Danny Meehan Recreational Field Improvements

Technical Specifications

BID SET

Prepared for:

Office of Capital Projects & Development Services
Town of Medley, Florida
7777 NW 72nd Avenue, Room 219

October 17, 2014

100% Design Submittal

Prepared by:

ATKINS
Spectrum Consulting Engineers, Inc.

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SECTION 00 31 32

SUBSURFACE INVESTIGATION

PART 1 – GENERAL

1.01 RELATED DOCUMENTS:

A. The subsurface investigation as performed by PSI, Inc., and is summarized with findings and recommendations in a report, which is included in these documents, and titled "Report of Geotechnical Engineering Services for Danny Meehan Park Improvements" PSI Project No. 0397-747 Dated June 20, 2014. This report is incorporated for the Contractor's use and hereby made a part of the Specification.

END OF SECTION

June 20, 2014

ATKINS
7175 Murrell Road
Melbourne, Florida 32940

Attention: Mr. John Wilt, P.E.
Senior Engineer III

Re: Report of Geotechnical Engineering Services
Danny Meehan Park Improvements
7901 N.W. South River Drive, Medley, Florida
PSI Project No.: 0397-747

Dear Mr. Wilt:

Professional Service Industries, Inc. (PSI) has completed a geotechnical engineering study in connection with the above referenced project. Our services were provided in general accordance with PSI Proposal No. P0-397-122663, dated May 1, 2014. Authorization to perform our services was provided by means of a Subcontract for Professional Services, dated May 28, 2014.

1.0 PROJECT INFORMATION

The area of study is located within the Danny Meehan Park, situated along N.W. South River Drive in Medley, Florida. A site vicinity map identifying the project location with respect to existing streets and features is presented on **Sheet 1** of the **Appendix**.

At the time of our study, the site was occupied by a soccer/baseball field, basketball court and asphalt paved parking. Our truck mounted drilling equipment used for the subsurface exploration did not experience any difficulty in moving around the site. Photographs from our site visit are presented in **Sheet 2** of the **Appendix**.

The project will involve the construction of a bathroom facility, new paved parking area, dry retention area, basketball court and soccer field as part of the park improvements. In addition, the improvements will include a stormwater management system(s).

Structural loads were not provided at this time. However, based on our experience with similar type facilities, we have assumed the structural loads to be relatively light, with wall loads of less than 3 kips/foot.

If any of the noted information is incorrect or has changed, please notify PSI so that we may amend the recommendations presented in this report, if appropriate.

2.0 FIELD EXPLORATION AND SUBSURFACE CONDITIONS

2.1 STANDARD PENETRATION TEST (SPT) BORINGS

To evaluate subsurface conditions at the site, we drilled/sampled six Standard Penetration Test (SPT) borings that were advanced to depths of 6 and 15 feet below grade. The approximate locations at which the borings were drilled are shown on **Sheet 3** of the **Appendix**.

After seating the sample spoon six inches, the number of successive blows required to drive the sampler twelve inches into the soil constitutes the test result commonly referred to as the "N" value. The “N” value has been empirically correlated with various soil properties and is considered to be indicative of the relative density of cohesionless soils and the consistency of cohesive materials. The SPT borings were performed using a CME-55 truck mounted drill rig equipped with an automatic hammer. The recovered split spoon samples were visually classified in the field and transported to the laboratory for further review. Following completion of our field services, all boreholes were backfilled with excavated soil/rock and the site generally cleaned, as required.

2.2 PERCOLATION TESTS

PSI performed three percolation tests at depths of 15 feet below grade within SPT boring P-1, P-2 and P-3. The percolation tests were performed in general accordance with the South Florida Water Management District (SFWMD) procedures for the "Usual Condition Constant Head" Percolation Test. SPT sampling was performed simultaneously as the boreholes were advanced using a 6-inch diameter casing. A 4-inch diameter perforated PVC pipe was placed in the borehole prior to retrieving the casing. Water was then pumped into the borehole in order to raise the water level as close to the ground surface as possible. Once the inflow equalized with the outflow rate, the average pumping rate and level of the water for this stabilized flow rate was recorded.

The hydraulic conductivity values determined from the tests are presented in **Table 1** of the **Appendix**. The values are in units of cubic feet of flow per second, per square foot of seepage area, per foot of head (cfs/ft^2-ft). The tabulated values are ultimate values. The designer should apply an appropriate factor of safety to the reported values.

It should be noted that while performing the percolation test the head of water could not be raised to the ground surface with the full output of the pump, which is set at 58 gallons per minute (GPM). Therefore, in calculating the hydraulic conductivity value, we have utilized an “Average Flow Rate” of 58 GPM. Furthermore, we do not recommend applying an Average Flow Rate of greater than 58 GPM in the hydraulic conductivity calculations as this test is performed under ideal conditions and the performance of the french drain which is designed using these idealized parameters over time may experience reduced flow rates.

2.3 SUBSURFACE AND GROUNDWATER CONDITIONS

The soil types encountered at the boring locations are presented on individual logs included in the **Appendix**. The stratification presented is based on visual observation of the recovered soil samples and the interpretation of the field logs by a geotechnical engineer. Included with the profiles are the N-values and groundwater levels measured at the time the borings were drilled.

The results of our borings performed for the study generally revealed a surficial topsoil cover or exposed soils underlain by granular fill material consisting of varying amounts of limerock and fine sand that persisted to depths of approximately 2 feet below grade. Below the granular fill stratum, the borings were underlain by interbedded layers of moderately cemented limestone and fine sand to the maximum termination depth of the explorations at 15 feet below grade.

An exception to the generalized conditions was noted in boring B-3, where a one foot thick stratum of slightly organic fine sand was encountered in the 1 to 2 feet depth interval. This stratum is not expected to pose any constraints to the planned construction. However, if this material is encountered and becomes problematic with regards to achieving compaction, then it should be excavated and removed to its full depth.

The groundwater table was observed in the borings at depths ranging from 3.0 to 3.7 feet below existing grade at the time of drilling.

It should be noted that groundwater levels at the site will fluctuate seasonally due to rainfall and the infiltration rate of the soil. Therefore, at a time of the year different from the time of drilling, there is a possibility of a change in the recorded levels. We estimate that during the peak of the wet hydroperiod, with rainfall and recharge at a maximum, groundwater levels at the site could be one to two feet higher than those reported herein (i.e. seasonal high groundwater table). Throughout the year, the groundwater table at the site will closely relate to the water levels in the Miami River, located north of the project site.

We recommend that the contractor determine the actual groundwater levels at the time of construction to assess the potential impact of groundwater on the construction procedure.

Please refer to the individual boring logs presented in the **Appendix** for details on the subsurface conditions at specific exploration locations.

3.0 EVALUATION AND SITE PREPARATION RECOMMENDATIONS

After completion of site preparation procedures described herein, the proposed bathroom facility can be supported on shallow foundations that are designed using a maximum net allowable bearing pressure of 3,000 pounds per square foot (psf), resting on compacted approved structural fill material or natural limestone. Based on our understanding of foundation loads as noted earlier, we estimate that shallow footings will experience less than one inch of total settlement.

The contractor should anticipate a high resistance to excavation activities (i.e. during footing excavation, as well as during the installation of below grade utilities and exfiltration trenches) as the limestone formation was encountered at relatively shallow depths. The limestone formation may require the use of special equipment and breaking tools during construction excavation work.

Based on the results of our field exploration, we anticipate site preparation procedures to include the steps listed below. All work should be carried out in accordance with current regulatory criteria with the site preparation work and construction activities being carried out with care so as not to impact the adjacent existing construction that is to remain.

1. If not already done, provisions should be made to relocate any interfering utility lines within the construction area. Excavations resulting from the removal of unwanted pipes should be infilled with suitable granular soils that are thoroughly compacted.

2. Site preparation for the proposed facility should include stripping and removal of any unwanted ground cover such as topsoil to expose clean granular soils. All construction debris (from removal of abandoned utilities) and unwanted ground cover should be completely removed from the site and properly disposed of. This work should be carried out in accordance with current regulatory criteria.

3. The footings for the facility should be placed on compacted approved structural fill material or natural limestone.

    A) It is recommended that the soils exposed at the bottom of the footing excavations be compacted to at least 95 percent of the Modified Proctor maximum dry density just before pouring concrete. If the footing bearing materials become disturbed due to surface water resulting from precipitation and runoff, the disturbed soils should be overexcavated and replaced with compacted limerock which is densified to at least 95 percent of the materials Modified Proctor maximum dry density as determined by ASTM designation D-1557.

    B) If the footings rest on the natural limestone formation, in lieu of compaction, the bottom of excavation should be observed by a geotechnical engineer from this office to verify the integrity of the limestone.

    C) All open foundation excavations should be observed and approved by a licensed geotechnical engineer or his representative prior to pouring concrete.

4. Structural fill material may be composed of either clean sands or limerock. The fill should consist of an inorganic, non-plastic material, free of any man-made debris and limerock with a three inch maximum particle size. Proper control of the placement and compaction of new fills for the project should be exercised by a representative of the geotechnical engineer. The fill materials should be placed in lifts not exceeding 12 inches in loose thickness. Each lift should be compacted to at least 95 percent of the Modified Proctor maximum dry density near the optimum moisture content as determined by ASTM D-1557. Fill to be compacted with a vibratory plate tamper or a small walk behind vibratory roller should be placed in lifts not exceeding six inches in loose thickness

    A) The structural fill to be used above the water table should have a Unified Soil Classification System designation of GP, GW, SP, SW, GP-GM, GW-GM, SW-SM, or SP-SM containing less than 12 percent material passing the No. 200 sieve

    B) The structural fill or backfill to be placed below the water table and to a height of one foot above it should consist of a combination of FDOT 57 Stone and structural fill material mixed in an approximate 50% proportion by volume. Density testing will not be required within this layer, however the subgrade preparation work should be observed by a representative from our office to confirm that the material is in a stable and unyielding condition.

    C) The use of a commercially available fill material by the name “Cyclone sand” should not be permitted for the project. Cyclone sand contains large amounts of fines and is therefore very sensitive to moisture. The moisture sensitivity of the material makes it difficult to compact and achieve the desired densities.

5. Groundwater control may be required at this site for either excavation dewatering or removal of temporarily perched water from a rain event. Such water can be controlled by pumping from sumps located in ditches or pits. Groundwater should be maintained at least one foot below the bottom of any excavation made during construction operations, or, at least two feet below the surface of any compaction operations.

6. It is mandated by federal regulations that all excavations, whether they be utility trenches, basement excavations or footing excavations, be constructed in accordance with OSHA guidelines and recommendations. It is our understanding that these regulations are being strictly enforced and if they are not closely followed, the owner and the contractor could be liable for substantial penalties.

4.0 PAVEMENT SECTION SUGGESTIONS

It is our assumption that new pavements will be constructed for the project and that no attempt will be made to re-use some or all of the pavements associated with the existing facility. On this basis, recommendations/suggestions for pavement design are presented herein.

Flexible pavement sections in this geographic area typically consist of an asphaltic concrete wearing course, a limerock base course and a stabilized subgrade (sub-base). Based on our experience in the area, the typical pavement section thicknesses noted in **Table A** below are considered suitable for the project.

Table A: Typical Pavement Section Suggestions

Type of Pavement	Layer	Material Description	Layer Thickness (inches)	
			Light Duty	Medium Duty
Flexible	(A)	Florida DOT Asphalt Type S	1.5	2.0
	(B)	Crushed limerock with minimum LBR of 100, compacted to 98% of the Modified Proctor maximum dry density	6.0	8.0
	(SB)	Stabilized subgrade (sub-base) fill with a minimum LBR of 40 compacted to 95% of the Modified Proctor maximum dry density	12.0	12.0
Rigid	(C)	Florida DOT Portland Cement Concrete	5.0	6.0
	(SB)	Granular subgrade compacted to 95% or more of the Modified Proctor maximum dry density	12.0	12.0
(A) = Asphaltic Concrete, (B) = Base Course, (SB) = Stabilized Subgrade (Sub-base) (C) = Concrete				

The base course materials in the pavements should consist of crushed limerock having a minimum Limerock Bearing Ratio (LBR) of 100. Base materials should meet the requirements presented in the latest revisions of the Florida Department of Transportation "Specifications for Road and Bridge Construction", Section 911 (limestone). The base course should be compacted to at least 98 percent of the material's maximum dry density (ASTM D-1557). The subgrade should be stabilized to a depth of 12 inches to achieve a minimum LBR of 40. This can be obtained by blending base material (limerock) with the existing subgrade soils. The required mixing ratio should be determined by laboratory testing. The stabilized subgrade should be compacted to at least 95 percent of the maximum dry density (ASTM D-1557).

Lastly, we recommend that a minimum separation of two feet be maintained between the bottom of the base and the seasonal high groundwater table levels.

Actual pavement section thicknesses should be provided by the Design Civil Engineer based on traffic loads, volume, and the owner's design life requirements. The noted sections represent minimum thicknesses for typical local construction practices and, as such, periodic maintenance should be anticipated. All pavement materials and construction procedures should conform to FDOT, American Concrete Institute (ACI), or appropriate city/county requirements.

5.0 REPORT LIMITATIONS

Our professional services have been performed, findings obtained, and recommendations prepared in accordance with generally accepted geotechnical engineering principles and practices at the time of this report. This company is not responsible for the conclusions, opinions or recommendations made by others based on this data. No other warranties are implied or expressed. After the plans and specifications are complete, it is recommended that PSI be provided the opportunity to review the final design and specifications, in order to verify that the earthwork and foundation recommendations are properly interpreted and implemented. At that time, it may be necessary to submit supplemental recommendations.

The scope of investigation was intended to evaluate soil conditions within the influence of the proposed shallow foundations. The analyses and recommendations submitted in this report are based upon the data obtained from the soil borings performed at the locations indicated. If any subsoil variations become evident during the course of this project, a re-evaluation of the recommendations contained in this report will be necessary after we have had an opportunity to observe the characteristics of the conditions encountered. The applicability of the report should also be reviewed in the event significant changes occur in the design, nature or location of the proposed canopy.

The scope of our services did not include an environmental assessment for the presence or absence of hazardous or toxic materials in the soil and groundwater. Any statements in this report regarding odors, staining of soils, or other unusual conditions observed are strictly for the information of our client.

This report has been prepared for the exclusive use of Atkins, and their design consultants, for the specific application to the design and construction at Danny Meehan Park in Medley, Florida.

6.0 CLOSURE

We trust this report is adequate for your current needs; however, should you have any questions or should additional information be required, please do not hesitate to contact our office at (305) 471-7725.

Respectfully Submitted,

Professional Service Industries, Inc.
Certificate of Authorization No: 3684

Gustavo A. Silva
Project Manager

Ian Kinnear, P.E
Chief Engineer
FL License No. 32614

Dhuruva (Dru) Badri, P.E.
Department Manager
FL License No. 68718

cc: Addressee (3 and PDF)
File (1 and PDF)

APPENDIX

Sheet 1:	Site Vicinity Map
Sheet 2:	Site Photographs
Sheet 3:	Boring Location Plan
	Boring Logs
Table 1:	Summary of Percolation Test Results
	Schematic of Usual Open-Hole Percolation Test

APPENDIX

SITE VICINITY MAP

GEOTECHNICAL ENGINEERING SERVICES
Danny Meehan Park
7901 N.W. South River Drive
Medley, Florida

DATE: 6/17/2014

DRAWN: GS

CHKD:: DB

SHEET No.: 1

PSI PROJECT No.: 0397-747

psi Information To Build On
Engineering • Consulting • Testing

SITE PHOTOGRAPHS

GEOTECHNICAL ENGINEERING SERVICES
Danny Meehan Park
7901 N.W. South River Drive
Medley, Florida

DATE: 6/17/2014

DRAWN: GS

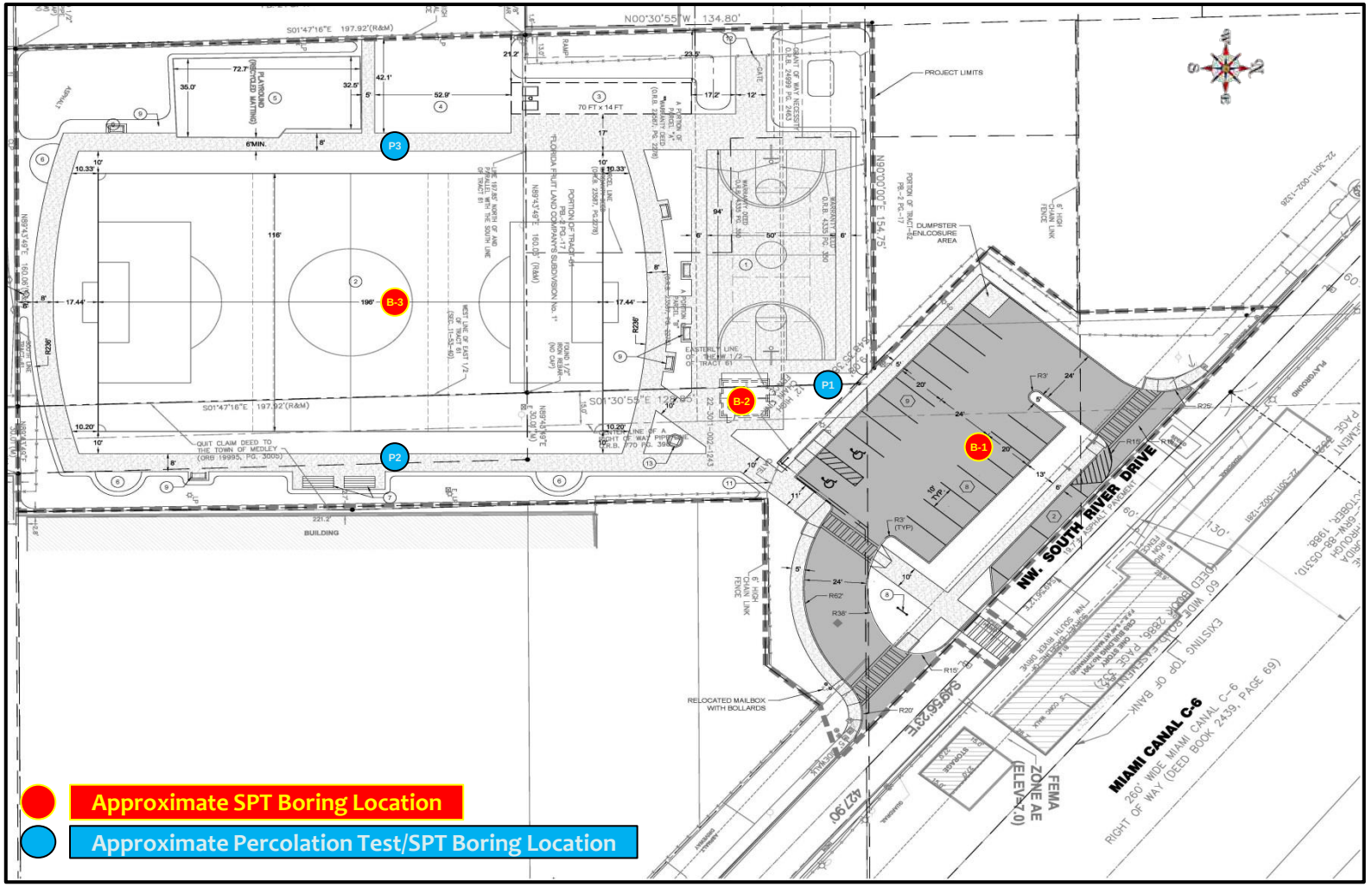
CHKD:: DB

SHEET No.: 2

PSI PROJECT No.: 0397-747

psi Information To Build On
Engineering • Consulting • Testing

BORING LOCATION PLAN



GEOTECHNICAL ENGINEERING SERVICES
Danny Meehan Park
7901 N.W. South River Drive
Medley, Florida

DATE: 4/17/2014

DRAWN: GS

CHKD:: DB

SHEET No.: 3

PSI PROJECT No.: 0397-747

psi Information To Build On
Engineering • Consulting • Testing

Professional Service Industries, Inc.
7950 N.W. 64th Street
Miami, FL 33166
Telephone: (305) 471-7725
Fax: (305) 593-1915

LOG OF BORING B-1

PSI Job No.: 0397-747
Project: Danny Meehan Park
Location: 7901 N.W. South River Drive
Medley, Florida

Drilling Method: SPT
Sampling Method: SS
Hammer Type: Automatic
Boring Location: Refer to Sheet 3

WATER LEVELS	
While Drilling	3.7 feet
Upon Completion	3.7 feet
Delay	N/A

Station: N/A
Offset: N/A

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	STANDARD PENETRATION TEST DATA N in blows/ft ◎ × Moisture ◪ PL ✚ LL (0, 25, 50) STRENGTH, tsf ▲ Qu ✳ Qp (0, 2.0, 4.0)	Additional Remarks
	0					Light Brown LIMEROCK with Fine Sand	GP				
				1		Light Brown Fine SAND with Limerock	SP	17-6-3-2 N=9			
						Light Brown Fine SAND with Limestone Lenses/Layers					
				2			SP	3-3-4-3 N=7			
						Light Brown LIMESTONE with Fine Sand					
	5			3				5-4-5-5 N=9			

Completion Depth: 6.0 ft
Date Boring Started: 6/13/14
Date Boring Completed: 6/13/14
Logged By: L.R.
Drilling Contractor: PSI, Inc.

Sample Types:
Auger Cutting
Split-Spoon
Rock Core
Shelby Tube
Hand Auger
Calif. Sampler
Texas Cone

Latitude:
Longitude:
Drill Rig: CME-55
Remarks:

The stratification lines represent approximate boundaries. The transition may be gradual.

Professional Service Industries, Inc.
7950 N.W. 64th Street
Miami, FL 33166
Telephone: (305) 471-7725
Fax: (305) 593-1915

LOG OF BORING B-2

PSI Job No.: 0397-747
Project: Danny Meehan Park
Location: 7901 N.W. South River Drive
Medley, Florida

Drilling Method: SPT
Sampling Method: SS
Hammer Type: Automatic
Boring Location: Refer to Sheet 3

WATER LEVELS

While Drilling	3.0 feet
Upon Completion	3.0 feet
Delay	N/A

Station: N/A
Offset: N/A

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	Additional Remarks
	0					Dark Brown Organic Fine SAND with Traces of Roots (TOPSOIL)	OL			
				1		Light Brown LIMEROCK with Fine Sand Light Brown LIMESTONE with Fine Sand	SP	13-11-8-7 N=19		
						Light Brown Fine SAND	SP			
				2		Light Brown LIMESTONE with Fine Sand		2-2-8-15 N=10		
	5			3				13-10-7-7 N=17		
				4				6-6-9-8 N=15		
				5				5-12-9-10 N=21		
	10					Light Brown Fine SAND				
							SP			
				6				4-4-5 N=9		
	15									

STANDARD PENETRATION TEST DATA
N in blows/ft ◎
Moisture ×
PL ◪
LL ✚
0 25 50

STRENGTH, tsf
Qu ▲
Qp ✳
0 2.0 4.0

Completion Depth:	15.0 ft
Date Boring Started:	6/13/14
Date Boring Completed:	6/13/14
Logged By:	L.R.
Drilling Contractor:	PSI, Inc.

Sample Types:
- Auger Cutting
- Split-Spoon
- Rock Core
- Shelby Tube
- Hand Auger
- Calif. Sampler
- Texas Cone

Latitude:
Longitude:
Drill Rig: CME-55
Remarks:

The stratification lines represent approximate boundaries. The transition may be gradual.

Professional Service Industries, Inc.
7950 N.W. 64th Street
Miami, FL 33166
Telephone: (305) 471-7725
Fax: (305) 593-1915

LOG OF BORING B-3

PSI Job No.: 0397-747
Project: Danny Meehan Park
Location: 7901 N.W. South River Drive
Medley, Florida

Drilling Method: SPT
Sampling Method: SS
Hammer Type: Automatic
Boring Location: Refer to Sheet 3

WATER LEVELS

While Drilling	3.3	feet
Upon Completion	3..3	feet
Delay	N/A	

Station: N/A
Offset: N/A

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	STANDARD PENETRATION TEST DATA N in blows/ft ◎ / STRENGTH, tsf	Additional Remarks
	0					Dark Brown Organic Fine SAND with Traces of Roots (TOPSOIL)	OL				
				1		Light Brown LIMEROCK with Fine Sand	SP	5-4-2-2 N=6			
						Light Brown Slightly Organic Fine SAND	SP-OL				
						Light Brown LIMESTONE with Fine Sand					
				2				3-4-4-4 N=8			
	5			3				5-7-5-5 N=12			

Moisture × PL ◪ LL ✚
0 25 50
Qu ▲ Qp ✳
0 2.0 4.0

Completion Depth: 6.0 ft
Date Boring Started: 6/13/14
Date Boring Completed: 6/13/14
Logged By: L.R.
Drilling Contractor: PSI, Inc.

Sample Types:
Auger Cutting
Split-Spoon
Rock Core
Shelby Tube
Hand Auger
Calif. Sampler
Texas Cone

Latitude:
Longitude:
Drill Rig: CME-55
Remarks:

The stratification lines represent approximate boundaries. The transition may be gradual.

Professional Service Industries, Inc.
7950 N.W. 64th Street
Miami, FL 33166
Telephone: (305) 471-7725
Fax: (305) 593-1915

LOG OF BORING P-1

PSI Job No.: 0397-747
Project: Danny Meehan Park
Location: 7901 N.W. South River Drive
Medley, Florida

Drilling Method: SPT
Sampling Method: SS
Hammer Type: Automatic
Boring Location: Refer to Sheet 3

WATER LEVELS

While Drilling	3.2 feet
Upon Completion	3.2 feet
Delay	N/A

Station: N/A
Offset: N/A

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	Additional Remarks
	0					Dark Brown Organic Fine SAND with Traces of Roots (TOPSOIL)	OL			
				1		Light Brown LIMEROCK with Fine Sand	SP	12-7-8-7 N=15		
						Light Brown LIMESTONE with Fine Sand				
				2				6-7-6-7 N=13		
	5			3				7-5-5-4 N=10		
				4				6-7-5-8 N=12		
				5				8-7-10-13 N=17		
	10									
				6				7-7-5 N=12		
	15					Note: Percolation Test Performed at 15 Feet Below the Ground Surface				

STANDARD PENETRATION TEST DATA
N in blows/ft ◎
× Moisture ◪ PL ✚ LL
0 25 50
STRENGTH, tsf
▲ Qu ✳ Qp
0 2.0 4.0

Completion Depth: 15.0 ft
Date Boring Started: 6/13/14
Date Boring Completed: 6/13/14
Logged By: L.R.
Drilling Contractor: PSI, Inc.

Sample Types:
Auger Cutting
Split-Spoon
Rock Core
Shelby Tube
Hand Auger
Calif. Sampler
Texas Cone

Latitude:
Longitude:
Drill Rig: CME-55
Remarks:

The stratification lines represent approximate boundaries. The transition may be gradual.

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Miami, FL 33166
Telephone: (305) 471-7725
Fax: (305) 593-1915

LOG OF BORING P-2

PSI Job No.: 0397-747
Project: Danny Meehan Park
Location: 7901 N.W. South River Drive
Medley, Florida

Drilling Method: SPT
Sampling Method: SS
Hammer Type: Automatic
Boring Location: Refer to Sheet 3

WATER LEVELS

While Drilling	3.3 feet
Upon Completion	3.3 feet
Delay	N/A

Station: N/A
Offset: N/A

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	Additional Remarks
	0					Dark Brown Organic Fine SAND with Traces of Roots (TOPSOIL)	OL			
				1		Light Brown LIMEROCK with Fine Sand	SP	11-6-4-3 N=10		
						Light Brown Fine SAND	SP			
						Light Brown LIMESTONE with Fine Sand				
				2				3-5-4-3 N=9		
	5			3				4-4-7-8 N=11		
				4				6-8-8-8 N=16		
				5				4-6-16-30 N=22		
	10					Light Brown Fine SAND with Limestone Lenses/Layers	SP			
				6				4-3-3 N=6		
	15					Note: Percolation Test Performed at 15 Feet Below the Ground Surface				

STANDARD PENETRATION TEST DATA
N in blows/ft ◎
Moisture ✕ PL ◪ LL ✚
0 25 50

STRENGTH, tsf
Qu ▲ Qp ✳
0 2.0 4.0

Completion Depth:	15.0 ft
Date Boring Started:	6/13/14
Date Boring Completed:	6/13/14
Logged By:	L.R.
Drilling Contractor:	PSI, Inc.

Sample Types:
Auger Cutting
Split-Spoon
Rock Core
Shelby Tube
Hand Auger
Calif. Sampler
Texas Cone

Latitude:
Longitude:
Drill Rig: CME-55
Remarks:

The stratification lines represent approximate boundaries. The transition may be gradual.

Professional Service Industries, Inc.
7950 N.W. 64th Street
Miami, FL 33166
Telephone: (305) 471-7725
Fax: (305) 593-1915

LOG OF BORING P-3

PSI Job No.: 0397-747
Project: Danny Meehan Park
Location: 7901 N.W. South River Drive
Medley, Florida

Drilling Method: SPT
Sampling Method: SS
Hammer Type: Automatic
Boring Location: Refer to Sheet 3

WATER LEVELS

While Drilling	3.4 feet
Upon Completion	3.4 feet
Delay	N/A

Station: N/A
Offset: N/A

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	Additional Remarks
	0					Dark Brown Organic Fine SAND with Traces of Roots (TOPSOIL)	OL			
				1		Light Brown LIMEROCK with Fine Sand	SP	9-7-6-4 N=13		
						Light Brown Fine SAND	SP			
						Light Brown LIMESTONE with Fine Sand				
				2				4-6-5-5 N=11		
	5			3				6-6-6-6 N=12		
				4				8-9-9-7 N=18		
				5				6-5-12-17 N=17		
	10					Light Brown Fine SAND with Limestone Lenses/Layers	SP			
				6				6-5-6 N=11		
	15					Note: Percolation Test Performed at 15 Feet Below the Ground Surface				

STANDARD PENETRATION TEST DATA
N in blows/ft ◎
Moisture ✕ PL ◪ LL ✚
0 25 50

STRENGTH, tsf
Qu ▲ Qp ✳
0 2.0 4.0

Completion Depth:	15.0 ft
Date Boring Started:	6/13/14
Date Boring Completed:	6/13/14
Logged By:	L.R.
Drilling Contractor:	PSI, Inc.

Sample Types:
Auger Cutting
Split-Spoon
Rock Core
Shelby Tube
Hand Auger
Calif. Sampler
Texas Cone

Latitude:
Longitude:
Drill Rig: CME-55
Remarks:

The stratification lines represent approximate boundaries. The transition may be gradual.

psi Information To Build On
Engineering • Consulting • Testing

TABLE 1: SUMMARY OF PERCOLATION TEST RESULTS
DANNY MEEHAN PARK
7901 N.W. SOUTH RIVER DRIVE
MEDLEY, FLORIDA
PSI PROJECT No.: 0397-747

Test No.	Date Performed	Diameter		Depth of Hole	Depth to Groundwater Level Below Ground Surface (Feet)		Hydraulic Head, H2	Saturated Hole Depth, Ds	Average Flow Rate, Q	K, Hydraulic Conductivity
		Casing (Inches)	Perforated PVC (Inches)	(Feet)	Prior to Test	During Test	(Feet)	(Feet)	(gpm)	cfs/ft^2-ft
P-1	17-Jun-14	6	4	15.0	3.2	0.0	3.2	11.8	58.0	1.9E-03
P-2	17-Jun-14	6	4	15.0	3.3	0.0	3.3	11.7	58.0	1.9E-03
P-3	17-Jun-14	6	4	15.0	3.4	0.0	3.4	11.6	58.0	1.8E-03

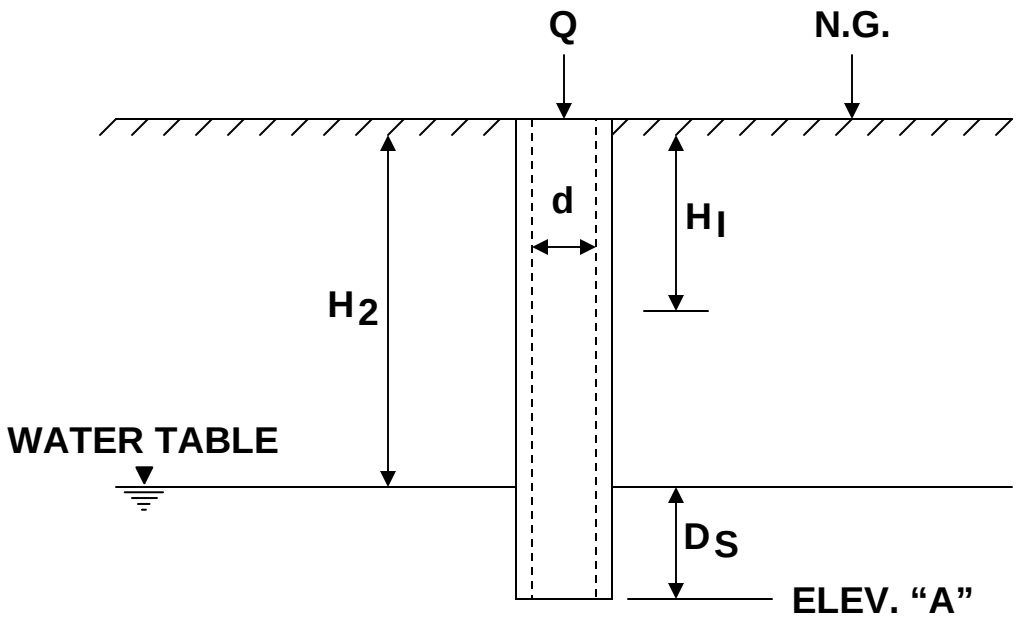
Note:

(1) The above hydraulic conductivity values are for a french drain installed to the same depth as the borehole tests. The values represent an ultimate value. The designer should apply the appropriate factor of safety.

(2) The hydraulic conductivity values were calculated based on the South Florida Water Management District's USUAL OPEN HOLE CONSTANT HEAD percolation test procedure as shown on the following page.

(3) A diameter of six inches was used in the computation of the Hydraulic Conductivity value presented in the above table.

USUAL OPEN – HOLE TEST



$$K = \frac{4Q}{\pi d (2H_2^2 + 4H_2D_S + H_2d)}$$

K= HYDRAULIC CONDUCTIVITY (CFS/FT.^{2} - FT.HEAD)

Q= "STABILIZED" FLOW RATE (CFS)

d= DIAMETER OF TEST HOLE (FEET)

H_2 = DEPTH TO WATER TABLE (FEET)

D_S = SATURATED HOLE DEPTH (FEET)

ELEV. "A"= PROPOSED TRENCH BOTTOM ELEV.

H_I = AVERAGE HEAD ON UNSATURATED HOLE SURFACE (FT.HEAD)

SECTION 107500 – FLAGPOLES

PART-1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes ground-mounted flagpole made from aluminum.

B. Owner-Furnished Material: 5’ x 8’ Flag.

1.3 PERFORMANCE REQUIREMENTS

A. Structural Performance: Flagpole assemblies, including anchorages and supports, shall withstand the effects of gravity loads, and the following loads and stresses within limits and under conditions indicated according to the following design criteria:

1. Seismic Loads: according to SEI/ASCE 7
2. Wind Loads: according to NAAMM FP 1001, "Guide Specifications for Design of Metal Flagpoles." SEI/ASCE 7.
3. Base flagpole design on nylon flag of maximum standard size suitable for use with flagpole or flag size indicated, whichever is more stringent.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, operating characteristics, fittings, accessories, and finishes for flagpoles.

B. Shop Drawings: For flagpoles. Include plans, elevations, details, and attachments to other work. Show general arrangement, jointing, fittings, accessories, grounding, anchoring, and support.

1. Include section, and details of foundation system for ground-mounted flagpoles.

C. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.

D. Delegated-Design Submittal: For flagpole assemblies indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Include loads, point reactions, and locations for attachment of flagpoles to building's structure.

E. Qualification Data: For qualified professional engineer.

F. Operation and Maintenance Data: For flagpoles to include in operation and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain flagpole as complete unit, including fittings, accessories, bases, and anchorage devices, from single source from single manufacturer.

1.6 DELIVERY, STORAGE, AND HANDLING

A. General: Spiral wrap flagpoles with heavy paper and enclose in a hard fiber tube or other protective container.

PART-2 PRODUCTS

1.7 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Concord Industries, Inc.
2. American Flagpole; a Kearney-National Inc. company.
3. Atlantic Fiberglass Products, Inc.
4. Baartol Company.
5. Eder Flag Manufacturing Company, Inc.
6. Ewing Flagpoles.
7. Lingo Inc.; Acme Flagpole Company Division.
8. Millerbernd Manufacturing Company.
9. Morgan-Francis; Division of Original Tractor Cab Co., Inc.
10. PLP Composite Technologies, Inc.
11. Pole-Tech Company Inc.
12. U.S. Flag & Flagpole Supply, LP.
13. USS Manufacturing Inc.

1.8 FLAGPOLES

A. Flagpole Construction, General: Construct flagpoles in one piece if possible. If more than one piece is necessary, comply with the following:

1. Fabricate shop and field joints without using fasteners, screw collars, or lead calking.
2. Provide flush hairline joints using self-aligning, snug-fitting, internal sleeves.
3. Provide self-aligning, snug-fitting joints.

B. Exposed Height: 25 feet (7.5 m)

C. Aluminum Flagpoles: Provide cone-tapered flagpoles fabricated from seamless extruded tubing complying with ASTM B 241/B 241M, Alloy 6063, with a minimum wall thickness of 3/16 inch (4.8 mm).

D. Metal Foundation Sleeve: Manufacturer's standard corrugated-steel foundation tube, not less than 0.064-inch- (1.6-mm-) nominal wall thickness. Provide with 3/16-inch (4.8-mm) steel bottom plate and support plate; 3/4-inch- (19-mm-) diameter, steel ground spike; and steel centering wedges welded together. Galvanize steel after assembly. Provide loose hardwood wedges at top of foundation tube for plumbing pole.

