an unhealthy, unsightly, or badly impaired condition as soon as possible during specified planting seasons.
2. Make such replacements in the same manner as specified for original materials.

J. Coordinate watering schedules with other plantings during installation and until final acceptance. DO NOT overwater as this will promote weeds.

K. Maintenance Instructions: Submit two (2) copies of typewritten instructions recommending procedures to be established by the Owner for the maintenance of grasses for one (1) full year. Submit one (1) set of instructions to Owner's Authorized Representative for approval. Submit two (2) copies of revised instructions prior to expiration of Contractor's maintenance period(s) required under the contract.

3.9 CLEANING

A. Daily removal of rubbish and debris caused by this work from the site.

B. Keep site clean during maintenance period.

3.10 PROTECTION

A. Seeded and sodded areas shall be protected against damage from the time work is started until the date of acceptance by the Owner's Authorized Representative. The moving of heavy equipment or materials over turf grass areas shall be done on planks if necessary.

3.11 INSPECTIONS

A. Make written request for inspection after areas have been sodded.

B. Submit request for inspection to Owner's Authorized Representative at least two (2) days prior to anticipated inspection date.

3.12 FINAL ACCEPTANCE

A. Due to seasonal requirements, final acceptance of this section may not coincide with that of the remaining contract work.

B. Request inspection for final acceptance at least ten (10) calendar days before the end of the establishment period.

C. Final acceptance shall be considered the time at which warm season turf grass areas are 100% established, and weed, pest and disease free with complete lush cover and no exposed soil areas showing. Weeds shall not occupy more than 2% of any 40'x40' test area.

D. Reseed areas as needed to provide 100 per cent coverage.

E. Replace rejected sodded areas as specified so that repair or replacement is rooted and established prior to approval.

3.13 WARRANTY

A. In accordance with the General Provisions warranty for grasses shall be valid for one (1) year after final acceptance. Replace dead materials and materials not in vigorous, thriving condition as soon as weather permits. Re-sod areas where grasses have not established. The opinion of the Owner's Authorized Representative as to what constitutes a dead stand of grass shall be final.

B. Replace grasses with same kind as originally planted at no cost to the Owner. Provide one (1) year warranty on replacement plants. Plants should be replaced at start of next season. Protect irrigation system, other piping conduit, or other work during replacement. Repair any damage immediately.

C. Warranty excludes replacement of plants after final acceptance because of injury by storm, drought, drowning, hail, freeze, insects, or diseases. Warranty excludes replacement of plants due to negligence, over watering, or improper maintenance by the Owner or Owner's maintenance contractor.

D. Plants will be guaranteed to be true to species, variety or cultivar as specified.

TABLE 32 9200-1

This chart indicates minimum length of time by which material samples must be submitted for approval before intended use and minimum quantity of each. Usable samples will be returned.

ITEM	TIME	QUANTITY	COMMENT
SOD	7 days	3 Square feet	Each variety specified
COMPOST	7 days	1-gallon bag	Organic finished compost
ORGANIC HERBICIDE	7 days	1/2-pint	Unopened container
ORGANIC FERTILIZER	14 days	1 quart	Provide sample
IMPORTED TOPSOIL	14 days	1-gallon bag	
OTHER MATERIAL	7 days	As directed or as approved.	

END OF SECTION 329200

Ray Roberts Lake State Park
Isle Du Bois – Flood Damage Repairs
Texas Parks and Wildlife
Project Number 128302

SECTION 329300 - LANDSCAPING

PART 1 - GENERAL

1.1 DESCRIPTION

A. Furnish all work and materials, appliances, tools, equipment, facilities, transportation, and services necessary for and incidental to performing all operations in connection with the installation of the landscape.

B. Conform to the requirements of the general conditions of the contract.

1.2 SUMMARY

A. Work included:

1. Providing complete landscaping as shown.
2. Excavation of plant pits.
3. Eliminating weeds – minimal two treatments.
4. Provide spike harrowing/ripping of compacted soils for beds.
5. Providing plant materials and related items.
6. Installing stockpiled existing topsoil.
7. Providing imported topsoil.
8. Providing organic compost.
9. Providing organic biological fertilizer.
10. Providing mulches for topdressing.
11. Providing tree ground staple pin.
12. Providing organic herbicide and organic fungicide.
13. Providing organic insecticides.
14. Finished grading of planting areas.
15. Watering with water-wise practices to establish and not over-water plants.
16. Warranty and replacements.

1.3 REFERENCES

A. The following Codes, Regulations, Reference Standards, and Specifications apply to work included in this Section and Section 329300.

1. Codes and regulations of the jurisdictional authorities.
2. "REFERENCE CODES AND STANDARDS":
    a. AASHTO: M288.
    b. ASTM: A6, C33.
    c. American Standard for Nursery Stock, Edition approved May 12, 2004 by American Nursery and Landscape Association (ANSI Z60.1-2004) - plant materials.
    d. Hortus Third, 1976 - Cornell University - plant nomenclature.

B. Observation at growing site does not preclude right of rejection at the Worksite. Plants damaged in transit or at the Worksite shall be rejected.

C. Personnel: Perform work only with qualified personnel familiar with required landscaping methods and materials.

1.4 DEFINITIONS

A. Weeds: Any plant not specified on the drawings or accepted as a substitute.

1.5 QUALITY ASSURANCE

A. Source quality control: Furnish certificates of inspection of landscape materials, to accompany shipments, as required by governmental authorities or as requested for inspection by Owner. Comply with applicable federal, state, county and local regulations governing landscape materials.

B. Growing location: Furnish certificates showing where materials have been grown or balled and burlapped.

C. Qualifications:

1. Manufacturer: Company specializing in manufacturing Products specified with minimum five (5) years documented experience.
2. Installer: Company specializing in performing the Work of this Section with minimum five (5) years documented experience installing projects of similar size and scope. The Landscape Contractor shall furnish a list of references or previous work experience as requested by the Owner. The Landscape Contractor shall employ only skilled personnel and provide adequate supervision.

1.6 SUBMITTALS

A. Provide representative quantities (1-gallon plastic bag or container) of imported topsoil, organic compost, fine cut mulch, and rustic cut mulch. Samples shall be approved by Owner's Authorized Representative prior to installation. Attach product name, address of manufacturer and/or supplier and appropriate literature and composition of material for each sample. Literature or Product Data shall consist of manufacturer's current specifications, with catalog cuts, data sheets and installation instructions. Samples shall be submitted no less than sixty (60) days prior to installation.

1. Organic Fertilizer: Manufacturer's literature.
2. Organic Herbicide: Manufacturer's literature.
3. If requested: Organic Fungicide: Manufacturer's literature.
4. If requested: Organic Insecticide(s): Manufacturer's literature for each type.
5. Tree Staple Pin: Full sized sample or Drawing submitted.

B. Plant Material Samples: Submit documentation no less than sixty (60) days prior to installation that all plant materials have been located and are ready to be secured. Arrange specific review procedure of plant materials at time of submission. Submittals and review shall be organized as follows:

1. Preliminary Review: Submit representative photographs for review of all plant materials in the required sizes and in available quantity at no less than sixty (60) working days prior to shipment to the site.
2. Submittal shall include each of these items per plant: 1) a minimum of one (1) high quality color bond image or 2) one (1) color digital image. Include one (1) set for each plant type and size required for the project. The 8-1/2" x 11" sheet/image is to include the name and address of the supplier, size of the plant in the picture and Botanical and English name of the plant and variety/cultivar name. Digital submittals are preferred due to expediting time and for reduction in the carbon footprint.
3. Tree photographs shall include a person or device to determine scale and shall include two (2) photographs of each tree type or group. The two (2) photographs shall be taken at approximately 90 degrees from each other. One (1) additional photograph shall be taken at the base of each tree to show root flare and root conditions at the soil surrounding the roof flare.
4. Provide any additional tree groups and specimen photographs as required to illustrate the quality and/or quantity of material.
5. Poor quality photographs, photographs that are not in color, not labeled, or photographs which do not adequately represent the plant material will be rejected.
6. Photograph Acceptance and Nursery Review: Acceptance of material through photographs/digital images does not preclude rejection of unsatisfactory material upon delivery. The Owner's Authorized Representative reserves the right to refuse review from photographs or at the grower if, in his judgment suitable material or sufficient quantities are not available. Contractor shall insure a sufficient quantity of plants will be available whenever trips are arranged to a nursery for the purposes of tagging material for the project.
7. Specific sources of materials may be listed in the plant schedule for availability, size, quality control of plant character and for matching of specific plant growing conditions.
8. Unavailable Material: If proof is submitted that any plant specified is not obtainable, a proposal will be considered for use of the nearest equivalent size or variety with corresponding adjustment of Contract price. Substantiate such proof in writing no later than sixty (60) days prior to installation.