1. Provide flashing collar of same material and finish as flagpole.

1.9 FITTINGS

A. Finial Ball: Manufacturer's standard flush-seam ball with threaded mounting stem, sized as indicated or, if not indicated, to match flagpole-butt diameter.

1. 0.063-inch (1.6-mm) spun aluminum**,** finished to match flagpole.

B. Internal Halyard, Winch System: Manually operated winch with control stop device and removable handle, stainless-steel cable halyard, and concealed revolving truck assembly with plastic-coated counterweight and sling. Provide flush access door secured with cylinder lock. Finish truck assembly to match flagpole.

1. Halyard Flag Snaps: Provide two chromium-plated bronze swivel snap hooks per halyard.

a. Provide with neoprene or vinyl covers.

1.10 MISCELLANEOUS MATERIALS

A. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107.

B. Drainage Material: Crushed stone, or crushed or uncrushed gravel; coarse aggregate.

C. Sand: ASTM C 33, fine aggregate.

D. Elastomeric Joint Sealant: Joint sealant complying with requirements in Division 07 Section "Joint Sealants" for Use NT (nontraffic) and for Use M, G, A, and, as applicable to joint substrates indicated, for Use O.

E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

1.11 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

1.12 ALUMINUM FINISHES

A. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils (0.04 mm). Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

1. Color and Gloss: Match Architect's sample.

PART-3 EXECUTION

1.13 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, including foundation; accurate placement, pattern, orientation of anchor bolts, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

1.14 PREPARATION

A. Prepare uncoated metal flagpoles that are set in foundation tubes by painting below-grade portions with a heavy coat of bituminous paint.

B. Foundation Excavation: Excavate to neat clean lines in undisturbed soil. Remove loose soil and foreign matter from excavation and moisten earth before placing concrete. Place and compact drainage material at excavation bottom.

C. Provide forms where required due to unstable soil conditions and for perimeter of flagpole base at grade. Secure and brace forms to prevent displacement during concreting.

D. Place concrete, as specified in Division 03 Section "Miscellaneous Cast-in-Place Concrete." Compact concrete in place by using vibrators. Moist-cure exposed concrete for not less than seven days or use nonstaining curing compound.

E. Trowel exposed concrete surfaces to a smooth, dense finish, free of trowel marks, and uniform in texture and appearance. Provide positive slope for water runoff to perimeter of concrete base.

1.15 FLAGPOLE INSTALLATION

A. General: Install flagpoles where shown and according to Shop Drawings and manufacturer's written instructions.

B. Ground Set: Place foundation sleeve, center, and brace to prevent displacement during concreting. Place concrete. Plumb and level foundation sleeve and allow concrete to cure. Install flagpole, plumb, in foundation sleeve.

1. Foundation Sleeve: Place sleeve seated on bottom plate between steel centering wedges and install hardwood wedges to secure flagpole in place. Place and compact sand in foundation tube and remove hardwood wedges. Seal top of foundation tube with a 2-inch (50-mm) layer of elastomeric joint sealant and cover with flashing collar.

C. Baseplate: Cast anchor bolts in concrete foundation. Install baseplate on washers placed over leveling nuts on anchor bolts and adjust until flagpole is plumb. After flagpole is plumb, tighten retaining nuts and fill space under baseplate solidly with nonshrink, nonmetallic grout. Finish exposed grout surfaces smooth and slope 45 degrees away from edges of baseplate.

D. Mounting Brackets and Bases: Anchor brackets and bases securely through to structural support with fasteners as indicated on Shop Drawings.

END OF SECTION 10 75 00

SECTION 260005 - ELECTRICAL REQUIREMENTS, GENERAL

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Conform to Division 01 and other sections of this division.

1.02 CODES

A. The work shall be in conformance with the following:

1.	NFPA 70	(NATIONAL ELECTRICAL CODE)
2.	NFPA 90A	(AIR CONDITIONING SYST.)
3.	NFPA 101	(LIFE SAFETY CODE)
4.	ADA Title III	(AMERICANS W/DISABILITIES)
5.	FBC	(Florida Building Code)

B. The installation shall also comply with all applicable rules and regulations of local and state laws and ordinances and of utility company supplying services if more stringent than contract documents. Include in the work, without extra cost any labor, materials, services, apparatus and drawings required to comply with all applicable laws, ordinances, rules and regulations. Inform the ARCHITECT of any work or materials which conflict with any of the applicable codes, standards, laws and regulations before submitting his bid. All work must be in compliance with applicable codes. ANY AND ALL DEVIATIONS FROM CONTRACT DOCUMENTS MUST BE APPROVED IN WRITING BY THE ARCHITECT AND OWNER.

1.03 QUALITY ASSURANCE

A. Manufacturers: Firms regularly engaged in manufacture of products of types and capacities required, whose products have been in satisfactory use in similar service for not less than five years.

B. Installer's Qualifications: Firm with at least three years of successful installation experience with projects similar to that required for this project.

C. NEC Compliance: Comply with NEC requirements pertaining to construction and installation of electrical devices.

1.04 ROUGH-IN

A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.

B. Refer to equipment specifications in Divisions 02 through 23 for rough-in requirements. Coordinate locations and elevations of all electrical equipment and devices. Do not scale electrical plans for locating any electrical equipment or devices. Check for required clearances on all installations.

1.05 ELECTRICAL INSTALLATIONS

A. Services shall not be interrupted without prior consent of the OWNER'S authorized representative and may be interrupted only at and for the specific time designated by the

OWNER'S authorized representative.

B. Make a thorough examination of the site and the contract documents. No claim for extra compensation will be recognized if difficulties are encountered which an examination of site conditions and contract documents prior to executing contract would have revealed.

C. Coordinate electrical equipment and materials installation with other building components.

D. Verify all dimensions by field measurements.

E. Arrange for chases, slots, and openings in other building components to allow for electrical installations. All penetrations through walls not provided for during initial construction will be cut using proper saw and/or drill. No breaking of walls with "blows" will be allowed.

F. Coordinate the installation of required supporting devices and sleeves to be set in poured in place concrete and other structural components, as they are constructed. Sequence, coordinate, and integrate installations of electrical materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing-in the building.

G. Coordinate the cutting and patching of building components to accommodate the installation of electrical equipment and materials.

H. Install electrical equipment to facilitate maintenance and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations.

I. Coordinate the installation of electrical materials and equipment above ceilings with suspension system, mechanical equipment and systems, and structural components.

J. Temporary electrical service and construction lighting shall be provided under this Section. CONTRACTOR shall provide for all electrical service for construction period, making all connections and removal of same at job conclusion. In addition, CONTRACTOR shall furnish and install temporary lighting for construction period. Illumination shall not be less than 10 Foot-Candles at any area being worked on during general construction and not less than 30 Foot-Candles on entire walls before any drywall finishing intermediate or finish coats of paint are applied, or any other finish material. At job completion, all temporary lamps shall be removed and replaced with new lamps.

K. All equipment mounted in suspended ceilings shall be independently supported at two diagonal corners with unspliced #9 galvanized wire tied to the building structure in a plumb position, or may be tied directly to the #9 galvanized wire at the point of attachment to the insulation grid. Any deviation from this approved support method must have prior approval from OWNER. Equipment with support wires that cannot be installed in plumb position shall have a separate support wire installed at all four corners and counter-splayed. (Equipment 12" x 12" or less may use 1 wire if approved by OWNER).

L. Minimum size conduit for all systems shall be 1/2". Minimum size of flexible conduit shall be 1/2” (3/8" for light fixture whips) and maximum length of flexible conduit shall be six feet, with four feet a minimum length. Minimum size conduit for all systems fed underground shall be 3/4".

M. All outside and/or underground conductors shall be continuous without splice or connection for any voltage or system, even if in pull box.

N. All electrical panels, intercom, telephone, and computer terminal boxes shall be mounted with the top six feet above finished floor. Equipment over six feet tall shall be installed with bottom of panel not less than four inches from floor. All floor mounted equipment is to be installed on a minimum 3-1/2" concrete pad.

O. ALL conductors and buss bars shall be copper. Aluminum is not allowed. All conductor insulation shall be THHN/THWN.

P. Conduit and conductor sizing shall be determined on the basis type of wire used.

Q. Electrical panels shall not be used as raceways.

R. The continuity of the ground, neutral, and hot circuits shall not be interrupted by the removal of any device or fixture or equipment. Conductors pulled straight through boxes shall count as two wires for box fill.

S. ALL work installed in walls and/or above ceilings or any concealed area shall be complete and approved by the OWNER'S representative and ARCHITECT before concealing or covering, including all devices and covers attached to boxes. All splicing and bonding shall be complete and approved by OWNER'S Representative and ARCHITECT before devices and covers are installed.

T. GFI receptacles shall be installed at each location requiring GFI protection. The use of GFI feed through receptacles will not be allowed. All receptacles within six feet of exposed water lines, faucets, etc. shall have GFI protection. All water cooler duplex receptacles shall be GFI. All outdoor outlets shall be weather-proof GFI.

U. Lighting fixtures installed in drywall and plaster ceilings shall have fixture frames attached to framing members to allow fixtures to be lay-in type. Flanged troffer type fixtures are not acceptable.

V. Minimum field supervision shall be as follows: There shall be a journeyman for each 4 workers or portion thereof and a master electrician for each 20 workers, starting at 20 workers.

W. No more than 3 circuits shall have common neutral. When a neutral conductor is required for each circuit, it will be indicated on the drawings.

X. Primary conduits and secondary conduits under power company's transformers shall be installed per power company requirements. Primary conduit shall be at least 48" below finished grade.

Y. All conductors shall be provided with overcurrent protection at supply source. Exceptions listed in NEC will not be allowed.

Z. PVC conduit use is only allowed below grade. Mark conduit locations below grade.

1.06 CUTTING AND PATCHING

A. Refer to the Division 01 for general requirements for cutting and patching.

B. Do not endanger or damage installed Work through procedures and processes of cutting and patching.

C. Arrange for repairs required to restore other work, because of damage caused as a result of electrical installations.

D. No additional compensation will be authorized for cutting and patching Work that is necessitated by ill-timed, defective, or non-conforming installations.

E. Perform cutting, fitting, and patching of electrical equipment and materials required to:

1. Uncover Work to provide for installation of ill-timed Work;
2. Remove and replace defective Work;
3. Remove and replace Work not conforming to requirements of the Contract Documents;
4. Remove samples of installed Work as specified for testing;
5. Install equipment and materials in existing structures;
6. Upon written instructions from the ARCHITECT/ENGINEER, uncover and restore Work to provide for ARCHITECT/ENGINEER observation of concealed Work.

F. Cut, remove and legally dispose of selected electrical equipment, components, and materials as indicated, including, but not limited to removal of electrical items indicated to be removed and items made obsolete by the new Work.

G. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.

H. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.

I. Locate, identify, and protect electrical services passing through remodeling or demolition area and serving other areas required to be maintained operational. When transit services must be interrupted, provide temporary services for the affected areas and notify the OWNER prior to changeover.

1.07 ELECTRICAL SUBMITTALS

A. Submit in accordance with General, Supplementary and Special Conditions.

B. Submittal of shop drawings, product data, and samples will be accepted only when submitted by The CONTRACTOR. Data submitted from subcontractors and material suppliers directly to the ARCHITECT, ENGINEER, or OWNER will not be processed.

1.08 PRODUCT OPTIONS AND SUBSTITUTIONS

A. Refer to the Instructions to Bidders and Division 01 for requirements in selecting products and requesting substitutions. Substitution necessitates taking care of all resulting conditions.

1.09 PRODUCT LISTING

A. Prepare listing of major electrical equipment and materials for the project.

B. Provide all information requested.

C. Submit this listing as a part of the submittal requirement specified in the Division 01.

D. When two or more items of the same material or equipment are required they shall be of the same manufacturer. Product manufacturer uniformity does not apply to raw materials, bulk materials, wire, conduit, fittings, sheet metal, steel bar stock, welding rods, solder, fasteners, motors for dissimilar equipment units, and similar items used in Work, except as otherwise indicated.

E. All switch board, panel boards, devices circuit and motor disconnects and transformers shall be of the same manufacturer.

F. Provide products which are compatible within systems and other connected items.

G. No substitution will be considered unless written request has been submitted to the ARCHITECT at least ten (10) days prior to the date for receipt of bids.

H. If the ARCHITECT and OWNER approves any proposed substitutions, such approval will be set forth in an addendum.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to project properly identified with names, model numbers, types, grades, compliance labels, and similar information needed for distinct identifications; adequately packaged and protected to prevent damage during shipment, storage, and handling.

B. Protect equipment and materials stored at the site, from damage in a dry, secure and protected environment.

C. Coordinate deliveries of electrical materials and equipment to minimize construction site congestion. Limit each shipment of materials and equipment to the items and quantities needed for the smooth and efficient flow of installations.

1.11 FIELD QUALITY CONTROL

A. Upon completion of installation of electrical connections, and after circuitry has been energized with rated power source, test connections to demonstrate capability and compliance with requirements. Ensure that direction of rotation of each motor fulfills requirement. Correct malfunctioning units at site, then retest to demonstrate compliance. Motor rotation changes shall be made at motor connection.

B. Prior to energizing circuitry, test wiring for electrical continuity, and for short-circuits. Ensure proper polarity of connections is maintained. Subsequent to energization, test wiring devices to demonstrate compliance with requirements.

1.12 RECORD DOCUMENTS

A. Refer to the Division 01 and Division 26 for requirements. The following paragraphs supplement the requirements of Division 01.

B. Mark drawings to indicate revisions to conduit size and location both exterior and interior dimensioned from building lines; actual equipment locations, dimensioned from column lines; concealed equipment, dimensioned to column lines; distribution and branch electrical circuitry; fuse and circuit breaker size and arrangements; support and hanger details; Change Orders; concealed control system devices. Changes are to be marked up on the CONTRACTORS as-builts, on a regular basis. Up-to-date as-builts are an integral part of processing monthly draw requests

C. Mark Specifications to indicate approved substitutions; change orders; actual equipment and materials used.

1.13 WARRANTIES

A. Refer to the Division 01 and Division 26 for procedures and submittal requirements for warranties. Refer to individual equipment specifications for warranty requirements.

B. Compile and assemble the warranties specified in Division 26, into a separated set of vinyl covered, three ring binders, tabulated and indexed for easy reference.

C. Provide complete warranty information for each item to include product or equipment to include date of beginning of warranty or bond; duration of warranty or bond; and names, addresses, and telephone numbers and procedures for filing a claim and obtaining warranty services.

1.14 CLEANING

A. Refer to the Division 01 and Division 26 for general requirements for final cleaning.

B. Clean all light fixtures, lamps and lenses prior to final acceptance. Replace all inoperative lamps.

PART 2 – PRODUCTS

A. Refer to all sections in Division 26.

PART 3 – EXECUTION

A. Refer to all sections in Division 26.

END OF SECTION 26 00 05

SECTION 260519 – LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Conform to Division 01 and other sections of this division.

B. This Section is a Division 26 Basic Electrical Materials and Methods section, and is part of each Division 26 section making reference to electrical wires and cables specified herein.

1.2 DESCRIPTION OF WORK

A. Extent of electrical wire and cable work is indicated by drawings and schedules.

B. Types of electrical wire, cable, and connectors specified in this Section include the following:

1. Copper conductors.
2. Fixture wires.
3. Split-bolt connectors.
4. Wirenut connectors.

C. Applications of electrical wire, cable, and connectors required for project are as follows:

1. For power distribution circuits.
2. For lighting circuits.
3. For appliance and equipment circuits.
4. For motor-branch circuits.
5. For control circuits.

1.3 QUALITY ASSURANCE

A. NEC Compliance: Comply with NEC requirements as applicable to construction, installation and color coding of electrical wires and cables.

B. IEEE Compliance: Comply with applicable requirements of IEEE Stds. 82, "Test Procedures for Impulse Voltage Tests on Insulated Conductors", and Std. 241, "IEEE Recommended Practice for Electric Power Systems in Commercial Buildings" pertaining to wiring systems.

C. ASTM Compliance: Comply with applicable requirements of ASTM B1, 2, 3, 8 and D-753. Provide copper conductors with conductivity of not less than 98% at 20°C (68°F).

D. The following systems of color coding shall be strictly adhered to. There shall be no color change for switch legs. Switch legs shall be marked at all junctions with colored tape on each wire with tape of contrasting color. Three way travelers shall be purple. In cases where more than one set of travelers are in the same conduit, travelers shall be marked with circuit number and colored tape. Colored tape shall be same color as corresponding switch leg marking.

1. grounding conductors, green;
2. 120/208 volt, ungrounded phase wires:

phase a - black
phase b - red
phase c - blue
neutral - white

3. 277/480 volt, ungrounded phase wires:

phase a - brown
phase b - orange
phase c - yellow
neutral - gray

E. The color code assigned to each phase wire shall be consistently followed throughout.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver wire and cable properly packaged in factory-fabricated type containers, or wound on NEMA specified type wire and cable reels.

B. Store wire and cable in clean dry space in original containers. Protect products from weather, damaging fumes, construction debris and traffic.

C. Handle wire and cable carefully to avoid abrading, puncturing and tearing wire and cable insulation and sheathing. Ensure that dielectric resistance integrity of wires/cables is maintained.

PART 2 - PRODUCTS

2.1 Building Wires: Provide factory-fabricated wires of sizes, ampacity ratings, and materials for applications and services indicated. No MC or AC cable will be accepted.

A. Type THHN and THWN: For dry and damp locations; maximum operating temperature 90°C (194°F). Insulation, flame-retardant, heat resistance, thermoplastic; conductor, annealed copper. 75°C rating shall be used for sizing and derating of all conductors.

B. All wiring for conventional devices shall be stranded wire with the exceptions as noted on the electrical drawings.

PART 3 - EXECUTION

3.1 INSTALLATION OF WIRES AND CABLES

A. General: Install electrical cables, wires and wiring connectors as indicated, in compliance with applicable requirements of NEC, NEMA, UL, and NECA's "Standard of Installation" and in accordance with recognized industry practices.

B. Unless otherwise noted, all branch circuit conductors shall be No. 12 AWG minimum.

C. Install UL Type THWN or THHN wiring in conduit, for feeders and branch circuits.

D. Pull conductors simultaneously where more than one is being installed in same raceway.

E. Use pulling compound or lubricant, where necessary; compound used must not deteriorate conductor or insulation.

F. Use pulling means including, fish tape, cable, rope and basket weave wire/cable grips which will not damage cables or raceway.

G. Keep conductor splices to minimum and all splices to be in junction boxes. No splices underground shall be allowed between buildings.

H. Install splices and tapes which possess equivalent-or-better mechanical strength and insulation ratings than conductors being spliced. Use splice and tap connectors which are compatible with conductor material. Provide a 6" loop in each conductor in all joint boxes and pull boxes.

I. Conductors of systems of different voltages or types shall not enter the same conduit or junction box. The number of current carrying conductors and total number of conductors to be installed in conduits shall be as noted in table below.

Conduit Size	Maximum number of current carrying conductors if		Total number of conductors in conduit	
	#12 wire	#10 wire	#12 wire	#10 wire
3/4"	6	3	9	5
1"	9	6	13	9

* Deviation of installation as identified above requires prior written approval of the OWNER.

J. The continuity of the ground, neutral, and hot circuits shall not be interrupted by the removal of any device or fixture.

K. Computer, fluorescent lights are non-liner loads with the neutral to be counted as a currant carrying conductor.

3.2 FIELD QUALITY CONTROL

A. Prior to energization of circuitry, check installed feeder wires and cables with megohm meter to determine insulation resistance levels to ensure requirements are fulfilled.

B. Prior to energization, test wires and cables for electrical continuity and for short-circuits.

C. Subsequent to wire and cable hook-ups, energize circuitry and demonstrate functioning in accordance with requirements. Where necessary, correct malfunctioning units, and then retest to demonstrate compliance.

END OF SECTION 26 05 19

SECTION 260526 – GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Conform to Division 01 and other sections of this division.

B. Division 26 Basic Materials and Methods sections apply to work of this Section.

1.2 SUMMARY

A. The extent of electrical grounding and bonding work is indicated by drawings and schedules and as specified herein. Grounding and bonding work is defined to encompass systems, circuits, and equipment.

B. The type of electrical grounding and bonding work specified in this Section includes the following:

1. Solidly grounded.

C. Applications of electrical grounding and bonding work in this Section include the following:

1. Electrical power systems.
2. Grounding electrodes.
3. Separately derived systems.
4. Raceways.
5. Service equipment.
6. Enclosures, pull boxes, junction boxes, etc.
7. Equipment.
8. Lighting standards.
9. Landscape lighting.
10. Signs.
11. Separate buildings.
12. Transformers.

D. Refer to other Division 26 sections for wires/cables, electrical raceways, boxes and fittings, and wiring devices which are required in conjunction with electrical grounding and bonding work; not work of this Section.

1.3 SUBMITTALS

A. Submit in accordance with General, Supplementary and Special Conditions.

B. Product Data: Submit manufacturer's data on grounding and bonding products and associated accessories.

1.4 QUALITY ASSURANCE

A. Codes and Standards:

1. Electrical Code Compliance: Comply with applicable local electrical code requirements of the authority having jurisdiction and current NEC as applicable to

electrical grounding and bonding, pertaining to systems, circuits and equipment.

2. UL Compliance: Comply with applicable requirements of UL Standards No.'s 467, "Electrical Grounding and Bonding Equipment" and 869, "Electrical Service Equipment", pertaining to grounding and bonding of systems, circuits and equipment. In addition, comply with UL Std. 486A, "Wire Connectors and Soldering Lugs for Use with Copper Conductors". Provide grounding and bonding products which are UL-listed and labeled for their intended usage. Solder lugs are not allowed.

PART 2 - PRODUCTS

2.1 GROUNDING AND BONDING

A. Materials and Components:

1. General: Except as otherwise indicated, provide electrical grounding and bonding systems indicated; with assembly of materials, including, but not limited to, cables/wires, connectors, solderless lug terminals, grounding electrodes and plate electrodes, bonding jumper braid, surge arresters, and additional accessories needed for a complete installation. Where more than one type component product meets indicated requirements, selection is Installer's option. Where materials or components are not indicated, provide products which comply with NEC and UL, requirements and with established industry standards for those applications indicated.

B. Conductors: Unless otherwise indicated, provide electrical grounding conductors for grounding system connections that match power supply wiring materials and are sized according to NEC.

C. Bonding Plates, Connectors, Terminals and Clamps: Provide electrical bonding plates, connectors, terminals, lugs and clamps as recommended by bonding plate, connector, terminal and clamp manufacturers for indicated applications.

D. Grounding Electrodes:

1. Grounding Electrodes shall consist of minimum three 3/4"x 10'-0” long copper clad rods arranged in a triangle configuration with ground rods placed at least ten feet apart and sleeved in Sch 40 PVC if exposed to physical damage.
2. Provide concrete box (flush in grade) with cast iron cover. Concrete box to house each individual ground rod for testing. Cast iron cover to have the words "GROUND ROD" inscribed on top.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions under which electrical grounding and bonding connections are to be made and notify CONTRACTOR in writing of conditions detrimental to proper completion of work. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER and OWNER.

3.2 INSTALLATION OF ELECTRICAL GROUNDING AND BONDING SYSTEMS

A. General: Install electrical grounding and bonding systems as indicated, in accordance with manufacturer's instructions and applicable portions of current NEC, NECA's "Standard of Installation" and in accordance with recognized industry practices to ensure that products comply with requirements.

B. Coordinate with other electrical work as necessary to interface installation of electrical grounding and bonding system work with other work.

C. Grounding electrode system for main service and separately derived systems: Grounding electrode conductors shall be sized according to 250.66 excluding exceptions and shall be installed unspliced from the grounded circuit conductor (neutral) at the main service or transformer for separately derived systems to the following electrodes: Metal cold water pipe, concrete encased electrodes, building steel, and three rod electrodes.

D. Grounding electrode system for separate buildings: The connection of the grounded circuit conductor (neutral) to the grounding electrode at each separate building shall not be made. An equipment grounding conductor shall be installed with the circuit conductors and shall be connected to an equipment ground bar located in each building's panel. Grounding electrode conductors shall be sized according to 250.66 excluding exceptions and shall be installed unspliced from the panel equipment ground bar to the following electrodes: Metal cold water pipe, building steel and three rod electrode.

E. Connect together service equipment enclosures, exposed noncurrent carrying metal parts of electrical equipment, metal raceway systems, grounding conductor in raceways and cables, receptacle ground connectors, and plumbing systems.

1. All raceways shall be provided with a No. 12 AWG green grounding conductor unless otherwise indicated. Grounding conductor shall be insulated, continuous green grounding conductor for #6 and smaller conductors, #4 and larger grounding conductors shall be marked with green tape. Equipment ground conductor shall be connected to ground bus in panelboards and bonded to all outlet, pull and junction boxes by a lug or screw approved for the purpose before installation of the boxes. Ground pigtails and/or ground clips are not acceptable.
2. Grounding type bushings shall be installed on all feeder and subfeeder conduits entering panelboards, pull boxes and transformers and all conduit entering oversized, concentric, and eccentric knock-outs.

F. Terminate feeder and branch circuit insulated equipment grounding conductors with grounding lug, bus, or bushing. Conductors looped under screw or bolt heads will not be permitted

G. Grounding electrode requirements: Metal underground water piping shall be in direct contact with the earth for a minimum of twenty feet and connections shall be made to the interior metal water piping within 5’-0” of floor. Piping shall be one-inch minimum. Concrete encased electrodes shall be encased in at least three inches of concrete footing or foundation that is in direct contact with the earth consisting of a continuous 5/8"x20'-0” rebar with a 20'-0” section of bare copper wire connected to the rebar by exothermic welding and extended 4'-0” above the slab and sleeved with Sch 40 PVC at slab penetration. The exposed conductor above the slab shall be protected from concrete, paint, dirt, etc. Rod electrodes shall consist of three (minimum) 3/4"x10'-0” (minimum) copper clad rods with threaded connections, placed at least ten feet apart in a tripoise configuration. No aluminum rods. The grounding electrode conductors shall be spliced only by means of the exothermic welding process. Unless otherwise authorized by owner, grounding clamps equal to Blackburn Grounding Type GUV or Burndy Type GAR may be used at all terminal

locations. Made electrodes shall have a resistance of 5 ohms or less. This resistance test (of made electrodes) shall be performed with the OWNER'S representative observing the test and notification of the ENGINEER for his witnessing of the results. Building steel shall be effectively grounded through direct connections from footer reinforcing to I-beam or bar joists with copper conductors.

H. Tighten grounding and bonding connectors and terminal, including screws and bolts, in accordance with manufacturer's published torque tightening values for connectors and bolts. Where manufacturer's torquing requirements are not indicated, tighten connections to comply with tightening torque values specified in UL 486A to assure permanent and effective grounding.

I. Install clamp-on connectors on clean metal contact surfaces, to ensure electrical conductivity and circuit integrity. All ground clamps and lugs shall be listed for application and shall be made completely of bronze or brass.

J. Grounding electrode conductors shall be protected with schedule 40 PVC where exposed to damage.

3.3 FIELD QUALITY CONTROL

A. Upon completion of installation of electrical grounding and bonding systems, test the grounding tripoise ground resistance with a ground resistance tester and with the tripoise ground conductor disconnected from the panelboard or switchboard. Where tests show resistance-to-ground is over five (5) ohms, take appropriate action to reduce resistance to five (5) ohms, or less, by driving additional ground rods; then retest to demonstrate compliance. Additional ground rods shall be furnished and installed at no cost to OWNER.

END OF SECTION 26 05 26

SECTION 260529 – HANGERS AND SUPPORTING DEVICES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Conform to Division 01 and other sections of this division.

B. This Section is a Division 26 Basic Electrical Materials and Methods section, and is a part of each Division 26 section making reference to electrical supporting devices specified herein.

1.2 DESCRIPTION OF WORK

A. Extent of supports, anchors, sleeves and seals is indicated by drawings and schedules and/or specified in other Division 26 sections.

B. Types of supports, anchors, sleeves and seals specified in this Section include the following:

1. Clevis hangers.
2. One-hole conduit straps.
3. Two-hole conduit straps.
4. Round steel rods.
5. Expansion anchors.
6. Toggle bolts.
7. Wall and floor seals.
8. Acorn Clamps.
9. Support Channel.
10. Galvanized tie wire (minimum #16 size)

C. Supports, anchors, sleeves and seals furnished as part of factory fabricated equipment, are specified as part of that equipment assembly in other Division 26 sections.

1.3 QUALITY ASSURANCE

A. NECA Compliance: Comply with National Electrical Contractors Association's "Standard of Installation" pertaining to anchors, fasteners, hangers, supports, and equipment mounting.

B. UL Compliance: Provide electrical components which are UL-listed and labeled.

1.4 SUBMITTALS

A. Submit in accordance with General, Supplementary and Special Conditions.

B. Product Data: Submit manufacturer's data on supporting devices including catalog cuts, specifications, and installation instructions, for each type of support, anchor, sleeve and seal.

PART 2 - PRODUCTS

2.1 MANUFACTURED SUPPORTING DEVICES

A. General: Provide supporting devices which comply with manufacturer's standard materials, design and construction in accordance with published product information, and as required for complete installation; and as herein specified. Where more than one type of supporting device meets indicated requirements, selection is Installer's option.

B. Supports: Provide supporting devices of types, sizes and materials indicated; and having the following construction features:

1. Clevis Hangers: For supporting metal conduit; galvanized steel; with one-half inch (1/2") diameter hole for round steel rod; approximately 54 pounds per 100 units.
2. Reducing Couplings: Steel rod reducing coupling, one-half inch (1/2") by five-eighths inch (5/8"); approximately sixteen (16) pounds per hundred (100) units.
3. One-Hole Conduit Straps: For supporting metal conduit; galvanized steel; approximately 7 pounds per 100 units.
4. Two-Hole Conduit Straps: For supporting metal conduit, galvanized steel.
5. Hexagon Nuts: For one-half inch (1/2") rod size; galvanized steel; approximately 4 pounds per 100 units.
6. Round Steel Rod: One-half inch (1/2") diameter; approximately sixty-seven (67) pounds per hundred feet (100'-0").
7. Offset Conduit Clamps: For supporting two inch (2") rigid metal conduit; galvanized steel; approximately two hundred (200) pounds per hundred (100) units.

C. Anchors: Provide anchors of types, sizes and materials indicated, with the following construction features:

1. Expansion Anchors: One-half inch (1/2"); approximately thirty-eight (38) pounds per hundred (100) units.
2. Toggle Bolts: Springhead; three-sixteenths inch (3/16") by four inch (4"); approximately five (5) pounds per hundred (100) units.

D. Sleeves and Seals: Provide sleeves and seals, of types, sizes and materials indicated, with the following construction features:

1. Wall and Floor Seals: Provide factory-assembled watertight wall and floor seals, of types and sizes indicated; suitable for sealing around conduit, pipe, or tubing passing through concrete floors and walls. Construct seals with steel sleeves, malleable iron body, neoprene sealing grommets and rings, metal pressure rings, pressure clamps and cap screws. Seals shall be fire rated where required.

E. U-Channel Strut Systems: Provide U-channel strut system for supporting electrical equipment, 12-gauge hot-dip galvanized steel, of types and sizes indicated; construct with nine-sixteenths inch (9/16") diameter holes, eight inch (8") o.c. on top surface, and with the following fittings which mate and match with U-channel:

1. Fixture hangers.
2. Channel hangers.
3. End caps.
4. Beam clamps.
5. Wiring studs.
6. Thinwall conduit clamps.
7. Rigid conduit clamps.
8. Conduit hangers.

2.2 FABRICATED SUPPORTING DEVICES

A. Pipe Sleeves: Provide pipe sleeves of one of the following:

1. Steel Pipe: Fabricate from Schedule 40 galvanized steel pipe; remove burrs.
2. Plastic Pipe: Fabricate from Schedule 40 PVC plastic pipe; remove burrs.

B. Sleeve Seals: Provide sleeves for piping which penetrates foundation walls below grade, or exterior walls. Caulk between sleeve and pipe with nontoxic, UL-classified caulking material to ensure watertight seal. Seals shall be fire rated where required.

C. Tie wire can be used only to secure conduit that is supported by the building structure. Tie wire shall be #16 galvanized wire with two strands of wire being used. Tie wire will not be allowed in any exposed area.

PART 3 - EXECUTION

3.1 INSTALLATION OF SUPPORTING DEVICES

A. Install hangers, anchors, sleeves and seals as indicated, in accordance with manufacturer's written instructions and with recognized industry practices to insure supporting devices comply with requirements. Comply with requirements of NECA and NEC for installation of supporting devices.

B. Coordinate with other electrical work, including raceway and wiring work, as necessary to interface installation of supporting devices with other work.

C. Install hangers, supports and attachments to support piping properly from building structure. Arrange for grouping of parallel runs of horizontal conduits to be supported together on trapeze type hangers where possible. Install supports with spacings indicated and in compliance with NEC requirements.

END OF SECTION 26 05 29

SECTION 260533 – RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Conform to Division 01 and other sections of this division.

B. This Section is a Division 26 Basic Electrical Materials and Methods section and is a part of each Division 26 section making reference to electrical wiring raceways, boxes and fittings specified herein.

PART 2 - ELECTRICAL BOXES AND FITTINGS

2.1 DESCRIPTION OF WORK

A. Extent of electrical box and associated fitting work is indicated by drawings and schedules.

B. Types of electrical boxes and fittings specified in this Section include the following:

1. Outlet boxes.
2. Junction boxes.
3. Pull boxes.
4. Floor boxes.

2.2 QUALITY ASSURANCE

A. NEC Compliance: Comply with NEC as applicable to construction and installation of electrical wiring boxes and fittings.

B. UL Compliance: Comply with applicable requirements of UL 50, UL 514-Series and UL 886 pertaining to electrical boxes and fittings. Provide electrical boxes and fittings which are UL-listed and labeled.

2.3 PRODUCTS - FABRICATED MATERIALS

A. Outlet Boxes: Provide galvanized coated flat rolled sheet-steel outlet wiring boxes, of shapes, cubic inch capacities, and sizes, including box depths as indicated, suitable for installation at respective locations. Construct outlet boxes with mounting holes, and with cable and conduit-size knockout openings in bottom and sides. Boxes shall be factory molded type. Sectional or gangable boxes are not allowed. Through-wall boxes are not allowed.

1. Outlet Box Accessories: Provide outlet box accessories as required for each installation, including box supports, mounting ears and brackets, wallboard hangers, box extension rings, fixture studs, cable clamps and metal straps for supporting outlet boxes, which are compatible with outlet boxes being used to fulfill installation requirements for individual wiring situations.
2. Ceiling boxes shall be four inch (4") square or octagonal, one and one-half inch (1-1/2") deep for exposed work or furred ceiling work and three inches (3") deep for concrete work. Plaster rings and/or fixture studs shall be provided where required.

B. Device Boxes: Provide galvanized coated flat rolled sheet-steel non-gangable device boxes, of shapes, cubic inch capacities, and sizes, including box depths as indicated, suitable for installation at respective locations. Construct device boxes for flush mounting with mounting holes, and with cable-size knockout openings in bottom and ends, and with threaded screw holes in end plates for fastening devices. Provide cable clamps and corrosion-resistant screws for fastening cable clamps, and for equipment type grounding. Sectional or gangable boxes are not allowed. Through-wall boxes are not allowed.

1. Device Box Accessories: Provide device box accessories as required for each installation, including mounting brackets, device box extensions, switch box supports, plaster ears, and plaster board expandable grip fasteners, which are compatible with device boxes being utilized to fulfill installation requirements for individual wiring situations.
2. Flush mounted wall outlets shall be four inch (4") square boxes or gang boxes, not less than one and one-half inches (1-1/2") deep. Boxes shall be provided with extension rings and/or covers with sufficient depth to bring the covers flush with the finished wall. Box extensions or "goofrings" will not be allowed.
3. Boxes for flush mounting in concrete block work with one or two devices shall have covers with square corners on the raised portion of the cover. The covers shall have a sufficient amount of depth to be flush with the face of the block. The bottom side of the covers or boxes shall be installed at the masonry course nearest to the dimension specified or noted, but not more than applicable code. Boxes installed in block walls shall be secured in place with mortar. Boxes to be flush with any combustible surface including black splash, tack board or sound board.
4. Outlet boxes for exposed wall mounting shall be cast metal type "FS" or "FD" boxes with suitable cast aluminum covers.
5. Exterior boxes for GFI receptacles shall be concrete box type, flush with exterior wall. All weatherproof receptacles shall be provided a weatherproof enclosure to comply with NEC. Back to back boxes with chase nipple are not allowed. Covers to meet code requirements for covers with attachment plug.

C. Rain-tight Outlet Boxes: For electrical outlets, provide corrosion-resistant cast-metal rain-tight outlet wiring\boxes, of types, shapes and sizes, including depth of boxes, with threaded conduit holes for fastening electrical conduit, cast-metal face plates with weatherproof cover enclosure suitably configured for each application, including face plate gaskets and corrosion - resistant plugs and fasteners.

D. Junction and Pull Boxes: Provide galvanized code-gauge sheet steel junction and pull boxes, with screw-on covers; of types, shapes and sizes, to suit each respective location and installation; with welded seams and equipped with stainless steel nuts, bolts, screws and washers.

E. All pull boxes used outside and underground shall be pre-cast concrete, with galvanized traffic rated cover, of sufficient size to make all entrances and exits from box in one horizontal plane.

F. Floor Boxes: Provide rain-tight adjustable floor boxes as indicated, with threaded conduit entrance ends and vertical adjusting rings, gaskets, brass floor plates with flush screw on covers with ground flange and stainless steel cover screws. Carpet and tile plates to be brass.

G. All outlet and device boxes shall be independently supported from structure.

2.4 EXECUTION - ELECTRICAL BOXES AND FITTINGS

A. General: Install electrical boxes and fittings as indicated, in accordance with manufacturer's written instructions, applicable requirements of NEC and in accordance with recognized industry practices to fulfill project requirements.

B. Coordinate installation of electrical boxes and fittings with wire/ cable, wiring device and raceway installation work.

C. Provide weather-tight outlets for interior and exterior locations exposed to weather or moisture.

D. Provide knockout closures to cap unused knockout holes where blanks have been removed.

E. Install electrical boxes in those locations which ensure ready accessibility to enclosed electrical wiring. J-boxes are not to be installed above plaster or drywall ceilings. (Exceptions: J-boxes for lay-in lighting fixtures as per section 26 51 13.)

F. Metallic electrical outlet boxes may be installed in vertical fire resistive assemblies classified as 2 hour or less without affecting the fire classification, provided such openings occur on one side only in each framing space and that openings do not exceed 16 square inches. Boxes located opposite sides of walls or partitions shall be separated by a horizontal distance of 24 inches.

G. In openings larger than sixteen (16) square inches, the wall shall be built around openings so as not to interfere with the integrity of the wall rating.

H. All clearances between such boxes and the gypsum board shall be completely filled with joint compound or other approved material.

I. Position recessed outlet boxes accurately to allow for surface finish thickness.

J. Set floor boxes level and flush with finish flooring material.

K. Fasten electrical boxes firmly and rigidly to substrates, or structural surfaces to which attached, or solidly embed electrical boxes in concrete or masonry. Note: Electric boxes above accessible ceiling system shall be firmly attached to a structural member of the ceiling insulation suspension system.

L. Subsequent to installation of boxes, protect boxes from construction debris and damage.

M. All outside, above grade pull boxes shall be galvanized.

N. All boxes, regardless of system or voltage, shall be installed flush within 1/8" of wall finish or finished face of tackboards, sound boards, cabinets, etc. Box extension or goof rings will not be allowed.

PART 3 - RACEWAYS

3.1 DESCRIPTION OF WORK

A. Extent of raceway work is indicated by drawings and schedules.

B. Types of raceways specified in this section include the following:

1. Electrical metallic tubing (EMT).
2. Liquid-tight flexible metal conduit.
3. Rigid metal conduit, galvanized.
4. Rigid nonmetallic conduit.
5. Flexible metal conduit, steel only. Aluminum is not allowed.

3.2 QUALITY ASSURANCE

A. Codes and Standards:

1. UL Compliance and Labeling: Comply with applicable requirements of UL safety standards pertaining to electrical raceway systems. Provide raceway products and components which have been UL-listed and labeled.

3.3 PRODUCTS - METAL CONDUIT AND TUBING

A. General: Provide metal conduit, tubing and fittings of types, grades, sizes and weights (wall thicknesses) for each service indicated.

B. Where types and grades are not indicated, provide proper selection determined by Installer to fulfill wiring requirements, and comply with applicable portions of NEC for raceways.

C. Rigid Steel Conduit: Shall be mild steel, manufactured, hot-dipped galvanized and produced to ANSI specifications C80.1 and Federal Specification WW-C 581, latest revisions and shall be labeled with the Underwriters' Laboratories marking.

D. Flexible Metal Conduit: UL 1. Formed from continuous length of spirally wound, interlocked zinc-coated strip steel.

E. Liquid-Tight Flexible Metal Conduit: Provide liquid-tight flexible metal conduit; construct of single strip, flexible, continuous, interlocked, and double-wrapped steel; galvanized inside and outside; coat with liquid-tight jacket of flexible polyvinyl chloride (PVC).

F. Rigid Metal Conduit Fittings: Cast malleable iron, galvanized or cadmium plated.

1. Use Type 1 fittings for rain-tight connections.
2. Use Type 2 fittings for concrete tight connections.

G. Flexible Metal Conduit Fittings: Provide conduit fittings for use with flexible steel conduit of threadless hinged clamp type. Inside type fittings are not allowed.

1. Straight Terminal Connectors: One piece body, female end with clamp and deep slotted machine screw for securing conduit, and male threaded end provided with locknut.
2. 45° or 90° Terminal Angle Connectors: Two-piece body construction with removable upper section, female end with clamp and deep slotted machine screw for securing conduit, and male threaded end provided with locknut.

H. Liquid-Tight Flexible Metal Conduit Fittings: Provide cadmium plated, malleable iron fittings with compression type steel ferrule and neoprene gasket sealing rings, with insulated, or noninsulated throat.

I. Electrical Metallic Tubing (EMT): Shall be mild steel, electrically welded, galvanized, and

produced to ANSI Specification C80.3 and Federal Specification WW-C-563, latest revisions and shall be labeled with the Underwriter's Laboratories marking.

J. EMT Fittings: Couplings and connectors for conduit shall be expansion gland compression type, steel, zinc or cadmium plated. Regal or Bridgeport specification grade Die-Cast.

K. No ENT or corrugated flexible conduit and MT cable will be allowed.

L. Minimum size conduit shall be 3/4" for all systems.

M. Minimum size flexible conduit shall be 1/2" for all systems (3/8" for light fixture whips). Maximum length shall be 6 feet and 4 foot minimum flex length.

N. Conduit Bodies: Provide galvanized cast-metal conduit bodies of types, shapes, and sizes as required to fulfill job requirements and NEC requirements. Construct conduit bodies with threaded conduit-entrance ends, removable covers, either cast or of galvanized steel and corrosion-resistant screws. SLB type are not allowed.

3.4 PRODUCTS - NONMETALLIC CONDUIT AND DUCTS

A. General: Provide nonmetallic conduit, ducts and fittings of types, sizes and weights for each service indicated. Where types and grades are not indicated, provide proper selection determined by Installer to fulfill wiring requirements which comply with provisions of NEC and Specifications for raceways.

B. Electrical Plastic Conduit:

1. Heavy Wall Conduit: Schedule 40, 90oC, UL-rated, constructed of polyvinyl chloride. For direct burial, UL-listed and in conformity with NEC Article 347.

C. Conduit and Tubing Accessories: Provide conduit, tubing and duct accessories of types, sizes, and materials, complying with the Manufacturer's published product information, which mate and match conduit and tubing.

3.5 WIREWAYS

A. General: Provide electrical wireways of types, grades, sizes and number of channels for each type of service as indicated. Provide complete assembly of raceway including, but not limited to, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps and other components and accessories as required for complete system.

B. Lay-in Wireways: Construct lay-in wireways with hinged covers, in accordance with UL 870 and with components UL-listed, including lengths, connectors, and fittings. Select units to allow fastening hinged cover closed without use of parts other than standard lengths, fittings and connectors. Construct units to be capable of sealing cover in closed position with sealing wire. Provide wireways with knockouts.

1. Connectors: Provide wireway connectors suitable for "lay-in" conductors, with connector covers permanently attached that removal is not necessary to utilize the lay-in feature.
2. Finish: Protect sheet metal parts with rust inhibiting coating and baked enamel finish. Plate finish hardware to prevent corrosion. Protect screws installed toward inside of wireway with spring nuts to prevent wire insulation damage.

C. Rain-tight Wireway: Construct rain-tight lay-in wireways with hinged covers, in accordance with UL 870 and with components UL listed, including lengths, connectors and fittings. Design units to allow fastening hinged cover closed without use of parts other than standard lengths, fittings and connectors. Construct units to be capable of sealing cover in closed position with sealing wire. Provide wireway units with knockouts only in bottom of troughs.

D. Rain-tight Troughs: Construct in accordance with UL 870, with components UL-listed.

1. Construction: 16-gauge galvanized sheet metal parts for 4" x 4" to 6" x 6" sections and 14-gauge parts for 8" x 8" and larger sections. Provide knockouts only in bottom of troughs, with suitable adapters to facilitate attaching to other NEMA 3R enclosures. Do not use gasketing that can rip or tear during installation, or would compromise rain-tight capability of the trough. Do not use cover screws that will protrude into the trough area and damage wire insulation.
2. Finish: Provide 14-gauge and 16-gauge galvanized sheet metal parts with corrosion-resistant phosphate primer and baked enamel finish. Plate hardware to prevent corrosion.

3.6 OBSERVATION

A. Examine areas and conditions under which raceways are to be installed and substrate which will support raceways. Notify OWNER'S REPRESENTATIVE in writing of conditions detrimental to proper completion of the work. Do not proceed with work until unsatisfactory conditions have been corrected in acceptable manner.

3.7 EXECUTION

A. General: Raceways run below grade, under floors on grade, or in concrete shall be PVC heavy wall type (Schedule 40) conduit. Conduit shall have rigid steel elbows and risers. All rigid metal conduit below grade and/or in concrete or mortar shall be sleeved with 10 mil polyethylene or coated with bitumastic. Rigid galvanized steel shall be used in all outside and all wet locations above grade and/or all locations exposed to weather and/or moisture. All raceways outside the building roof line shall be a minimum of 42" (48" for primary) below finished grade, including where they exit the slab. Sidewalks are not to be considered in the building area, unless under roof area. Exposed rigid risers shall be continuous to cabinets, panels, J-boxes, etc. Fill and backfill procedures and compaction requirements as per Division. Two will be used with marking tape 24" above conduit. Conduit installed above accessible ceilings shall be supported from the building structure and shall not be supported from or attached to the suspended ceiling suspension system. All conduit shall be made up tight. No intermediate metal conduit (IMC) will be allowed. No metal conduit is to be isolated within PVC runs of pipe. EMT shall not be installed less than 8" above slab, and shall be installed in dry and indoor locations only. EMT in contact with grout, mortar, or other cementious products such as grouted cells, headers, lintels, etc. shall be sleeved with 10 mil polyethylene before installation.

B. Sizes of raceways shall be not less than NEC requirements using THW for sizing and shall not in any case be less than indicated on the drawings. Larger size raceways and/or pull boxes shall be installed if there is excessive length of unbroken run or excessive number of bends. Combining of circuits other than those indicated on the drawings will not be permitted. Location of pull boxes shall be approved by ARCHITECT and OWNER before installation.

C. Coordinate with other work including wires/cables, boxes, and panel work, as necessary to interface installation of electrical raceways and components with other work.

1. Avoid use of dissimilar metals throughout system to eliminate possibility of electrolysis. Where dissimilar metals are in contact, coat surfaces with corrosion inhibiting compound before assembling.
2. Use roughing-in dimensions of electrically operated unit furnished by supplier. Set conduit and boxes for connection to units only after receiving review of dimensions and after checking location with other trades.
3. Provide nylon pull cord in empty conduits. Test all empty conduits with ball mandrel. Clear any conduit which rejects ball mandrel. Pay costs involved for restoration of conduit and surrounding surfaces to original condition. Provide corrosion resistant engraved metal tags at each end of empty conduits designating destination. Place tags on wall or walk where conduit exits building.
4. Use liquid-tight flexible conduit where subjected to one or more of the following conditions:

    a. Exterior location.
    b. Moist or humid atmosphere where condensate can be expected to accumulate.
    c. Corrosive atmosphere.
    d. Subjected to water spray or dripping oil, water or grease, especially all kitchen areas.

D. Cut conduits straight, properly ream, and cut threads for heavy wall conduit deep and clean.

E. Field-bend conduit with benders designed for purpose so as not to distort nor vary internal diameter.

F. Fasten conduit terminations in sheet metal enclosures by two (2) locknuts, and terminate with bushing. Install locknuts inside and outside enclosure.

G. Conduits are not to cross pipe shafts, or ventilating duct openings.

H. Keep conduits a minimum distance of six inches (6") from parallel runs of flues, hot water pipes or other sources of heat. Wherever possible, install horizontal raceway runs above water and steam piping.

I. Support riser conduit at each floor level with clamp hangers.

J. Use of running threads at conduit joints and terminations is prohibited. Where required, use 3-piece union or split coupling.

K. Complete installation of electrical raceways before starting installation of cables/wires within raceways.

L. Concealed Conduits:

1. Metallic raceways installed underground or in floors below grade, or outside are to have conduit threads painted with cold galvanizing paint. Remove oil and clean prior to painting. Draw up coupling and conduit sufficiently tight to ensure water tightness.
2. Install all underground conduits outside foundation minimum of 42" (to top of pipe) below finished grade, including exit point. Underground conduit shall be inspected and approved before backfilling. Primary pipe to be 48” to top of pipe.
3. Conduit below concrete slabs and footers under or inside building foundations shall

be a minimum of 6" below bottom of concrete and/or at an adequate depth to conceal radius of bends.

4. All conduit installed in walls and above ceilings shall be 100% complete and approved by inspectors before covering is installed.

M. Conduits in Concrete Slabs:

1. Place conduits between bottom reinforcing steel and top reinforcing steel. Place conduits either parallel, or at 90 degrees, to main reinforcing steel.
2. Separate conduits by not less than diameter of largest conduit to ensure proper concrete bond.
3. Conduits crossing in slab must be reviewed for proper cover by ENGINEER, ARCHITECT, and OWNER.
4. Embedded conduit diameter is not to exceed one-third (1/3) of slab thickness.

N. Install conduits as not to damage or run through structural members. Avoid horizontal or cross runs in building partitions or side walls.

O. Conduits Above Grade:

1. Install exposed conduits and all conduit above grade and extensions from concealed conduit systems neatly, parallel with, or at right angles to walls and building structure. Support conduits within three feet of fittings, boxes, etc, and on spacing not to exceed eight feet.
2. Install exposed conduit work as not to interfere with ceiling inserts, lights or ventilation ducts or outlets.
3. Support exposed conduits by use of hangers, clamps, or clips. Conduit not exposed will be allowed to be secured in place with double #16 galvanized tie wire if the tie wire does not support the weight of the conduit. Support conduits on each side of bends and on spacing not to exceed 8'-0". Conduit shall not be supported from suspended ceiling supports or grid systems.
4. Run conduits for outlets on waterproof walls exposed. Set anchors for supporting conduit on waterproof wall in waterproof cement.
5. The above requirements for exposed conduits also apply to conduits installed in space above hung ceilings, and in crawl spaces.
6. Conduit shall not be installed on roof tops or walkway covers.
7. Conduit penetrating concrete floors not within 12" of walls shall have couplings installed flush with top slab.
8. Flexible metal conduit shall be steel. Aluminum is not allowed. Minimum size of flexible metal conduit is 1/2" (Exception: Light fixture whips). Flexible metal conduit shall not be installed in damp or wet locations, through walls, or used as a raceway in concealed or inaccessible areas. It shall be supported within 12" of connectors and maximum of 32" between supports.

P. Non-Metallic Conduits:

1. Make solvent cemented joints in accordance with recommendations of manufacturer.
2. Install PVC conduits in accordance with NEC and in compliance with local utility practices.
3. Conduit and elbows shall be installed on the secondary side at power company's transformers. Wire and cable installation shall be such that wire pulling rope or cable will not damage elbows.
4. PVC, RGS, elbows, and aluminum risers shall be installed for all primary services

per Power Company and OWNER requirements.

5. Rigid elbow shall be used throughout with PVC conduit.

Q. Conduit Fittings:

1. Use locknuts for securing conduit to metal enclosure with sharp edge for digging into metal, and ridged outside circumference for proper fastening.
2. Bushings for terminating conduits smaller than 1" are to have flared bottom and ribbed sides, with smooth upper edges to prevent injury to cable insulation. Bushings shall be installed during rough-in and before installing conductors.
3. Install insulated type bushings for terminating conduits 1" and larger. Bushings are to have flared bottom and ribbed sides. Upper edge to have phenolic insulating ring molded into bushing. Bushings shall be installed during rough-in and before installing conductors.
4. Bushing of standard or insulated type to have screw type grounding terminal. Bushings shall be installed on all threaded conduit.
5. Miscellaneous fittings such as reducers, chase nipples, 3-piece unions, split couplings and plugs to be specifically designed for their particular application.
6. Grounding type bushings shall be installed on all feeder and subfeeder conduits entering panelboards, pull boxes and transformers and all conduit entering oversized, concentric and eccentric knock-outs.

3.8 INSTALLATION OF RACEWAYS AND WIREWAYS

A. General: Mechanically assemble metal enclosures, and raceways for conductors to form continuous electrical conductor, and connect to electrical boxes, fittings and cabinets as to provide effective electrical continuity and rigid mechanical assembly.

B. Avoid use of dissimilar metals throughout system to eliminate possibility of electrolysis. Where dissimilar metals are in contact, coat all surfaces with corrosion inhibiting compound before assembling.

C. Install expansion fittings in all raceways wherever structural expansion joints are crossed.

D. Make changes in direction of raceway run with proper fittings, supplied by raceway manufacturer. No field bends of raceway sections will be permitted.

E. Properly support and anchor raceways for their entire length by structural materials. Raceways are not to span any space unsupported.

F. Use boxes as supplied by raceway manufacturer wherever junction, pull or devices boxes are required. Standard electrical "handy" boxes, etc. shall not be permitted. Underground, outside pull boxes shall be pre-cast concrete with traffic rated covers.

G. Raceway penetrations of fire rated walls and/or floors shall be sealed to maintain integrity of construction. All products, materials and methods of installation shall be UL approved and meet NFPA requirements.

H. Fire rating of construction assemblies are specified under architectural section of the contract documents.

I. Unless otherwise noted on drawings; the following materials may be used.

1. Rock wool: Minimum four pound per cubic foot density; flame spread 15, smoke

developed 0, fuel contribution 0 by ASTM 384; minimum melting point 2000oF.

2. Concrete and masonry are also approved firestop materials by NFPA 90A.
3. UL approved products such as Nelson Type CLK Silicon Sealant. Manufacturer's recommendations shall be strictly followed.

J. Submit complete data on fire stopping materials and construction methods for review by ARCHITECT before proceeding with work.

PART 4 - ELECTRICAL CONNECTIONS FOR EQUIPMENT

4.1 DESCRIPTION OF WORK

A. Extent of electrical connections for equipment is indicated by drawings and schedules. Electrical connections are hereby defined to include connections used for providing electrical power to equipment.

B. Electrical connections for equipment, not furnished as integral part of equipment, are specified in Divisions 22 and 23, and other Division 26 sections, and are work of this Section.

C. Motor starters and controllers, not furnished as integral part of equipment, are specified in applicable Division 26 sections and are work of this Section.

D. Junction boxes and disconnect switches required for connecting motors and other electrical units of equipment are specified in applicable Division 26 sections and are work of this Section.

E. Electrical identification for wire/cable conductors is specified in Division 26 section, "Electrical Identification", and is work of this Section.

F. Raceways and wires/cables required for connecting motors and other electrical units of equipment are specified in applicable Division 26 sections, and are work of this Section.

G. Provide and install all conduit with pull string required by Division 23 specifications. Coordinate with the Mechanical Subcontractor for the locations.

4.2 QUALITY ASSURANCE

A. NEC Compliance: Comply with applicable requirements of NEC as to type products used and installation of electrical power connections (terminals and splices), for junction boxes, motor starters, and disconnect switches.

B. UL Compliance: Comply with UL Std 486A, "Wire Connectors and Soldering Lugs for Use With Copper Conductors" including, but not limited to, tightening of electrical connectors to torque values indicated. Provide electrical connection products and materials which are UL-listed and UL-labeled. Solder lugs are not allowed.

4.3 PRODUCTS - MATERIALS AND COMPONENTS

A. General: For each electrical connection indicated, provide complete assembly of materials, including but not necessarily limited to, pressure connectors, terminals (lugs), electrical insulating tape, cable ties, solderless wirenuts and other items and accessories as needed to complete splices and terminations of types indicated.

B. Metal Conduit, Tubing and Fittings:

1. General: Provide metal conduit, tubing and fittings of types, grades, sizes and weights (wall thicknesses) indicated for each type service. Where types and grades are not indicated, provide proper selection as determined by Installer to fulfill wiring requirements and comply with NEC requirements for raceways. Provide products complying with Division 26 basic electrical materials and methods section "Raceways" and in accordance with the following listing of metal conduit, tubing and fittings:

a. Rigid steel conduit.
b. Rigid metal conduit fittings.
c. Electrical metallic tubing.
d. EMT fittings.
e. Flexible metal conduit.
f. Flexible metal conduit fittings.
g. Liquid-tight flexible metal conduit.
h. Liquid-tight flexible metal conduit fittings.

C. Wires, Cables, and Connectors:

1. General: Provide wires, cables, and connectors complying with Division 26 basic electrical materials and methods section "Low-Voltage Electrical Power Conductors and Cables".
2. Wires/Cables: Unless otherwise indicated, provide wires/cables (conductors) for electrical connections which match, including sizes and ratings, of wires/cables which are supplying electrical power. Provide copper conductors with conductivity of not less than 98% at 20°C (68°F).

D. Connectors and Terminals: Provide electrical connectors and terminals which mate and match, including sizes and ratings, with equipment terminals and are recommended by equipment manufacturer for intended applications.

4.4 EXECUTION - OBSERVATION

A. Observe area and conditions under which electrical connections for equipment are to be installed and notify OWNER'S REPRESENTATIVE in writing of conditions detrimental to proper completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in an acceptable manner.

4.5 INSTALLATION OF ELECTRICAL CONNECTION

A. Install electrical connections as indicated; in accordance with equipment manufacturer's written instructions and with recognized industry practices, and complying with applicable requirements of UL and NEC to ensure that products fulfill requirements.

B. Coordinate with other work, including wires/cables, raceway and equipment installation, as necessary to properly interface installation of electrical connections for equipment with other work.

C. Connect electrical power supply conductors to equipment conductors in accordance with equipment manufacturer's written instructions and wiring diagrams. Mate and match conductors of electrical connections for proper interface between electrical power supplies

and installed equipment.

D. Maintain existing electrical service and feeders to occupied areas and operational facilities, unless otherwise indicated, or when authorized otherwise in writing by OWNER, or ARCHITECT/ENGINEER. Provide temporary service during interruptions to existing facilities. When necessary, schedule momentary outages for replacing existing wiring systems with new wiring systems. When that "cutting-over" has been successfully accomplished, remove, relocate, or abandon existing wiring as indicated.

E. Cover splices with electrical insulating material equivalent to, or of greater insulation resistivity rating, than electrical insulation rating of those conductors being spliced.

F. Where pull boxes are installed outdoors or underground, the conductor shall not be spliced for any voltage or system.

G. Prepare cables and wires, by cutting and stripping covering armor, jacket, and insulation properly to ensure uniform and neat appearance where cables and wires are terminated. Exercise care to avoid cutting through tapes which will remain on conductors. Also avoid "ringing" copper conductors while skinning wire.

H. Trim cables and wires as short as practicable and arrange routing to facilitate inspection, testing and maintenance.

I. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturers published torque tightening values for equipment connectors. Accomplish tightening by utilizing proper torquing tools, including torque screwdriver, beam-type torque wrench, and ratchet wrench with adjustable torque settings. Where manufacturer's torquing requirements are not available, tighten connectors and terminals to comply with torquing values contained in UL Std. 486A.

J. Provide flexible conduit for motor connections, and other electrical equipment connections, where subject to movement and vibration. This requirement shall include all equipment containing motors.

K. Provide liquid-tight flexible conduit for connection of motors and other electrical equipment where subject to movement and vibration and also where connections are subjected to one or more of the following conditions:

1. Exterior location.
2. Moist or humid atmosphere where condensation can be expected to accumulate.
3. Corrosive atmosphere.
4. Water spray.
5. Dripping oil, grease, or water.
6. Rooms with floor drains.
7. All kitchen equipment.

4.6 FIELD QUALITY CONTROL

A. Upon completion of installation of electrical connections, and after circuitry has been energized with rated power source, test connections to demonstrate capability and compliance with requirements. Insure that direction of rotation of each motor fulfills requirement. Correct malfunctioning units at site, then retest to demonstrate compliance. Motor rotation changes shall be made at motor connection.

END OF SECTION 26 05 33

SECTION 260553 – IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Conform to Division 01 and other sections of this division.

B. This Section is a Division 26 Basic Electrical Materials and Methods section, and is part of each Division 26 section making reference to Electrical Identification specified herein.

C. Refer to Division 01 and Division 26 for equipment and system nameplates, and performance data; not work of this Section.

1.2 DESCRIPTION OF WORK

A. Extent of electrical identification work is indicated by drawings and schedules.

B. Types of electrical identification work specified in this Section include the following:

1. Equipment/system identification signs.

PART 2 - PRODUCTS

2.1 ELECTRICAL IDENTIFICATION MATERIALS

A. Engraved Plastic-Laminate Signs:

1. General: Provide engraving stock melamine plastic laminate, in sizes and thicknesses indicated, engraved with engraver's standard letter style of sizes and wording indicated, black face and white core plies (letter color) except as otherwise indicated, punched for mechanical fastening. Secure with self tapping stainless steel screws.
2. Signs shall be black face with white core plies (letter color).

    a. Thickness: Minimum one-sixteenth inch (1/16"), except as otherwise indicated.
    b. Fasteners: Self-tapping stainless steel screws, except contact-type permanent adhesive where screws cannot or should not penetrate substrate.

2.2 LETTERING AND GRAPHICS

A. General: Coordinate names, abbreviations and other designations used in electrical identification work, with corresponding designations shown, specified or scheduled. Provide numbers, lettering and wording as indicated or, if not otherwise indicated, as recommended by manufacturer or as required for proper identification and operation/maintenance of electrical systems and equipment.

PART 3 - EXECUTION

3.1 APPLICATION AND INSTALLATION

A. General Installation Requirements:

1. Install electrical identification products as indicated, in accordance with manufacturer's written instructions, and requirements of NEC.
2. Coordination: Where identification is to be applied to surfaces which require finish, install identification after completion of painting.
3. Regulations: Comply with governing regulations and requests of governing authorities for identification of electrical work.

B. Equipment/System Identification:

1. General: Install engraved plastic-laminate sign on each major unit of electrical equipment in building; including central or master unit of each electrical system including communication/control/signal systems, unless unit is specified with its own self-explanatory identification or signal system. Provide text matching terminology and numbering of the contract documents and shop drawings. Provide signs for each unit of the following categories of electrical work:

    a. Panelboards, electrical cabinets and disconnect enclosures, starters, and time clocks.
    b. Access panels/doors to electrical facilities.
    c. Transformers.
    d. Telephone and computer switching equipment and terminal cabinets.
    e. Call system master station and terminal cabinets.

2. Install signs at locations indicated or, where not otherwise indicated, at location for best convenience of viewing without interference with operation and maintenance of equipment. Secure to substrate with fasteners.
3. All power junction box covers shall be marked with panel name and circuit numbers. These markings shall be made with a permanent type marker.
4. Panel schedules shall be typed using room numbers to indicate locations of all receptacles, lights, and equipment.

END OF SECTION 26 05 53

SECTION 262213 – LOW-VOLTAGE DISTRIBUTION TRANSFORMERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Conform to Division 01 and other sections of this division.

B. Division 26 Basic Electrical Materials and Methods sections apply to work specified in this Section.

1.2 DESCRIPTION OF WORK

A. Extent of transformer work is indicated by drawings and schedules.

B. Types of transformers specified in this Section include the following:

1. Dry-type transformers, NEMA TP-1 rated.

C. Electrical wiring connections for transformers are specified in applicable Division 26 sections.

1.3 QUALITY ASSURANCE

A. NEC Compliance: Comply with NEC as applicable to installation and construction of electrical power/distribution transformers.

B. ANSI Compliance: Comply with applicable requirements of ANSI Standards C57-Series pertaining to power/distribution transformers.

C. NEMA Compliance: Comply with requirements of NEMA Std Pub/No.'s ST 20; "Dry-Type Transformers for General Applications", TR 1, and TR 27. All transformers shall be TP-1 rated.

D. UL Compliance: Comply with applicable requirements of ANSI/UL 506; "Safety Standard for Specialty Transformers".

E. NESC Compliance: Comply with applicable requirements of National Electrical Safety Code (ANSI Std C2) pertaining to indoor and outdoor installation of transformers.

1.4 SUBMITTALS

A. Submit in accordance with General, Supplementary and Special Conditions.

B. Product Data: Submit manufacturer's technical product data including rated KVA, frequency, primary and secondary voltages and percent taps.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering

products which may be incorporated in the work, but are not limited to, the following:

1. Square D Company.
2. General Electric Co.
3. Siemens.
4. Cutler Hammer.

2.2 POWER/DISTRIBUTION TRANSFORMERS

A. General: Except as otherwise indicated, provide manufacturer's standard materials and components as indicated by published product information, designed and constructed as recommended by manufacturer and as required for complete installation.

B. Dry-Type Distribution Transformers:

1. Transformers sizes 15 KVA and below shall have two (2) - 2 1/2 percent taps above and below rated primary voltage.
2. Transformers sizes 30 KVA and above shall have four (4) - 2 1/2 percent taps, two above and two below rated primary voltage.
3. Transformers 15 KVA and below shall be 115oC temperature rise above 40oC ambient or as noted on the construction drawings.
4. Transformers 30 KVA and above shall be 150oC temperature rise above 40oC ambient or as noted on the construction drawings.
5. Limit transformer surface temperature rise to maximum of 50oC rise above a 40oC ambient. Provide wiring connectors suitable for copper or aluminum wiring. Cushion-mount transformers with external vibration isolation supports; sound-level ratings not to exceed 45 db for transformers 15 to 45 KVA and 50 db for 50 to 150 KVA as determined in accordance with ANSI/NEMA standards. Electrically ground core and coils to transformer enclosure by means of flexible metal grounding strap. Provide transformers with fully-enclosed sheet steel enclosures. Provide transformers suitable for wall mounting.

C. Equipment/System Identification: Provide equipment/system identification nameplates complying with Division 26 05 53 Basic Electrical Materials and Methods section "Identification for Electrical Systems" in accordance with the following listing:

1. Equipment/System Identification.

D. Finishes: Coat interior and exterior surfaces of transformer, including bolted joints, with manufacturer's standard color baked-on enamel.

PART 3 - EXECUTION

3.1 INSPECTION

A. Installer must examine areas and conditions under which power/distribution transformers and ancillary equipment are to be installed, and notify OWNER’S REPRESENTATIVE in writing of conditions detrimental to proper completion of the work. Do not proceed with the work until satisfactory conditions have been corrected in a manner acceptable to Installer.

3.2 INSTALLATION OF TRANSFORMERS

A. Install transformers as indicated, complying with manufacturer's written instructions,

applicable requirements of NEC, NESC, NEMA, ANSI and IEEE standards and in accordance with recognized industry practices to insure that products fulfill requirements.

B. Provide 4" concrete pad under all floor mounted transformers, with spring or rubber-n-sheet isolators. Wall mounted transformers shall be suspended from the structure above or on brackets secure to wall to carry various transformer weights.

3.3 GROUNDING

A. Provide equipment grounding connections for power/distribution transformers as indicated.

3.4 TESTING

A. Prior to energization of transformers, check all accessible connections for compliance with manufacturer's torque tightening specifications.

B. Prior to energization, check circuitry for electrical continuity, and for short-circuits.

C. Upon completion of installation of transformers, energize primary circuitry at rated voltage and frequency from normal power source, and test transformers, including, but not limited to, audible sound levels, to demonstrate capability and compliance with requirements.

D. Where possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new units or components and proceed with retesting.

END OF SECTION 26 22 13

SECTION 262416 – PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Conform to Division 01 and other sections of this division.

B. Division 26 Basic Electrical Materials and Methods sections apply to work specified in this Section.

1.2 SUMMARY

A. Extent of panelboard and enclosure work, including cabinets and cutout boxes, is indicated by drawings and schedules, and as specified herein.

B. Types of panelboards and enclosures required for the project include the following:

1. Lighting and appliance panelboards.
2. Power-distribution panelboards.

C. Refer to other Division 26 sections for wires/cables, electrical boxes and fittings and raceway work required in conjunction with installation of panelboards and enclosures.

1.3 SUBMITTALS

A. Submit in accordance with General, Supplementary and Special Conditions.

B. Product Data: Submit manufacturer's data on panelboards and enclosures. Shop drawings shall indicate arrangement of busses, branch circuits, enclosures, dimensions, etc.

1.4 QUALITY ASSURANCE

A. Codes and Standards:

1. Electrical Code Compliance: Comply with applicable local code requirements of the authority having jurisdiction and NEC Article 384 as applicable to installation, and construction of electrical panelboards and enclosures.
2. UL Compliance: Comply with applicable requirements of UL 67, "Electric Panelboards", and UL codes 50, 869, 486A and 1053 pertaining to panelboards, accessories and enclosures. Provide panelboard units which are UL listed and labeled.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturer’s offering electrical panelboard products which may be incorporated in the work is limited to, the following:

1. Electrical panels with a capacity less than 400 amperes shall be Square "D" Type

NQ, NQOD, & NF, General Electric Type AQ & AE, Easton/Cutler Hammer Type Pow-R-Line 1a, 2a, 3a, or Siemens Type S1-S3. Circuit breakers shall be bolt-on type.

2. Unless otherwise noted, electrical panels with a capacity of 400 amperes or more shall be Square "D" I-line for the base bid. An alternate bid may be submitted for General Electric Spectra, Cutler Hammer or ITE. Alternate bids are to state the difference in price. General Electric Spectra shall have all spare spaces filled with an equal amount of 225 amp and 400 amp circuit breaker mounting modules with hole fillers and filler blanks.

2.2 PANELBOARDS

A. General: Except as otherwise indicated, provide panelboards, enclosures and ancillary components, of types, sizes, and ratings indicated, which comply with manufacturer's standard materials; with the design and construction in accordance with published product information; equip with proper number of unit panelboard devices as required for complete installation. Where types, sizes, or ratings are not indicated, comply with NEC, UL and established industry standards for those applications indicated.

1. Provide 20% spare breaker space in all panelboards.

B. Power Distribution Panelboards: Provide dead-front safety type power distribution panelboards as indicated, with panelboard switching and protective devices in quantities, ratings, types, and with arrangement shown; with anti-turn solderless pressure type main lug connectors approved for use with copper conductors. Select unit with feeders connecting at top of panel. Equip with copper bus bars with not less than 98-percent conductivity, and with full-sized neutral bus; provide suitable lugs on neutral bus for outgoing feeders requiring neutral connections. Provide bolt-on, molded-case circuit-breaker types for each circuit, with toggle handles that indicate when tripped. Provide panelboards with bare uninsulated grounding bars suitable for bolting to enclosures. Select enclosures fabricated by same manufacturer as panelboards, which mate and match properly with panelboards.

1. Power panelboards shall be General Electric Spectra Series, Square D type "I Line". Voltage shall be as indicated.

C. Lighting and Appliance Panelboards: Provide dead-front safety type lighting and appliance panelboards as indicated, with switching and protective devices in quantities, ratings, types and arrangements shown; with anti-burn solderless pressure type lug connectors approved for use with copper conductors; construct unit for connecting feeders at top of panel; equip with copper bus bars, full-sized neutral bar, with bolt-on type heavy duty, quick-make, quick-break, circuit-breakers, with toggle handles that indicate when tripped. Provide suitable lugs on neutral bus for each outgoing feeder required; and provide bare uninsulated grounding bars suitable for bolting to enclosures. Select enclosures fabricated by same manufacturer as panelboards, which mate and match properly with panelboards.

1. Panelboards shall be General Electric AQ-Series or Square D type "NQOD". Panelboard boxes shall be 5-3/4" deep. Voltage shall be as indicated.

D. Panelboard Enclosures: Provide galvanized sheet steel cabinet type enclosures, in sizes and NEMA types as indicated, code-gauge, minimum 16-gauge thickness. Cabinets shall be furnished without knock-outs and all holes for raceways shall be drilled and punched on the job. Panelboard enclosures shall be five and three-fourths inches (5-3/4") deep. Provide fronts with adjustable trim clamps, and doors with flush locks and keys, all panelboard enclosures keyed alike, with concealed piano door hinges and door swings as

indicated. Provide baked gray enamel finish over a rust inhibitor coating. Design enclosures for recessed mounting. Provide enclosures which are fabricated by same manufacturer as panelboards, which mate and match properly with panelboards to be enclosed.

E. Panelboards shall be numbered with odd numbers on the left side of the panel and even numbers on the right side of the panel. Panelboards shall have a circuit directory card mounted in a frame with plastic cover mounted on the inside of the door, and directory cards shall be completed with a typewriter to indicate areas and/or devices served by each circuit using. All panelboards being used for this project shall have new typed directories.

F. Molded-Case Circuit Breakers: Provide factory-assembled, bolt-on, molded-case circuit breakers of frame sizes, characteristics, and ratings including RMS symmetrical interrupting ratings indicated. Select breakers with permanent thermal and instantaneous magnetic trip and with fault-current limiting protection, ampere ratings as indicated. Multi-pole breakers shall have a common trip bar so that the tripping of one pole will automatically trip all poles of the breaker. Construct with over-center, trip-free, toggle-type operating mechanisms with quick-make, quick-break action and positive handle trip indication. Construct breakers for mounting and operating in any physical position and operating in an ambient temperature of 40°C. Provide breakers with mechanical screw type removable connector lugs, AL/CU rated.

G. Panelboards shall be installed complete with connectors and associated hardware for all circuit breakers and circuit breaker spaces listed in the panelboard schedule.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions under which panelboards and enclosures are to be installed, and notify OWNER'S REPRESENTATIVE in writing of conditions detrimental to proper completion of work. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER and OWNER.

3.2 INSTALLATION OF PANELBOARDS

A. Install panelboards and enclosures as indicated, in accordance with manufacturer's written instructions, applicable requirements of NEC standards and NECA's "Standards of Installation", and in compliance with recognized industry practices to ensure that products fulfill requirements. Panelboard enclosures shall not be used as raceways.

B. Panelboards or any other electrical equipment located in smoke or fire rated walls shall be mounted on Unistrut channels. Channels shall be supported from floor and structure above ceiling. There shall be no penetrations of the fire rated assembly pursuant to the equipment installation.

C. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for equipment connectors.

D. Fasten enclosures firmly to walls and structural surfaces, insuring that they are permanently and mechanically anchored.

3.3 GROUNDING

A. Provide equipment grounding connections for panelboard enclosures as indicated.

B. Prior to energization, check panelboards for electrical continuity of circuits and for short-circuits.

3.4 ADJUSTING AND CLEANING

A. Adjust operating mechanisms for free mechanical movement.

B. Touch-up scratched or marred surfaces to match original finishes.

END OF SECTION 26 24 16

SECTION 262726 – WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Conform to Division 01 and other sections of this division.

B. This Section is a Division 26 Basic Electrical Materials and Methods section, and is part of each Division 26 section making reference to wiring devices specified herein.