C. Sources: Within at least sixty (60) days prior to delivery to site, notify Owner and Owner's Authorized Representative in writing of source of plant material and bed preparation materials required for the project. This data is to be furnished in addition to representative samples.

D. Special Warranty: Submit written special warranty registered with manufacturer as specified in this Section.

E. Compost: Provide supplier's product information of compost including material content, pH, and composition. If requested by the Owner's representative, provide additional documentation and testing of compost materials as specified in Parts 2 and 3 of this Section.

F. Maintenance Instructions: Submit two (2) copies of typewritten instructions showing compliance with Landscape Maintenance Section 320190 for one (1) full year. Submit to Owner's Authorized Representative for approval. Submit two (2) copies of revised instructions prior to expiration of Contractor's maintenance period(s) required under the contract.

1.7 PROJECT CONDITIONS OR SITE CONDITIONS

A. Verify and examine site conditions with the Owner's Authorized Representative. Proceed when official notice is given to the Contractor that the Work site is ready. Proceed with and complete the landscape work as rapidly as portions of the site become available.

B. Planting Restrictions: Perform actual planting only when weather and soil conditions are suitable in accordance with locally accepted practice. Do not install plant life when ambient temperatures may drop below 35 degrees F or above 100 degrees F. Commence landscaping work when the Site is free of rocks and debris. All planting areas to be left at depth per drawing details/sections from finished grade by others for landscape contractor to add soil amendments.

C. Protection:

1. Do not move equipment over existing or newly placed paving without approval of Owner's Authorized Representative.
2. Provide road-boarding to protect paving.
3. Protect paving, structures and any other site improvement from damage, with protection boards, ramps, and protective sheeting.

D. Utilities:

1. Determine locations of underground utilities and perform work in a manner which is intended to avoid possible damage. Hand excavate, where required, to minimize possibility of damage to underground utilities.
2. Coordinate work with Owner's Authorized Representative to prevent damage to existing underground sprinkler (irrigation) system at trees.
3. Water is not available on site. Refer to temporary irrigation system drawings for proposed irrigation system.

1.8 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver packaged materials in sealed containers showing weight, analysis and name of manufacturer, supplier or grower. Protect materials from deterioration during delivery and while stored at the site.

B. Storage: Store products with protection from weather or other conditions which would damage or impair the effectiveness of the product. Protect metal containers from sun during summer months with temperatures above 80 degrees F.

C. Preparation of Plant Materials:

1. Balled and Burlapped (B&B) Plants: Dig and prepare shipment in a manner intended to protect roots, foliage and branches from damage, and protect the shape for future development.
2. Container Grown Plants: Prepare shipment in a manner intended to protect roots, foliage and branches from damage, and protect the shape for future development.
3. Plants should bear label from the grower certifying genus and species. Labels should be securely attached and waterproof bearing legible designation of botanical and common name. Plants not labeled may be rejected.

D. Deliver trees, shrubs and other plants after preparation for planting have been completed and plant immediately.

E. Damage: Protect plant material in transit and at the site. Material not properly protected, and which is damaged will be rejected.

F. Unloading, Handling and Staging of Trees:

1. Staging systems shall be prepared in advance to adequately hold trees above ground for optimum tree health prior to planting. Many times, even with the best planning and coordination, trees cannot be planted when they are delivered.
2. Use extreme caution when handling trees. Use a strap cradle, adequate for weight and size of tree and root ball, attached to the root ball to unload and move trees. Strapping and wire baskets can break or loosen. Never move, lift, or handle by attaching to or by putting pressure on the trunk. Be very careful not to damage or scar trunks and branches.
3. Prior to unloading, proper moisture shall be maintained in root balls. Trucks shall be staged in the shade prior to unloading. Unloading time shall be no more than two (2) hours per trunk.
4. Immediately after unloading, no more than one hour after unloading, stand the trees up to reduce risk of sun scald. Properly staged trees shall be standing, untied and spaced.
5. Remove cardboard trunk protector within forty-eight (48) hours of trees being stood upright to reduce the risk of damage.
6. Monitor moisture in the root ball by probing the soil with a soil probe and manage supplemental irrigation accordingly. Be careful not to over or under irrigate.
7. During cold weather periods, root balls must be protected from freezing temperatures.
8. Storage is at Contractor's own risk.

G. Handling of Plant Materials:

1. Do not deliver plants until the site conditions are ready for planting. If planting is delayed, heel-in bare rooted or freshly dug plants in a bed containing adequate mulch to keep roots moist. Separate bundles and trim roots, if long or damaged, using sharp pruning shears.
2. Place plants in flats, pots, or other containers in a sheltered spot protected from sun, wind and mechanical damage and keep roots moist. Storage is at Contractor's own risk.
3. Do not lift or handle any plants by tops, stems or trunks at any time. Do not bind or handle plants with wire or rope at any time.

1.9 SCHEDULING

A. Submit a proposed work schedule to the Owner's Authorized Representative for approval at least sixty (60) days prior to start of work under this Section. After approval, no modification shall be made to this schedule without written authorization by the Owner.

B. In general, the work shall proceed as rapidly as the site becomes available, consistent with normal seasonal limitations for planting work.

1.10 WARRANTY

A. General: Warranties specified in this Section shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to and run concurrent with other warranties made by the Contractor under requirements of the Contract Documents.

B. In accordance with the General Provisions, warranty for plants and trees shall be valid for one year after final acceptance. Replace dead materials and materials not in vigorous, thriving condition as soon as weather permits.

C. Replace dead trees or trees not in vigorous, thriving condition as soon as weather permits. Replace trees, which have partially died thereby damaging shape, size, or symmetry. The opinion of the Owner's Authorized Representative as to what constitutes a dead plant shall be final.

D. Replace plants and trees with same kind and size as originally planted at no cost to the Owner. Provide one (1) year warranty on replacement plants. Trees should be replaced at start of next planting or digging season. In such cases, remove dead trees immediately. Protect irrigation system, other piping conduit, or other work during replacement. Repair any damage immediately.

E. Warranty excludes replacement of plants after final acceptance because of injury by storm, drought, drowning, hail, freeze, insects, or diseases.

F. Plants will be guaranteed to be true to species, variety or cultivar as specified.

G. Warranty: Warrant that all perennials and shrubs planted under this Contract will be healthy and in flourishing condition of active growth one (1) year from date of Substantial Completion.

H. Replacements: As soon as weather conditions permit, replace, without cost to Owner all dead plants and all plants not in a vigorous, thriving condition, as determined by Owner's Authorized Representative during and at the end of Warranty Period.

1.11 REPLACEMENTS

A. General:

1. Plant materials exhibiting conditions which are determined as being unacceptable due to workmanship by the Contractor shall be repaired and/or replaced at no additional cost to the Owner.

2. Closely match replacements to adjacent specimens of the same species. Apply all requirements of this Specification to all replacements.

B. Replacement Quantities: Contractor shall be held responsible for a maximum of two (2) replacements for each failed tree, perennial and shrub after final acceptance during the Warranty Period.