1.2 DESCRIPTION OF WORK

A. The extent of wiring device work is indicated by drawings and schedules. Wiring devices are defined as single discrete units of electrical distribution systems which are intended to carry but not utilize electric energy.

B. Types of electrical wiring devices in this Section include the following:

1. Receptacles
2. Ground-fault circuit interrupters
3. Switches
4. Wallplates
5. Timers
6. Time Clocks

1.3 QUALITY ASSURANCE

A. NEC Compliance: Comply with NEC as applicable to installation and wiring of electrical wiring devices.

B. UL Compliance: Comply with applicable requirements of UL 20, 486A, 498 and 943 pertaining to installation of wiring devices. Provide wiring devices which are UL-listed and UL-labeled.

1.4 SUBMITTALS

A. Submit in accordance with General, Supplementary and Special Conditions.

B. Product Data: Submit manufacturer's data on electrical wiring devices.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, manufacturers providing wiring devices which may be incorporated in the work include, but are not limited to, the following (for each type and rating of wiring device):

1. Arrow-Hart, Cooper Industries
2. General Electric Co.
3. Harvey Hubbell, Inc.

4. Pass and Seymour, Inc.
5. Leviton Manufacturing Co., Inc.
6. Stater Electric Co.
7. Paragon Time Clocks
8. Tork Time Clocks
9. Intermatic Time Clocks

2.2 FABRICATED WIRING DEVICES

A. General: Provide factory-fabricated wiring devices, in types, colors, and electrical ratings for applications indicated and which comply with NEMA Stds. Pub/No. WD

1. Provide ivory color devices except as otherwise indicated.

B. Receptacles:

1. All receptacles shall be the grounding type with ground connection made through an extra pole which shall be permanently connected to the green grounding conductor. This conductor shall be bonded to each box also.
2. Duplex receptacles for 20 ampere, 120 volt service shall be two-pole, three-wire receptacles rated 20 amperes at 125 volts, Pass and Seymour Catalog No. PS5362-I.
3. Single receptacles for 20 amps, 120 volts service shall be two-pole, three-wire rated 20 amperes at 125 volts, Pass and Seymour Catalog No. PS5351-I.
4. Ground-fault interrupters, Pass and Seymour Catalog No. PS2095-I.
5. Receptacles denoted on drawings as "Computer Receptacles" to be gray in color, Pass and Seymour Catalog No. PS5362-GRY.
6. Exterior weatherproof receptacles shall have cast aluminum in-use covers by Intermatic or equal.

C. Switches:

1. Snap: Provide toggle switches, rated 20 amps at 120/277 volts quiet type and shall be UL approved without derating for tungsten lamp loads or inductive loads. The following catalog numbers are Pass and Seymour.

Type	Catalog No.
Single Pole	PS20AC1-I
Three Way	PS20AC3-I
Four Way	PS20AC4-I

2. Tamperproof type switches shall be rated 20 Amperes at 120/277 Volts, PS20AC3IL three way, PS20AC1IL single way switch manufactured by Pass and Seymour.

D. Time Clocks:

1. See electrical drawings.

2.3 WIRING DEVICE ACCESSORIES

A. Wallplates: Provide Type 302 stainless steel, specification grade wallplates for single and combination wiring devices, of types, sizes, and with ganging and cutouts as indicated. Select plates which mate and match wiring devices to which attached. Construct with metal

screws for securing plates to devices: screw heads to match finish of plates.

PART 3 - EXECUTION

3.1 INSTALLATION OF WIRING DEVICES

A. Install wiring devices as indicated, in accordance with manufacturer's written instructions, applicable requirements of NEC and NECA's "Standard of Installation" and in accordance with recognized industry practices to fulfill project requirements.

B. Install wiring devices only in electrical boxes which are clean; free from excess building materials, dirt and debris.

C. Install wiring devices after wiring work is completed and inspected.

D. Install wallplates after painting work is completed.

E. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for wiring devices. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Stds 486A and B. Use properly scaled torque indicating hand tool.

F. On all devices (receptacles), place ground connection down.

3.2 PROTECTION OF WALLPLATES AND RECEPTACLES

A. Upon installation of wallplates and receptacles, advise CONTRACTOR regarding proper and cautious use of convenience outlets. At time of substantial completion, replace those items which have been damaged, including those burned and scored by faulty plugs.

3.3 GROUNDING

A. Provide equipment grounding connections for all wiring devices, unless otherwise indicated. Tighten connections to comply with tightening torques specified in UL Std 486A to assure permanent and effective grounds. Grounding conductor shall be bonded to all boxes with a separate screw. Screws used to support boxes are not to be used for grounding. Bonding screws shall be installed in box during rough-in installation. Bonding screws shall be green hexagonal type.

3.4 TESTING

A. Prior to energizing circuitry, test wiring for electrical continuity, and for short-circuits. Ensure proper polarity of connections is maintained. Subsequent to energization, test wiring devices to demonstrate compliance with requirements.

END OF SECTION 26 27 26

SECTION 262816 – ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Conform to Division 01 and other sections of this division.

B. This section is a Division 26 Basic Electrical Materials and Methods section, and is part of each Division 26 section making reference to enclosed switches and circuit breakers specified herein.

PART 2 - CIRCUIT AND MOTOR DISCONNECTS

2.1 DESCRIPTION OF WORK

A. Extent of circuit and motor disconnect switch work is indicated on drawings and schedules and as required by N.E.C.

B. Types of circuit and motor disconnect switches in this Section include the following:

1. Equipment disconnects.
2. Appliance disconnects.
3. Motor-circuit disconnects.

C. Wires/cables, raceways, and electrical boxes and fittings required in connection with circuit and motor disconnect work are specified in other Division 26 Basic Electrical Materials and Methods sections.

2.2 QUALITY ASSURANCE

A. NEC Compliance: Comply with NEC requirements pertaining to construction and installation of electrical circuit and motor disconnect devices.

B. UL Compliance: Comply with requirements of UL 98, "Enclosed and Dead-Front Switches." Provide circuit and motor disconnect switches which have been UL-listed and labeled.

C. NEMA Compliance: Comply with applicable requirements of NEMA Stds. Pub No. KS 1, "Enclosed Switches" and 250, "Enclosures for Electrical Equipment (1000 Volts Maximum)."

2.3 SUBMITTALS

A. Submit in accordance with General, Supplementary and Special Conditions.

B. Product Data: Submit manufacturer's data on circuit and motor disconnect switches.

2.4 ACCEPTABLE MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering circuit and motor disconnects which may be incorporated in the work are limited to, the following (for each type of switch) (all devices, panels and components shall be of the same

manufacturer):

1. Square D Company.
2. General Electric.
3. Cutler Hammer.
4. Siemens

2.5 FABRICATED SWITCHES

A. Heavy-Duty Safety Switches: Provide surface-mounted, heavy-duty type, NEMA HD sheet-steel enclosed safety switches, of types, sizes and electrical characteristics indicated; incorporating quick-make, quick-break type switches; construct so that switch blades are visible in OFF position with door open. Equip with operating handle which is integral part of enclosure base and whose operating position is easily recognizable, and is pad-lockable in OFF position; construct current carrying parts of high-conductivity copper, with silver-tungsten type switch contacts, and positive pressure type reinforced fuse clips.

1. All fuses for safety switches shall be dual element, cartridge type. Fuses shall be Bussman "Fusetron" or Chase-Shawmut "Trionic." The CONTRACTOR shall furnish and install proper size fuses where required for all fusible equipment and shall furnish to the OWNER one spare fuse for each fuse installed.

2.6 EXECUTION: CIRCUIT AND MOTOR DISCONNECT SWITCHES

A. Install circuit and motor disconnect switches as indicated, complying with manufacturer's written instructions, applicable requirements of NEC, NEMA, and NECA's "Standard of Installation", and in accordance with recognized industry practices.

B. Install disconnect switches (molded case, breaker disconnect (non-fused) with deadfront) for use with motor-driven appliances, and motors and controllers within sight of controller (no more than 25’-0”) position unless otherwise indicated.

C. Unless otherwise indicated, protective devices shall be mounted with top of cabinet or enclosure six feet (6'-0") above finished floor, shall be properly aligned and shall be adequately supported independently of the connecting raceways. All steel shapes, etc., necessary for the support of the equipment shall be furnished and installed where the building structure is not suitable for mounting the equipment directly thereon. Unless otherwise indicated, all branch circuit protective devices enclosures shall be NEMA type I, general purpose type. Branch circuit protective devices installed outdoors or exposed to the weather shall have weatherproof enclosures, NEMA type 3R or type 4.

2.7 GROUNDING

A. Provide equipment grounding connections, sufficiently tight to assure a permanent and effective ground, for electrical disconnect switches where indicated. Install factory ground bar kit.

2.8 FIELD QUALITY CONTROL

A. Subsequent to completion of installation of electrical disconnect switches, energize circuitry and demonstrate capability and compliance with requirements. Where possible, correct malfunctioning units at project site, then retest to demonstrate compliance; otherwise remove and replace with new units and retest.

PART 3 - MOTOR STARTERS

3.1 DESCRIPTION OF WORK

A. Extent of motor starter work is indicated by drawings and schedules.

3.2 QUALITY ASSURANCE

A. NEC Compliance: Comply with NEC as applicable to wiring methods, construction and installation of motorstarters.

B. UL Compliance: Provide motor starters and components which are UL-listed and labeled.

3.3 SUBMITTALS

A. Product Data: Submit manufacturer's data on motor starters.

3.4 ACCEPTABLE MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering motor starters which may be incorporated in the work include the following:

1. Allen-Bradley Co.
2. General Electric Co.
3. Square D Co.

3.5 MOTOR STARTERS: GENERAL

A. Except as otherwise indicated, provide motor starters and ancillary components which comply with manufacturer's standard materials, design and construction in accordance with published product information and as required for complete installation.

1. Manual motor starters for 115 volts, single phase motors one horsepower and smaller, shall be single pole, horsepower rated switches with thermal overload units and heaters. Starters shall be Square D Class 2510, Allen-Bradley 600, or General Electric CR-101, with stainless steel cover plates.
2. Magnetic full voltage starters for three phase motors shall be three pole, horsepower rated, magnetically operated with three thermal overload units and four extra auxiliary contacts. Coordinate control voltage with Division 23. Provide and install control transformers to achieve required voltage. A Hand-Off-Automatic, HOA switch shall be mounted in front cover. Starters shall be Square D Class 8536, Allen-Bradley 709, or General Electric CR-206.
3. Combination magnetic, full voltage starters for three phase motors shall be three pole horsepower rated, magnetically operated switches, with three thermal overload units and four extra auxiliary contacts. Coordinate control voltage with Division 23. Provide and install control transformers to achieve required voltage. A three pole horsepower rated, non-fusible disconnect switch shall also be included in the enclosure. HOA switch shall be mounted in front cover. Starters shall be Square D Class 8538, Allen-Bradley 712, or General Electric CR-207.

3.6 EXECUTION: MOTOR STARTERS

A. Install motor starters as indicated, in accordance with equipment manufacturer's written instructions and with recognized industry practices; complying with applicable requirements of NEC, UL and NEMA standards, to insure that products fulfill requirements.

B. Motor starters or any other electrical equipment located in smoke or fire rated walls shall be mounted on Unistrut channels. Channels shall be supported from floor and structure above ceiling. There shall be no penetrations of the fire rated assembly pursuant to the equipment installation.

C. Unless otherwise indicated, motor starters shown on the drawing shall be furnished and installed under this Section. The full load current and starting characteristics of each motor shall be verified for proper selection of motor over load devices.

D. Furnish and install all steel shapes, etc., necessary for a support of all motor starters.

E. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for equipment connectors.

3.7 ADJUSTING AND CLEANING

A. Inspect electrical starter's operating mechanisms for malfunctioning and, where necessary, adjust units for free mechanical movement.

B. Touch-up scratched or marred surfaces to match original finish.

3.8 FIELD QUALITY CONTROL

A. Subsequent to connecting wires/cables, energize motor starter circuitry and demonstrate functioning of equipment in accordance with requirements; where necessary correct malfunctioning units, and then retest to demonstrate compliance. Insure that direction of rotation of each motor fulfills requirements, and make changes in rotation at motor wiring terminal.

END OF SECTION 26 28 16

SECTION 264300 – TRANSIENT VOLTAGE SUPPRESSION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Conform to Division 01 and other sections of this division.

B. This section is a Division 26 Basic Electrical Materials and Methods section, and is a part of each Division 26 section making reference to electrical transient voltage suppression specified herein.

1.2 DESCRIPTION OF WORK

A. The work required under this division shall include all materials, labor and auxiliaries required to furnish and install complete transient voltage suppression for the protection of building electrical and electronics systems from the effects of line induced transient voltage transient voltage and lightning discharge as indicated on drawings or specified in this section.

B. Types of transient voltage suppression specified in this section include the following:

1. Service entrance type.
2. Distribution and branch circuit panels.

1.3 QUALITY ASSURANCE

A. All transient voltage suppression devices shall be manufactured by a company normally engaged in the design, development, and manufacture of such devices for electrical and electronics system equipment.

B. The transient voltage suppressor manufacturer shall offer technical assistance through support by a factory representative and local stoking distributor.

C. Submittals: Transient voltage suppression submittal shall include:

1. Manufacturer's performance data on each suppressor type.
2. Dimensioned drawing of each suppressor type.

D. To establish the type and operating characteristics of the transient voltage suppression devices, equipment manufactured by Leviton Manufacturing Company is used as a guide in determining the functions of the transient voltage suppression system. Other equipment will be considered for approval provided the following is submitted in writing to the ENGINEER prior to bid date.

1. Manufacturer qualifications (as listed above; Paragraph 1.03-A).
2. Complete submittals (as listed above; Paragraph 1.03-C).

E. Equipment Certification: Items shall be listed by Underwriters' Laboratories, shall bear the seal and be marked in accordance with referenced standard.

F. Transient voltage suppression devices shall be installed and located in accordance with requirements of all applicable National Fire Protection Association (NFPA) Codes.

1.4 WARRANTY

A. All transient voltage suppression devices shall be warranted to be free from defects in materials and workmanship under normal use in accordance with the instructions provided for a period of five (5) years.

B. Any suppressor which shows evidence of failure or incorrect operating during the warranty period shall be repaired by the manufacturer and installer.

1.5 CODES AND STANDARDS

A. The following standards and publications are referenced in various parts of this specification and shall apply:

1. Current Edition of UL 1449 - Standard for safety, Transient Voltage Transient voltage Suppressors.
2. Current Edition of UL 1363 - Standard for Temporary Power Taps.
3. Current Edition of ANSI/IEEE C62.41 (IEEE 587) - Guide for Transient voltage Voltages in Low-Voltage AC Power Circuits.
4. Current Edition of ANSI/IEEE C62.33 - Standard Test Specifications for Varistor Transient voltage Protection Devices.
5. Current Edition of ANSI/IEEE C62.45 - IEEE Guide for Transient voltage Testing for Equipment Connected to Low-Voltage AC Power Circuits.

PART 2 - PRODUCTS

2.1 SUPPRESSORS

A. The transient voltage suppressor manufacturer shall offer a complete line of transient voltage suppression products to support the required suppressors listed in Part 1.

B. The panel mounted unit suppressor shall be designed with replaceable modules for purposes of in-service replacement. The unit suppressor shall be designed with redundant back-up transient voltage protection in the event of a module failure.

1. Module status indicators shall be provided to indicate the status of the complete unit suppressor. The LED status indicators shall be located on the hinged front cover to redundantly indicate module or unit failure. The unit suppressor shall include alarm contacts (one N.O. and one N.C.) for remote annunciation of unit status.
2. Unit status indicators shall be provided to indicate the status of the complete unit suppressor. The LED status indicators shall be located on the hinged front cover to redundantly indicate module or unit failure. The unit suppressor shall include alarm contacts (one N.O. and one N.C.) for remote annunciation of unit status.

C. Suppressors shall be designed for the specific type and voltage of electrical service and shall provide clamping action for both north (L-N) and common (L-N-G) mode protection.

D. Suppressors shall be of a hybrid design, and include circuitry with tight, wave-tracking clamping characteristics.

E. Suppressors shall be designed to withstand a maximum continuous operating voltage of not less than 115% of nominal RMS line voltage.

F. Suppressors shall contain internal safety fusing, when required, to disconnect the suppressor from the electrical source if the suppressor fails, in order to prevent catastrophic failure modes.

G. Suppressors shall be failsafe, shall allow no follow-through current, shall have repeated transient voltage capability, shall be solid state, shall be self-restoring, and shall be fully automatic.

H. Suppressors shall be UL 1449 listed and shall be approved for the location in which they are installed.

I. Suppressors shall have an operating temperature range of -40oC to +85oC.

2.2 SUPPRESSOR CRITERIA: Suppressors shall meet or exceed the following criteria:

A. Service Entrance: Leviton Manufacturing 57000 Series or approved equal.

1. 120/208 Volt, 3 Phase, 4 Wire, Wye:

a. Leviton Model 57120-M3.
b. Minimum transient voltage capacity of 75,000 Amps.
c. Suppressors shall be tested as per IEEE C62.41-1991 to determine clamping voltage using Cat. C3 test criteria.

2. 277/480 Volt, 3 Phase, 4 Wire, Wye:

a. Leviton Model 57277-M3.
b. Minimum transient voltage capacity of 75,000 Amps.
c. Suppressors shall be tested as per IEEE C62.41-1991 to determine clamping voltage using Cat. C3 test criteria.

3. Suppressors shall be sequential transient voltage tested as per IEEE C62.45-1987, and shall withstand 1000 test cycles at 10KA, Cat. C3 test criteria.

B. Distribution secondary and/or subpanels: Leviton Manufacturing 47000 Series or approved equal.

1. 120/208 Volt, 3 Phase, 4 Wire, Wye:

a. Leviton Model 47120-007
b. Minimum transient voltage capacity of 50,000 Amps.
c. Suppressors shall be tested as per IEEE C62.41-1991 to determine clamping voltage using UL 1449 testing criteria.

2. 277/480 Volt, 3 Phase, 4 Wire, Wye:

a. Leviton Model 47277-007
b. Minimum transient voltage capacity of 50,000 Amps.
c. Suppressors shall be tested as per IEEE C62.41-1991 to determine clamping voltage using UL 1449 testing criteria.

3. Suppressors shall be sequential transient voltage tested as per IEEE c62.45-1987, and shall withstand 1000 testcycles at 3KA, Cat. B3 test criteria.

C. The UL 1449 suppression rating for any mode shall not exceed.

SERVICE ENTRANCE		DISTRIBUTION/SUB-PANEL	
VOLTAGE	PHASE	MAX SUPPRESSION RATING	MAX SUPPRESSION RATING
120/208	3	500V	400V
277/480	3	1000V	800V

D. Dedicated 120 volt, 20 amp power connection to circuits as per paragraph 1.05-a-3: Levition Manufacturing model 51020-WM. Provide hardwire or receptacle type device to match equipment when required.

2.3 ACCEPTABLE MANUFACTURERS:

A. Leviton

B. LEA Dynatech

C. Joslyn

D, Liebert

E. Current Technologies

F. E.F.I.

G. Atlantic Scientific

PART 3 - EXECUTION

3.1 INSTALLATION OF SUPPRESSORS

A. Suppressors shall be installed as close as practical to the electric panel or electronic equipment to be protected, consistent with available space. Suppressors shall be close nippled to the device being protected in a position near the neutral bus which will minimize lead length between suppressor and the buses or control breaker to which the suppressor connects. Suppressor leads shall not extend beyond the suppressor manufacturer's recommended maximum lead length without specific approval of the ENGINEER.

B. Suppressors shall be installed in a neat, workmanlike manner. Lead dress shall be as short and as straight as possible and be consistent with recommended industry practices for the system on which these devices are installed.

C. Supplementary grounding and bonding connections required between the bonding bus or ground plane for each equipment cluster and other locations as indicated herein shall be accomplished using the Manufacturers recommended core copper conductor and approved connections unless otherwise noted. Referenced to a common earth ground.

D. Suppressors shall be installed in a manner that allows simple replacement within short periods of downtime.

E. Service entrance and panel type suppressors shall be installed with a means of disconnecting the suppressor. Provide a dedicated circuit breaker or fused disconnect per

the manufacturer's recommendations and rated to interrupt the available fault current at that location.

F. The transient voltage suppression equipment shall be UL listed and installed per the NEC and the manufacturer's specification.

END OF SECTION 26 43 00

SECTION 265600 - EXTERIOR LIGHTING FIXTURES, LAMPS, AND BALLASTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Conform to Division 01 and other sections of this division.

B. Division 26 Basic Electrical Materials and Methods sections apply to work specified in this Section.

1.02 SUMMARY

A. Extent, location, and details of lighting fixture work are indicated on drawings and in schedules.

1.03 SUBMITTALS

A. Submit in accordance with General, Supplementary and Special Conditions.

B. Product Data: Submit manufacturer's product data and installation instructions on each type building lighting fixture and component.

C. Shop Drawings: Submit fixture shop drawings in booklet form with separate sheet for each fixture, assembled in "luminaire type" alphabetical or numerical order, with proposed fixture and accessories clearly indicated on each sheet. Submit details indicating compatibility with ceiling grid system. Submit separate chart with number of fixtures to be supplied and manufacturer's recommended replacement ballasts and lamps.

1.04 QUALITY ASSURANCE

A. Codes and Standards:

1. UL Compliance: Comply with UL standards. Provide exterior lighting fixtures and components which are UL-listed and labeled.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver lighting fixtures in factory-fabricated containers or wrappings, which properly protect fixtures from damage.

B. Store lighting fixtures in original packaging. Store inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, humidity, laid flat and blocked off ground. Fixtures shall be stored in completely dry and protected area. Covering with plastic in areas subject to moisture and/or areas where other items and/or people climbing or standing on them is not acceptable.

C. Handle lighting fixtures carefully to prevent damage, breaking, and scoring of finishes. Do not install damaged units or components; replace with new.

1.06 SEQUENCING AND SCHEDULING

A. Coordinate with other work including wires/cables, electrical boxes and fittings, and

raceways, to properly interface installation of lighting fixtures with other work.

B. Sequence lighting installation with other work to minimize possibility of damage and soiling during remainder of construction.

PART 2 - PRODUCTS

2.01 LIGHT FIXTURES

A. General: Provide lighting fixtures, of sizes, types and ratings indicated; complete with, but not limited to, housings, lamps, lamp holders, reflectors, energy efficient ballasts and wiring. Ship fixtures factory-assembled, with those components required for a complete installation.

B. Lamps: HID lamps shall be of the type as recommended by the fixture manufacturer. All HID lamps shall be of the same manufacturer and same manufacturing run to minimize variations in color quality.

C. Ballast: Ballasts for high intensity discharge fixtures shall be individually fused. Fuses shall be installed on the line side of the fixture located in pole handhole.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas and conditions under which lighting fixtures are to be installed, and substrate for supporting lighting fixtures. Notify OWNER'S REPRESENTATIVE in writing of conditions detrimental to proper completion of the work. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to ENGINEER and OWNER.

3.02 INSTALLATION OF LIGHTING FIXTURES

A. Install lighting fixtures at locations and heights as indicated, in accordance with fixture manufacturer's written instructions, applicable requirements of NEC, NECA's "Standard of Installation", NEMA standards, and with recognized industry practices to ensure that lighting fixtures fulfill requirements.

B. Provide fixtures with davit arms to properly support fixture weight. Submit design of hangers, method of fastening, other than indicated or specified herein, for review by ARCHITECT, ENGINEER and OWNER.

C. Fasten fixtures securely to pole structural support; and ensure that pole mounted fixtures are plumb and level.

D. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for equipment connectors.

3.03 ADJUSTING AND CLEANING

A. Clean lighting fixtures of dirt and construction debris upon completion of installation. Clean

fingerprints and smudges from lenses and reflectors. Fixtures shall be lamped with new lamps at the time of Final Inspection.

B. Protect installed fixtures from damage during remainder of construction period.

3.04 GROUNDING

A. Provide equipment grounding connections for lighting fixtures as indicated.

3.05 DEMONSTRATION

A. Upon completion of installation of lighting fixtures, and after circuitry has been energized; apply electrical energy to demonstrate capability and compliance with requirements. Where possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new units, and proceed with retesting.

END OF SECTION 26 56 00

SECTION 265668 – EXTERIOR ATHLETIC LIGHTING

PART 1 – GENERAL

1.1 SUMMARY

A. Work covered by this section of the specifications shall conform to the contract documents, engineering plans as well as state and local codes.

B. The purpose of these specifications is to define the performance and design standards for Danny Meehan Park. The manufacturer/contractor shall supply lighting equipment to meet or exceed the standards set forth in these specifications.

C. The sports lighting will be for the following venues:
   1. Multipurpose Field
   2. Basketball Court

D. The primary goals of this sports lighting project are:
   1. Guaranteed Light Levels: Selection of appropriate light levels impact the safety of the players and the enjoyment of spectators. Therefore light levels are guaranteed to not drop below specified target values for a period of 25 years.
   2. Life-cycle Cost: In order to reduce the operating budget, the preferred lighting system shall be energy efficient and cost effective to operate. All maintenance costs shall be eliminated.
   3. Control and Monitoring: To allow for optimized use of labor resources and avoid unneeded operation of the facility, customer requires a remote on/off control system for the lighting system including all costs to monitor for 25 years. Fields should be proactively monitored to detect fixture outages over a 25-year life cycle. All communication costs shall be included in the bid.
   4. Environmental Light Control: It is the primary goal of this project to minimize spill light and glare to the players, spectators and adjoining properties.

1.2 LIGHTING PERFORMANCE

A. Performance Requirements: Playing surfaces shall be lit to an average target light level and uniformity as specified in the chart below. Lighting calculations shall be developed and field measurements taken on the grid spacing with the minimum number of grid points specified below. Average illumination level shall be measured in accordance with the IESNA LM-5-04 (IESNA Guide for Photometric Measurements of Area and Sports Lighting Installations). Light levels shall be guaranteed not to drop below desired target values from the first 100 hours of operation for the maximum warranty period of 25 years in accordance to IES RP-6-01, Page 5, Maintained Average Illuminance. Hours of usage shall comply with the following:

Area of Lighting	Annual Usage Hours	25 Year Usage Hours
Multipurpose Field	500	12,500
Basketball Court	1,200	30,000

B. Mounting Heights: To ensure proper aiming angles for reduced glare and to provide better playability, minimum mounting heights shall be 50 Feet for the Multipurpose Field and 40 Feet for the Basketball Court.. Higher mounting heights may be required based on photometric report clarification per Section 1.3.

# of Poles	Pole Designation	Pole Height
4	Multipurpose Field	50'

1	Basketball Court	40'

C. Lighting Methodology: There are two methods that will be considered for calculation of the lighting designs for this project. The approved Lighting Method #1, automated timed power adjustments, as described in C.1 utilizes methodology that adjusts light levels through a series of programmed adjustments. The alternate Lighting Method #2, straight depreciation, as described in C.2 uses continuous lamp lumen depreciation which is recovered by relamping and cleaning lenses of the luminaires. Both methods must be at or above target light values throughout the 25 years of the contract/warranty provided by the manufacturer. Scans shall reflect initial design lumens, end of life design lumens, recoverable light loss factor (RLLF), and the Coefficient Utilization (CU) for the design. A +/- 10% design/testing allowance is not permitted in the design logic.

1. Lighting Method #1: Automated Timed Power Adjustments:

   a. The lighting system shall use automated timed power adjustments to achieve a lumen maintenance control strategy as described in the IESNA Lighting Handbook 10th Edition, Lighting Controls Section page 16-8: "Lumen maintenance involves adjusting lamp output over time to maintain constant light output as lamps age and dirt accumulation reduces luminaire output. With lumen maintenance control, either lamps are dimmed when new, or the lamp's current is increased as the system ages."

   b. Manufacturers bidding an automated timed power adjustment system must provide an independent test report certifying the system meets the lumen maintenance control strategy above and verifying the field performance of the system for the duration of the useful life of the lamp based on lamp replacement hours. Report shall be signed by a licensed professional engineer with outdoor lighting experience. If report is not provided at least 10 days prior to bid opening, the manufacturer shall provide the initial and maintained designs called for in this specification under Lighting Method #2: Alternate Manufacturers, section 1.2.C.2.

   c. Project References: Manufacturers bidding any form of Automated Timed Power Adjustment light system must provide a minimum of (10) project references within the state of FL that have been completed within the last 12 months utilizing this exact technology. Manufacturer will include project name, project city, and if requested, contact name and contact phone number for each reference.

Area of Lighting	Average Target Light Levels	Maximum to Minimum Uniformity Ratio	Grid Points	Grid Spacing
Multipurpose Field	30 FC	2.0:1	66	20' by 20'
Basketball Court	30 FC	6.0: 1	50	10' by 10'

2. Lighting Method #2 – Continuous Depreciating Light

   a. Light Level Requirements: Manufacturer shall provide computer models and guarantee target light levels on the field over 25 years. The specified maximum Recoverable Light Loss Factor of .69 and maintenance/group relamping schedule shall be provided in accordance with recommendations in the Leukos Abstract Volume 6, Number 3, January 2010, page 183-201: “Light Loss Factors for Sports Lighting”, and presented at the 2009 IESNA Annual Conference.

For Lighting Method #2, scans for both initial and target light levels are required.

1500w Fixture RLLF Requirements

Lamp Replacement Interval (hours)	Recoverable Light Loss Factor (RLLF)
2,100	.69

b. Independent Test Report: If lamp replacement interval is greater than 3,000 hours for 1500 watt lamps, manufacturer shall supply an independent test report with lumen depreciation over proposed lamp life.

c. Based on anticipated hours of usage 500 hours per year for the Multipurpose Field and 1,200 for the Basketball Court, Method #2 systems would require a minimum of 5 group lamp replacements for the Multipurpose Field and 14 group lamp replacements for the Basketball Courts over the 25 years.

Area of Lighting	25 Year Usage Hours	25 Year Group Relamps Required
Multipurpose Field	500	5
Basketball Court	1,200	14

Area of Lighting	Average Initial Light Levels	Average Target Light Levels	Maximum to Minimum Uniformity Ratio	Grid Points	Grid Spacing
Multipurpose Field	43.5 FC	30 FC	2.0:1	66	30' by 30'
Basketball Court	43.5 FC	30 FC	6.0: 1	50	10' by 10'

d. Revised Electrical Distribution: Manufacturer shall provide revised electrical distribution plans to include changes to service entrance, panel, and wire sizing if increased power is required which exceeds specified design loads.

1.3 ENVIRONMENTAL LIGHT CONTROL

A. Glare Control - The installed lighting system must provide light control in order to be environmentally responsible, provide good playability, and ensure the facility is aesthetically pleasing to the community. Pole locations dictated per photometric designs included in construction documents.

Fixtures must have an external visor to reduce glare as well as spill light. Horizontal optic fixtures are not allowed. High output lamps (over 162,000 lumens) are not allowed.

1. Photometric reports must be provided to demonstrate the capability of achieving the following specified performance. Reports shall be certified by a qualified independent testing laboratory with a minimum of five years experience or by a manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products. ITL reports will remain confidential and be returned to the manufacturer after the bid is awarded.

2. Luminaire Mounting Height – Proper mounting heights allow for sufficient vertical aiming angles which reduce glare and help ensure the illumination on the playing field is balanced, providing adequate modeling of the ball for optimal playability. The basis of design for this project would require mounting heights as indicated in the chart below

Field	Poles
Multipurpose Field	50'mh
Basketball Court	40'mh

3. Upper Beam Definition

No fixture shall exceed the candlepower at the specified degrees above the center of the beam in the vertical plane as specified in the following table.

NEMA Classification of Vertical Beam	Candela	Degrees Above the Center of the Beam in the Vertical Plane
4	10,000	15 degrees

If a manufacturer's photometric report indicates that they cannot meet this criteria, they may increase mounting heights (see below) to maintain the same impact for playability, spectator comfort and impact on the adjoining properties. If a manufacturer's photometric report indicates that they can achieve 10,000 candela at an angle below 15 degrees they may decrease mounting heights using the formula below, providing aiming angles abide by I.E.S. good lighting practices

This mounting height increase/decrease will be calculated by referencing the fixture photometric report and determining the angle above or below vertical that the fixture achieves a candela reading less than or equal to 10,000 candela. Pole heights will be increased/decreased 3.25' for every one degree above/below 15.0 degrees needed to achieve a candela reading of 10,000. For example: If 10,000 candela is achieved at 17 degrees above vertical, a minimum mounting height of 56.5' (Multipurpose Field) (2.0 degrees x 3.25') would be required for the poles.

1.4 LIFE CYCLE COSTS

Manufacturer shall submit 25-year life cycle cost calculation as outlined in the required submittal information. If lamp replacement interval is greater than 3000 hours, manufacturer shall supply an independent test report with applicable recoverable light loss factor, initial, and end of life lumens.

Lamp replacement schedule per charts below:

Lighting Method 1 Lamp Replacement	Lighting Method 2 Lamp Replacement
5,000 hour intervals	2,100 hour intervals

PART 2 – PRODUCT

2.1 SPORTS LIGHTING SYSTEM CONSTRUCTION

A. Manufacturing Requirements: All components shall be designed and manufactured as a system. All luminaires, wire harnesses, ballast and other enclosures shall be factory assembled, aimed, wired and tested.

B. Durability: All exposed components shall be constructed of corrosion resistant material and/or coated to help prevent corrosion. All exposed carbon steel shall be hot dip galvanized per ASTM A123. All exposed aluminum shall be powder coated with high performance polyester or anodized. All exterior reflective inserts shall be anodized, coated, and protected from direct environmental exposure to prevent reflective degradation or corrosion. All exposed hardware

and fasteners shall be stainless steel of 18-8 grade or better, passivated and coated with aluminum-based thermosetting epoxy resin for protection against corrosion and stress corrosion cracking. Structural fasteners may be carbon steel and galvanized meeting ASTM A153 and ISO/EN 1461 (for hot dipped galvanizing), or ASTM B695 (for mechanical galvanizing). All wiring shall be enclosed within the crossarms, pole, or electrical components enclosure.

C. System Description: Lighting system shall consist of the following:
   1. Galvanized steel poles and crossarm assembly. Optional Concrete pole with a minimum of 8,000 psi and concrete backfill provided will be an acceptable alternative provided building code, wind speed and foundation designs per specifications are adhered to.
   2. Non-approved pole technology. Square static cast poles will not be accepted. Direct bury steel poles which utilize the extended portion of the steel shaft for their foundation will not be accepted due to potential for internal and external corrosive reaction to the soils and long term performance concerns.
   3. Pre-stressed concrete base embedded in concrete backfill allowed to cure for 12-24 hours before pole stress is applied. Alternate may be an anchor bolt foundation designed such that the steel pole and any exposed steel portion of the foundation is located a minimum of 18 inches above final grade. The concrete for anchor bolt foundations shall be allowed to cure for a minimum of 28 days before the pole stress is applied.
   4. All luminaires shall be constructed with a die-cast aluminum housing or external hail shroud to protect the luminaire reflector system.
   5. Manufacturer will remote all ballasts and supporting electrical equipment in aluminum enclosures mounted approximately 10’ above grade. The enclosures shall be touch-safe and include ballast, capacitor and fusing with indicator lights on fuses to notify when a fuse is to be replaced for each luminaire. Safety disconnect per circuit for each pole structure will be located in the enclosure. Integral ballast fixtures will not be accepted.
   6. Wire harness complete with an abrasion protection sleeve, strain relief and plug-in connections for fast, trouble-free installation.
   7. All luminaires, visors, and crossarm assemblies shall withstand <Wind Speed> mph winds and maintain luminaire aiming alignment
   8. Controls and Monitoring Cabinet to provide on-off control and monitoring of the lighting system constructed of NEMA Type 4 aluminum. Communication method shall be provided by manufacturer. Cabinet shall contain custom configured contactor modules for 30, 60, and 100 amps, labeled to match field diagrams and electrical design. Manual Off-On-Auto selector switches shall be provided.
   9. Lightning Protection: Contractor shall provide integrated lightning grounding via concrete encased electrode grounding system as defined by NFPA 780 and be UL Listed per UL 96 and UL 96A. If grounding is not integrated into the structure, the Manufacturer shall supply grounding electrodes, copper down conductors and exothermic weld kits. Electrodes and conductors shall be sized as required by NFPA 780. The grounding electrode shall be not less than 5/8 inch diameter and 8 feet long, with a minimum of 10 feet embedment. Grounding electrode shall be connected to the structure by a grounding electrode conductor with a minimum size of 2 AWG for poles with 75 feet mounting height or less, and 2/0 AWG for poles with more than 75 feet mounting height.

D. Safety: All system components shall be UL listed for the appropriate application.

2.2 ELECTRICAL

A. Electric Power Requirements for the Sports Lighting Equipment:
   1. Electric power: 480 Volt, 3 Phase
   2. Maximum total voltage drop: Voltage drop to the disconnect switch located on the poles shall not exceed three percent of the rated voltage.

B. Energy Consumption: The average kW consumption for the field lighting system shall be 23.5 kW for metal halide fixtures in Lighting Method 1. Lighting Method 2 kW will be defined in Life Cycle calculation chart (1.4) using a RLLF of .69.

C. Revised Electrical Distribution: Manufacturer shall provide, at their cost, revised electrical distribution plans to include changes to service entrance, panel, and wire sizing if using Lighting Method 2.

2.3 STRUCTURAL PARAMETERS

A. Mounting Heights: To ensure proper aiming angles for reduced glare and to provide better playability, the minimum pole mounting heights from the playing field surface shall be as noted in Section 1.2.B and Section 1.3. Higher mounting heights may be required based on photometric performance of manufacturer's luminaires to meet spill and glare requirements.

B. Support Structure Wind Load Strength: Poles and other support structures, brackets, arms, bases, anchorages and foundations shall be determined based on the FL Building Code, wind speed of 175, exposure category Exposure C and an importance factor of 1.0, HVHZ. Luminaire, visor, and crossarm shall withstand 150 mph winds and maintain luminaire aiming alignment.