PART 2 - PRODUCTS

2.1 PLANTS

A. General: Provide healthy, field-grown ball and burlapped plants or nursery-grown container and boxed plants, well-formed No. 1 grade from a recognized, local nursery, and of the species and variety shown on the drawings, well-developed branches conforming to and complying with the last edition of American Standard for Nursery Stock, Edition approved May 12, 2004 by American Nursery and Landscape Association (ANSI Z60.1-2004). Listed plant heights are from tops of root balls to nominal tops of plants. Provide only healthy, vigorous stock, grown under climatic conditions similar to conditions in the locality of the project and free of disease, insects, eggs, larvae, and defects such as knots, sun-scald, injuries, abrasions, or disfigurement.

B. Vigor: Plants shall be sound, healthy and vigorous, well branched and densely foliated when in leaf. They shall be free of disease, insect pests, eggs, or larvae. They shall have healthy, well-developed, vigorous and fibrous root systems. Plants shall be free from physical damage or adverse conditions which would prevent thriving growth.

C. Container and Boxed Stock material:

1. Verify that all container stock has been grown in the containers in which delivered for at least six (6) months, but not over two (2) years.
2. Plants shall have a root ball size of minimum of ten (10) inches in diameter for each one (1) inch caliper, measured six (6) inches above root ball.
3. Root system development:

    a. Samples must prove to be free of kinked, circling or girdling roots and with no evidence of a pot-bound condition.
    b. Trees shall have been grown in heavy or heavy clay soil and irrigated with drip irrigation. Loose potting soils are not acceptable since root mass will flex with trunk sway and allow potential overturn of tree.
    c. Field grown plants recently planted into containers will be accepted if roots have developed into new soils.
4. Root flare of plant material shall be visible at nursery prior to delivery, and after transplanting into the landscape.
5. Root balls shall not be cracked or broken prior to shipment.
6. Do not remove self-locking tags prior to delivery to site.
7. Remove all weeds and other invasive plants from the base of the nursery plant's root container prior to delivery to site.

D. Nursery grown B&B material:

1. Plants shall have a root ball size of minimum of ten (10) inches in diameter for each one (1) inch caliper, measured six (6) inches above root ball.

    a. All named cultivars shall be own root clones; no grafted or bud-grafted trees will be accepted.

2. Root system development:

    a. 100% mechanically root-pruned at least once and transplanted a minimum of three (3) times during the first three (3) years of the tree's life.
    b. Trees shall have been grown in heavy clay soil and irrigated with drip irrigation.
    c. Plants shall be well healed in for a minimum of thirty (30) days with a flush of new roots at the edge of the burlap prior to shipping. Recently dug plants will not be accepted.
    d. Trees shall have no girdling roots, have no "J" shaped roots, and the trunk flare shall be visible.
3. Ensure balls are firm, neat, slightly tapered, and well burlapped.
4. Root balls shall not be cracked or broken prior to shipment.
5. Root flare of plant material must be above ground and visible at nursery before harvest, prior to delivery, and after transplanting into the landscape.
6. Do not remove self-locking tags prior to delivery to site.
7. Remove all weeds and other invasive plants from the base of the nursery plant's root ball prior to delivery to site.

E. Ornamental and Shade Trees - Canopy development:

1. No. 1 grade nursery stock healthy, vigorous, full-branched, well-shaped, trunk diameter, and height requirements as specified
2. There shall be a strong central leader to the top of the canopy. The tip of the leader on the main trunk must be intact and its terminal bud must be the highest part of the tree.
3. No branch can have a diameter greater than 2/3 the trunk diameter measured directly above the branch crotch. The tree will have no inclusions or co-dominant branches.
4. The tree crown shall be structurally uniform. Branches shall be evenly distributed around the trunk. The crown shall be full of foliage which is evenly distributed around the tree.
5. Trees that have had branches tipped or cropped will not be accepted.
6. Provide trees with full rounded crowns, meeting height and spread standards after pruning. No flat sided trees or trees with open areas on any side will be acceptable. Trees shall be consistently superior in form and branching, and typical of the growth habit of their species unless otherwise specified.

F. Tree Caliper Measurement Requirements: for a single stem tree, the diameter (caliper) of the trunk shall be measured twelve (12) inches above the top of the root ball for a tree having a diameter up to and including eight (8) inches, and measured at four and one-half feet above the top of the root ball for a tree having a diameter of more than eight (8) inches. For multi-stem trees, the diameter of the trunk measured at the narrowest point below branching when branching occurs higher than twelve (12) inches above the top of the root ball. When branching occurs at or lower than twelve (12) inches above the top of the root ball, caliper means the diameter of the

largest stem plus the average diameter of the remaining stems, measured at four and one-half (4.5) feet above the top of the root ball.

G. Ornamental native grasses, shrubs or perennials: Nursery grown, healthy, vigorous, of normal habit of growth for species, free from disease, insect eggs, and larvae. Specified sizes are before pruning and measured with branches in normal position. Plants to be well rooted and established in the container.

H. Plants shall conform to the sizes and quality noted in the plant list and/or as indicated, with the exception of that larger plants than those specified may be used if approved by the Owner's Authorized Representative. Use of larger plants shall not increase the contract price. Specified sizes shall be after pruning, and plants shall be measured with their branches in normal position.

I. Pruning: Do not prune plants before delivery. If pruning is necessary, prune with direction from Owner's Authorized Representative (Landscape Architect).

J. Plant protection during shipping: Wrap canopy of plants prior to loading to ensure that branch structures are protected, and that wind damage is minimized. Smaller plant material will be handled and loaded to protect character and form of each plant. Removal of protection strapping and wrapping shall be handled with care to prevent damage to the plant material once it is delivered to the site. Damaged materials will be subject to rejection.

K. Upon delivery to site:

1. Reject trees with cracked, lose or broken balls when frame or burlap is removed at time of planting.
2. Trees will be individually approved or rejected by the Owner's Authorized Representative on site.
3. Trees: Free of physical damage such as scrapes, bark abrasions, or split branches.
4. Trees for planting adjacent to sidewalk shall be pruned and branched up to seven (7) foot height above the finished grade of the sidewalk or accessible surface for pedestrian clearances as directed by the Owner's Authorized Representative.

2.2 STOCKPILED TOPSOIL – available on site.

After being stockpiled, topsoil will be depleted of organics due to excessive heat within the core of the pile. Test and amend the topsoil to have between 5 and 15 percent of total dry weight. Topsoil may be amended with compost meeting requirements of 2.4 below to meet organic percent.

2.3 IMPORTED TOPSOIL (if needed)

A. Sandy Loam (Imported topsoil): sandy loam topsoil which is friable, fertile, dark loamy soil, free of clay lumps, subsoil, stones and other extraneous material and free of weeds and foreign grasses. Loam containing dallisgrass and nutgrass (nutsedge) will be rejected. Physical properties as follows:

1. Clay: between 10 and 20 percent

2. Silt: between 20 and 30 percent
3. Sand: approximately 60 percent
4. Organic matter: between 5 and 15 percent of total dry weight. Imported topsoil may be amended with compost meeting requirements of 2.4 below to meet organic percent.

2.4 COMPOST - Professional Compost – Fully Mature Compost - 100% plant based

A. Compost: shall be compost for mix above that is fully finished compost that has been produced by aerobic (biological) decomposition of organic matter and meets or exceeds the requirements set forth by the United States Department of Agriculture, the United States Composting Council (USCC), and State composting requirements. Compost feedstock shall include fully composted cotton burrs, local grass trimmings, leaves, brush and processed wood fiber and shall add an average of 1.1 lbs. N^1, 0.13 lbs. P^1, and 0.8 lbs. K^1 of pure consumable organic nutrients per one (100) square feet for each inch depth added plus minerals and trace elements. Compost shall not include food waste, stable waste, treated lumber, pallets, pine bark, raw manure or mushroom compost waste. Compost shall not include any man-made materials or chemicals. Do not use mixed municipal solid waste compost since it varies from season to season. Ensure compost does not contain any visible inorganic refuse, other physical contaminants, or any substance considered to be harmful to plant growth. It must be turned a minimum of five (5) times and not achieve a temperature greater than 160 degrees Fahrenheit. Each turning cycle should not be shorter than fourteen (14) days minimum. Compost shall be completely composted for a minimum of six to twelve (6 - 12) months. Particle Sizes 97% will pass through a one-half (1/2) inch screen, 99%+ will pass through a three-quarter (3/4) inch screen. Compost material shall have no pungent smell, but rather an earthy smell.