C. Wind Loads: Wind loads shall be based on the 2010 Florida Building Code. Wind loads to be calculated using ASCE 7-10, an ultimate design wind speed of 175 and exposure category Exposure C..

D. Pole Structural Design: The stress analysis and safety factor of the poles shall conform to 2001 AASHTO Standard Specification for Structural Supports for Highway Signs, Luminaires, and Traffic Signals (LTS-4).

E. Foundation Design: The foundation design shall be based on soils that meet or exceed those of a Class 3 material as defined by 2010 FBC Table 1819.6.

2.4 CONTROLS AND MONITORING

A. Remote Monitoring System: System shall monitor lighting performance and notify manufacturer if individual luminaire outage is detected so that appropriate maintenance can be scheduled. The controller shall determine switch position (Manual or Auto) and contactor status (open or closed)

B. Remote Lighting Control System: System shall allow owner and users with a security code to schedule on/off system operation via a web site, phone, fax or email up to ten years in advance. Manufacturer shall provide and maintain a two-way TCP/IP communication link. Trained staff shall be available 24/7 to provide scheduling support and assist with reporting needs.

The owner may assign various security levels to schedulers by function and/or fields. This function must be flexible to allow a range of privileges such as full scheduling capabilities for all fields, to only having permission to execute "early off" commands by phone. Scheduling tool shall be capable of setting curfew limits.

Controller shall accept and store 7-day schedules, be protected against memory loss during power outages, and shall reboot once power is regained and execute any commands that would have occurred during outage.

C. Management Tools: Manufacturer shall provide a web-based database and dashboard tool of actual field usage and provide reports by facility and user group. Dashboard shall also show current status of lamp outages, control operation and service scheduling including relamping

operations completed and scheduled. Mobile application will be provided suitable for IOS, Android and Blackberry devices.

Hours of Usage: Manufacturer shall provide a means of tracking actual hours of usage for the field lighting system that is readily accessible to the owner.

1. Cumulative hours: shall be tracked to show the total hours used by the facility
2. Current lamp hours: shall be tracked separately to reflect the amount of hours on the current set of lamps being used, so relamping can be scheduled accurately.
3. Report hours saved by using early off and push buttons by users.

D. Communication Costs: Manufacturer shall include communication costs for operating the controls and monitoring system for a period of 25 years.

PART 3 – EXECUTION

3.1 FIELD QUALITY CONTROL

A. Delivery Timing Equipment On-Site: The equipment must be on-site 4- 6 weeks from receipt of approved submittals and receipt of complete order information.

B. Illumination Measurements: Upon substantial completion of the project and in the presence of the Contractor, Project Engineer, Owner's Representative, and Manufacturer's Representative, illumination measurements shall be taken and verified. The illumination measurements shall be conducted in accordance with IESNA LM-5-04. For Lighting Method 1, Timed Power Adjustment systems, light levels must be measured and exceed the specified target levels. For Lighting Method 2, light levels must be measured and meet the specified initial light levels.

C. Field Light Level Accountability
1. Light levels are guaranteed not to fall below the target maintained light levels for the entire warranteed period of 25 Years.
2. Manufacturer/Contractor shall provide to the owner as part of the bid package a new light meter that will be utilized both for initial light level testing and annual testing of the system. Initial light test certification at project completion shall be conducted by a third party State of FL Electrical Engineer (P.E.).
3. The contractor/manufacturer shall be responsible for an additional inspection one year from the date of commissioning of the lighting system and will utilize the owner’s light meter in the presence of the owner.
4. The contractor/manufacturer will be held responsible for any and all changes needed to bring these fields back to compliance for light levels and uniformities. Contractor/Manufacturer will be held responsible for any damage to the fields during these repairs.

D. Correcting Non-Conformance: If, in the opinion of the Owner or his appointed Representative, the actual performance levels including foot-candles, uniformity ratios, and maximum kilowatt consumptions are not in conformance with the requirements of the performance specifications and submitted information, the manufacturer shall be liable to any or all of the following:
1. Manufacturer shall at his expense provide and install any necessary additional fixtures to meet the minimum lighting standards. The Manufacturer shall also either replace the existing poles to meet the new wind load (EPA) requirements or verify by certification by a licensed structural engineer that the existing poles will withstand the additional wind load.
2. Manufacturer shall minimize the Owner's additional long term fixture maintenance and energy consumption costs created by the additional fixtures by reimbursing the Owner the amount of $1,000.00 (one thousand dollars) for each additional fixture required.
3. Manufacturer shall remove the entire unacceptable lighting system and install a new lighting system to meet the specifications

3.2 25 YEAR WARRANTY

A. Each manufacturer shall supply a signed warranty covering the entire system for 25 years OR for the maximum hours of coverage based on the estimated annual usage, whichever occurs first. Warranty shall guarantee light levels will not fall below target maintained levels. A +/- 10% design/testing allowance will not be allowed. Warranty shall also cover: lamp replacements, system energy consumption, monitoring, maintenance and control services, spill light control, and structural integrity. Manufacturer shall maintain specifically-funded financial reserves to assure fulfillment of the warranty for the full term. Warranty may exclude fuses, storm damage, vandalism, abuse and unauthorized repairs or alterations.

B. Group lamp replacements for Method 1 systems (Time Powered Adjustment) must occur in accordance with the independent test report provided by the manufacturer. Group lamp replacements for Method 2 systems (Continuous Depreciating Light) must relamp every 2100 hours.

C. Maintenance: Manufacturer shall monitor the performance of the lighting system, including on/off status, hours of usage and lamp outage for 25 years from the date of equipment shipment. Individual lamp outages shall be repaired when the usage of any field is materially impacted. Owner agrees to check fuses in the event of a luminaire outage.

PART 4 – DESIGN APPROVAL

4.0 PRE-BID SUBMITTAL REQUIREMENTS

A. Design Approval: The owner / engineer will review pre-bid submittals per section 4.0.B from all the manufacturers to ensure compliance to the specification 10 days prior to bid. If the design meets the design requirements of the specifications, a letter and/or addendum will be issued to the manufacturer indicating approval for the specific design submitted.

B. Lighting Options
1. Method 1: Time Powered Adjustment Technology - Musco's Green Generation Lighting® sports lighting system is the listed "Lighting Method 1" product.
2. Method 2: Straight Depreciation Technology

C. All manufacturers except the basis of design shall submit the information at the end of this section at least 10 days prior to bid. An addendum will be issued prior to bid; listing other approved lighting manufacturers and the design method to be used.

D. Bidders are required to bid only products that have been approved by this specification or addendum by the owner or owner's representative. Bids received that do not utilize an approved system/design, will be rejected.

REQUIRED SUBMITTAL INFORMATION FOR ALL MANUFACTURERS 10 DAYS PRIOR TO BID

All items listed below are mandatory, shall comply with the specification and be submitted according to pre-bid submittal requirements. Complete the Yes/No column to indicate compliance (Y) or noncompliance (N) for each item. Submit checklist below with submittal.

Yes / No	Tab	Item	Description
	A	Letter/ Checklist	Listing of all information being submitted must be included on the table of contents. List the name of the manufacturer's local representative and his/her phone number. Signed submittal checklist to be included.
	B	Equipment Layout	Drawing(s) showing field layouts with pole locations
	C	On Field Lighting Design	Lighting design drawing(s) showing: a. Field Name, date, file number, prepared by b. Outline of field(s) being lighted, as well as pole locations referenced to the center of the field (x & y), Illuminance levels at grid spacing specified c. Pole height, number of fixtures per pole, as well as luminaire information including wattage, lumens and optics d. Height of light test meter above field surface. e. Summary table showing the number and spacing of grid points; average, minimum and maximum illuminance levels in foot candles (fc); uniformity including maximum to minimum ratio, coefficient of variance (CV), coefficient of utilization (CU) uniformity gradient; number of luminaries, total kilowatts, average tilt factor; light loss factor. f. Manufacturer's using Lighting Method 2 shall provide both initial and maintained light scans using a maximum recoverable right loss factor (RLLF) as specified in section 1.2.C.2 and shall be shown on lighting design.
	D	Off Field Lighting Design	Lighting design drawing showing initial spill light levels along the boundary line (defined on bid drawings) in footcandles. Light levels shall be taken at 30-foot intervals along the boundary line. Readings shall be taken with the meter orientation at both horizontal and aimed towards the most intense bank of lights.
	E	Performance Guarantee	Provide performance guarantee including a written commitment to undertake all corrections required to meet the performance requirements noted in these specifications at no expense to the owner. Light levels must be guaranteed to not fall below target levels for 25 years.
	E	Structural Calculations	Pole structural calculations and foundation design showing foundation shape, depth backfill requirements, rebar and anchor bolts (if required). Pole base reaction forces shall be shown on the foundation drawing along with soil bearing pressures. Design must be stamped by a structural engineer in the state of FL, if required by owner.
	F	Control & Monitoring System	Manufacturer of the control and monitoring system shall provide written definition and schematics for automated control system to include monitoring.
	G	Electrical Distribution Plans	Manufacturer using Lighting Method 2 must include a revised electrical distribution plan including changes to service entrance, panels and wire sizing, signed by a licensed Electrical Engineer in the state of FL.
	H	Warranty	Provide written warranty information including all terms and conditions.
	I	Independent Testing Report	a. Lighting Method 1 is to provide an independent test report certifying the system meets the lumen maintenance control strategy defined in Section 1.2.C.1.a, verifying the field performance of the system for the duration of the useful life of the lamp based on lamp replacement hours. Report shall be signed by a licensed professional engineer with outdoor lighting experience. If Manufacturer using Lighting Method 2 desires to provide a recoverable light loss factor other than specified in section 1.2.C.2, Independent field test report from licensed

			professional engineer will be required to substantiate the ability to maintain light levels in accordance with section 1.7-A of the specification. Both initial and maintained light scans must still be provided. Independent Engineer conducting the report must have no affiliation with the manufacturer and report must be based on actual testing data. Testing must be done on the system as a whole, not on individual components. Manufacturer bidding Lighting Method 2 must supply independent test report if lamp life relamping projection is greater than 3000 hours.
	J	Project References	Manufacturer to provide a list of 10 projects where the technology, specific fixture, controls and monitoring system, and warranty proposed for this project has been installed in the state of FL. Reference list will include project name, project city, ship date, and if requested, contact name and contact phone number.
	K	Product Information	Complete bill of material and current brochures/cut sheets for all product being provided.
	L	Non-Compliance	Manufacturer shall list all items that do not comply with the specifications. If in full compliance, tab may be omitted.
	M	Life-cycle Cost Calculation	Document life-cycle cost calculations as defined in the specification. Identify energy costs for operating the luminaires, maintenance cost for the system including spot lamp replacement, and group relamping costs. All costs should be based on 25 Years. (complete table below)

			Lighting Method 1	Lighting Method 2
a.	Luminaire energy consumption Multipurpose Field - ___ luminaires x ___kW demand per luminaire x .15 kWh rate x # annual usage hours x 25 years			
b.	Basketball Court - ___ luminaires x ___kW demand per luminaire x .15 kWh rate x # annual usage hours x 25 years			
	TOTAL 25 -Year Life-cycle Operating Cost	=		

The information supplied herein shall be used for the purpose of complying with the specifications for Danny Meehan Park. By signing below I agree that all requirements of the specifications have been met and that the manufacturer will be responsible for any future costs incurred to bring their equipment into compliance for all items not meeting specifications and not listed in the Non-Compliance section.

Manufacturer: _____ Signature: _____

Contact Name: _____ Date: _____/_____/_____

Contractor: _____ Signature: _____

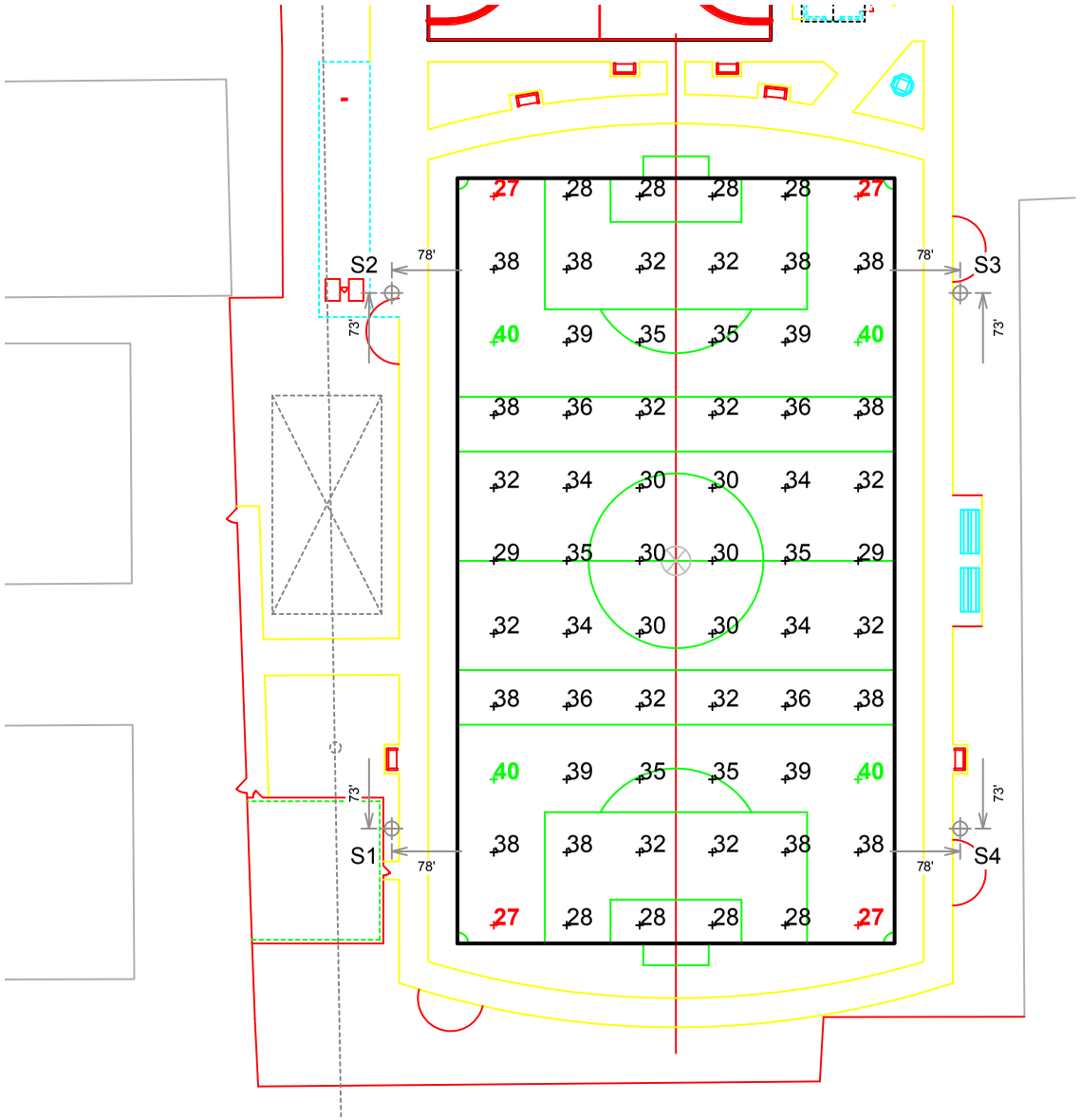
NOTE: MUSCO LIGHTING PLANS AND DETAILS

A. Refer to the following attachments for additional information.

END OF SECTION 26 56 01

EQUIPMENT LIST FOR AREAS SHOWN

Pole				Luminaires				
QTY	LOCATION	SIZE	GRADE ELEVATION	MOUNTING HEIGHT	LAMP TYPE	QTY / POLE	THIS GRID	OTHER GRIDS
4	S1-S4	50'	-	50'	1500W MZ	3	3	0
4	TOTALS					12	12	0



SCALE IN FEET 1 : 50

0' 50' 100'

Pole location(s) ⊕ dimensions are relative to 0,0 reference point(s) ⊗

MY PROJECT

Name:	**Danny Meehan Fields**
Location:	Medley,FL

GRID SUMMARY

Name:	**Multipurpose**
Size:	120' x 210'
Spacing:	20.0' x 20.0'
Height:	3.0' above grade

CONSTANT ILLUMINATION

SUMMARY	HORIZONTAL FOOTCANDLES
	Entire Grid
Guaranteed Average:	**30**
Scan Average:	33.61
Maximum:	40
Minimum:	27
Avg / Min:	1.25
Guaranteed Max / Min:	**2**
Max / Min:	1.49
UG (adjacent pts):	1.42
CU:	0.55
No. of Points:	66

LUMINAIRE INFORMATION	
Luminaire Type:	Green Generation
Rated Lamp Life:	5,000 hours
Design Lumens:	134,000
Avg Lamp Tilt Factor:	1.000
No. of Luminaires:	12
Avg KW:	18.77 (20.4 max)

Guaranteed Performance: The Guaranteed Average CONSTANT ILLUMINATION described above is guaranteed for the rated life of the lamp.

Field Measurements: Illumination measured in accordance with IESNA LM-5-04 and CIBSE LG4. Individual values may vary. See the Warranty document for details.

Electrical System Requirements: Refer to Amperage Draw Chart and/or the **"Musco Control System Summary"** for electrical sizing.

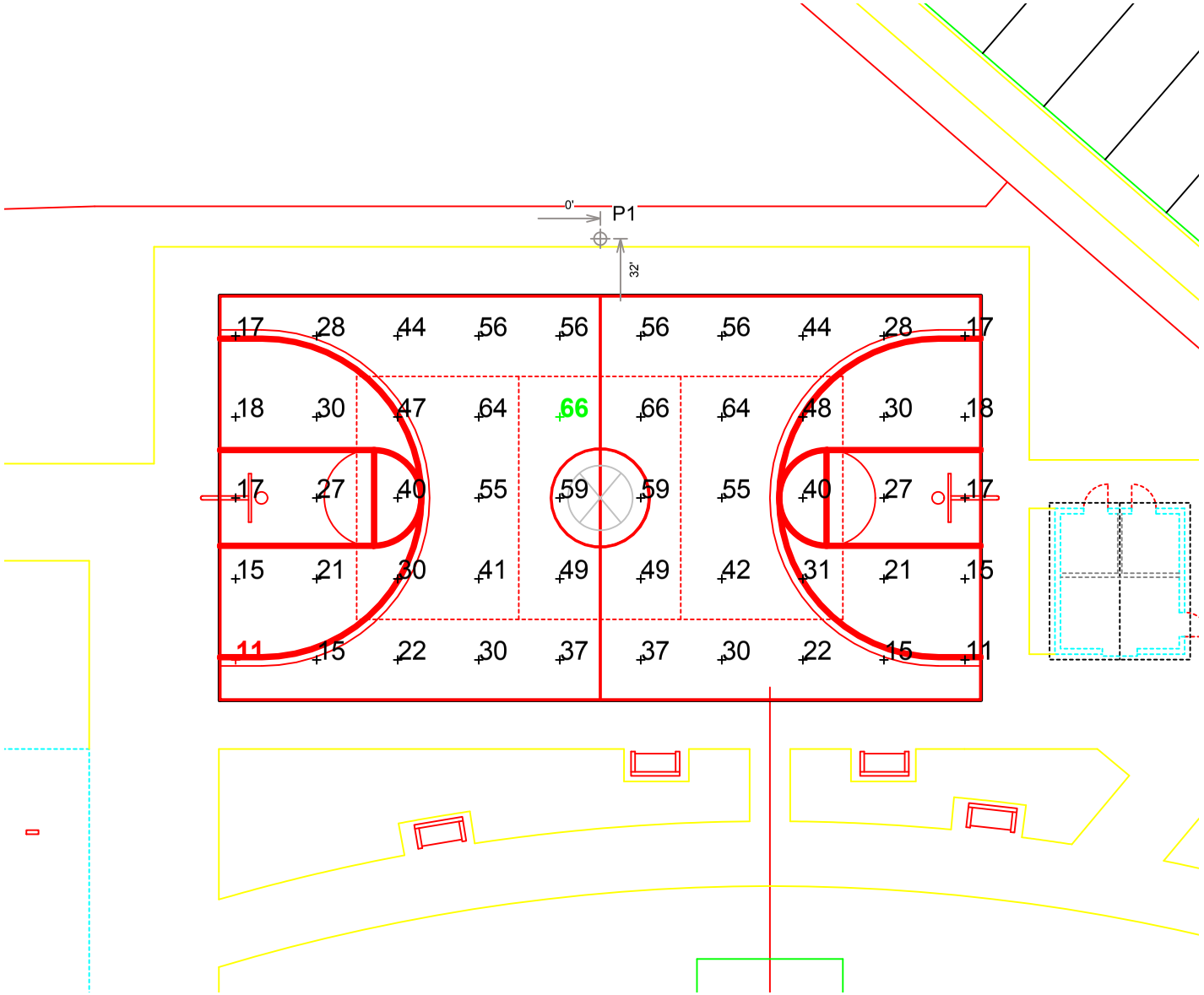
Installation Requirements: Results assume +/- 3% nominal voltage at line side of the ballast and structures located within 3 feet (1m) of design locations.

ENGINEERED DESIGN

By:	**Jake Van Polen**	
File # / Date:	167356A	02-Jun-14

EQUIPMENT LIST FOR AREAS SHOWN

Pole				Luminaires				
QTY	LOCATION	SIZE	GRADE ELEVATION	MOUNTING HEIGHT	LAMP TYPE	QTY / POLE	THIS GRID	OTHER GRIDS
1	P1	40'	-	40'	1500W MZ	3	3	0
1	TOTALS					3	3	0



MY PROJECT

Name:	**Danny Meehan Fields**
Location:	Medley,FL

GRID SUMMARY

Name:	**Basketball**
Size:	94' x 50'
Spacing:	10.0' x 10.0'
Height:	3.0' above grade

CONSTANT ILLUMINATION

SUMMARY	HORIZONTAL FOOTCANDLES
	Entire Grid
Guaranteed Average:	**30**
Scan Average:	35.92
Maximum:	66
Minimum:	11
Avg / Min:	3.18
Guaranteed Max / Min:	**6**
Max / Min:	5.86
UG (adjacent pts):	1.66
CU:	0.45
No. of Points:	50

LUMINAIRE INFORMATION	
Luminaire Type:	Green Generation
Rated Lamp Life:	12,000 / 5,000 hrs
Design Lumens:	88,000 / 134,000
Avg Lamp Tilt Factor:	1.000
No. of Luminaires:	3
Avg KW:	4.69 (5.1 max)

Guaranteed Performance: The Guaranteed Average CONSTANT ILLUMINATION described above is guaranteed for the rated life of the lamp.

Field Measurements: Illumination measured in accordance with IESNA LM-5-04 and CIBSE LG4. Individual values may vary. See the Warranty document for details.

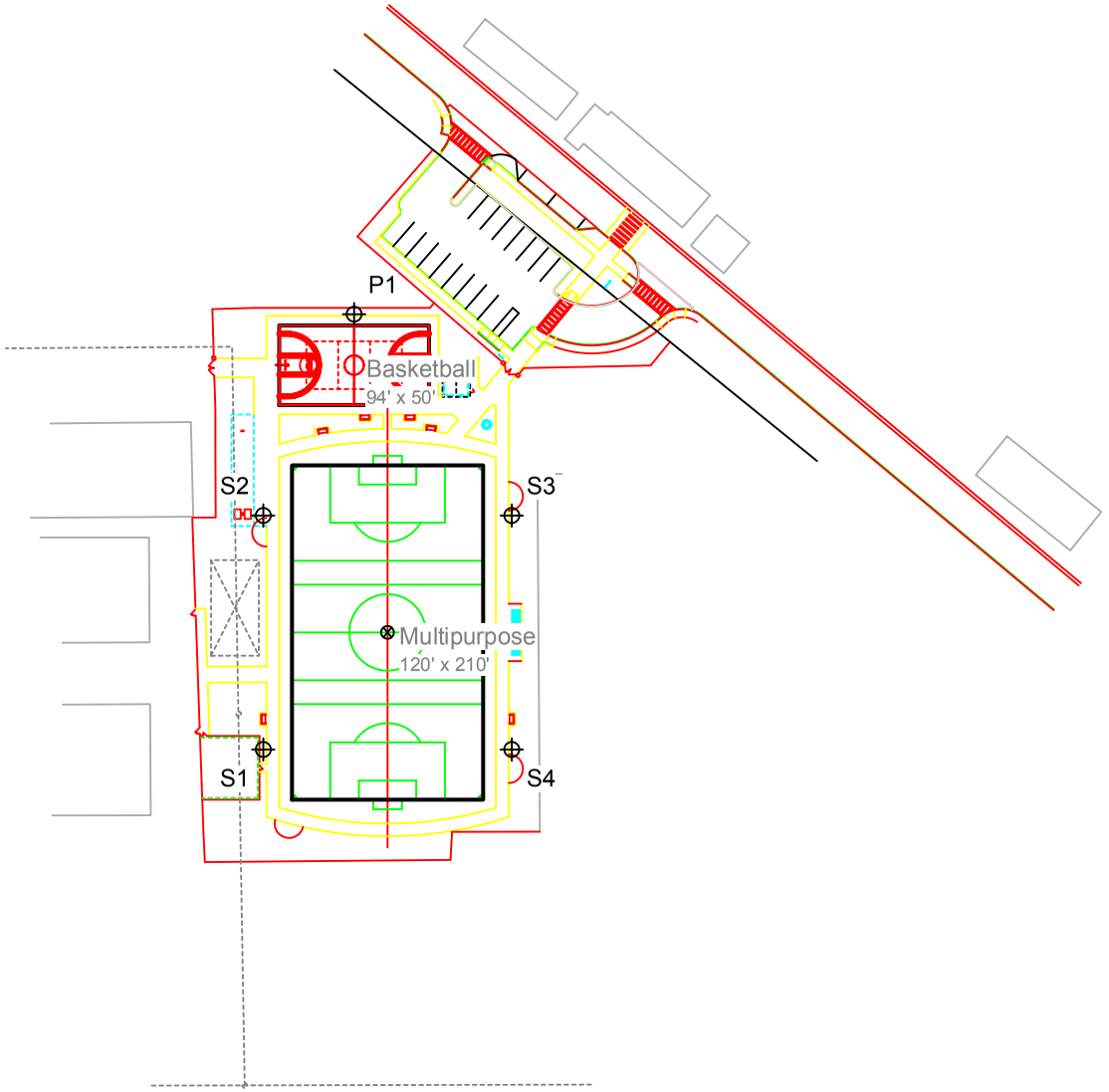
Electrical System Requirements: Refer to Amperage Draw Chart and/or the **"Musco Control System Summary"** for electrical sizing.

Installation Requirements: Results assume +/- 3% nominal voltage at line side of the ballast and structures located within 3 feet (1m) of design locations.

ENGINEERED DESIGN

By:	**Jake Van Polen**	
File # / Date:	167356A	02-Jun-14

ILLUMINATION SUMMARY



MY PROJECT

Name: Danny Meehan Fields
Location: Medley,FL

EQUIPMENT LAYOUT

INCLUDES:
· Basketball
· Multipurpose

Electrical System Requirements: Refer to Amperage Draw Chart and/or the **"Musco Control System Summary"** for electrical sizing.

Installation Requirements: Results assume +/- 3% nominal voltage at line side of the ballast and structures located within 3 feet (1m) of design locations.

EQUIPMENT LIST FOR AREAS SHOWN

Pole				Luminaires		
QTY	LOCATION	SIZE	GRADE ELEVATION	MOUNTING HEIGHT	LAMP TYPE	QTY / POLE
1	P1	40'	-	40'	1500W MZ	3
4	S1-S4	50'	-	50'	1500W MZ	3
5	TOTALS					15

SINGLE LUMINAIRE AMPERAGE DRAW CHART

Ballast Specifications (.90 min power factor)	Line Amperage Per Luminaire (max draw)						
Single Phase Voltage	208 (60)	220 (60)	240 (60)	277 (60)	347 (60)	380 (60)	480 (60)
1500 watt MZ	8.6	8.3	7.5	6.5	5.1	4.7	3.7

SCALE IN FEET 1 : 120

0' 120' 240'

Pole location(s) ⊕ dimensions are relative to 0,0 reference point(s) ⊗

ENGINEERED DESIGN

By: Jake Van Polen
File # / Date: 167356A 02-Jun-14

Control System Summary

Project Specific Notes:

Project Information

Project #:	167356
Project Name:	Danny Meehan Fields
Date:	06/02/14
Project Engineer:	Jake Van Polen
Sales Representative:	Jason Frucht
Control System Type:	Control and Monitoring
Communication Type:	Digital Cellular
Scan:	167356A
Document ID:	167356P1V1-0602113453
Distribution Panel Location or ID:	Multi-purpose
Total # of Distribution Panel Locations for Project:	1
Design Voltage/Hertz/Phase:	480/60/3
Control Voltage:	120

Equipment Listing

DESCRIPTION	APPROXIMATE SIZE
1.Control and Monitoring Cabinet	24 X 48
2.Surge Protection Device	6 X 10

	QTY	SIZE
Total Contactors	5	30 AMP
Total Off/On/Auto Switches:	2	

Materials Checklist

Contractor/Customer Supplied:

- ❑ A single control circuit must be supplied per distribution panel location.
  - — If the control voltage is NOT available, a control transformer is required.
- ❑ Electrical distribution panel to provide overcurrent protection for circuits
  - — Thermal/Magnetic circuit breaker sized per full load amps on Circuit Summary by Zone Chart
- ❑ Wiring:
  - — Dedicated control power circuit
  - — Power circuit to and from lighting contactors
  - — Monitoring circuit from surge protection device to Control and Monitoring cabinet 1
  - — Harnesses for cabinets at remote locations
  - — Means of grounding, including lightning ground protection
- ❑ Electrical conduit wireway system
  - — Entrance hubs rated NEMA 4: must be die-cast zinc, PVC, or copper-free die-cast aluminum
- ❑ Mounting hardware for cabinets
- ❑ Control circuit lock-on device to prevent unauthorized power interruption to control power
- ❑ Anti-corrosion compound to apply to ends of wire, if necessary

Call Control-Link Central(TM) operations center at 877/347-3319 to schedule activation of the control system upon completion of the installation. Note: Activation may take up to 1 1/2 hours

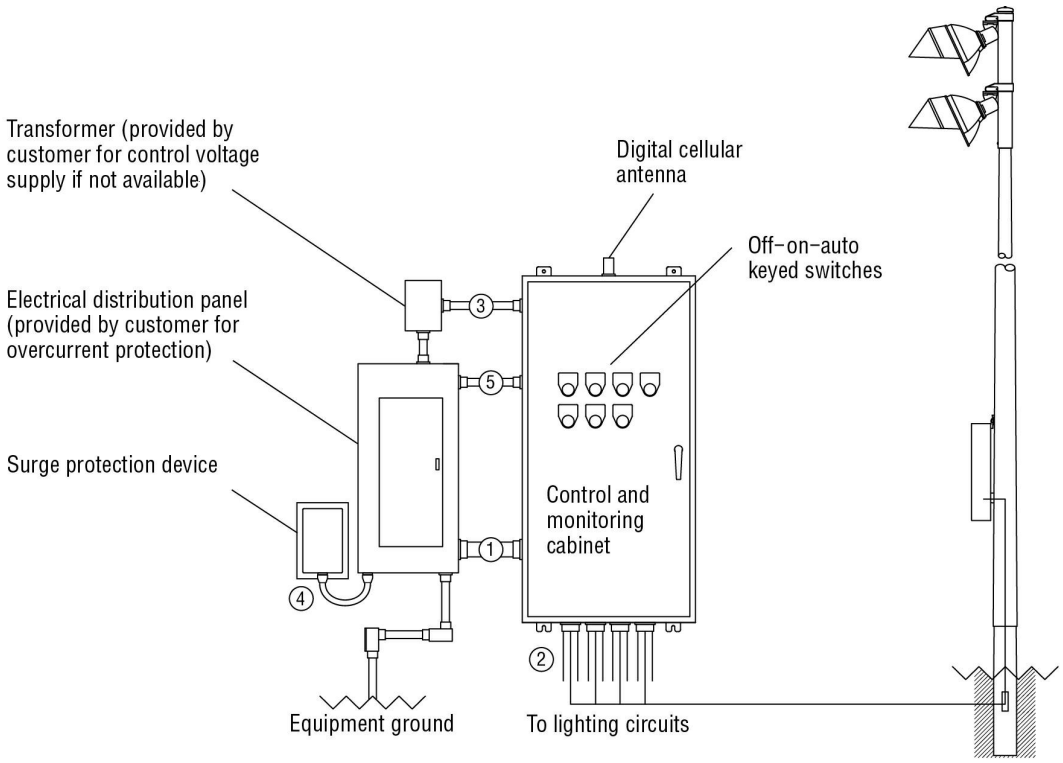
IMPORTANT NOTES

1. Please confirm that the design voltage listed above is accurate for this facility. Design voltage/phase is defined as the voltage/phase being connected and utilized at each lighting pole's ballast enclosure disconnect. Inaccurate design voltage/phase can result in additional costs and delays. Contact your Musco sales representative to confirm this item.
2. In a 3 phase design, all 3 phases are to be run to each pole. When a 3 phase design is used Musco's single phase luminaires come pre-wired to utilize all 3 phases across the entire facility.
3. One contactor is required for each pole. When a pole has multiple circuits, one contactor is required for each circuit. All contactors are UL 100% rated for the published continuous load. All contactors are 3 pole.
4. If the lighting system will be fed from more than one distribution location, additional equipment may be required. Contact your Musco sales representative.
5. A single control circuit must be supplied per control system.
6. Size overcurrent devices using the full load amps column of the Circuit Summary By Zone chart- Minimum power factor is 0.9.

NOTE: Refer to Installation Instructions for more details on equipment information and the installation requirements

Form: T-5030-1

Control•Link® Control and Monitoring System



Wire	Description	# of Wires	Typ. Wire Size (AWG)	Max. Wire Length (FT)	Wire from Musco	Notes
1	Line power to contactors, and equipment grounding conductor	Note A	Note B	27	No	A – E
2	Load power to lighting circuits	Note A	Note B	N/A	No	A – D
3	Control power (dedicated, 20A)	3	12	N/A	No	C, D
4	Surge protection device to distribution panel	– –	– –	N/A	Yes	F
5	Surge protection device monitoring	3	14	N/A	Yes	C, D, F

R60-32-00_B

Notes:
A. Voltage and phasing per the notes on cover page.
B. Calculate per load and voltage drop.
C. All conduit diameters should be per code.
D. Refer to control and monitoring system installation instructions for more details on equipment information and the installation requirements.
E. Contact Musco if maximum wire length from circuit breaker to contactor exceeds value in chart.
F. Refer to surge protection device installation instructions for more details on equipment information and the installation requirements.

IMPORTANT: Control (3) and monitoring (5) wires must be in separate conduit from line and load power wiring (1, 2).

Form: T-5030-1

Control System Summary

SWITCHING SCHEDULE

Field/Zone Description	Zones
Multipurpose	**1**
Basketball	**2**

CONTROL POWER CONSUMPTION	
120V Single Phase	
VA loading of Musco Supplied Equipment	INRUSH: 1813.0
	SEALED: 220.8

BALLAST SPECIFICATIONS .90 Minimum Power Factor	VOLTAGE: 480v		THREE PHASE				
BALLAST OPERATING VOLTAGE	208	220	240	277	347	380	480
1500 Watt Metal Halide Lamp Operating line amperage per fixture- maximum	8.6	8.3	7.5	6.5	5.1	4.7	3.7
1000 Watt Metal Halide Lamp Operating line amperage per fixture- maximum	6.5	6.4	5.8	4.9	4.0	3.6	2.9

CIRCUIT SUMMARY BY ZONE

POLE	CIRCUIT DESCRIPTION	# OF FIXTURES	FULL LOAD AMPS	CONTACTOR SIZE (AMPS)	CONTACTOR ID	ZONE
S1	Multipurpose	3	7.4	30	C1	1
S2	Multipurpose	3	7.4	30	C2	1
S3	Multipurpose	3	7.4	30	C3	1
S4	Multipurpose	3	7.4	30	C4	1
P1	Basketball	3	7.4	30	C5	2

Control System Summary

Form: T-5030-1

PANEL SUMMARY

CABINET #	CONTROL MODULE LOCATION	CONTACTOR ID	CIRCUIT DESCRIPTION	FULL LOAD AMPS	DISTRIBUTION PANEL ID (BY OTHERS)	CIRCUIT BREAKER POSITION (BY OTHERS)
1	1	C1	Pole S1	7.40		
1	1	C2	Pole S2	7.40		
1	1	C3	Pole S3	7.40		
1	1	C4	Pole S4	7.40		
1	1	C5	Pole P1	7.40		

ZONE SCHEDULE

			CIRCUIT DESCRIPTION	
ZONE	SELECTOR SWITCH	ZONE DESCRIPTION	POLE ID	CONTACTOR ID
Zone 1	1	Multipurpose	S1 S2 S3 S4	C1 C2 C3 C4
Zone 2	2	Basketball	P1	C5

SECTION 31 10 00 - SITE CLEARING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 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.
7. Temporary erosion- and sedimentation-control measures.

B. Related Sections:

1. Section 31 20 00 “Earth Moving”.
2. Section 31 23 19 “Dewatering.”
3. Section 31 25 00 “Erosion and Sedimentation Control.”

1.3 DEFINITIONS

A. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.

B. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil; but in disturbed areas such as urban environments, the surface soil can be subsoil.

C. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction, and indicated on Drawings.

D. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction, and indicated on Drawings.

E. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.4 MATERIAL OWNERSHIP

A. Except for stripped topsoil and other 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.

1.5 INFORMATIONAL SUBMITTALS

A. Existing Conditions: Documentation of existing trees and plantings, adjoining construction, and site improvements that establishes preconstruction conditions that might be misconstrued as damage caused by site clearing.

1. Use sufficiently detailed photographs or videotape.
2. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plants designated to remain.

B. Record Drawings: Identifying and accurately showing locations of capped utilities and other subsurface structural, electrical, and mechanical conditions.

1.6 QUALITY ASSURANCE

A. Preinstallation Conference: Conduct conference at Project site.

1.7 PROJECT CONDITIONS

A. Improvements on Adjoining Property: Authority for performing site clearing indicated on property adjoining Owner's property will be obtained by Owner before award of Contract.