Supporting documentation should be made available upon request. The contractor is obligated to provide testing of the compost at the supplier's yard and at the job site for quality assurance.

Acceptable Professional compost is as supplied by Soil Building Systems, 2101 Walnut Hill Lane, Dallas, Texas 75229, (972-831-8181), attention: Baron Ablon, or equivalent as determined by the Owner's Authorized Representative.

Table 1

Physical Requirements for Compost

pH: 7.9 – 8.9
Maturity: germination and vigor greater than 90% in accordance with TMECC 05.05-A, "Germination and Vigor"
Solvita® Compost Maturity Index: value of 7 or higher

B. The contractor is obligated to provide testing of the compost at the supplier's yard and at the job site for quality assurance.

C. Quality and properties of compost must match or be equivalent to requirements of 2.4 A. and be 100% plant based due to use in planting areas and effect of runoff into site stormwater detention basin.

D. TESTING OF THE COMPOST AT THE JOB SITE

NOTE: Contractor is advised to test the designated compost stockpile at the supplier's yard prior to loading to ensure the designated pile passes the compost maturity test. If the compost does not pass the test at the jobsite, it will be rejected.

1. Use Solvita® Compost Maturity Test Kit or approved equal. Solvita® test kit shall be recently purchased and shall be stored in a refrigerator protected from heat until use at the site. (The two parameters which Solvita® measures (CO2 / NH3) are the mostly frequently cited factors that correlate closely with maturity and potential phytotoxicity. Ammonia is also an odorous aerosol toxicant and is a potential worker hazard at agricultural and compost facilities.) Provide Compost maturity test results to measure both carbon-dioxide (CO2) and ammonia (NH3) evolution and provide a Maturity Index value, useful or compost quality evaluation. Compost maturity test is TMECC Test #05-08A.
2. Provide results to Owner's Authorized Representative at the job site.
3. Owner's Authorized Representative has the right to reject the material if it does not meet the above parameters.

2.5 PRE-EMERGENCE AND POST-EMERGENCE FOR WEED REMOVAL - ORGANIC HERBICIDE, SOIL-SOLARIZATION, AND HAND PULLING

A. Chemical Herbicides will not be used due to detrimental effects on the soils and due to runoff effects.

B. For site bed treatments: initial during bed preparation, prior to planting, and for spot treatment with a wick after planting.

C. Nonselective organic herbicide such as: Mirimichi Green Pro Weed Control, EPA approved and OMRI listed, as manufactured by Mirimichi Green Express, 418 Hermitage Road, Castle Hayne, NC 28429, (910-602-1681); as supplied by San Jacinto Environmental Supplies, Houston, TX (713-957-0909), local representative: Lanse Fullinwider, cell: (214-534-2317), or other suppliers.

D. Nonselective organic herbicide, such as Agricultural grade (20%) vinegar. Vinegar can be mixed with citrus oil.

E. Alternate: Soil-solarization – clear sheet roll plastic of at least one and one-half (1 1/2) to two (2) mils thickness treated with ultraviolet (UV) inhibitor in size to cover entire bed area.

F. Hand weeding or plant specific application of organic herbicide shall be used to control weeds during plant establishment.

2.6 ORGANIC BIOLOGICAL FERTILIZER: to build soil structure within urban environment. Synthetic fertilizers will not be used due to runoff issues and per iSWM (Integrated Storm Water Management) best practices.

A. Homogenous, granulated all organic biological fertilizer containing soil microbes, endo & ecto mycorrhizal fungi, vitamins, minerals, plant hormones, stimulators, essential carbon and protein: MicroLife Multi-Purpose 6-2-4 All Organic Biological Fertilizer, as supplied by San Jacinto Environmental Supplies, (713) 957-0909, local representative: Lanse Fullinwider, cell: (214-534-2317), or equivalent product as approved by the Owner's Authorized Representative or Landscape Architect. See Section 3 for application rate to amended soils.

B. Locally Available:

1. Re-wholesaler: AG Organics, 450 Business Park Drive, Suites 100, Prosper, TX 75078, (972) 347-3330.
2. Wholesale: Southwest Wholesale Nursery, 2220 Sandy Lake Road, Carrollton, TX 75006, (972) 245-4557.

C. Organic Fertilizer: To build soil structure within urban environment. Synthetic fertilizers will not be used due to runoff issues into the lake for iSWM (Integrated Storm Water Management).

2.7 MISCELLANEOUS PLANTING MATERIALS

A. Wrapping Material: Do not use!

B. Tree Paint: Do not use!

2.8 TOPDRESSING MATERIALS

A. Mulch for Planting bed and Tree Topdressing (1st layer): Fine Cut Hardwood Mulch - hammer mill processed, decomposed - heat sterilized two (2) times to remove latent weed seeds, aged for minimum two (2) months, native hardwood mulch with frayed edges, screened to remove fines. No soft green or unprocessed materials allowed. 98% of material will not exceed four (4) inches in length. shall have no pungent odors but will have an earthy smell. As processed and supplied by Soil Building Systems, Dallas, Texas, (972-831-8181), attention: Baron Ablon, or equivalent as approved by the Owner's Authorized Representative.

B. Mulch for Tree Topdressing (2nd layer): Rustic Cut Hardwood Mulch - hammer mill processed, decomposed - heat sterilized two (2) times to remove latent weed seeds, aged for minimum two (2) months, native hardwood mulch with frayed edges, screened to remove fines. No soft green or unprocessed materials allowed. 95%+ of material will not exceed eight (8) inches in length. Material shall have no pungent odors but will have an earthy smell. As processed and supplied by Soil Building Systems, 2101 Walnut Hill Lane, Dallas, TX 75229 (972-831-8181), attention: Baron Ablon, or equivalent as approved by the Owner's Authorized Representative.

2.9 TREE STAPLE FOR ORNAMENTAL AND SHADE TREES

A. For stapling of small tree root balls to sloped lawn areas.

B. Re-bar staple pin in configuration as per detail.

2.10 ORGANIC FUNGICIDES

A. As needed for specific conditions.

B. No chemical fungicides shall be used due to detrimental effects on the health of the soils.

C. MicroGro Granular Root Protector - Biological Fungicide as supplied by San Jacinto Environmental Supplies, Houston, TX (713) 957-0909, local representative: Lanse Fullinwider, cell: (214-534-2317), or available locally at Southwest Wholesale Nursery, Lewisville, TX, or

equivalent product as approved by the Owner's Authorized Representative or Landscape Architect.

D. Contractor shall recommend products for submittal and approval by the Owner's Representative or Landscape Architect depending on final plant selections and their susceptibility to certain fungi.

2.11 ORGANIC INSECTICIDES (if needed)

A. Soft Bodied Insects (aphids, mites, thrips, white flies, lace bugs, etc.):

1. EcoSMART® Organic Insecticides as manufactured by a division of the Kittrich® Corporation, Atlanta, GA 30336, (714-736-1011), or equivalent product as approved by the Owner's Authorized Representative or Landscape Architect.
2. Neem Oil – submit product for approval.

B. Scale: Use two (2) ounces of Orange Oil mixed with one (1) ounce of Neem Oil to a gallon of water. Submit products for approval.

C. Caterpillars, Armyworms, Sod Webworms: Use Bacillus Thuringiensis (BT) biological agent. Submit product/manufacturer/supplier for approval.