1. Do not proceed with work on adjoining property until directed by Architect.

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

C. Utility Locator Service: Notify One Call for area where Project is located before site clearing.

D. Do not commence site clearing operations until temporary erosion- and sedimentation-control measures are in place.

E. The following practices are prohibited within protection zones:

1. Storage of construction materials, debris, or excavated material.
2. Parking vehicles or equipment.
3. Foot traffic.
4. Erection of sheds or structures.
5. Impoundment of water.
6. Excavation or other digging unless otherwise indicated.
7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

F. Do not direct vehicle or equipment exhaust towards protection zones.

G. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.

H. Soil Stripping, Handling, and Stockpiling: Perform only when the topsoil is dry or slightly moist.

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. 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 CLEARING AND GRUBBING

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

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 9 inches, and compact each layer to a density equal to adjacent original ground.

3.4 TOPSOIL STRIPPING

A. Strip any existing topsoil in a manner to prevent intermingling with underlying subsoil or other waste materials.

1. Remove subsoil and nonsoil materials from topsoil, including clay lumps, gravel, and other objects more than 2 inches in diameter; trash, debris, weeds, roots, and other waste materials.

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

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1. Do not stockpile topsoil within protection zones.
2. Dispose of surplus topsoil. Surplus topsoil is that which exceeds quantity indicated to be stockpiled or reused.
3. Stockpile surplus topsoil to allow for respreading deeper topsoil.

3.5 SITE IMPROVEMENTS

A. Remove existing above- and below-grade improvements as indicated and necessary to facilitate new construction, including fencing, bleachers and other improvements shown to be removed on the construction drawings.

B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.

1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut along line of existing pavement to remain before removing adjacent existing pavement. Saw-cut faces vertically.
2. Paint cut ends of steel reinforcement in concrete to remain with two coats of antirust coating, following coating manufacturer's written instructions. Keep paint off surfaces that will remain exposed.

3.6 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 31 10 00

SECTION 31 11 00 – CLEARING AND GRUBBING

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including Conditions of the Contract and Division 01 Specification Sections, apply to this Section.

1.02 DESCRIPTION

A. This section includes site clearing and grubbing for the removal and disposal of all timber, brush, stumps, roots, grass, weeds, sawdust, rubbish, structures, and existing pavement. This work shall conform to the requirements of Section 110 of the FDOT Standard Specifications, latest edition.

1.03 RELATED WORK

A. Section 31 20 00: Earth Moving

B. Section 31 23 19: Dewatering

C. Section 31 25 00: Erosion and Sedimentation Control

1.04 REFERENCED STANDARDS

A. Florida Department of Transportation: Standard Specification for Road and Bridge Construction – Latest Edition.

1.05 SUBMITTALS

(Not Used)

1.06 QUALITY ASSURANCE

A. A testing laboratory provided by the Owner shall make such site inspections and test as are deemed advisable. The Contractor shall coordinate with the testing laboratory and schedule work so as to permit a reasonable time for testing as the work progresses.

Cost of all testing of the work requested by the Owner, and meeting the minimum specified requirements, shall be paid for by the Owner. Cost for re-testing due to failure of test shall be at Contractor's expense.

1.07 PERMITS

A. During construction the Contractor shall comply with all requirements of the South Florida Water Management and jurisdictional authorities.

B. Throughout the course of the work the Contractor shall maintain a copy of all permits on-site and available for review by any regulatory agency, as required.

1.08 START OF WORK

A. Prior to initiating clearing and grubbing operations, field survey the property and stake out the limits of construction.

B. Install all silt fence along the limits of construction as indicated on the Drawings.

C. Initiate clearing and grubbing operations.

PART 2 – PRODUCTS

2.01 SILT FENCES

A. Silt fences shall consist of woven or non-woven Geotextile fabrics as specified in Section 985 of the FDOT Standard Specification for Road and Bridge Construction – Latest Edition.

PART 3 - EXECUTION

3.01 CLEARING

A. In all areas of the project, unless otherwise noted, remove and dispose of trees, snags, stumps, shrubs, brush, limbs, and other vegetative growth. Remove all evidence of their presence from the surface including sticks and branches greater than 1 inch in diameter or thickness. Remove and dispose of trash piles, rubbish, and stockpiled organic material. Protect trees, shrubs, and vegetative growth which are not designated for removal. Burning is not allowed.

3.02 GRUBBING

A. In all areas of the project, unless otherwise noted, remove all stumps, roots, brush and other debris greater than 1 inch in diameter to a depth of not less than two feet below existing grade.

B. Agritilling: In areas where agritilling is suitable and the existing top soil is less than 1.5” thick, then, in lieu of stripping, the Contractor may mechanically pull the material in the area to be stripped using equipment specifically designed for this purpose. Standard root raking is not considered as an acceptable method for this operation. The machine used shall have a rotating drum with teeth that pull the roots from the soils rather than mixing them into the soils, and capable of sifting soils from the root debris along a screen conveyor. Teeth shall have a minimum depth reach of 8 inches. If the Contractor elects to mechanically pull the root material from the topsoil, it shall be done with a minimum of two passes. The first pass shall be with a machine that is designed to extract the larger roots and the second pass shall be with a smaller machine (potato picker). A third pass may be required with the potato picker. In addition, subsequent to the mechanical pulling of the roots, discing with a 36” diameter disc shall be required. Discing shall be accomplished by making two passes, with the second pass perpendicular to the first.

3.03 DISPOSAL OF MATERIALS

A. Dispose of all vegetation in accordance with Local and State requirments.

B. Haul away and properly dispose of all non-combustible materials off of property.

C. The Contractor shall not allow any debris to accumulate on-site and shall remove such debris.

END OF SECTION 31 11 00

SECTION 31 20 00 - EARTH MOVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Project Geotechnical Report, Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 REFERENCED STANDARDS

A. FDOT Standard Specifications for Road and Bridge Construction, Latest Edition.

B. FDOT Design Standards, Latest Edition.

C. Town of Medley Engineering Standards.

D. Miami Dade County Design Standards.

E. ASTM D 1557: Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10-lb Rammer and 18-in. Drop.

F. ASTM D 3282: Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes.

G. AASHTO T 180: Moisture Density Relationship of Soils using a 10 lb. Rammer and an 18 in. Drop.

1.3 SUMMARY

A. Section Includes:

1. Preparing subgrades for slabs on grade, walks, pavements, turf and grasses and plants.
2. Excavating and backfilling for buildings and structures.
3. Drainage course for concrete slabs-on-grade.
4. Subbase course for concrete walks and pavements.
5. Subbase course for asphalt paving.
6. Subsurface drainage backfill for walls and trenches.
7. Excavating and backfilling trenches for utilities and pits for buried utility structures.
8. Excavating well hole to accommodate elevator-cylinder assembly.

B. Related Sections:
1. Section 311000 "Site Clearing" for site stripping, grubbing, stripping and stockpiling topsoil, and removal of above- and below-grade improvements and utilities.
2. Section 312319 "Dewatering" for lowering and disposing of ground water during construction.

1.4 DEFINITIONS

A. Backfill: Soil material or controlled low-strength 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 Architect. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work
2. Bulk Excavation: Excavation more than 10 feet in width and more than 30 feet in length.

3. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.

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

H. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material that exceed 1 cu. yd. for bulk excavation or 3/4 cu. yd. for footing, trench, and pit excavation that cannot be removed by rock excavating equipment equivalent to the following in size and performance ratings, without systematic drilling, ram hammering, ripping, or blasting, when permitted:

1. Excavation of Footings, Trenches, and Pits: Late-model, track-mounted hydraulic excavator; equipped with a 42-inch-wide, maximum, short-tip-radius rock bucket; rated at not less than 138-hp flywheel power with bucket-curling force of not less than 28,700 lbf and stick-crowd force of not less than 18,400 lbf with extra-long reach boom; measured according to SAE J-1179.
2. Bulk Excavation: Late-model, track-mounted loader; rated at not less than 230-hp flywheel power and developing a minimum of 47,992-lbf breakout force with a general-purpose bare bucket; measured according to SAE J-732.

I. 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.

J. 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.

K. 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.

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

M. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil and is the zone where plant roots grow.

Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil and is the zone where plant roots grow. Its appearance is generally friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 2 inches in diameter; and free of subsoil and weeds, roots, toxic materials, or other nonsoil materials.

Topsoil shall be composed of 80% clean sand and 20% peat, muck or other organic compost. It shall be free of weeds, subsoil, stones, earth clods, stick, roots or other objectionable extraneous matter or debris. It shall not contain toxic materials and shall have a pH range between 6.0 and 7.0.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of the following manufactured products required:

1. Geotextiles.
2. Controlled low-strength material, including design mixture.
3. Warning tapes.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified testing agency.

B. Material Test Reports: For each on-site and borrow soil material proposed for fill and backfill as follows:

1. Classification according to ASTM D 2487.
2. Laboratory compaction curve according to ASTM D 1557.

C. Preexcavation Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as damage caused by earth moving operations. Submit before earth moving begins.

1.7 QUALITY ASSURANCE

A. Geotechnical Testing Agency Qualifications: Qualified according to ASTM E 329 and ASTM D 3740 for testing indicated.

B. Preexcavation Conference: Conduct conference at Project site.

1.8 PROJECT CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earth moving operations.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.

B. Utility Locator Service: Notify "One Call" for area where Project is located before beginning earth moving operations.

C. Do not commence earth moving operations until temporary erosion- and sedimentation-control measures, specified in Section 311000 "Site Clearing," 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 classifications acceptable by the project geotechnical report maintained within 2 percent of the optimum moisture content at time of compaction.

C. Unsatisfactory Soils: Any soil classification not specified as acceptable by the project geotechnical report.

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

2.2 GEOTEXTILES

A. Subsurface Drainage Geotextile: Meet the requirements of FDOT Standard Specification 985 and Design Standard Index 199, Type D-3.

B. Erosion Control Geotextile: Meet the requirements of FDOT Standard Specification Section 985 and Design Standard Index 199, Type E.

2.3 CONTROLLED LOW-STRENGTH MATERIAL

A. Flowable Fill shall meet the requirements of FDOT Standard Specification 121.

2.4 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 as follows:

1. Red: Electric.
2. Yellow: Gas, oil, steam, and dangerous materials.
3. Orange: Telephone and other communications.
4. Blue: Water systems.
5. Green: Sewer systems.
6. Purple: Reuse/Reclaimed.

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 as follows:

1. Red: Electric.
2. Yellow: Gas, oil, steam, and dangerous materials.
3. Orange: Telephone and other communications.
4. Blue: Water systems.
5. Green: Sewer systems.
6. Purple: Reuse/Reclaimed.

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.

3.2 DEWATERING

A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.

B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.

1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.

3.3 EXPLOSIVES

A. Explosives: Do not use explosives.

3.4 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.
2. Remove rock to lines and grades indicated to permit installation of permanent construction without exceeding the following dimensions:

    a. 24 inches outside of concrete forms other than at footings.
    b. 12 inches outside of concrete forms at footings.
    c. 6 inches outside of minimum required dimensions of concrete cast against grade.
    d. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
    e. 6 inches beneath bottom of concrete slabs-on-grade.
    f. 6 inches beneath pipe in trenches, and the greater of 24 inches wider than pipe or 42 inches wide.

3.5 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.
2. Pile Foundations: Stop excavations 6 to 12 inches above bottom of pile cap before piles are placed. After piles have been driven, remove loose and displaced material. Excavate to final grade, leaving solid base to receive concrete pile caps.
3. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus 1 inch. Do not disturb bottom of excavations intended as bearing surfaces.

3.6 EXCAVATION FOR WALKS AND PAVEMENTS

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

3.7 EXCAVATION FOR UTILITY TRENCHES

A. Excavation for potable water and sanitary sewer trenches shall be in accordance with City of Medley Engineering Standards.

B. Excavate trenches to indicated gradients, lines, depths, and elevations.

1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.

C. 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: As indicated.

D. 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. For pipes and conduit less than 6 inches in nominal diameter, hand-excavate trench bottoms and support pipe and conduit on an undisturbed subgrade.
2. For pipes and conduit 6 inches or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe or conduit circumference. Fill depressions with tamped sand backfill.
3. For flat-bottomed, multiple-duct conduit units, hand-excavate trench bottoms and support conduit on an undisturbed subgrade.
4. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

E. Trench Bottoms: Excavate trenches 4 inches deeper than bottom of pipe and conduit elevations to allow for bedding course. Hand-excavate deeper for bells of pipe.

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

3.8 SUBGRADE INSPECTION

A. Notify Architect when excavations have reached required subgrade.

B. Proof-roll subgrade in accordance with project geotechnical requirements to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

C. Reconstruct subgrades damaged by accumulated water, or construction activities, as directed by Architect, without additional compensation.

3.9 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 Architect.

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

3.10 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.

3.11 BACKFILL

A. Place and compact backfill in excavations promptly, but not before completing the following:

1. Construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.
2. Surveying locations of underground utilities for Record Documents.
3. Testing and inspecting underground utilities.
4. Removing concrete formwork.
5. Removing trash and debris.
6. Removing temporary shoring and bracing, and sheeting.
7. Installing permanent or temporary horizontal bracing on horizontally supported walls.

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

3.12 UTILITY TRENCH BACKFILL

A. Water and Sewer utility trench backfill shall be in accordance with City of Medley Engineering Standards and Miami-Dade WASD Standards.

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

C. 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.

D. Trenches under Footings: Backfill trenches excavated under footings and within 18 inches of bottom of footings with satisfactory soil; fill with concrete to elevation of bottom of footings. Concrete is specified in Section 033000 “Cast-inPlace Concrete”.

E. Backfill voids with satisfactory soil while removing shoring and bracing.

F. 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.

G. Controlled Low-Strength Material: Place initial backfill of controlled low-strength material to a height of 12 inches over the pipe or conduit. Coordinate backfilling with utilities testing.

H. Place and compact final backfill of satisfactory soil to final subgrade elevation.

I. Controlled Low-Strength Material: Place final backfill of controlled low-strength material to final subgrade elevation.

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

3.13 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.
5. Under footings and foundations, use engineered fill.

C. Place soil fill on subgrades free of mud.

3.14 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. 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.

3.15 COMPACTION OF SOIL BACKFILLS AND FILLS

A. Place backfill and fill soil materials in layers not more than 9 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. Compaction of soil backfills and fills shall be in accordance with the Project Geotechnical Report, the City of Medley Engineering Standards, Miami-Dade Engineering Standards and FDOT Standard Specifications.

3.16 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.

1. Provide a smooth transition between adjacent existing grades and new grades.
2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

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

1. Turf or Unpaved Areas: Plus or minus 1 inch.
2. Walks: Plus or minus 1 inch.
3. Pavements: Plus or minus ½ inch.

C. Grading inside Building Lines: Finish subgrade to a tolerance of ½ inch when tested with a 10-foot straightedge.

D. Laser Grading: The soccer field shall be laser graded in accordance with the construction drawings and details to a tolerance of 0.10 ft elevation. The contractor shall provide an as-built survey for review based on a 20 ft grid spacing. The as-built survey shall be reviewed by the Engineer prior to placing sod. Any deficiencies shall be corrected by the contractor at no additional cost.

3.17 SUBBASE UNDER PAVEMENTS AND WALKS

A. 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 6 inches or less in compacted thickness in a single layer.
3. 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.
4. Compact subbase course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 98 percent of maximum dry unit weight according to ASTM D 1557.

B. Pavement Shoulders: Place shoulders along edges of subbase course to prevent lateral movement. Construct shoulders, at least 12 inches wide, of satisfactory soil materials and compact simultaneously with each subbase layer to not less than 98 percent of maximum dry unit weight according to ASTM D 1557.

3.18 TOPSOIL

A. Place topsoil 6 inches deep over all planted areas. The cost of topsoil shall be included in the cost for earthwork.

3.19 FIELD QUALITY CONTROL

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

1. Determine prior to placement of fill that site has been prepared in compliance with requirements.
2. Determine that fill material and maximum lift thickness comply with requirements.
3. Determine, at the required frequency, that in-place density of compacted fill complies with requirements.

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 Architect.

E. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:

1. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 2,000 sq. ft. or less of paved area or building slab, but in no case fewer than three tests.
2. Foundation Wall Backfill: At each compacted backfill layer, at least one test for every 100 feet or less of wall length, but no fewer than two tests.
3. Trench Backfill: At each compacted initial and final backfill layer, at least one test for every 300 feet or less of trench length, but no fewer than two tests.
4. Storm Sewer Trench Backfill: Test in accordance with FDOT Standard Specification 125.
5. Water and sewer trench backfill shall be tested in accordance with City of Medley Engineering Standards.

F. 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.

3.20 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic 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.

1. Scarify or remove and replace soil material to depth as directed by Architect; reshape and recompact.

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.

3.21 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 31 20 00

SECTION 31 23 19 - DEWATERING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including Conditions of the Contract and Division 01 Specification Sections, apply to this Section.

1.2 SCOPE OF WORK

A. The work to be performed under this section shall include the design and installation of temporary dewatering system until completion of construction to remove subsurface waters from retention pond, borrow area, structure or utility trench excavations as required.

1.3 RELATED WORK

A. Section 31 11 00: Clearing and Grubbing

B. Section 31 20 00: Earth Moving

C. Section 31 25 00: Erosion & Sedimentation Control

1.4 QUALITY ASSURANCE

A The temporary dewatering system used for this project shall be designed by a firm who regularly engages in the design of dewatering systems and who is fully experienced, reputable and qualified in the design of such dewatering systems.

B. The dewatering of any excavation areas and the disposal of water during construction shall be in strict accordance with all local and state government rules, regulations and permit conditions. In addition, the Contractor shall take any and all actions necessary to prevent subsidence or other damage to adjacent areas which might result from the dewatering operation.

1.5 SUBMITTALS

A. Submit to the South Florida Water Management Disctrict (SFWMD) for permitting of the dewatering operations prior to the pumping activities, the proposed method(s) of dewatering for the various portions of the Work. Dewatering methods selected by Contractor shall be subject to approval by SFWMD. The Contractor shall remain responsible for the adequacy and safety of the methods.

B. Submittal shall at a minimum include the following:

1. Estimates of points of discharge
2. Discharge flows
3. Specifications of all pumps.
4. Site map showing general typical arrangement of pumps, wells and well points; locations of headers and discharge lines; and means of discharge and disposal of water.
5. Include a narrative outlining dewatering procedures.

1.6 DEWATERING SYSTEM CRITERIA

A. The dewatering system shall be capable of dewatering and maintaining groundwater levels low enough for the proper performance of necessary operations for the construction of retention

areas, structures, utiltiteis and other improvements requiring construction at or near the normal ground water table.

B. The permitting of dewatering operations with the regulatory agencies shall be the ultimate responsibility of the Contractor.

C. The maximum pumpage per day shall not exceed the SFWMD dewatering permit.

D. Disposal of dewatering water shall conform to the requirements of SFWMD and FDEP.

E. Any discharge to surface water will require monitoring of both the quantity and quality of the discharge, and discharge to surface waters cannot exceed a turbidity level of 29 NTU over background.

PART 2 – PRODUCTS

2.1 GENERAL

The equipment utilized shall be standard dewatering equipment of proven ability as designed, manufactured and installed by firms having experience in the design and production of such equipment. The equipment furnished shall be designed, constructed and installed in accordance with the best practices and methods.

PART 3 – EXECUTION

3.1 PUMPING AND DRAINAGE

A. The Contractor shall at all times during construction provide and maintain proper equipment and facilities to remove all water entering the proposed excavations, and shall keep such excavations dry so as to obtain a satisfactorily undisturbed subgrade foundation condition until the walls, structures or pipes to be built thereon have been completed to such extent that they will not be floated or otherwise damaged by allowing water levels to return to natural levels. The dewatering system installed shall be in conformity with the overall construction plan and certification of this shall be provided by the Contractor. The Contractor shall be required to monitor the performance of the dewatering systems during the progress of the work and require such modifications as may be required to assure that the systems are performing satisfactorily.

B. Dewatering shall at all times be conducted in such a manner as to preserve the undisturbed bearing capacity of the subgrade soils at proposed bottom of excavation and to the integrity of adjacent structures. At a minimum, the water level shall be 2 feet below the trench or excavation bottom. Well or sump installations shall be constructed with proper sand filters to prevent drawing of finer grained soils from the surrounding ground.

C. Water entering the excavation from surface runoff shall be collected in shallow ditches around the perimeter of the excavation, drained to sumps, and pumped from the excavation to maintain a bottom free from standing water.

D. The Contractor shall take all additional precautions required to prevent uplift of any structure during construction.

F. Flotation shall be prevented by the Contractor by maintaining a positive and continuous operation of the dewatering system. The Contractor shall be fully responsible and liable for all damages which may result from failure of this system.

G. Removal of dewatering equipment shall be accomplished after the Contractor and the Engineer agree that the system is no longer required; the material and equipment constituting the system shall be removed by the Contractor.

H. The Contractor shall take all necessary precautions to preclude the accidental discharge of fuel, oil, hydrocarbons, drilling fluids and other contaminates in order to prevent adverse effects on groundwater quality.

1. Fuel containment must be provided for each pump in the event of a leak or spill. This may be provided via an earthen berm covered with plastic or a double walled factory containment system. Volume must be at least 110 percent of fuel capacity.

I. Drain excavations and other prepared work areas occurring below groundwater level and maintain in a dewatered condition while performing work at those elevations.

J. Prevent surface water drainage from entering excavations, and ponding on subgrades and other prepared work areas.

K. Maintain dry excavations and subgrades by whatever means necessary while working in each area.

1. Reduce groundwater level to a sufficient depth to ensure that bottom soils are not saturated or develop a "quick" condition.
2. Reroute surface water drainage away from excavations, prepared subgrades, and other work areas.
3. Prevent excessive rainwater, to the extent that detrimental softening, undermining, washout, and similar damage would occur, from accumulating in excavations, upon subgrades, and at other prepared work areas.
4. Do not use excavations as temporary drainage.

L. In the event that erosion prevention and control devices shown in these plans prove to be ineffective, alternate methods for maintaining state water quality standards for discharge from the construction site shall be required.

3.2 PROTECTION AND SITE CLEAN-UP

A. At all times during the progress of the Work the Contractor shall use all reasonable precautions to prevent weather tampering with the wellpoints (if used) or the entrance of foreign material into the existing storm drain system.

B. The quality of all water discharged shall comply with the requirements of the United States Environmental Protection Agency, Florida Department of Environmental Regulation, South Florida Water Management District and any other regulatory agency having proper jurisdiction. No pumped groundwater shall discharge to surface waters. In critical areas, dewatering discharge shall require additional turbidity monitoring by project personnel.

C. Immediately upon completion of the dewatering operations, the Contractor shall remove all of his equipment, materials, and supplies from the site of the work, removal of all surplus materials and debris, fill in all holes or excavations as directed by the Owner.

END OF SECTION 31 23 19

SECTION 31 25 00 – EROSION AND SEDIMENTATION CONTROL

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including Conditions of the Contract and Division 01 Specification Sections, apply to this Section.

1.2 DESCRIPTION

A. The work specified in this Section consists of furnishing and installing materials and taking measures required to control erosion on the project and in areas outside the right of way where work is accomplished in conjunction with the project. The intent of this work is to prevent pollution of water, detrimental effects of public or private property adjacent to the project right of way and damage to work on the project. These measures will consist of construction and maintenance of temporary erosion control features or, where practical, the construction and maintenance of permanent erosion control features.

B. Refer to General Conditions for additional erosion and sedimentation control requirements including procedures to monitor and report turbidity levels.

1.3 RELATED WORK

A. Section 31 11 00: Clearing and Grubbing

B. Section 31 20 00: Earth Moving

C. Section 31 23 19: Dewatering

D. Section 31 23 00: Excavating and Backfilling

1.3 REFERENCED STANDARDS

A. Florida Department of Transportation: Standard Specification for Road and Bridge Construction - Latest Edition.

B. Florida Department of Transportation: Roadway and Traffic Design Standards.

C. The Florida Stormwater Erosion and Sedimentation Control Manual

1.4 SUBMITTALS

A. Submit copies of a certification from the manufacturer and/or supplier that all materials used in this work meet the appropriate project specification.

1.5 QUALITY ASSURANCE

A. A testing laboratory provided on-site by the Owner will make such tests as are deemed advisable. The Contractor shall schedule his work so as to permit a reasonable time for testing before proceeding with the work and shall keep the laboratory informed of his progress. Costs for all testing requested by the Owner, and meeting the minimum requirements, and shall be paid for by the Owner. The cost of re-testing due to failure to meet the required standards shall be at Contractor’s expense.

1.6 PERMITS

A. Contractor shall comply with all requirements of the FDEP General Permit For Stormwater Discharge from Large and Small Construction Activities, South Florida Water Management District (SFWMD) and South Broward Drainage District (SBDD).

B. Throughout the course of the work the Contractor shall maintain a copy of all permits on-site and available for review by any regulatory agency, as required.

1.7 CONTROL OF CONTRACTOR'S OPERATIONS WHICH MAY RESULT IN WATER POLLUTION

A. Take sufficient precautions to prevent pollution of streams, canals, lakes, and other water impoundments, with fuels, oils, bitumens, calcium chloride, or other harmful materials. Conduct and schedule operations so as to avoid or otherwise minimize pollution or siltation of such streams, etc. and to avoid interference with movement of migratory fish. Do not dump the residue from dust collectors or washers into any water body.

B. Construction operations in rivers, streams, lakes, canals, and other impoundments shall be restricted to those areas where it is necessary to perform filling or excavation to accomplish the work shown in the Contract Documents and to those areas which must be entered to construct temporary or permanent structures. As soon as conditions permit, promptly clear canals, streams, and impoundments of all obstructions placed therein or caused by construction operations.

C. Except as necessary for construction, do not deposit excavated material in streams, canals, or impoundments, or in a position close enough thereto, to be washed away by high water or runoff.

D. Where pumps are used to remove highly turbid waters from enclosed construction areas such as cofferdams or forms, treat the water prior to discharge into waters of the State. Pump the water into grassed swales, appropriate vegetated areas, or sediment basins, or confine it by an appropriate enclosure such as siltation curtains when other methods are not considered appropriate. Do not contaminate waters of the State.

E. Do not disturb lands or waters outside the limits of construction, except as may be found necessary to complete the work.

1.8 START OF WORK

A. Prior to starting work the Contractor shall, field survey and stake the limits of construction.

B. Install all silt fence along the limits of construction as indicated on the Drawings.

C. Initiate permitted operations.

PART 2 - PRODUCTS

2.1 GENERAL

D. Materials used for the construction of the temporary erosion and sedimentation control measures are not to be incorporated into the completed project and therefore may be new or used materials.

E. No testing of materials used in construction of temporary erosion control features will be required.

PART 3 – EXECUTION

3.1 GENERAL

A. Construct and maintain erosion sedimentation control measures in accordance with the Project Stormwater Pollution Prevention Plan (SWPPP) and the FDEP General Permit.

B. Incorporate permanent erosion control features into the project at the earliest practical time. Correct conditions, using temporary measures that develop during construction to control erosion prior to the time it is practical to construct permanent control features.

C. Construct temporary and permanent erosion and sediment control measures to prevent the pollution of adjacent water ways in conformance with the laws, rules and regulations of Federal, State and local agencies.

3.2 INSTALLATION

A. Installation of erosion and sedimentation control measures shall be in accordance with the Project Stormwater Pollution Prevention Plan (SWPPP and the FDEP General Permit).

3.3 REMOVAL OF TEMPORARY EROSION CONTROL FEATURES

A. In general, remove any temporary erosion control features existing at the time of construction of the permanent erosion control features in such a manner that there will be no detrimental effect. Removal of such measures shall not occur prior to receipt of approvals from the Owner.

3.4 MAINTENANCE OF EROSION CONTROL FEATURES

A. General: Provide continuous routine maintenance of permanent and temporary erosion control features until the project is completed and accepted.

3.5 PROTECTION DURING SUSPENSION OF CONTRACT TIME

A In the event that it is necessary that the construction operations be suspended for any appreciable length of time, shape the top of the earthwork in such a manner as to permit runoff of rainwater and construct earth berms along the top edges of embankments to intercept runoff water. Provide temporary slope drains to carry runoff from cuts and embankments which are located in the vicinity of rivers, streams, canals, lakes, and impoundments. Should such preventive measures fail, immediately take such other action as necessary to effectively prevent erosion and siltation.

3.6 SURFACE WATER MANAGEMENT, STORMWATER RUNOFF CONTROL AND EROSION CONTROL

A. In addition to all other applicable laws, ordinances, codes, rules, regulations, orders and decrees with which Contractor is obligated to comply, the Contractor shall fully comply with, the Storm Water Pollution Prevention Plan (SWPPP) for this Project.

B. Prior to construction the Contractor shall submit to the Owner for delivery to FDEP a completed and executed Notice of Intent (NOI) for Stormwater Discharges Associated with Industrial Activity Under the NPDES General Permit, EPA Form 3510-6(0-92).

C. The Contractor shall be responsible for all runoff control efforts, including without limitation providing protection of areas receiving runoff, in accordance with any applicable regulations, codes, plans and permits.

D. The Contractor shall furnish, install and maintain, at no additional cost to the owner, all necessary surface protection such as temporary retention basins, silt screens, diapers, jute mesh, filter fabric, sod, sandbags, etc., for turbidity control and to prevent erosion

and surface degradation.

E. The Contractor recognizes and agrees that should any of the ponds, lakes, canals or other bodies of water adjacent to the site become contaminated due to the actions or inactions of the Contractor, the costs to flocculate, clean or remedy such contamination by any means necessary of required, will be borne by the Contractor. The Owner shall take turbidity readings on a basis needed to monitor compliance with permit conditions and shall enforce all applicable environmental regulations.

END OF SECTION 31 25 00

SECTION 32 11 00 - LIMEROCK BASE

PART 1 - GENERAL

1.1 DESCRIPTION

A. The work under this section shall include furnishing all labor, materials, equipment and transportation and performing all work necessary to construct a base course composed of limerock upon the prepared subgrade in accordance with these Specifications and with the lines, grades, notes and typical cross sections shown on the Drawings.

1.2 RELATED WORK

A. Section 31 20 00: Earth Moving

B. Section 02240: Stabilized Subgrade

C. Section 02507: Prime and Tack Coats

D. Section 02534: Asphaltic Concrete

1.3 REFERENCED STANDARDS

A. Florida Department of Transportation (FDOT) - Standard Specification for Road and Bridge Construction, current edition in force.

B. AASHTO T-180: Moisture-Density Relations of Soils Using a 10 lb. Rammer and an 18-in. (457 mm) Drop.

1.4 SUBMITTALS

A. The contractor shall provide certification from appropriate testing laboratories that proposed materials meet the requirements of the project specification.

B. Where required the contractor shall submit samples of proposed materials for independent testing.

1.5 QUALITY ASSURANCE

A. Furnish complete laboratory analysis and obtain approval of the material by the Engineer prior to placement.

1.6 Construct the base course in accordance with the applicable provisions of the Florida Department of Transportation Standard Specifications For Road and Bridge Construction (FDOT Specifications) and as specified herein.

1.7 PERMITS

A. Contractor shall maintain a copy of all permits on-site and available for review by any regulatory agency, throughout the course of the work.

1.8 JOB CONDITIONS

A. Test borings made on the site and the sub-surface exploration data are separately bound and provided upon request with each set of Contract Documents and are for the Contractor's information ONLY.

1.9 TESTING AND INSPECTIONS

A. Testing and inspections of limerock base shall comply with FDOT Standard Specifications.

PART 2 - PART 2 – PRODUCTS

2.1 MATERIALS

A. Source: The Contractor shall provide all limerock materials from sources complying with the requirements specified herein.

B. Material composition and quality and moisture content shall be in accordance with FDOT Standard Specification Section 200 and Section 911.

PART 3 - EXECUTION

3.1 GENERAL

A. Equipment: All equipment for limerock installation and compaction shall be in good condition and properly serviced.

B. Spreaders: The Contractor shall use mechanical rock spreaders, equipped with a device that strikes off the limerock uniformly to the appropriate laying thickness, and capable of producing an even distribution. Where use of a mechanical spreader is not practical; the Contractor may spread the limerock using bulldozers or blade graders.

C. Limits of Construction: Construct the limerock base to the full dimensions shown on the Drawings.

3.2 PERFORMANCE

A. Transporting Limerock: The Contractor shall transport limerock from the source to the point where it is to be used. The installation of limerock may require running over limerock previously

placed, and dumping on the end of a preceding spread. Where this is required, existing limerock shall be maintained in good condition as needed. No hauling over the subgrade or dumping on the subgrade will be permitted.

B. Spreading Limerock:
   1. Spread limerock uniformly, and remove and replace all segregated areas of fine or coarse rock with well-graded rock.
   2. When the specified compacted thickness of the base is greater than 6-inches, construct the base in two courses with the first course approximately one-half the total thickness of the finished base, but not less than the thickness required to bear the weight of the construction equipment without disturbing the subgrade.

C. Compacting and Finishing Base:
   1. Single Course Base: After spreading is completed, scarify the entire surface and then shape to produce the required grade and cross section after compaction.
   2. Double Course Base: After placing and compacting the first base course, clean the first course of foreign material, blade and bring to a surface cross section approximately parallel to that of the finished base. Prior to the spreading of any material for the upper course, conduct the density tests for the lower course and determine that the required compaction has been obtained. Prior to placing material for the second course, scarify the initial layer to achieve a uniform and seamless layer of base material for the entire thickness.
   3. After the spreading of material for the second course is completed, finish and shape its surface so as to produce the required grade and cross section after compaction, free of scabs and laminations.

D. Density Requirements: As soon as proper conditions of moisture are attained, compact the material to a density of not less than 98 percent of the maximum density as determined by AASHTO T 180.
   1. Density Tests:
      a. During final compacting operations, if blading of any areas is necessary to obtain the true grade and cross section, complete the compacting operations for such areas prior to making the density determinations on the finished base.

E. Correction of Defects:
   1. If at any time the subgrade material should become mixed with the base course material, dig out and remove the mixture, replace the materials removed with clean base material, and shape and compact the subgrade as specified above.
   2. If cracks or checks appear in the base, either before or after priming, which in the opinion of the Engineer would impair the structural efficiency of the base course, remove such cracks or checks by rescarifying, reshaping, adding base material where necessary and re-compacting.

F. Testing Surface: Check the finished surface with a template cut to required crown and cross section and with a 15-foot straightedge laid parallel to the centerline of the road. Correct all irregularities greater than 1/4-inch by scarifying and by removing or adding limerock as may be required, and recompacting the entire area as specified herein before.

G. Thickness Determinations:
   1. Measure the thickness of the compacted limerock base at intervals of not more than 200-feet at various points on the cross sections, prior to the application of the prime coat.
   2. Take the measurements in holes through the base of not less than 3-inches in diameter. Where the compacted base is deficient by more than ½" inch from the thickness called for on the Drawings, correct such areas by scarifying and adding limerock for a distance of 100-feet in each direction from the edge of the deficient area. Bring the affected areas to the required state of compaction and to the required thickness and cross section.

H. Priming and Maintaining:
   1. Apply the prime coat only when the base is firm and unyielding, meets the specified density requirements and the moisture content in the top half of the base does not exceed 90 percent of the optimum moisture content of the base material.
   2. Prior to applying the surface course, check that the crown and grade are true, with no rutting or other distortion, and that the base meets all the specified requirements.

3.3 QUALITY ASSURANCE

A. Testing for quality control shall be in accordance with FDOT Standard Specification 200-7.

END OF SECTION 32 11 00

SECTION 32 11 16
STABILIZED SUBGRADE

PART 1 - GENERAL

1.01 DESCRIPTION

A. The work under this section shall include furnishing and installing materials as necessary to stabilize prepared subgrade in accordance with the specifications and to the lines, grades and typical cross section shown on the Drawings.

1.02 RELATED WORK

A. Section 02120: Earthwork

B. Section 02232: Limerock Base

1.03 REFERENCED STANDARDS

A. AASHTO T 180: Moisture-Density Relation of Soils Using a 10-lb. (4.54 kg) Rammer and an 18-in. (457 mm) Drop.

B. Florida Department of Transportation (FDOT) - Standard Specification for Road and Bridge Construction – 2004.

1.04 SUBMITTALS

A. The contractor shall provide certification from appropriate testing laboratories that proposed materials meet the requirements of the project specification.

B. Where required the contractor shall submit samples of proposed materials for independent testing.

1.05 QUALITY ASSURANCE

A. Furnish complete laboratory analysis and obtain approval of the material by the engineer prior to placement.

B. Construct stabilized subgrade in conformance with applicable provision of the FDOT Specifications.

1.06 PERMITS

A. Contractor shall comply with all requirements of the project permits during construction.

1.07 JOB CONDITIONS

A. Test borings made on the site and the sub-surface exploration data are separately bound and provided upon request with each set of Contract Documents and are for the Contractor's information ONLY.

1.08 TESTING AND INSPECTION

A. Testing and inspecting of stabilized subgrade shall comply with the requirements specified herein.

PART 2 – PRODUCTS

2.01 MATERIALS

A. General: Use either Commercial Materials or Local Materials as defined hereunder, at the Contractor's option.

1. Determine bearing value by the Limerock Bearing Ratio (LBR) Method.

2. After grading operations are substantially complete, determine the quantity (if any) of selected stabilizing material to be added for compliance with the bearing value requirements.

3. Ensure that the finished subgrade meets the bearing value requirements, regardless of the quantity of stabilizing materials necessary to be added.

B. Commercial Materials: Commercial materials shall consist of Limerock, limerock overburden, cemented coquina or crushed shell meeting the following requirements:

1. Limerock and Limerock Overburden: Material with have:

- at least 70 percentage of carbonates of calcium and magnesium
- a plasticity index not exceeding 10
- a liquid limit less than 40
- at least 97% shall pass a 3 □-inch sieve

2. Crushed Shell: Mollusk shell (i.e., oysters, mussels, clams, cemented coquina, etc.) meeting the following requirements.

- Plasticity index less than 10
- Liquid limit less than 40
- at least 97 percent by weight of the total material passing a 3 □-inch sieve
- at least 50 percent by weight of the total material retained on the No. 4 sieve
- not more than 20% by weight of the total material passing the No. 200 sieve (as determined by washing the material over the sieve)
- in the event that the shell meets the above requirements without crushing, crushing will not be required
- the use of steamed shell will not be permitted

C. Local Material: High-bearing-value soils or sand-clay material meeting the following:

- At least 97% by weight will pass a 3 □-inch sieve
- Plasticity index less than 10

- Liquid limit less than 40
- blending of materials to meet these requirements will not be permitted unless authorized by the Engineer
- when permitted, test and obtain approval for the blended material before using

D. Admixture: Lime or other approved material which will reduce the soil plasticity by chemical action may be mixed in with the stabilizing material.

PART 3 - EXECUTION

3.01 PREPARATION

A. General:

1. Prior to the beginning of stabilizing operations, complete the subgrade to the lines, grades and cross section shown on the Drawings.

2. Stabilize the subgrade in one course, unless the equipment and methods being used do not provide the required uniformity, particle size limitation, compaction and other desired results, in which case, perform the processing in more than one course as approved by the Engineer.

3.02 APPLICATION

A. Stabilizing Material: Spread the stabilizing material uniformly over the area to be stabilized by means of mechanical material spreaders. Where use of such equipment is not practicable other means of spreading may be used, but only upon written approval of the Engineer.

B. Mixing: Stabilizing material shall be mixed with subgrade soil by means of rotary tillers, or other equipment meeting the approval of the Engineer. Thoroughly mix the stabilizing material with the subgrade throughout the entire depth and width of the area to be stabilized.

C. Maximum Particle Size Of Mixed Materials: At the completion of mixing, check that all particles of material within the limits of the area stabilized will pass a 3 □-inch ring. Remove from the stabilized area any particles not meeting this requirement or break them down so as to meet this requirement.

D. Compaction: After the mixing operations have been completed and requirements for bearing value, uniformity and particle size have been satisfied, compact the stabilized area to a density of not less than 95% of maximum density as determined by AASHTO T 180. Compact the materials at a moisture content within +/- 1% of optimum moisture. If the moisture content of the material is improper for attaining the specified density, either add water or allow drying until the proper moisture content for the specified compaction is reached.

E Finish Grading: Grade and shape the completed stabilized subgrade to conform with the finished lines, grades and cross-section indicated in the Drawings.

F. Quality Assurance:

1. After the stabilizing and compacting operations have been completed, check that the subgrade is firm and substantially unyielding, to the extent that it will support construction equipment and has the bearing value required.

2. Remove and replace with suitable material all soft and yielding material, and any other portions of the subgrade which will not compact readily, and bring the whole subgrade to line and grade, with proper allowance for subsequent compaction.

G. Maintenance Of Completed Subgrade: Upon completion, maintain the subgrade free from ruts, depressions and any damage resulting from the hauling or handling of materials, equipment, tools, etc. Maintain the required density until the subsequent base or pavement is in place. Make any repairs, replacement, etc., of curb and gutter, sidewalk, etc., which might become necessary in order to recompact the subgrade in the event of underwash or other damage. Construct and maintain ditches and drains as necessary to protect the completed subgrade from damage by storm water.

3.03 FIELD QUALITY CONTROL

A. Bearing Value Requirements:

1. General: Bearing value samples will be obtained and tested by the Engineer at completion of satisfactory mixing of the stabilized area. For any area where the bearing value obtained is deficient from the value indicated in the Drawings, in excess of the tolerances established herein, spread and mix in additional stabilizing material as specified above for the full width of the roadway being stabilized and longitudinally for a distance of 50-feet beyond the limits of the area in which the bearing value is deficient. Pay for all retesting required until subgrade meets the specified requirements.

2. Tolerances In Bearing Value Requirements: An undertolerance of 2.0 from the specified bearing value of LBR 40 will be allowed based on tests performed on samples obtained after mixing operations have been completed.

END OF SECTION

SECTION 32 12 13 – PREPARATORY COATS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including Conditions of the Contract and Division 01 Specification Sections, apply to this Section.

1.2 DESCRIPTION

A. Scope: The work specified in this section shall include furnishing all labor, materials, equipment and transportation and performing all work necessary to provide a bituminous coating on a previously prepared base in accordance with these Specifications and notes shown on the Drawings.

1.3 RELATED WORK

A. Section 32 11 00: Limerock Base
B. Section 32 12 16: Superpave Asphalt Paving

1.4 REFERENCED STANDARDS

A. AASHTO M 81: Cut-Back Asphalt (Rapid Curing Type)
B. AASHTO M 140: Emulsified Asphalt
C. AASHTO M 208: Cationic Emulsified Asphalt
D. AASHTO T 59: Testing Emulsified Asphalt
E. Florida Department of Transportation: Standard Specifications for Road and Bridge Construction, Latest Edition.

1.5 SUBMITTALS

A. General: Submit shop drawings in accordance with the General Conditions and Division 1 showing the materials to be used and manufacturer's certificates showing compliance with the specifications.

1.6 QUALITY ASSURANCE

A. Standards: Comply with the Standard Specifications for Road and Bridge Construction, Section 300, of the Florida Department of Transportation, and Supplemental Specifications thereto, hereinafter referred to as FDOT Specifications, except as amended herein. The FDOT

Specifications are hereby made a part of this Contract to the extent they are applicable thereto and shall be as binding upon the Contractor as though reproduced herein in their entirety.

B. Laboratory Analysis: Complete and submit laboratory analysis by a Certified Test Laboratory on all materials and obtain materials acceptance by the Owner, prior to placement.

1.7 PERMITS – Not used

PART 2 - PRODUCTS

2.1 PRIME COAT

A. Material: The material used for prime coat shall be:

1. Cut-back Asphalt Grade RC-70 or RC-250 meeting the requirements of AASHTO M 81 except that the penetration range shall be from 60-120 instead of 80-120.

For Grade RC-3000, in addition to the requirements shown in Table I of AASHTO M 81 the following values shall be added to the requirements for Distillation Test:

Distillate, percentage by volume of total distillate to 680 deg. F.	Grade RC-3000 Max.
to 320 deg. F	0
to 374 deg. F	10
to 437 deg. F	40

All other requirements for the distillation test (and for other properties included in the table) shall be as shown in Table I of AASHTO M 81.

2. Emulsified Asphalt Grades SS-1 or CCS-1, SS-1H or CCS-1H diluted in equal proportion with water. Emulsified Asphalt Grades AE-60, AE-90, AE-150 or AE-200 diluted at the ratio of six parts emulsified asphalt to four parts water. Special MS-Emulsion diluted at the ratio of six parts emulsified asphalt to four parts water; Asphalt Emulsion Prime (AEP) meeting the following:

a. Anionic Emulsified Asphalt shall meet the requirements of AASHTO M 140 with the exception that the cement mix test will be waived when the asphalt is used in non-mix application, such as tack coats and primes.

b. Cationic Emulsified Asphalt shall meet the requirements of AASHTO M 208.

c. Emulsified Asphalt Grades AE-60, AE-90, AE-150 and AE-200 shall meet the following requirements:

HIGH FLOAT EMULSIONS

	Asphalt Emulsion Grade			
	AE-60		AE-90	
	Min	Max	Min	Max
Tests on Emulsion:				
Saybolt Furol Viscosity at 122°F, sec.	75	400	75	400
Settlement 5 days, %		5		5
Storage Stability 24 hours, %		1		1
Sieve Test, %		0.10		0.10
Demulsibility, 50 mL CaCl2 0.10N, %	75		75	
	AE-60		AE-90	
	Min	Max	Min	Max
Residue by Distillation, %	65		65	
Oil Portion, % by Volume (500°F Dist)		1		2
Tests on Residue:				
Penetration (0.1mm), 77°F, 100 g, 5 sec.	40		70	
Absolute Viscosity, poise, 140°F	3200		1600	
Ductility 77°F, 50 mm/min, mm	400		400	
Float Test 140°F, sec	1200		1200	
Solubility in Trichloroethylene, %	97.5		97.5	

	AE-150		AE-200	
	Min	Max	Min	Max
Tests on Emulsion:				
Saybolt Furol Viscosity at 122°F, sec.	75	400	45	
Settlement, 5 days, %		5		5
Storage Stability 24 hours, %		1		1
Sieve Test, %		0.10		0.10
Demulsibility, 50 mL, CaCl2 0.10N, %	75		75	
Residue by Distillation, %	65		62	
Oil Portion, % by Volume (500°F Dist)		3		8
Tests on Residue:				
Penetration (0.1mm) 77°F, 100 g, 5 sec.	125		150	
Absolute Viscosity, poise, 140°F	800		400	
Ductility, 77°F, 50 mm/min, mm	400			
Float Test, 140°F, sec.	1200		1200	
Solubility in Trichloroethylene, %	97.5		97.5	

d. Special MS-Emulsion shall meet the following requirements with a minimum application temperature of 170°F:

SPECIAL MS-EMULSION

	Min	Max
Tests on Emulsion:		
Saybolt Furol Viscosity at 77°F, sec.	45	--
Storage Stability 24 hours, %	--	1
Sieve Test, %	--	0.10
Demulsibility, 50 ml CaCl2 0.10N, %	65	--
Residue by Distillation, %	62	--
Naptha Content, % by Volume (500°F Dist.)	--	8
Tests on Residue:		
Penetration (0.1mm), 77°F, 100 g, 5 sec.	50	--
Ductility, 77°F, 50 mm/min, mm	400	--
Absolute Viscosity, poise, 140°F	800	--
Solubility in Trichloroethylene, %	97.5	--

e. Emulsified Asphalt Grade CRS-2H shall meet the following requirements:

EMULSIFIED ASPHALT GRADE CRS-2H

	Min	Max
Tests on Emulsion:		
Saybolt Furol Viscosity at 122°F, sec.	100	400
Settlement 5 days, %	--	5
Storage Stability 24 hours, %	--	1
Demulsibility, 35 mL 0.8% Sodium Dioctyl Sulfosuccinate, %	40	
Particle Charge	Positive	
Sieve Test, %	--	0.1
Residue, %	65	--
Tests on Residue:		
Penetration (0.1mm), 77°F, 100 g, 5 sec.	80	140
Ductility, 77°F, 50 mm/min, mm	400	--
Solubility in Trichloroethylene, %	97.5	--

f. Asphalt Emulsion Prime shall meet the following requirements:

ASPHALT EMULSION PRIME (AEP)

	Min	Max
Tests on Emulsion:		
Saybolt Furol Viscosity at 77°F, sec.	20	150
Settlement 5 days, %	--	5

Storage Stability 24 hours, %	--	1
Sieve Test, %	--	0.1
Residue, %	55	--
Naptha Content, % by Volume (500°F Dist)	--	12
Tests on Residue:		
Penetration (0.1mm), 77°F, 100 g, 5 sec.	40	200
Ductility, 77°F, 50 mm/min, mm	400	--
Solubility in Trichloroethylene, %	97.5	--

Where Emulsified Asphalt is deficient from the minimum percentage of residue required in the applicable specifications, payment for such material will be made at reduced rates as shown in the following table:

Deficiency from Minimum Percent Residue	Percentage of Original Contract Price
1 - 3	95
4 - 6	85
7 - 9	75
*More than 9	50

* At the discretion of the Owner or the Owner's Representative, the asphaltic mixture, the base material, the surface treatment, or the mineral seal coat containing this material may be left in place with 50 percent payment made therefore, or be removed to the extent required by the Owner or the Owner's Representative and acceptably replaced.

The viscosity requirements for all Grades of Emulsified Asphalt used as tack coat or prime coat may be waived by the Owner or the Owner's Representative if satisfactory results are being obtained.

2.2 COVER MATERIAL FOR PRIME COAT

A. Cover: If an emulsified asphalt is used for prime coat, the cover material shall be hot-asphalt coated (mix to contain from two to four percent asphalt-cement) to achieve a prime coat which will remain reasonably intact until the surface course is placed.

B. Alternate Cover: If material other than emulsified asphalt is used for the prime coat, the cover material shall be either sand (bare or hot-asphalt coated) or screenings. The sand shall be nonplastic and free from any appreciable amount of silt, clay balls and root particles, and from any noticeable sticks, trash, vegetation or other organic matter. Screenings shall be Miami Oolite, Miami Ft. Thompson, or Loxahatchee Ft. Thompson Formations as specified in FDOT Specification Section 902-5.2.3.

2.3 TACK COAT

A. Material: Unless a specific type or grade of material is called for on the drawings or specifications, use undiluted Emulsified Asphalt Grades RS-1 or RS-2.

B. RS Type Asphalt: Emulsified asphalt (RS Type) shall meet the following requirements:

	Min	Max
Tests on Emulsion:		
Saybolt Furol Viscosity at 77°F, sec.	75	--
Storage Stability 24 hours, %	--	1.0
Sieve Test, %	--	0.1
Naptha Content, % by volume	5	15
Residue, %	55	--
Tests on Residue:*		
Penetration (0.1mm), at 77°F, 100g, 5 sec.	50	--
Viscosity at 140°F, poise	800	--
Solubility in trichloroethylene, %	97.5	--

* Residue by distillation shall be in accordance with AASHTO T 59 except that the maximum temperature shall be 329° +/- 10°F (165° +/- 5°C) and the sample shall be maintained at this temperature for 20 minutes.

PART 3 - EXECUTION

3.1 EQUIPMENT

A. Pressure Distributor: The pressure distributor shall be equipped with pneumatic tires having a sufficient width of rubber in contact with the road surface to avoid breaking the bond or forming a rut in the surface. The distance between the centers of openings of the outside nozzles of the spray bar shall be equal to the width of the application required, within an allowable variation of two inches. The outside nozzle at each end of the spray bar shall have an area of opening not less than 25 percent nor more than 75 percent, in excess of the other nozzles. All other nozzles shall have uniform openings. When the application covers less than the full width, the normal opening of the end nozzle at the junction line may remain the same as those of the interior nozzles.

3.2 PREPARATION

A. General: Before any bituminous material is applied, all loose material, dust, dirt, caked clay and other foreign materials which might prevent proper bond with the existing surface shall be removed for the full width of the application. Particular care shall be taken in cleaning the outer edges of the strip to be treated, to insure that the prime or tack coat will adhere.

B. Concrete Protection: When the prime or tack coat is applied adjacent to curb and gutter, valley gutter or any other concrete surfaces, such concrete surfaces (except where they are to be covered with a bituminous wearing course) shall be covered with heavy paper, or otherwise protected while the prime or tack coat is being applied. Any bituminous material deposited on such concrete surfaces shall be removed immediately.

3.3 WEATHER LIMITATIONS

A. Weather: Prime and tack coats shall be applied when the air temperature, in the shade, is above 40°F, and when all other weather conditions and the condition of the surface are suitable. Do not apply bituminous material while rain is falling or when there is water on the surface to be covered.

3.4 APPLICATION OF PRIME COAT

A. General: The surface to be primed shall be clean and the moisture content of the base shall not exceed 90 percent of the optimum moisture content of the base material. The temperature of the prime material shall be between 100°F and 150°F. The actual temperature shall be that which will insure uniform distribution. The material shall be applied by means of a pressure distributor, as specified above. The amount to be applied will be dependent on the character of the surface and shall be sufficient to coat the surface thoroughly and uniformly, with no excess. A prime coat is required on newly constructed limerock bases.

B. Rate of Application: For Limerock, Limerock Stabilized, and Local Rock Bases, the rate of application shall not be less than 0.10 gallon per square yard. For Sand-clay, Shell and Shell Stabilized Bases, the rate of application shall not be less than 0.15 gallons per square yard.

C. Partial Width of Application: If warranted by traffic conditions, the application may be made on only one-half of the width of the base at one time, in which case positive means shall be used to secure the correct amount of bituminous material at the joint.

D. Sanding:

1. If an emulsified asphalt is used to prime coat, the primed base shall be uniformly covered by an application of sand-bituminous hot mix or screenings at an approximate rate of ten pounds per square yard. The entire surface of the sand-bituminous hot mix or screenings cover material shall be rolled with a traffic roller as required to produce a reasonable dense mat.

2. If material other than emulsified asphalt is used for prime coat, the primed base shall be covered by a light uniform application of cover material. If considered necessary for proper distribution of spread, the cover material shall be lightly dragged with a drag broom, after which it shall be rolled with a traffic roller, for at least ten passes over the entire area.

3.5 APPLICATION OF TACK COAT

A. General: Where a bituminous surface is to be laid and a tack coat is required, the tack coat shall be applied as specified below.

B. Tack Coat: Use a tack coat on existing pavement to be resurfaced, primed bases in areas which have become excessively dirty and cannot be cleaned, in areas where the prime has

cured and lost its bonding effect, or in areas where the prime coat is over 30 days old. Heat Rs-1 or RS-2 to a temperature of 140 to 180° F.

C. Method of Application: The tack coat shall be applied with a pressure distributor except that, on small jobs if approved by the Owner or the Owner's Representative, application may be by other mechanical devices or by hand methods. The bituminous material shall be heated to a suitable temperature and shall be applied in a thin, uniform layer.

D. Rate of Application: The rate of application shall be between 0.02 and 0.08 gallon per square yard. For tack coat applied on concrete pavement which is to be surfaced, the rate of application may exceed the upper limit.

E. Curing and Time of Application: The tack coat shall be applied sufficiently in advance of the laying of the bituminous mix to permit drying but shall not be applied so far in advance that it might lose its adhesiveness as a result of being covered with dust or other foreign material.

F. Protection: The tack coat surface shall be kept free from traffic until the subsequent layer of bituminous hot mix has been laid.

END OF SECTION 32 12 13

SECTION 321216 SUPERPAVE ASPHALT PAVING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including Conditions of the Contract and Division 01 Specification Sections, apply to this Section.

1.2 GENERAL

A. Construct a Superpave Asphalt Concrete pavement with the type of mixture specified in the Contract, or when offered as alternates, as selected. Superpave mixes are identified as Type SP-9.5, Type SP-12.5 or Type SP-19.0.

B. Meet the requirements of Section 320 of the FDOT Standard Specifications for plant and equipment. Meet the general construction requirements of Section 330 of the FDOT Standard Specifications, including the provision for Quality Control Plans and Quality Control Systems as specified in 6-8.

C. The Engineer will accept the work on a LOT-to-LOT basis in accordance with the applicable requirements of this Specification. The size of the LOT will be as specified in 334-5.2.

1.3 RELATED WORK

A. Section 31 20 00: Earth Moving

B. Section 32 11 33: Cement-treated Base

C. Section 32 12 13: Preparatory Coats

D. Section 32 17 23: Pavement Markings

1.4 REFERENCED STANDARDS

A. Florida Department of Transportation: Standard Specifications for Road and Bridge Construction – Latest Edition.

1.5 SUBMITTALS

A. Procedures: In accordance with Section 01 33 00.

B. Certificates: Submit manufacturers/suppliers certificates of compliance with these Specifications for all materials proposed for use on this project.

1.6 QUALITY ASSURANCE

A. Standards: Comply with the Standard Specifications for Road and Bridge Construction, of the Florida Department of Transportation, and Supplemental Specifications thereto, hereinafter referred to as FDOT Specifications, except as amended herein. The FDOT Specifications are hereby made a part of this Contract to the extent they are applicable

thereto and shall be as binding upon the Contractor as though reproduced herein in their entirety.

B. Laboratory Analysis: Complete and submit laboratory analysis by a Certified Testing Laboratory on all materials and obtain materials acceptance by the Engineer, prior to placement.

C. Water flood tests of finished paving: In addition to tests and requirements of FDOT Section 330-12], conduct a water flood test of areas as directed by Owner.

PART 2 – PRODUCTS

2.1 TRAFFIC LEVELS

A. The requirements for Type SP Asphalt Concrete mixtures are based on the design traffic level of the project, expressed in 18,000 pound Equivalent Single Axle Loads (ESAL's). The five traffic levels are as shown in Table 32 12 16-1.

Table 32 12 16-1
Superpave Traffic Levels

Traffic Level	Traffic Level ($1x10^6$ ESAL's)
A	<0.3
B	0.3 to <3
C	3 to <10
D	10 to <30
E	≥30

B. The traffic level(s) for the project are as specified in the Contract. A Type SP mix one traffic level higher than the traffic level specified in the Contract may be substituted, at no cost to the Owner (i.e. Traffic Level B may be substituted for Traffic Level A, etc.).

2.2 GRADATION CLASSIFICATION

A. The Superpave mixes are classified as either coarse or fine, depending on the overall gradation of the mixture. Coarse and fine mixes are defined in 3.02-C.

1. The equivalent AASHTO nominal maximum aggregate size Superpave mixes are as follows:

Type SP-9.5 ..... 9.5 mm

Type SP-12.5 ..... 12.5 mm

Type SP-19.0 ..... 19.0 mm

2.3 THICKNESS

A. The total thickness of the Type SP asphalt layer(s) will be the plan thickness as shown in the Contract documents. Before paving, propose a thickness for each individual layer

meeting the requirements of this specification, which when combined with other layers (as applicable) will equal the plan thickness. For construction purposes, the plan thickness and individual layer thickness will be converted to spread rate based on the maximum specific gravity of the asphalt mix being used, as well as the minimum density level, as shown in the following equation:

1. Spread rate (lbs/yd^2) = $t \times G_{mm} \times 43.3$

   Where: t = Thickness (in.) (Plan thickness or individual layer thickness)

   G_{mm} = Maximum specific gravity from the verified mix design

   The weight of the mixture shall be determined as provided in 320-2.2. For target purposes only, spread rate calculations should be rounded to the nearest whole number.

   Note: Plan quantities are based on a G_{mm} of 2.540, corresponding to a spread rate of 110 lbs/yd^2-in. Pay quantities will be based on the actual maximum specific gravity of the mix being used.

B. LAYER THICKNESSES - FINE MIXES

1. The allowable layer thicknesses for fine Type SP Asphalt Concrete mixtures are as follows:

   Type SP-9.5 ..... 1 - 1 1/2 inches

   Type SP-12.5 ..... 1 1/2 - 2 1/2 inches

   Type SP-19.0 ..... 2 - 3 inches

2. In addition to the minimum and maximum thickness requirements, the following restrictions are placed on fine mixes when used as a structural course:

   Type SP-9.5 - Limited to the top two structural layers, two layers maximum.

   Type SP-9.5 – May not be used on Traffic Level D and E applications.

   Type SP-19.0 - May not be used in the final (top) structural layer.

C. LAYER THICKNESSES - COARSE MIXES

1. The allowable layer thicknesses for coarse Type SP Asphalt Concrete mixtures are as follows:

   Type SP-9.5 ..... 1 1/2 - 2 inches

Type SP-12.5 ..... 2 - 3 inches

Type SP-19.0 ..... 3 - 3 1/2 inches

2. In addition to the minimum and maximum thickness requirements, the following restrictions are placed on coarse mixes when used as a structural course:

Type SP-19.0 - May not be used in the final (top) structural layer.

D. ADDITIONAL REQUIREMENTS

1. The following requirements also apply to coarse and fine Type SP Asphalt Concrete mixtures:

a. A minimum 1 1/2 inch initial lift is required over an Asphalt Rubber Membrane Interlayer (ARMI).

b. When construction includes the paving of adjacent shoulders (≤5 feet wide), the layer thickness for the upper pavement layer and shoulder must be the same and paved in a single pass, unless called for differently in the Contract documents.

c. All overbuild layers must be fine Type SP Asphalt Concrete designed at the traffic level as stated in the Contract. Use the minimum and maximum layer thicknesses as specified above unless called for differently in the Contract documents. On variable thickness overbuild layers, the minimum allowable thickness may be reduced by 1/2 inch, and the maximum allowable thickness may be increased 1/2 inch, unless called for differently in the Contract documents.

2.4 GENERAL REQUIREMENTS

A. Meet the material requirements specified by the FDOT Standard Specification. Specific FDOT references are as follows:

Superpave PG Asphalt Binder or Recycling Agent 916-1, 916-2

Coarse Aggregate.....Section 901

Fine Aggregate.....Section 902

2.5 SUPERPAVE ASPHALT BINDER

A. Unless specified otherwise in the Contract, use a PG 67-22 asphalt binder with the following exceptions: for Traffic Level D, use a PG 76-22 asphalt binder in the final structural layer; for Traffic Level E, use a PG 76-22 asphalt binder in the top two structural layers. In addition, meet the requirements of 2.03.

2.6 RECLAIMED ASPHALT PAVEMENT (RAP) MATERIAL

A. GENERAL REQUIREMENTS

1. RAP may be used as a component of the asphalt mixture subject to the following requirements:

   a. For Traffic Levels A, B and C mixtures, limit the amount of RAP material used in the mix to a maximum of 50 percent by weight of total aggregate. For Traffic Levels D and E mixtures, limit the amount of RAP material used in the mix to a maximum of 30 percent by weight of total aggregate.

   b. When using a PG 76-22 Asphalt Binder, limit the amount of RAP material used in the mix to a maximum of 15 percent by weight of total aggregate.

   c. Assume full responsibility for the design, production and construction of asphalt mixes which incorporate RAP as a component material.

   d. Use RAP from an FDOT approved stockpile or RAP that has an FDOT furnished Pavement Composition Data Sheet.

   e. Do not use RAP material in any friction course mixes.

   f. Provide stockpiled RAP material that is reasonably consistent in characteristics and contains no aggregate particles which are soft or conglomerates of fines.

   g. Provide RAP material having a minimum average asphalt content of 4.0 percent by weight of total mix. The Engineer may sample the stockpile to verify that this requirement is met.

B. MATERIAL CHARACTERIZATION

1. Assume responsibility for establishing the asphalt binder content, gradation, viscosity and bulk specific gravity (G_{sb}) of the RAP material based on a representative sampling of the material. Obtain the samples by one of the following methods:

   a. Roadway cores: Cut a minimum number of cores to be representative of the pavement prior to milling. Fill the core holes prior to opening to traffic. Assume responsibility for accounting for the degradation that will occur during the milling operation.

   b. Milling: Obtain representative samples by milling the existing pavement to the full depth shown on the plans for a minimum length of approximately 200 feet. If required to maintain traffic, immediately replace the pavement removed with the mix specified in the Contract. This mix will be paid for at the Contract unit price.

   c. Stockpile sampling: Obtain samples from a stockpile of either milled or processed RAP. Take representative samples at random locations around the stockpile. Request the Engineer to make a visual inspection of the stockpiled RAP material. Based on visual inspection and a review of the test data, the Engineer will determine the suitability of the stockpiled materials. Once the RAP stockpile has been approved, do not add additional material without prior approval of the Engineer.

d. Determine the binder content and gradation of the RAP material in accordance with FM 5-563 and FM 1-T 030, respectively. Extract and recover the asphalt binder from the RAP in accordance with FM 5-524 and FM 3-D 5404, respectively. Determine the viscosity of the recovered asphalt binder in accordance with ASTM D2171. Establish the Gsb of the RAP material by using one of the following methods:

i. Calculate the G_{sb} value based upon the effective specific gravity (G_{se}) of the RAP material, determined on the basis of the asphalt binder content and maximum specific gravity (G_{mm}) of the RAP material. The Engineer will approve the estimated asphalt binder absorption value used in the calculation.

ii. Measure the G_{sb} of the RAP aggregate, in accordance with FM 1-T 084 and FM 1-T 085. Obtain the aggregate by using either a solvent or ignition oven extraction method.

C. ASPHALT BINDER FOR MIXES WITH RAP

1. Select the appropriate asphalt binder grade based on Table 32 12 16-2. The Engineer reserves the right to change the asphalt binder type and grade at design based on the characteristics of the RAP asphalt binder, and reserves the right to make changes during production. Maintain the viscosity of the recycled mixture within the range of 4,000 to 12,000 poises. Obtain a sample of the mixture for the Engineer within the first 1,000 tons of production and at a continuing frequency of one sample per 4,000 tons of mix.

Table 32 12 16-2
Asphalt Binder Grade for Mixes Containing RAP

Percent RAP	Asphalt Binder Grade
<20	PG 67-22
20 – 29	PG 64-22
≥ 30	Recycling Agent

2.7 RECYCLED CRUSHED GLASS

A. Recycled crushed glass may be used as a component of the asphalt mixture subject to the following requirements:

1. Consider the recycled crushed glass a local material and meet all requirements specified in 902-6.

2. Limit the amount of recycled crushed glass to a maximum of 15 percent by weight of total aggregate.

3. Use an asphalt binder that contains a minimum of 0.5 percent anti-stripping agent by weight of binder. The antistrip additive shall be one of the products included on the Qualified Products List specified in 6-1 of the Specifications. The

antistrip additive shall be introduced into the asphalt binder by the supplier during loading.

4. Do not use recycled crushed glass in friction course mixtures or in structural course mixtures which are to be used as the final wearing surface.

PART 3 – EXECUTION

3.1 GENERAL COMPOSITION OF MIXTURE

A. Compose the asphalt mixture using a combination of aggregate (coarse, fine or mixtures thereof), mineral filler, if required, and asphalt binder material. Size, grade and combine the aggregate fractions to meet the grading and physical properties of the mix design. Aggregates from various sources may be combined.

3.2 MIX DESIGN

A. Design the asphalt mixture in accordance with AASHTO R35-04, except as noted herein. Prior to the production of any asphalt mixture, submit the proposed mix design with supporting test data indicating compliance with all mix design criteria to the Engineer. Include representative samples of all component materials, including asphalt binder. Allow the State Materials Engineer a maximum of four weeks to either conditionally verify or reject the mix as designed. Final verification of the mix design will occur when the requirements of 3.06-C have been met. Do not use more than three mix designs per nominal maximum aggregate size per traffic level per binder grade per contract year.

B. The Engineer will consider any marked variations from original test data for a mix design or any evidence of inadequate field performance of a mix design as sufficient evidence that the properties of the mix design have changed, and the Engineer will no longer allow the use of the mix design.

C. MIXTURE GRADATION REQUIREMENTS

1. Combine the coarse and fine aggregate in proportions that will produce an asphalt mixture meeting all of the requirements defined in this specification and conform to the gradation requirements at design as defined in AASHTO M323-04, Table 3. Aggregates from various sources may be combined.

D. MIXTURE GRADATION CLASSIFICATION

1. Plot the combined mixture gradation on an FHWA 0.45 Power Gradation Chart. Include the Control Points from AASHTO M323-04, Table-3, as well as the Primary Control Sieve (PCS) Control Point from AASHTO M323-04, Table 4. Coarse mixes are defined as having a combined aggregate gradation that passes below the primary control sieve control point, and fine mixes are defined as having a gradation that passes above or through the primary control sieve control point. Use either a coarse mix or fine mix for Traffic Levels A - E.

E. COARSE AGGREGATE ANGULARITY

1. When tested in accordance with ASTM D 5821, meet the percentage of fractured faces requirements specified in AASHTO M323-04, Table 5.

F. FINE AGGREGATE ANGULARITY

1. When tested in accordance with AASHTO T-304, Method A, meet the uncompacted void content of fine aggregate specified in AASHTO M323-04, Table 5.

G. FLAT AND ELONGATED PARTICLES

1. When tested in accordance with ASTM D 4791, (with the exception that the material passing the 3/8 inch sieve and retained on the No. 4 sieve shall be included), meet the requirements specified in AASHTO M323-04, Table 5. Measure the aggregate using the ratio of 5:1, comparing the length (longest dimension) to the thickness (shortest dimension) of the aggregate particles.

H. SAND EQUIVALENT

1. When tested in accordance with AASHTO T 176, meet the sand equivalent requirements specified in AASHTO M323-04, Table 5.

I. GYRATORY COMPACTION

1. Compact the design mixture in accordance with AASHTO T312-04. Use the number of gyrations as defined in AASHTO R35-04, Table 1 with the following exceptions: for Traffic Level C mixes, compact the mixture as specified for the Traffic Level of 0.3×10^6 to $< 3 \times 10^6$ ESAL's; for Traffic Level E mixes, compact the mixture as specified for 10×10^6 to $< 30 \times 10^6$ ESAL's.

J. DESIGN CRITERIA

1. Meet the requirements for nominal maximum aggregate size as defined in AASHTO M323-04, as well as for relative density, VMA, VFA, and dust-to-binder ratio as specified in AASHTO M323-04, Table 6. Use a dust-to-binder ratio of 0.8 to 1.6 for coarse mixes.

K. MOISTURE SUSCEPTIBILITY

1. Test 4 inch specimens in accordance with FM 1-T 283. Provide a mixture having a retained tensile strength ratio of at least 0.80 and a minimum tensile strength (unconditioned) of 100 psi. If necessary, add a liquid anti-stripping agent, which is on the Department's Qualified Products List or hydrated lime (meeting the requirements of 337-10.2) in order to meet these criteria.

L. ADDITIONAL INFORMATION

1. In addition to the requirements listed above, provide the following information with each proposed mix design submitted for verification:

   a. The design traffic level and the design number of gyrations (N_{design}).

   b. The source and description of the materials to be used.

c. The DOT source number and the DOT product code of the aggregate components furnished from a DOT approved source.

d. The gradation and proportions of the raw materials as intended to be combined in the paving mixture. The gradation of the component materials shall be representative of the material at the time of use. Compensate for any change in aggregate gradation caused by handling and processing as necessary.

e. A single percentage of the combined mineral aggregate passing each specified sieve. Degradation of the aggregate due to processing (particularly material passing the No. 200 sieve) should be accounted for and identified.

f. The bulk specific gravity (G_{sb}) value for each individual aggregate and RAP component, as identified in the Department's aggregate control program.

g. A single percentage of asphalt binder by weight of total mix intended to be incorporated in the completed mixture, shown to the nearest 0.1 percent.

h. A target temperature at which the mixture is to be discharged from the plant and a target roadway temperature (per 330-6.3). Do not exceed a target temperature of 330°F for modified asphalts and 315°F for unmodified asphalts.

i. Provide the physical properties achieved at four different asphalt binder contents. One of which shall be at the optimum asphalt content, and must conform to all specified physical requirements.

j. The name of the CTQP Qualified Mix Designer.

k. The ignition oven calibration factor.

3.3 MIX DESIGN REVISIONS

A. During production, the Contractor may request a target value revision to a mix design, subject to meeting the following requirements: (1) the target change falls within the limits defined in Table 32 12 16-3, (2) appropriate data exists demonstrating that the mix complies with production air voids specification criteria, and (3) the mixture gradation meets the basic gradation requirements defined in 3.02-C.

Table 32 12 16-3
Limits for Potential Adjustments to Mix Design Target Values

Characteristic	Limit from Original Mix Design
No. 8 sieve and Coarser	± 5.0 percent
No. 16 sieve	± 4.0 percent
No. 30 sieve	± 4.0 percent
No. 50 sieve	± 3.0 percent
No. 100 sieve	± 3.0 percent

No. 200 sieve	± 1.0 percent
Asphalt Binder Content (1)	± 0.3 percent

Note: (1) Reductions to the asphalt binder content will not be permitted if the VMA during production is lower than 1.0 percent below the design criteria.

B. Submit all requests for revisions to mix designs, along with supporting documentation, to the Engineer. In order to expedite the revision process, the request for revision or discussions on the possibility of a revision may be made verbally, but must be followed up by a written request. The verified mix design will remain in effect until the Engineer authorizes a change. In no case will the effective date of the revision be established earlier than the date of the first communication between the Contractor and the Engineer regarding the revision.

C. A new design mix will be required if aggregate sources change, or for any substitution of an aggregate product with a different aggregate code, unless approved by the Engineer.

3.4 CONTRACTOR PROCESS CONTROL

A. Assume full responsibility for controlling all operations and processes such that the requirements of these Specifications are met at all times. Perform any tests necessary at the plant and roadway for process control purposes.

B. Address in the Quality Control Plan how Process Control failures will be handled. Investigate, at a minimum, the production process, testing equipment and/or sampling methods to determine the cause of the failure, and make any necessary changes to assure compliance with these Specifications. Obtain a follow up sample immediately after corrective actions are taken to assess the adequacy of the corrections. In the event the follow-up Process Control sample also fails to meet Specification requirements, cease production of the asphalt mixture until the problem is adequately resolved to the satisfaction of the Engineer.

3.5 ACCEPTANCE OF THE MIXTURE

A. GENERAL

1. The mixture will be accepted at the plant with respect to gradation (P_{-8} and P_{-200}), asphalt content (P_b), and volumetrics (volumetrics is defined as air voids at N_{design}). The mixture will be accepted on the roadway with respect to density of roadway cores. Acceptance will be on a LOT-by-LOT basis (for each mix design) based on tests of random samples obtained within each sublot taken at a frequency of one set of samples per sublot. A roadway LOT and a plant production LOT shall be the same. Acceptance of the mixture will be based on Contractor Quality Control test results that have been verified by the Owner.

B. SAMPLING AND TESTING REQUIREMENTS

1. Obtain the samples in accordance with FM 1-T 168. Obtain samples at the plant of a sufficient quantity to be split into three smaller samples; one for Quality Control, one for Verification and one for Resolution testing; each sample at

approximately 35 pounds. The split samples for Verification testing and Resolution testing shall be reduced in size and stored in three boxes each. The approximate size of each box must be 12” x 8” x 4”. Label and safely store these boxes in a manner agreed upon by the Engineer for future testing. The Contractor can retain additional split samples at their option.

2. The asphalt content of the mixture will be determined in accordance with FM 5-563. In the event the FM 5-563 ignition oven goes out of service during production, the Contractor may elect to use a replacement oven at another location for no more than 72 hours while the oven is being repaired. The gradation of the recovered aggregate will be determined in accordance with FM 1-T 030. Volumetric testing will be in accordance with AASHTO T312-04 and FM 1-T 209. Prior to testing volumetric samples, condition the test-sized sample for one hour at the target roadway compaction temperature in a covered, shallow, flat pan. Test for roadway density in accordance with FM 1-T 166.

3.6 LOT SIZES

A. LOT sizes will be 2,000 tons with each LOT subdivided into four equal sublots of 500 tons each, the Contractor will develop a random sampling plan for each sublot and direct the Paving Sub Contractor on sample points, based on tonnage, for each sublot during construction. The Contractor will submit the random sampling plan to the Engineer for approval.