D. Chinch Bugs:

1. EcoSMART® Granular, as manufactured by a division of the Kittrich® Corporation, Atlanta, GA 30336, (714-736-1011, or equivalent product as approved by the Owner's Authorized Representative or Landscape Architect.

2.12 ORGANIC INSECTICIDE - FIRE ANTS

A. Fire Ant Bait:

1. PayBack® Fire Ant Bait with Conserve® Insecticide (spinosad 0.015%) granular form as manufactured by Southern Agricultural Insecticides, Inc., Palmetto, FL 34220, (941-722-3285).
2. Ferti-lome Come and Get It! Fire Ant Killer with Conserve® Insecticide (spinosad 0.015%) granular form as manufactured by Ferti-lome – Voluntary Purchasing Groups, Inc., 230 FM 87, Bonham, TX 75418.

B. Dusting Powder: Perma-Guard® Commercial Insecticide D-20 (pyrethrins 0.02%, technical piperonyl butoxide 1.0%, silicon dioxide from diatomaceous earth 88.0%) as manufactured by Perma-Guard, Inc., Albuquerque, NM 87102, (505-243-1460), or equivalent product as approved by the Owner's Authorized Representative or Landscape Architect.

2.13 WATER

A. Temporary. Refer to the irrigation specifications and plans. Truck or other means of watering shall be required to establish turf areas where no existing or temporary irrigation system exists.

B. Applied and monitored by Contractor to establish trees plantings.

C. Keep tree roots and pocket plantings moist with watering schedules to promote deep roots and to prevent runoff. Overwatering of plants should not occur. Refer to irrigation plans.

2.14 MACHINERY AND EQUIPMENT

A. Machinery requirements listed under this Section are NOT intended to be restrictive of specific manufacturers or models, unless so stated. Specific mention of the manufacturers is intended as a guide to illustrate the final product of the maintenance operations desired. All equipment used shall be and maintained in top working condition at all times.

B. Pruning and grinding tools shall be maintained in safe, working condition, cutting edges shall be sharp at all times.

C. Fertilizer and insecticide spreaders shall be of the hand-held or cyclone type. Vehicle-mounted or push cyclone spreaders shall be allowed. The Contractor shall be responsible for any grade, plant material (turf and trees), or hardscape amenity (fence, pavement, arbor, steel edging, stone wall, etc.) damage caused by the spreader and the application process. Spreaders shall be in a safe working condition at all times.

D. Insecticide and fungicide sprayers shall be of the hand-held, backpack, or vehicle-mounted type. The Contractor shall be responsible for any grade, plant material (turf and trees), or hardscape amenity (fence, pavement, arbor, steel edging, aluminum edging, stone wall, etc.) damage caused by the spreader and the application process. Sprayers shall be in a safe working condition at all times.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.

1. Verify that all planting areas are clear of stones larger than one (1) inch diameter, weeds, debris and other extraneous materials.
2. Verify that grades are within one (1) inch plus or minus of the required finished grades. Report all variations in writing.

B. Soil Moisture:

Inadequate Moisture: Do not commence work of this section when soil moisture content is so great that excessive compaction will occur, nor when it is so dry that dust will form in air or that clods will not break readily. Apply water, as necessary, to bring soil to an optimum moisture content for planting.

C. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the owner.

3.2 SITE PREPARATION

A. Coordinate protection of existing utilities.

B. Coordinate with General Contractor for scheduling and sequencing of planting.

C. Examine rough excavated grade/subgrade for planting areas and verify conditions under which work is to be performed. Do not proceed with work until all grading and related work is completed in a satisfactory manner so that the landscape installation can proceed. All lumps, clods, and debris over two (2) inches in diameter shall be removed from the Worksite.

D. Delineate mulch/planting bed areas and receive approval from Owner's Authorized Representative prior to starting work. Beginning of installation means acceptance of existing site conditions.

3.3 BED PREPARATION UNDER EXISTING TREE(S)

A. Hand rake area under existing tree canopy to remove debris and seedlings from top of soil strata. Dispose of all waste material off site per requirements of local authority.

B. Under adjacent existing tree(s), place and spread compost over area to depth which will produce a one and one half (1.5) inch depth after natural settlement and will conform to finish lines, grades and elevations.

C. Apply organic biological fertilizer at rate per manufacturer's recommendations for bed preparation at forty (40) lbs. per one thousand (1,000) square feet.

D. Hand rake mix compost and organic biological fertilizer into native soil to three (3) inch depth to eliminate slip-plane between the materials and to prepare an acceptable bed for plants. Make a minimum of one (1) pass to break up clods and integrate compost evenly into the existing soil.

E. Coordinate installation and placement of temporary irrigation at edge of bed under tree to ensure that the bed area is covered.

F. Water beds to promote germination of dormant weeds and grasses.

G. Treat weeds in bed with application of organic herbicide or hand pull weeds from bed.

3.4 TREE AND PLANT PREPARATION AT HOLDING AREA PRIOR TO INSTALLATION

A. Contractor shall completely remove all weeds, vines or plant seedlings, including their root system, growing at top of container or on top of the root ball to ensure that these invasive non-specified plants do not gain foothold to establish and cause additional maintenance to remove.

B. Removal and disposal of all weeds, vines or plant seedlings shall occur prior to any plant moving for installation or placement.

3.5 POCKET PLANTING INTO MULCH AREA UNDER TREE

A. Contractor shall mark proposed locations for plants with contractor stakes. Obtain approval from Owner's Authorized Representative. Do not place plants where installing will injure tree roots.

B. The Owner's Authorized Representative reserves right to interchange or shift locations of plants prior to planting.

C. Once locations have been approved by Owner's Authorized Representative, carefully excavate for plant.

D. Plant in square pits two (2) times greater in diameter than root balls or container diameter.

E. Remove the container from the prepared plant.

F. Score the root ball vertically at four (4) equal points around the edge prior to planting.

G. Plant ornamental grasses and perennials such that top of the root ball at the flare of the plant is one half (1/2) inch above finished grade for seeded turf areas, and one (1) inch above the top of sod finished grade.

H. Backfill to depths of root balls with turf bed amended media (refer to Section 329200). Carefully settle by watering to prevent air pockets. Water in thoroughly.

I. Carefully prune plants to remove dead or broken branches and smooth around plant to provide even surfaces.

3.6 CANOPY & ORNAMENTAL TREE PLANTING AT TURF AREAS

A. Stake locations for approval.

B. After approval of tree locations, excavate pit per D below. The pit should be the same depth as the height of the root ball or slightly less so that the root ball sits no more than two (2) inches above surrounding grade.

C. Excavate trench from front of tree pit to face of natural slope to disturb existing soil for allowance of drainage from the tree pit. Reinstall the soil back into the trench and compact.

D. Plant in square pits two (2) times greater in diameter than root balls or container diameter.

E. Till soil to ten (10) inch depth within ten (10) foot radius of tree for trees in turf lawn areas.

F. Handling trees: Use extreme caution. Use a strap cradle (adequate for weight and size of root ball) attached to root ball to unload and move trees. Strapping and wire basket can break or loosen. Never move, lift or handle by attaching to or by putting pressure on the trunk. Be certain that equipment, including straps, chains, and cradles, are rated for the weights of the trees being lifted.

G. Remove any plastic wrap and any circling roots from the root ball. Handle tree only by root ball.

H. Plant tree directly into excavated pit such that the trunk flare will be two (2) inches above surrounding finished grade in planter bed. Refer to planting details for cross-section of tree planters.

I. Maintain tree in a straight and plumb position while backfilling with planting media consisting of native stockpiled/imported topsoil to not more than one half (½) the depth of the root ball.

J. Saturate the planting hole with water after backfilling is one half (½) complete to aid removal of air from the backfill.

K. After initial backfill, watering, and the tree is plumb, then add backfill to just below the top horizontal wire ring, saturate planting hole and adjust root ball, if necessary, to make tree straight and plum.

L. After above items have been completed, remove synthetic wrap, cardboard packaging, and cut/remove the top portion of the wire basket down to and including the first horizontal ring. Remove the burlap from the top portions of the root ball.

M. Complete the backfill with native stockpiled/imported topsoil to within nine (9) inches from top of root ball.

N. Backfill the top nine (9) inches with mix of one (1) part compost to one (1) part native stockpiled/imported topsoil blended with two (2) ounces of organic biological fertilizer per each five (5) gallon increment in tree root ball size and thoroughly saturate top backfill layer with water to aid removal of air pockets.

O. After backfill has substantially settled and the tree is straight and plumb, staple pin tree root ball per Detail from uphill orientation to anchor the root ball until the root system is thoroughly established. Check root ball staple anchoring as needed to make sure that the tree and root ball are stable.

P. Provide watering dam at the edge of the tree's drip line/canopy edge to keep the tree's root flare fully exposed.

Q. Remove all remaining straps, tags, tapes, ties, stakes and other items from the trunk and canopy of the tree.

R. If rock is encountered:

1. Owner's Representative may select alternative location if possible.
2. Rock shall be removed to a minimum of six (6) inches below the plant if an alternative location cannot be selected and tree drainage pits shall be installed.

3.7 PRUNING OF NEW TREES (only if required)

A. Prune trees to preserve natural character of plant. Remove sucker growth, broken or badly bruised branches, and crossed branches.

B. Thin native trees heavier than nursery grown plants.

C. When directed by the Owner's Authorized Representative, remove approximately one-third of wood by thinning. Do not cut back terminal branches.

3.8 TREE ROOT BALL ANCHORING

A. Staple anchor all trees root balls as detailed.

B. Take precautions during stapling operation to prevent damage or injury to roots.

3.9 TOP DRESSING TREES IN TURF AREAS AND UNDER EXISTING TREE

A. After finished grade has been approved and watering saucer/dam is in place for trees or larger plant materials, top dress tree root balls or root area first with a two (2) inch layer of fine mulch.

B. Then top dress over first mulch layer with rustic cut mulch to a depth of two (2) inches compacted depth.

C. Top dressing must achieve specified depth to attain final acceptance.

D. Hold mulch back to expose the flare of the tree trunk at the root ball.

3.10 NEW AND EXISTING TREES

A. Trees shall be continuously and routinely inspected for distress caused by construction activities. Notify Owner's Authorized Representative at first sign of distress.

B. Any Fire Ant mounds around or on top of a new or protected tree root zone shall be treated immediately and the mound removed physically. Do not allow the mound to build on the tree trunk as this will cover the tree root flare and possibly cause injury or death. Insure that any organic herbicide application to the Fire Ant mound is safe for application atop tree root zones.

C. Trees: Pruning will be carried out by experienced pruning personnel.

1. Receive approval in the field for extent of pruning from Owner's Authorized Representative.
2. Sterilize pruning tools between individual plants, especially in the genus Quercus. Paint all wounds on plants of the genus Quercus with wound paint as soon as possible. Paint deliberate wounds (pruning) within one (I) hour. Paint accidental wounds (storm or equipment damage or vandalism) as soon as they are observed.
3. Raise limbs to an acceptable height as approved by the Owner's Authorized Representative. Raise limbs to seven (7) foot height for trees within ten (10) feet of sidewalk.
4. No weed-eaters or edgers are to be used within fifteen (15) inches of any tree. Should the need for trimming be necessary within fifteen (15) inches of any tree, it shall be done so by hand trimming only.

D. Remove dead wood, broken branches, mistletoe and suckers from trees as needed. Thin prune by removing no more than twenty (20) percent of growth. Sterilize pruning tools between individual plants to keep down spread of disease. Paint all wounds of plants of the genus Quercus with orange shellac as soon as possible. Paint deliberate wounds within one hour and accidental wounds due to storms, etc. as soon as possible.

E. Dispose of all waste and removed material off site per requirements of local authority.

3.11 WEED REMOVAL

A. Contractor shall hand-remove foreign grass, weeds, and immature weeds prior to formation of seed heads.

B. Contractor shall obtain prior approval from the Owner's Authorized Representative before applying the approved organic herbicides.

C. The Contractor shall be held solely responsible for plant loss due to the application of organic herbicides. Any loss of plant material shall be replaced at Contractor's sole expense and all plant replacements shall be of the same species and size of the existing plant materials.

D. Hand weeding or plant specific application of organic herbicide shall be used during plant establishment.

3.12 DEEP ROOT WATERING

A. Deep root water all existing trees to remain within the construction limits of the project once every two (2) weeks during the summer and once (1) a month during the winter, during the duration of the project and until final acceptance. This should be adjusted to the amount of rain. However, unless it has rained at least one-half (1/2) inch since the last watering, continue to deep root water. Complete deep root watering by filling each tree saucer three (3) times and letting it percolate dry.

B. Water new plantings under existing tree to provide optimum soil moisture level for plant germination and root development and not to exceed watering requirements.

3.13 PLANT CARE UNTIL FINAL ACCEPTANCE

A. Water: When irrigation system is not operational, provide necessary hoses and other watering equipment required to complete landscaping.

B. Maintain plantings and trees by watering, cultivating, weeding, raking, fertilizing, controlling diseases and pests, cleaning, and replacing plants as necessary to keep landscape in a vigorous, healthy condition as needed until final acceptance. Maintenance until final acceptance includes but is not limited to the following:

1. Watering Trees: Tree balls to be kept moistened to the depth of the tree ball.
2. Weeding: Remove weeds and foreign grass at bases of plants at least once (1) a week.
3. Application of approved organic insecticides, organic herbicides and organic fungicides shall be in accordance with manufacturer's instructions per Owner and Owner's Authorized Representative approval. Remedy damage from use of insecticides.
4. Trimming and pruning includes only removal of dead or broken branches, and treatment of pruned areas and other wounds. Do not shear any plants.
5. Disease control.
6. Tree straightening: Best for the health of the trees to wait until dormancy to straighten or reset the trees that have started to root into the backfill. Straighten by carefully digging out around the root ball and lifting with appropriate equipment. Never pull, push or put pressure on the trunk. Then repeat applicable planting instructions 3.6.

C. Coordinate watering schedules during installation and until final acceptance. Provide deep root watering with watering truck or temporary irrigation to keep root balls moist on newly installed trees at a minimum of once (1) every two (2) weeks during summer months or as weather conditions indicate.

D. Maintenance Instructions: Submit two (2) copies of typewritten instructions recommending procedures to be established by the Owner for the maintenance of landscape work for one (1) full year. Submit one (1) set of instructions to Owner's Authorized Representative for approval. Submit two (2) copies of revised instructions prior to expiration of Contractor's maintenance period(s) required under the contract.

3.14 CLEAN-UP

A. Keep premises neat and orderly including organization of storage areas. Remove trash and debris from excavated planting areas, preparing beds, or planting plants from Work site daily as work progresses. Keep paved areas clean by sweeping or hosing.

3.15 SITE ENVIRONMENTAL PROCEDURES

A. Waste Management: Comply with local requirements for recycling and reusing waste.

B. Waste Disposal: Disposal of waste, including accessories and used items, by recycling or reusing waste to the extent practical. When washing containers for recycling, do not permit runoff to enter storm drains or sewer systems or penetrate soils.

3.16 FINAL ACCEPTANCE

A. Due to seasonal requirements, final acceptance of this section may not coincide with that of the remaining contract work.

B. Request inspection for final acceptance at least ten (10) calendar days before the end of the plant care and maintenance as described in 3.13.

C. Final acceptance shall be considered the time at which planting, related work and clean-up are one hundred (100%) percent completed.

END OF SECTION 329300

SECTION 330500 - COMMON WORK RESULTS FOR UTILITIES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Piping joining materials.
2. Sleeves.
3. Identification devices.
4. Grout
5. Piping system common requirements.
6. Equipment installation common requirements.
7. Concrete bases.
8. Metal supports and anchorages.

1.2 DEFINITIONS

A. Exposed Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions.

B. Concealed Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

1.3 ACTION SUBMITTALS

A. Product Data: For the following:

1. Identification devices.

PART 2 - PRODUCTS

2.1 PIPING JOINING MATERIALS

A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch maximum thickness, unless otherwise indicated.

a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.

b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

2. AWWA C110, rubber, flat face, 1/8-inch-thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.

B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

C. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

D. Solvent Cements for Joining Plastic Piping:

1. ABS Piping: ASTM D2235.
2. CPVC Piping: ASTM F493.
3. PVC Piping: ASTM D2564. Include primer according to ASTM F656.
4. PVC to ABS Piping Transition: ASTM D3138.

2.2 SLEEVES

A. PVC Pipe Sleeves: ASTM D1785, Schedule 40.

2.3 IDENTIFICATION DEVICES

A. Equipment Nameplates: Metal permanently fastened to equipment with data engraved or stamped.

1. Data: Manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and essential data.
2. Location: Accessible and visible.

B. Snap-on Plastic Pipe Markers: Manufacturer's standard preprinted, semirigid, snap-on type. Include color-coding according to ASME A13.1, unless otherwise indicated.

C. Pressure-Sensitive Pipe Markers: Manufacturer's standard preprinted, color-coded, pressure-sensitive-vinyl type with permanent adhesive.

D. Pipes with OD, Including Insulation, Less Than 6 Inches: Full-band pipe markers, extending 360 degrees around pipe at each location.

E. Pipes with OD, Including Insulation, 6 Inches and Larger: Either full-band or strip-type pipe markers, at least three times letter height and of length required for label.

F. Lettering: Use piping system terms indicated and abbreviate only as necessary for each application length.

1. Arrows: Either integrally with piping system service lettering to accommodate both directions of flow, or as separate unit on each pipe marker to indicate direction of flow.

G. Plastic Tape: Manufacturer's standard color-coded, pressure-sensitive, self-adhesive vinyl tape, at least 3 mils thick.

1. Width: 1-1/2 inches on pipes with OD, including insulation, less than 6 inches; 2-1/2 inches for larger pipes.
2. Color: Comply with ASME A13.1, unless otherwise indicated.

H. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch sequenced numbers. Include 5/32-inch hole for fastener.

1. Material: 0.032-inch- thick, polished brass or aluminum.
2. Material: 0.0375-inch- thick stainless steel.
3. Material: 3/32-inch- thick plastic laminate with 2 black surfaces and a white inner layer.
4. Material: Valve manufacturer's standard solid plastic.
5. Size: 1-1/2 inches in diameter, unless otherwise indicated.
6. Shape: As indicated for each piping system.

I. Valve Tag Fasteners: Brass, wire-link or beaded chain; or brass S-hooks.

J. Engraved Plastic-Laminate Signs: ASTM D709, Type I, cellulose, paper-base, phenolic-resin-laminate engraving stock; Grade ES-2, black surface, black phenolic core, with white melamine subcore, unless otherwise indicated. Fabricate in sizes required for message. Provide holes for mechanical fastening.

1. Engraving: Engraver's standard letter style, of sizes and with terms to match equipment identification.
2. Thickness: 1/16 inch, unless otherwise indicated.
3. Thickness: 1/16 inch, for units up to 20 sq. in. or 8 inches in length, and 1/8 inch for larger units.
4. Fasteners: Self-tapping, stainless-steel screws or contact-type permanent adhesive.

K. Plastic Equipment Markers: Manufacturer's standard laminated plastic, in the following color codes:

1. Green: Cooling equipment and components.
2. Yellow: Heating equipment and components.
3. Brown: Energy reclamation equipment and components.
4. Blue: Equipment and components that do not meet criteria above.
5. Hazardous Equipment: Use colors and designs recommended by ASME A13.1.
6. Terminology: Match schedules as closely as possible. Include the following:

    a. Name and plan number.
    b. Equipment service.
    c. Design capacity.
    d. Other design parameters such as pressure drop, entering and leaving conditions, and speed.

7. Size: 2-1/2 by 4 inches for control devices, dampers, and valves; 4-1/2 by 6 inches for equipment.

2.4 GROUT

A. Description: ASTM C1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.

1. Characteristics: Post hardening, volume adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
2. Design Mix: 5000-psi, 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

A. Install piping according to the following requirements and utilities Sections specifying piping systems.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on the Coordination Drawings.

C. Install piping to permit valve servicing.

D. Install piping at indicated slopes.

E. Install piping free of sags and bends.

F. Install fittings for changes in direction and branch connections.

G. Select system components with pressure rating equal to or greater than system operating pressure.

H. Sleeves are not required for core-drilled holes.

I. Permanent sleeves are not required for holes formed by removable PE sleeves.

J. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.

1. Cut sleeves to length for mounting flush with both surfaces.

K. Verify final equipment locations for roughing-in.

L. Refer to equipment specifications in other Sections for roughing-in requirements.

3.2 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and utilities Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

E. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

F. Grooved Joints: Assemble joints with grooved-end pipe coupling with coupling housing, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.

G. Plastic Piping Solvent-Cemented Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F402 for safe-handling practice of cleaners, primers, and solvent cements.
2. ABS Piping: Join according to ASTM D2235 and ASTM D2661 appendixes.
3. CPVC Piping: Join according to ASTM D2846/D2846M Appendix.
4. PVC Pressure Piping: Join schedule number ASTM D1785, PVC pipe and PVC socket fittings according to ASTM D2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D2855.
5. PVC Nonpressure Piping: Join according to ASTM D2855.
6. PVC to ABS Nonpressure Transition Fittings: Join according to ASTM D3138 Appendix.

H. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D3139.

I. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D3212.

J. Plastic Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D2657.

1. Plain-End PE Pipe and Fittings: Use butt fusion.
2. Plain-End PE Pipe and Socket Fittings: Use socket fusion.

K. Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

3.3 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3.4 EQUIPMENT INSTALLATION

A. Install equipment level and plumb, unless otherwise indicated.

B. Install equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference with other installations. Extend grease fittings to an accessible location.

C. Install equipment to allow right of way to piping systems installed at required slope.

3.5 IDENTIFICATION

A. Piping Systems: Install pipe markers on each system. Include arrows showing normal direction of flow.

1. Plastic markers, with application systems. Install on insulation segment if required for hot noninsulated piping.
2. Locate pipe markers on exposed piping according to the following:

a. Near each valve and control device.
b. Near each branch, excluding short takeoffs for equipment and terminal units. Mark each pipe at branch if flow pattern is not obvious.
c. Near locations where pipes pass through walls or floors or enter inaccessible enclosures.
d. At manholes and similar access points that permit view of concealed piping.
e. Near major equipment items and other points of origination and termination.

B. Equipment: Install engraved plastic-laminate sign or equipment marker on or near each major item of equipment.

1. Lettering Size: Minimum 1/4 inch high for name of unit if viewing distance is less than 24 inches, 1/2 inch high for distances up to 72 inches, and proportionately larger lettering for greater distances. Provide secondary lettering two-thirds to three-fourths of size of principal lettering.

2. Text of Signs: Provide name of identified unit. Include text to distinguish among multiple units, inform user of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.

C. Adjusting: Relocate identifying devices that become visually blocked by work of this or other Divisions.

3.6 CONCRETE BASES

A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.

1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.
2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of base.
3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. Install anchor bolts to elevations required for proper attachment to supported equipment.
6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
7. Use 3000-psi 28-day compressive-strength concrete and reinforcement as specified in Section 033000 "Cast-in-Place Concrete."

3.7 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor piped utility materials and equipment.

B. Field Welding: Comply with AWS D1.1/D1.1M.

3.8 GROUTING

A. Mix and install grout for equipment base bearing surfaces, pump and other equipment base plates, and anchors.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placement of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases and provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout.

END OF SECTION 330500

SECTION 334114 - LANDSCAPE DRAINAGE SYSTEM AT PLAYGROUND

PART 1 – GENERAL

1.1 DESCRIPTION

A. Furnish all work and materials, appliances, tools, equipment, facilities, transportation, and services necessary for and incidental to performing all operations in connection with the installation of the landscape drainage/underdrain system.

B. Conform to the requirements of the general conditions of the contract.

1.2 SUMMARY

A. Section Includes: Providing and installing landscape drainage/underdrain system.

1. Trenching and backfilling.
2. Providing and installing all pipe, including joints and fittings, cutting pipe to conform to structures and outfall at atmosphere.
3. Providing and installing clean outs with solid wye or bend connection.
4. Providing and installing drain pipe grate cover with concrete collar at outfall.
5. Providing and installing drains catch basins with grates to point of connection at piping.

B. Related Work Specified Elsewhere:

1. Concrete Paving at Playground – Section 321314.
2. Playground Equipment – Section 116816.

1.3 REFERENCES

A. Applicable Standards: Apply the current of latest edition of American Society for Testing and Materials (ASTM).

1. D 1785-15e1: Polyvinyl Chloride (PVC) Plastic pipe. Schedule 40, 80 and 120.
2. Standard and perforated Schedule 40 PVC pipe and fittings conforming to ASTM D 2729 sewer piping or D2665 DWV piping.
3. F 405-13: Corrugated Polyethylene tubing and fittings.
4. Standard Specifications – North Central Texas Council of Governments and Local Building Code.

1.4 QUALITY ASSURANCE

A. General: Perform work in accordance with all applicable laws, codes and regulations required by the local city code, building code or university standards.

B. Qualifications: Installer (for permeable playground surfaces): Company specializing in performing the Work of this Section with minimum five (5) years documented experience installing projects of similar size and scope. The Landscape Contractor shall furnish a list of references or previous work experience as requested by the Owner. The Landscape Contractor shall employ only skilled personnel and provide adequate supervision.

1.5 SUBMITTALS

A. Product Data: Submit manufacturer's latest catalog cuts and specifications for each specified product.

B. Samples:

1. Solid drain pipe: Manufacturer's literature and twelve (12) inch piece of pipe.
2. Clean-outs: Manufacturer's literature and gray threaded sewer cap with inverted key plug.
3. Drain Body and Grate: Manufacturer's literature for each size and component.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver products in original factory unopened, undamaged packaging bearing identification of product, manufacturer, batch number, and expiration data, as applicable.

B. Store the product in a location protected from damage, construction activity, and precipitation in strict accordance with the manufacturer's recommendations.

C. Pipe: Cap openings against entry by foreign matter where required.

D. Damaged Materials: Remove all damaged materials and replace at no expense to Owner.

1.7 COORDINATION

A. Concealed Work: Verify and locate existing pipes, cast in place pipes for point of connection and structures to be coordinated with playground drainage work. Review all available records and make all necessary explorations and excavations.

B. Field Measurements: Establish lines and levels for each drainage system and coordinate with other systems for prevent conflicts and maintain proper clearances.

C. Notification: Submit to Owner's Authorized Representative written notification of all discrepancies in the Drawings or existing conditions which preclude successful installation of landscape drainage work as specified.

1.8 FINAL ACCEPTANCE

A. Review Date: Make a written request for review for Final Acceptance at least five days in advance.

B. Completion: Work will be accepted upon satisfactory completion of all landscape drainage work.

C. Responsibility: Upon Final Acceptance, Owner will assume responsibility for maintenance of the work.

PART 2 – MATERIALS

2.1 SOLID POLYVINYL CHLORIDE (PVC) PIPE AND FITTINGS

A. Marking and identification: Schedule 40 PVC pipe shall be continuously and permanently marked with the following information: manufacturer's name, size, type of pipe and material, SDR number, product standard number and the National Sanitation Foundation (NSF) seal. Polyvinyl chloride pipe and fittings PVC 1120, conforming to ASTM D1785-15el, sizes as shown on the Drawings.

B. Marking and identification: Schedule 80 PVC pipe shall be continuously and permanently marked with the following information: manufacturer's name, size, type of pipe and material, number, product standard number and the National Sanitation Foundation (NSF) seal. Polyvinyl chloride pipe and fittings conforming to ASTM D 1785-15el and ASTM D 2467, size as shown on the Drawings.

C. Recessed Clean-out Threaded Plug with Inverted Key Plug, color: Gray or Black. Threaded plug cap to have inverted plug to prevent mowers from damaging the surface or bearing on plug of cleanout. (Required at end of piping run to provide for cleanout of playground drain lines.)

2.2 SUBSURFACE PLAYGROUND DRAINS

A. Shall be polyethylene grate NDS #980 9" Square Grate and NDS #932 9"x9" Low Profile Housing Adapter, color: black, as manufactured by National Diversified Sales, Inc. (NDS), 851 N. Harvard Avenue, Lindsay, California 93247, (1-800-726-1994) or Local Representative: WWIP Corp. (214-920-8420) or equivalent as determined by Owner's Authorized Representative.

2.3 MITERED DRAIN AT ATMOSPHERE

A. Shall be high-density polyethylene grate (HDPE), Model 6MD3P, color: gray, as manufactured by Mitered Drain, Inc., P.O. Box 1556, Windsor, California 95492, (7070620-0606) or equivalent as determined by Owner's Authorized Representative.

PART 3 – EXECUTION

3.1 GENERAL

A. Existing Utilities: Where grade or alignment or pipe if obstructed by existing utility structures such as conduits, ducts or pipes, permanently support, relocate, remove or reconstruct the obstruction.

B. Deviations: Make no deviations from specified line or grade without written acceptance of change by Owner's Authorized Representative.

C. Verification: Verify rim elevations of area drains relative to adjacent walls prior to beginning of work.

3.2 TRENCHING AND BACKFILLING

A. When trench excavation encounters hardpan, rock, mud, quicksand, debris, or other unsuitable bedding material, trench shall be further excavated to a suitable limit as directed by Owner's Authorized Representative. Excavation shall then be backfilled with approved import material that will provide adequate pipe bedding. Import material will be cement stabilized sand for sections of solid PVC piping, unless otherwise specified.

1. Cement stabilized sand shall be used for backfilling around the solid PVC pipe and to the spring line (middle) of the pipe. The remaining trench may be backfilled with excavated material, except that if said material is unsuitable for compaction, imported suitable material shall be used.

B. All trench backfill shall be compacted to (ninety-five (95%) percent) relative density per ASTM D698.

3.3 PIPE INSTALLATION

A. All pipe shall be installed and tested in accordance with the Standard Specifications prior to covering.

B. Solid polyvinyl chloride pipe and underdrain pipe shall be installed as detailed in the plans and in accordance with the manufacturer's current printed recommendations.

C. Solid polyvinyl chloride pipe (Schedule 80 PVC) drain under walk shall be installed as detailed in the plans with cut mitered end to accept the mitered drain for the outfall side.

D. Insure all pipe has flow to discharge points.

3.4 UNDERDRAIN SYSTEM

A. Excavate trenches for drainage.

B. Install stainless steel screws with vinyl or stainless-steel washers into drain body prior to anchor drain body into concrete slab pour.

C. Install drain body with grate and as shown on the Drawings and Details and in strict accordance with the manufacturer's current specifications.

D. Tie subsurface drain pipe(s) to drain body.

E. Provide solid PVC pipe clean outs/extensions off subsurface drain pipe in direction of flow as shown in locations on drawing. Provide a cast concrete collar around the cleanout to prevent mowers from damaging the cleanout.

F. Provide protection of underdrain system until playground surfacing is installed.

3.5 CLEAN-UP

A. Keep all areas of work clean, neat and orderly at all times.

B. Upon completion of work, remove off the site all surplus materials, tools, equipment, rubbish, excess materials and debris resulting from the work.

END OF SECTION 334114