B. PARTIAL LOTS

1. A partial LOT is defined as a LOT size that is less than a full LOT. A partial LOT may occur due to the following:

   a. The completion of a given mix type or mix design on a project.

   b. A LOT termination due to a 60 day or greater delay in production. (Time periods other than 60 days may be used if agreed to by both Engineer and Contractor.)

   c. A LOT is terminated per 3.08-E.

2. All partial LOTs will be evaluated based on the number of tests available, and will not be redefined.

3.7 QUALITY CONTROL SAMPLING AND TESTING

A. Obtain all samples randomly.

B. Should the Engineer determine that the Quality Control requirements are not being met or that unsatisfactory results are being obtained, or should any instances of falsification of test data occur, approval of the Contractor’s Quality Control Plan will be suspended and production will be stopped.

C. PLANT SAMPLING AND TESTING REQUIREMENTS

1. Obtain one random sample of mix per sublot in accordance with 3.05-B as directed by the Engineer. Test the Quality Control split sample for gradation, asphalt binder content and volumetrics in accordance with 3.05-B. Complete all Quality Control testing within one working day from the time the samples were obtained.

D. ROADWAY SAMPLING AND TESTING REQUIREMENTS

1. Obtain five 6 inch diameter roadway cores within 24 hours of placement at random locations as directed by the Engineer within each sublot. Test these Quality Control samples for density (G_{mb}) in accordance with 3.05-B. In situations where it is impractical to cut five cores per sublot, obtain a minimum of three cores per sublot at random locations as identified by the Engineer. Do not obtain cores any closer than 12 inches from an unsupported edge. Maintain traffic during the coring operation; core the roadway, patch the core holes (within three days of coring); and trim the cores to the proper thickness prior to density testing.

2. Density for the sublot shall be based on the average value for the cores cut from the sublot with the target density being the maximum specific gravity (G_{mm}) of the sublot. Once the average density of a sublot has been determined, do not retest the samples unless approved by the Engineer. Ensure proper handling and storage of all cores until the LOT in question has been accepted.

E. INDIVIDUAL TEST TOLERANCES FOR QUALITY CONTROL TESTING

1. In the event that an individual Quality Control test result of a sublot for air voids, or the average sublot density for coarse graded mixes does not meet the requirements of Table 32 12 16-4, terminate the LOT and stop production of the mixture until the problem is adequately resolved (to the satisfaction of the Engineer), unless it can be demonstrated to the satisfaction of the Engineer that the problem can immediately be (or already has been) resolved. Address any material represented by the failing test result in accordance with 3.11-E.

2. In the event that an individual Quality Control test result of a sublot for gradation (P_{-8} or P_{-200}), asphalt binder content, or the average sublot density for fine graded mixes does not meet the requirements of Table 32 12 16-4, or an individual core density is less than 91.00 percent of G_{mm} (for coarse mixes), take steps to correct the situation and report the actions to the Engineer.

3. In the event that two consecutive individual Quality Control test results (for the same material characteristic) for gradation (P_{-8} and P_{-200}), asphalt binder content, or the average sublot density for fine graded mixes do not meet the requirements of Table 32 12 16-4, or two individual core densities within a sublot are less than 91.00 percent of G_{mm} (for coarse mixes), terminate the LOT and stop production of the mixture until the problem is adequately resolved (to the satisfaction of the Engineer), unless it can be demonstrated to the satisfaction of the Engineer that the problem can immediately be (or already has been) resolved. Address any material represented by the failing test result in accordance with 3.11-E.

Table 32 12 16-4
Master Production Range

Characteristic	Tolerance (1)
Asphalt Binder Content (percent)	Target ±0.55
Passing No. 8 Sieve (percent)	Target ±5.50
Passing No. 200 Sieve (percent)	Target ±1.50
Air Voids (percent) Coarse Graded	2.00 - 6.00
Air Voids (percent) Fine Graded	2.30 - 6.00
Density, percent G_{mm} (2)	
Coarse Graded (minimum)	93.00
Fine Graded (minimum)	90.00

(1) Tolerances for sample size of n = 1 from the verified mix design
(2) Based on an average of 5 randomly located cores

3.8 SURFACE TOLERANCE

A. The asphalt mixture will be accepted on the roadway with respect to surface tolerance in accordance with the applicable requirements of FDOT 330-12.

3.9 MINIMUM ACCEPTABLE QUALITY LEVEL

A. PAVEMENT ACCEPTANCE

1. Meet the requirements of paragraph 3.7 and 3.8 in this Section. Pavement not accepted shall be removed and replaced at no cost to the Owner, or as approved by the Engineer.

B. DEFECTIVE MATERIAL

1. Assume responsibility for removing and replacing all defective material placed on the project, at no cost to the Owner.

2. As an exception to the above and upon approval of the Engineer, obtain an engineering analysis by an independent laboratory (as approved by the Engineer) to determine the disposition of the material. The engineering analysis must be signed and sealed by a Professional Engineer licensed in the State of Florida.

3. Any material that remains in place will be accepted with a composite pay factor, or as determined by the Engineer.

END OF SECTION

SECTION 321313 - CONCRETE PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. FDOT Standard Specifications for Road and Bridge Construction, 2013. Section 346 Portland Cement Concrete, Section 350 Cement Concrete Pavement and related sections.

C. FDOT Design Standards, 2012.

1.2 SUMMARY

A. Section Includes:

1. Concrete Pavement as noted on the plans.

B. Related Sections:

1. Section 03 30 00 “Cast-in-Place Concrete” for general building applications of concrete.

DEFINITIONS

C. Cementious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash and other pozzolans, and ground granulated blast-furnace slag.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples for Initial Selection: For each type of product, ingredient, or admixture requiring color selection.

C. Samples for Verification: For each type of product or exposed finish, prepared as Samples of size indicated below:

1. Exposed Aggregate: 10-lb Sample of each mix.

D. Design Mixtures:

1. For each concrete paving mixture. Include alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

E. Qualification Data: For qualified, Installer of detectable warnings, ready-mix concrete manufacturer, and testing agency.

F. Material Certificates: For the following, from manufacturer:

1. Cementitious materials.
2. Steel reinforcement and reinforcement accessories.
3. Fiber reinforcement.
4. Admixtures.
5. Curing compounds.
6. Applied finish materials.
7. Bonding agent or epoxy adhesive.
8. Joint fillers.

G. Material Test Reports: For each of the following:

1. Aggregates. Include service-record data indicating absence of deleterious expansion of concrete due to alkali-aggregate reactivity.

H. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Detectable Warning Installer Qualifications: An employer of workers trained and approved by manufacturer of stamped concrete paving systems.

B. 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").

C. Testing Agency Qualifications: Qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.

1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.

D. Concrete Testing Service: Engage a qualified testing agency to perform material evaluation tests and to design concrete mixtures.

E. ACI Publications: Comply with ACI 301 and ACI 330 unless otherwise indicated.

F. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Build mockups of full-thickness sections of concrete paving to demonstrate typical joints; surface finish, texture, and color; curing; and standard of workmanship.
2. Build mockups of concrete paving in the location and of the size indicated or, if not indicated, build mockups where directed by Architect and not less than 60 inches by 60 inches.
3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
4. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

G. Preinstallation Conference: Conduct conference at Project site.

1. Review methods and procedures related to concrete paving, including but not limited to, the following:

a. Concrete mixture design.
b. Quality control of concrete materials and concrete paving construction practices.

2. Require representatives of each entity directly concerned with concrete paving to attend, including the following:

a. Contractor's superintendent.
b. Independent testing agency responsible for concrete design mixtures.
c. Ready-mix concrete manufacturer.
d. Concrete paving subcontractor.

1.5 PROJECT CONDITIONS

A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

PART 2 - PRODUCTS

2.1 FORMS

A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, and smooth exposed surfaces.

1. Use flexible or uniformly curved forms for curves with a radius of 100 feet or less.

B. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and that will not impair subsequent treatments of concrete surfaces.

2.2 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of same type, brand, and source throughout Project:

1. Portland Cement shall be in accordance with FDOT Standard Specification 921.
1. Normal-Weight Aggregates: Provide aggregates from a single source and free of materials with deleterious reactivity to alkali in cement.

B. Aggregates.

1. Coarse-Aggregates shall be in accordance with FDOT Standard Specification 901.
2. Fine Aggregates shall be in accordance with FDOT Standard Specification 902.

C. Exposed Aggregate shall be hard, and durable; washed; free of materials with deleterious reactivity to cement or that cause staining; from a single source. Size, color and grading shall be in accordance with the Hardscape Drawings.

D. Water : Potable and complying with FDOT Standard Specification 923.

E. Admixtures shall be in accordance with FDOT Standard Specification 924.

F. Color Pigment: ASTM C 979, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable, free of carbon black, nonfading, and resistant to lime and other alkalis. Color shall be as indicated on the Hardscape Drawings.

2.3 FIBER REINFORCEMENT

A. Synthetic Fiber: Propex Concrete Systems; Fibermesh 300 or approved equal, application rate 1.5 lbs per cubic yard.

2.4 CURING MATERIALS

A. Curing materials for concrete shall be in accordance with FDOT Standard Specification 925.

2.5 RELATED MATERIALS

A. Joint Materials shall be in accordance with FDOT Standard Specification 932..

B. Bonding Agents and Adhesives shall be in accordance with FDOT Standard Specification 926.

C. Chemical Surface Retarder: Water-soluble, liquid, set retarder with color dye, for horizontal concrete surface application, capable of temporarily delaying final hardening of concrete to a depth of ¼ inch.

1. Products: Subject to compliance with requirements, provide one of the following:

a. ChemMasters; Exposee.
b. Conspec by Dayton Superior; Delay S.
c. Dayton Superior Corporation; Sure Etch (J-73).
d. Edoco by Dayton Superior; True Etch Surface Retarder.
e. Euclid Chemical Company (The), an RPM company; Surface Retarder Formula S.
f. Kaufman Products, Inc.; Expose.
g. Meadows, W. R., Inc.; TOP-STOP.
h. Metalcrete Industries; Surftard.
i. Nox-Crete Products Group; CRETE-NOX TA.
j. Scofield, L. M. Company; LITHOTEX Top Surface Retarder.
k. Sika Corporation, Inc.; Rugasol-S.
l. SpecChem, LLC; Spec Etch.
m. TK Products, Division of Sierra Corporation; TK-6000 Concrete Surface Retarder.
n. Unitex; TOP-ETCH Surface Retarder.
o. Vexcon Chemicals Inc.; Certi-Vex Envioset.

2.6 DETECTABLE WARNING MATERIALS

A. Detectable Warning Surfaces shall be in accordance with FDOT Standard Specification 527 and the Design Standards.

2.7 CONCRETE MIXTURES

A. Prepare design mixtures in accordance with FDOT Standard Specification 346, for each type and strength of normal-weight concrete, and as determined by either laboratory trial mixtures or field experience. Proportion mixtures to provide normal-weight concrete with the following properties:

1. Compressive Strength (28 Days): 4,000 psi.
2. Maximum Water-Cementitious Materials Ratio at Point of Placement: 0.53.
3. Slump Limit: in accordance with Table 2 FDOT Specification 346.

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

1. Use water reducing 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.

C. Synthetic Fiber: Uniformly disperse in concrete mixture at manufacturer's recommended rate.

D. Color Pigment: Add color pigment to concrete mixture according to manufacturer's written instructions and to result in hardened concrete color consistent with approved mockup.

2.8 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to FDOT Standard Specification Section 350. Furnish batch certificates for each batch discharged and used in the Work.

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.

B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Mix concrete materials in appropriate drum-type batch machine mixer.

1. For concrete batches of 1 cu. yd or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
2. For concrete batches larger than 1 cu. yd, increase mixing time by 15 seconds for each additional 1 cu. yd..
3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixing time, quantity, and amount of water added.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.

B. Proof-roll prepared subbase surface below concrete paving to identify soft pockets and areas of excess yielding.

1. Completely proof-roll subbase in one direction and repeat in perpendicular direction. Limit vehicle speed to 3 mph.
2. Proof-roll with a pneumatic-tired and loaded, 10-wheel, tandem-axle dump truck weighing not less than 15 tons..
3. Correct subbase with soft spots and areas of pumping or rutting exceeding depth of ½ inch according to requirements in Division 31 Section "Earth Moving."

C. Proceed with installation only after unsatisfactory conditions have been corrected.

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 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.

1. When joining existing paving, place transverse joints to align with previously placed joints 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.

1. Continue steel reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of paving strips unless otherwise indicated.
2. Provide tie bars at sides of paving strips where indicated.
3. Butt Joints: Use bonding agent at joint locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
4. Keyed Joints: Provide preformed keyway-section forms or bulkhead forms with keys unless otherwise indicated. Embed keys at least 1 ½ inches into concrete.
5. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or coat with asphalt one-half of dowel length to prevent concrete bonding to one side of joint.

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.

1. Extend joint fillers full width and depth of joint.
2. Terminate joint filler not less than ½ inch or more than 1 inch below finished surface if joint sealant is indicated.
3. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.
4. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.
5. During concrete placement, protect top edge of joint filler with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.

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, as follows:

1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with grooving tool to a ¼ inch radius. Repeat grooving of contraction joints after applying surface finishes. Eliminate grooving-tool marks on concrete surfaces.

   a. Tolerance: Ensure that grooved joints are within 3 inches either way from centers of dowels.

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 will not tear, abrade, or otherwise damage surface and before developing random contraction cracks.

   a. Tolerance: Ensure that sawed joints are within 3 inches either way from centers of dowels.

3. Doweled Contraction Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or coat with asphalt one-half of dowel length to prevent concrete bonding to one side of joint.

E. Edging: After initial floating, tool edges of paving, gutters, curbs, and joints in concrete with an edging tool to a 3/8 inch radius. Repeat tooling of edges after applying surface finishes. Eliminate edging-tool marks on concrete surfaces.

3.5 CONCRETE PLACEMENT, FINISHING

A. Concrete placement and finishing shall be in accordance with FDOT Standard Specification 350. Provide finish in Hardscape areas in accordance with the project drawings.

3.6 CONCRETE PROTECTION AND CURING

A. Concrete protection and curing shall be in accordance with FDOT Standard Specification 350.

3.7 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-foot- long, unleveled straightedge not to exceed 1/2 inch.
4. Alignment of Tie-Bar End Relative to Line Perpendicular to Paving Edge: 1/2 inch per 12 inches of tie bar.
5. Lateral Alignment and Spacing of Dowels: 1 inch.
6. Vertical Alignment of Dowels: 1/4 inch.
7. Alignment of Dowel-Bar End Relative to Line Perpendicular to Paving Edge: 1/4 inch per 12 inches of dowel.
8. Joint Spacing: 3 inches.
9. Contraction Joint Depth: Plus 1/4 inch, no minus.
10. Joint Width: Plus 1/8 inch, no minus.
11. Cross Slope: Per FDOT Standard Specifications and the Construction Drawings and Details.

3.8 FIELD QUALITY CONTROL

A. Testing Agency: Owner will a qualified testing agency to perform tests and inspections in accordance with FDOT Standard Specifications.

B. Strength of each concrete mixture will be satisfactory if average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.

C. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.

D. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.

E. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.

F. Concrete paving will be considered defective if it does not pass tests and inspections.

G. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.9 REPAIRS 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. Drill test cores, where directed by Architect, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory paving areas with portland cement concrete bonded to paving with epoxy adhesive.

C. 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.

D. 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 32 13 73 - CONCRETE PAVING JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 DESCRIPTION

A. The work to be performed under this section shall include furnishing all materials and labor necessary for the implementation of the joint sealants detailed in the design drawings.

1.3 RELATED WORK

A. Section 32 13 13 Concrete Paving.

1.4 REFERENCED STANDARDS

A. Florida Department of Transportation (FDOT) - Standard Specification for Road and Bridge Construction, current edition in force.

1.5 SUBMITTALS

A. The contractor shall provide certification from appropriate testing laboratories that proposed materials meet the requirements of the project specification.

B. Where required the contractor shall submit samples of proposed materials for independent testing.

1.6 INTENT

A. The intent of these specifications is to ensure that the Contractor furnish and install equipment and materials, which are of, uniform high quality and high reliability. The Contractor shall remain totally responsible for all equipment and materials until their complete installation and acceptance by the Owner.

PART 2 - PRODUCTS

2.1 COMPLIANCE

A. All products and materials shall comply with Florida Department of Transportation specifications.

PART 3 – EXECUTION

3.1 COMPLIANCE

A. All work shall comply with Florida Department of Transportation design standards and specifications.

END OF SECTION

SECTION 02 5 20 - CONCRETE GUTTER AND CURB ELEMENTS

PART 1 - GENERAL

1.1 DESCRIPTION

A.General: The work specified in this section consists of the construction of Portland cement concrete curb and gutter, concrete traffic separator, valley gutter, special concrete gutter, and any other types of concrete curb not specified in other sections. The various items shall be constructed in conformity with the lines, grades, dimensions and notes shown on the Drawings, except as amended herein.

1.2 RELATED WORK

A.	Section 03 11 00:	Concrete Forming and Accessories
B.	Section 03 24 00:	Concrete Reinforcing
C.	Section 03 30 00:	Cast-in-Place Concrete
D.	Section 32 13 13:	Concrete Paving.

1.3 REFERENCED STANDARDS

A. AASHTO M 148: Liquid Membrane-Forming Compounds for Curing Concrete

B. AASHTO M 173: Specification for Concrete Joint-Sealer, Hot Poured Elastic Type

C. ASTM C 920: Specification for Elastomeric Joint Sealants

D. ASTM D 1751: Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types)

E. Florida Department of Transportation: Standard Specification for Road and Bridge Construction, latest edition in force.

F. Florida Department of Transportation: Design Standards, latest edition in force.

1.4 SUBMITTALS

Products: Submit a concrete mix design and signed (by contractor and concrete producer) certificate of compliance with this specification.

1.5 QUALITY ASSURANCE

A.General: A Testing Laboratory provided on-site by the Owner will make such tests as are deemed advisable. The Contractor shall schedule their work so as to permit a reasonable time for testing before placing succeeding lifts and shall keep the laboratory informed of their progress. Costs for all testing requested by the Owner, and meeting the minimum requirements, shall be paid for by the Owner.

1.6 PERMITS

(Not Used)

PART 2 - PRODUCTS

2.1 GENERAL

A. Curb and Gutter: Provide concrete curb and gutter, valley gutter and other types of concrete curb elements in accordance with the applicable provisions of FDOT Standard Specifications for Road and Bridge Construction, Section 520.

2.2 MATERIALS

A. Concrete: Class B (3,000 psi) conforming to the requirements of Section 03300.

B. Reinforcing Steel: Steel bars and welded wire fabric conforming to the requirements of Section 03200.

C. Preformed Joint Filler: Nonextruding and resilient bituminous type and conforming to the requirements of ASTM D 1751.

D. Membrane Curing Compound: Clear fugitive dye conforming to the requirements of AASHTO M 148, Type 1-D, Class A.

E. Joint Sealer For Gutters:

1. Cold Applied Type (In lieu of the hot poured type): A two part polysulfide base self-leveling sealant for horizontal surfaces, developed for foot and vehicular traffic, and conforming to ASTM C 920, Type M, Grade P, Class 12.5, Use T.

PART 3 – EXECUTION

3.1 PREPARATION

A. Subgrade Condition:

1.Maintain the finished subgrade in a smooth, compact condition and restore any areas that are disturbed prior to placing of the concrete. Keep the subgrade moist at the time the concrete is placed and uniformly apply water ahead of the placing operations as directed by the Engineer.

A. Trim the subgrade accurately to the required elevation with a ¼-inch tolerance. Trim high areas to proper elevation. Fill low areas with suitable material, compacted to the specified density, or fill with concrete integrally with the placing of the pavement.

B. Setting Forms: Set the forms accurately to line and grade, such that they rest firmly, throughout their entire length upon the compacted subgrade surface. Join forms neatly and tightly and brace to resist the pressure of the concrete and the finish operations. Obtain approval of the alignment and grade of all forms before and immediately prior to the placing of concrete.

C. Mixing Concrete: As specified in Section 03300.

3.2 INSTALLATION/APPLICATION

A. Placing Concrete:

1. Distribute the concrete on the subgrade to such depth that, when it is consolidated and finished, the thickness required by the Drawings will be obtained at all points and the surface will at no point be below the grade specified for the finished surface. Deposit the concrete on the subgrade continuously between transverse joints, without the use of intermediate bulkheads and in a manner that will require as little rehandling as possible.

2. Place reinforcement, if required, as shown on the Drawings and maintain it at this location during the placing and finishing operations.

3. Thoroughly consolidate the concrete against and along the faces of all forms by means of vibrators. Do not permit vibrators to come in contact with the subgrade or a side form. Continue vibration at any one location not so long as to produce puddling or the accumulation of excessive grout on the surface, and never longer than 15 seconds.

B. Striking-Off, Consolidating and Finishing Concrete:

1.Immediately after the placing, strike off, consolidate and finish the concrete to produce a finished product conforming to the cross section, width and surface finish required by the Drawings and Specifications.

2.After the concrete has sufficiently set a minimum of 12-hours, remove the forms and backfill, compact and grade the space on each side of the earth in a satisfactory manner without damage to the concrete work. Fill honeycombs with sand cement mortar. Plastering will not be allowed on the face of the curb. Remove rejected curb, curb and gutter or valley gutter and replace to the satisfaction of the Engineer without additional compensation.

C.Final Finish: As soon as the water sheen has disappeared and just before the concrete becomes non-plastic, apply a light broom finish to the surface.

D. Joints:

1.Transverse Construction Joints: Construct at the end of all pours and at other locations where the pouring operations are stopped for as long as 30 minutes, but not within 10 feet of any other transverse joint or of either end of a section of curb. If sufficient concrete has not been placed to form a slab at least 10 feet long, remove the excess concrete, back to the last preceding joint. Form the joints by placing a wood or metal bulk-head accurately and securely in place, in a plane perpendicular to the profile and centerline of the pavement. Saw construction joints in a manner similar to contraction joints, so that a groove will be formed for holding the joint sealing compound.
2.Transverse Contraction Joints: Construct at 10-foot intervals by sawing the surface of the hardened concrete. Saw the cut perpendicular to the surface of the pavement and extending to a depth of six inches below the top of the curb and 1-1/2 inches below the gutter. Saw the joints as soon as the concrete has hardened to the degree that tearing and raveling are not excessive and before uncontrolled shrinkage cracking begins. If, at any time, uncontrolled cracking occurs, modify the construction methods.

3.Transverse Expansion Joints: Form ½-inch expansion joints by placing preformed joint filler at the ends of each radius return, around all structures, and at intervals not exceeding 500 feet.

4.Cleaning and Sealing Joints: As soon after completion of the curing period as feasible and before the roadway is opened to traffic, fill with joint sealing material all joints in gutters which are to be sealed. Just prior to sealing, clean each joint thoroughly of all foreign material (including any membrane-curing compound) so that the joint faces are clean and surface-dry when the sealer is applied.

a.Apply the sealing material to each joint as shown on the Drawings and in accordance with the manufacturer's recommendations. Apply in such a manner that the material will not be spilled on the exposed surfaces of the concrete and immediately remove any excess material on the surface of the concrete gutter.

b.Clean out and seal as specified above all cracks occurring in the gutter prior to its acceptance, except fill the cracks and fractures with joint sealer and remove any excess filler material level with the gutter surface.

E. Curing:

1. After the finishing operations have been completed and as soon as the concrete has hardened sufficiently that marring of the surface will not occur, cover the entire surface and the edges of the newly placed concrete and cure with membrane curing compound.

2.Apply curing compound uniformly to the surfaces to be cured, in a continuous film, at the rate of application and in the manner recommended by the manufacturer.

3.Do not apply curing compound during periods of rainfall, nor to the inside faces of joints to be sealed. Should the film become damaged from any cause within the required curing period, repair the damaged portions immediately with additional compound. Upon removal of side forms, immediately coat the sides of the slabs exposed to provide a curing treatment equal to that provided for the surface.

END OF SECTION 32 16 00

SECTION 32 17 23 – PAVEMENT MARKINGS AND SIGNAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including Conditions of the Contract and Division 01 Specification Sections, apply to this Section.

1.2 DESCRIPTION

A. The work to be performed under this section shall include furnishing all materials and labor necessary for the implementation of the signing and pavement markings plan detailed in the design drawings.

1.3 RELATED WORK

A. Section 32 12 16: Superpave Asphalt Paving

1.4 REFERENCED STANDARDS

A. Florida Department of Transportation: Standard Specification for Road and Bridge Construction – Latest Edition.

B. Florida Department of Transportation: Road and Traffic Design Standards – Latest Edition.

C. Town of Medley Engineering Standards.

D. Miami-Dade County Engineering Standards.

1.5 SUBMITTALS

A. Submit copies of a certification from the manufacturer and/or supplier that all materials used in this work meet the appropriate project specification.

1.6 QUALITY ASSURANCE

A. A Testing Laboratory provided on-site by the Owner will make such tests as are deemed advisable. The Contractor shall schedule his work so as to permit a reasonable time for testing before placing succeeding lifts and shall keep the laboratory informed of his progress. Costs for all testing requested by the Owner, and meeting the minimum requirements, shall be paid for by the Owner.

1.7 APPLICABLE CODES, STANDARDS AND SPECIFICATIONS

A. All work on signing and pavement markings (paint and thermoplastic) shall conform to the applicable technical specifications of the latest edition of the Florida Department of Transportation Standard Specifications for Roadway and Bridge Construction, the Design Detail Drawings, and the Florida Department of Transportation Roadway and Traffic Standard Index, Town of Medley Engineering Standards and Miami-Dade County Engineering Standards.

1.8 INTENT

A. The intent of these specifications is to ensure that the Contractor furnish and install equipment and materials, which are of, uniform high quality and high reliability. The Contractor shall remain totally responsible for all equipment and materials until their complete installation and acceptance by the Owner.

PART 2 - PRODUCTS

2.1 COMPLIANCE

A. All products and materials shall comply with Florida Department of Transportation specifications.

PART 3 – EXECUTION

3.1 COMPLIANCE

A. All work shall comply with Florida Department of Transportation standards, Town of Medley and Miami-Dade County Engineering Standards.

B. Parking spaces, gore markings, traffic arrows shall be painted.

C. Stop bars, cross walk markings, and double yellow pavement markings shall be thermoplastic.

END OF SECTION

SECTION 32 25 10 - CONCRETE WALKS & RAMPS

PART 1 - GENERAL

1.1 DESCRIPTION

A. General: This section specifies materials and work required to construct concrete walks and handicap ramps.

1.2 RELATED WORK

A. Section 03100: Concrete Forming and Accessories

B. Section 03200: Concrete Reinforcing

C. Section 03300: Cast-In-Place Concrete

C. Section 031313: Concrete Paving

1.3 REFERENCED STANDARDS

A. AASHTO M 33: Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type)

B. AASHTO M 85: Specification for Portland Cement

C. AASHTO M 182: Specification for Burlap Cloth Made from Jute or Kenaf

D. ANSI/ASTM C 33: Specification for Concrete Aggregates

E. ANSI/ASTM C 150: Specification for Portland Cement

F. ASTM C 171: Specification for Sheet Materials for Curing Concrete

G. ASTM C 260: Specification for Air-Entraining Admixtures for Concrete

H. ASTM C 494: Specification for Chemical Admixtures for Concrete

I. American Concrete Institute (ACI)

J. Americans with Disabilities (ADA)

K. Florida Accessibility Code for Building Construction

L. Florida Department of Transportation Design Standards 2012 (FDOT).

M. FDOT Standard Specifications for Road and Bridge Construction, 2013.

1.4 SUBMITTALS

A. Products: Submit a concrete mix design and signed (by contractor and concrete producer) certificate of compliance with this specification.

1.5 QUALITY INSURANCE

A. Contractor Experience: Contractor shall have a minimum of five years experience at installing architectural concrete and special poured-in-place concrete paving. Contractor shall provide a list of references and completed projects which best represents its work.

1.6 PERMITS – Not used

1.7 ON-SITE SAMPLES – Not used

1.8 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery: Schedule operations to avoid unnecessary rehandling.

B. Storage:

1. General: Store in accordance with manufacturer's recommendations and as noted.

2. Portland Cement: Store on platforms above ground and protect from adverse environmental conditions.

3. Aggregates: Store to prevent foreign material contamination.

4. Utility Joint Materials and Lubricants: Store in cool and dry location free of oil, grease, excessive heat and direct sunrays.

C. Handling:

1. General: Comply with manufacturer's recommendations and as noted.

2. Aggregates: Handle to prevent segregation.

1.9 PROJECT CONDITIONS

A. Limitations:

1. Underground Utilities: Do not proceed with concrete construction until underground construction is complete; including, but not limited to, electrical and irrigation sleeving work.

2. Curbing: Do not proceed with concrete walk construction until adjacent or adjoining curb construction is complete.

3. Demolition of existing curbing at handicap ramp tie-ins to roadways is included in the Scope of Work.

4. Construction of the drop curb at the toe of the handicap ramps is also included in

the Scope of Work, if drop curb is not existing.

PART 2 - PRODUCTS

2.1 FORMS

A. Straight or Tangent Walks:

1. Steel

2. Contractor's option: Wood

3. Slip-forming

B. Curved Walks:

1. Flexible spring steel

2. Contractors option: Laminated wood

3. Slip-forming

2.2 CONCRETE

A. Concrete Walks and Ramps:

1. Portland cement

Class "A" Concrete: ANSI/ASTM C 150
Type: II A

Class "B" Concrete: ANSI/ASTM C 150
Type: II

High early strength concrete: ANSI/ASTM C 150
Type: III

2. Fine aggregate: ANSI/ASTM C 33

3. Coarse aggregate: ANSI/ASTM C 33

a. Size number: 67 (3/4 inch to No. 4)

4. Admixtures:

a. Air-entraining: ASTM C 260

b. Water Reducing: ASTM C 494, Type A

c. Accelerator: Nonchloride, ASTM C 494, Type C or E

d. Retarder: ASTM C 494, Type B or D

5. Water: Clean and free of oil, acid and injurious amounts of vegetable matter, alkalis

and salts.

a. Reclaimed (or reuse), river, stream and lake water are prohibited. Only potable water shall be used in concrete batching.

6. Forms: ACI 347-68

B. Mixes:

1. Concrete Walks: Class "A" concrete

a. 28-day compressive strength: 3000 PSI with no under tolerance.

b. Air entrainment: Four to six percent

c. Slump: Not to exceed five inches

2.3 FIBER REINFORCEMENT

A. Fiber reinforcement shall be in accordance with Section 32 13 13 Concrete Paving.

2.4 JOINT MATERIALS

A. Expansion and isolation joints: AASHTO M 33

1. Type: Bituminous preformed joint filler

2. Nominal Thickness: 1/2 inch

2.5 CURING MATERIAL

A. Mat Method: Burlap Mats: AASHTO M 182:

a. Class: 1

B. White-Pigmented Curing Compound in accordance with FDOT Specification 350-11.

2.6 MISCELLANEOUS PRODUCTS

A. Form Release Compound:

1. Type: Nonstaining, approved by the Owner's Representative

B. Cement Mortar: AASHTO M 85

1. Type: 1A

2. Color to match concrete walk

PART 3 - EXECUTION

3.1 PROTECTION AND RESTORATION

A. Concrete:

1. Protect completed concrete from damage.

2. Restore damaged and/or non-conforming concrete as directed by the Owner's Representative at no cost to the Owner.

3.2 SUBGRADE PREPARATION

A. General:

1. Paved areas, Section 02120: Earthwork and as noted on the drawings.

2. Verify utility casing elevations, including but not limited to valve boxes and covers, and reset or adjust to meet flush with finished concrete surface of walks and/or ramps.

B. Concrete Walks and Ramps:

1. Verify subgrade elevations and correct discrepancies before proceeding with concrete placement to ensure the proper relationship between walks and adjacent roadways, curbs and other appurtenances, as indicated on the drawings.

2. Do not place concrete base on wet or muddy subgrade.

3. Dampen subgrade if dry and compact to required density prior to placement of concrete.

3.3 FORMS

A. General:

1. Clean and coat forms with form release compound, prior to use.

2. Install forms to lines, grades and elevations indicated or as specified.

3. Brace forms to prevent movement during concrete placement.

4. Formwork shall be reviewed and approved by the Owner's Representative prior to placement of concrete.

5. Slip-forming of concrete walks is allowed.

3.4 EXPANSION AND ISOLATION JOINTS

A. General:

1. Install expansion joints at intervals shown below or as indicated on the drawings:

a. For 5’-0” wide sidewalks, place expansion joints every 15’-0”
b. For 6’-0” wide sidewalks, place expansion joints every 18’-0”
c. For 8’-0” wide sidewalks, place expansion joints every 24’-0”

2. Place expansion joints perpendicular to concrete surface.

3. Place expansion joints with top edge 1/8-inch below concrete surface.

3.5 CONTRACTION (CONTROL) JOINTS

A. General:

1. Provide contraction (control) joints at intervals shown below or as indicated on the drawings:

a. For 5’-0” wide sidewalks, place expansion joints every 5’-0”
b. For 6’-0” wide sidewalks, place expansion joints every 6’-0”
c. For 8’-0” wide sidewalks, place expansion joints every 8’-0”

2. Form contraction joints, perpendicular to concrete surface, with removable 1/8 inch form spreader plates.

3. Contractor's option: form contraction joints with 3/4 inch jointing tool.

4. Where indicated or specified, saw contraction joints, to 1 inch depth, 12 hours after concrete placement.

3.6 CONCRETE PLACEMENT

A. General:

1. Place concrete in forms in one uniform layer.

2. Consolidate concrete by tamping, spading or vibrating to prevent honeycombing.

3. Place and consolidate concrete carefully to prevent joint material dislocation.

3.07 FINISHING

A. General:

1. Strike off top surfaces to top of forms and to smooth and uniform texture.

2. Remove joint support channel when concrete attains initial set.

3. Finish edges and joints with 1/8 inch radius edging tool.

4. Maintain forms in place 12 hours after concrete placement.

5. Correct defects (e.g. holes, honeycomb areas, broken edges, etc.) upon removal of forms, with cement mortar.

B. Finishing methodology may be modified in order to achieve desired appearance. Obtain

approval for finishes from Owner's Representative prior to beginning concrete walks and ramps work.

C. Paving Finish Schedule:

1. Concrete walks: Coordinate finish color, type and joint patterns with Hardscape and Architectural Drawings. Otherwise provide light broom finish

2. Handicap ramps: Non-skid broom finish and as indicated on the Drawings

3.08 CURING

A. Mat Method:

1. Moisten mats thoroughly with water placing on concrete.

2. Place mats on exposed concrete surfaces with six inch joint overlaps.

3. Maintain mats in continuously moist condition for seven calendar days.

4. Repair or replace damaged mats.

5. Contractor's Option: Sheeting Method

6. Moisten concrete surfaces with a fine spray of water before sheeting placement.

7. Place sheeting on exposed concrete surfaces with light-colored side up and 12-inch joint overlaps.

8. Anchor sheeting securely in place.

9. Maintaining sheeting in place for seven calendar days.

10. Repair or replace damaged sections of sheeting.

B. Membrane Curing Compound Method:

Apply membrane-forming curing compound to damp concrete surfaces as soon as possible (but no later than 2 hours) after final finishing operations are complete. Apply uniformly in a 2-coat continuous operation by power spray equipment of rollers in accordance with the manufacturer's recommendations. Recoat areas which are subjected to heavy rainfall within 3 hours after initial application. Maintain the continuity of the coating and repair damage to the coat during the entire cure period.

Do not use membrane curing compounds on surfaces which are to be covered with a coating material applied directly to the concrete or with a covering material bonded to the concrete, such as other concrete, floor hardener/sealer, waterproofing, dampproofing, flooring, painting, and other coatings and finish materials, unless otherwise approved by the Owner's Representative.

3.09 TESTING

Conduct the following:

1. Walk Horizontal Level Alignment Test:

2. Tolerance: Not to exceed 1/2-inch between any two contacts on 10 foot straightedge, except along horizontal curves.

3. Test locations: Random and determined by the Owner's Representative.

4. Test observation: By the Owner's Representative.

5. Walk Surface Smoothness Test:

6. Tolerance: Not to exceed 3/8 inch between any two surface contacts on 10 foot straightedge.

7. Test locations: Random and determined by the Owner's Representative.

8. Test observation: By the Owner's Representative.

Slopes and Tolerances:

1. Maximum cross-slope of walks shall be 2.0% with an allowable construction tolerance of ±0.4%. At transition panels adjacent to handicap ramps, cross-slope shall vary as needed in accordance with ADA requirements.

2. Maximum longitudinal slope of walks (in direction of travel) shall be 5.0% (20:1). Actual slopes of individual sections shall be as indicated on the Drawings.

3. Maximum longitudinal slope of ramps (in direction of travel) shall be 8.33% (12:1). Maximum slope on ramp flares, where applicable, shall be 10.0% (10:1).

Corrective Work:

1. Correct work not conforming to specified tolerances and/or to ADA or other applicable requirements as directed by the Owner's Representative at no additional cost to the Owner.

END OF SECTION 32 25 10

SECTION 323119 - DECORATIVE METAL FENCES AND GATES

PART - 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. The contractor shall provide all labor, materials and appurtenances necessary for installation of the industrial ornamental aluminum fence system defined herein at Danny Meehan Recreational Field Improvement.

B. The manufacturer shall supply a total industrial ornamental aluminum fence system which shall include all components (i.e., pickets, rails, posts, gates and hardware) required.

C. Section Includes:
   1. Decorative aluminum fences.
   2. Swing gates.

D. Related Sections:

   1. Division 03 CONCRETE for concrete post concrete fill.
   2. Division 31 EARTHWORK for site excavation, fill, and backfill where decorative metal fences and gates are located.

1.3 PERFORMANCE REQUIREMENTS

A. Lightning-Protection System: Maximum grounding-resistance value of 25 ohms under normal dry conditions.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For gates. Include plans, elevations, sections, details, and attachments to other work.

C. Samples: For each fence material and for each color specified.

   1. Provide Samples 12 inches (300 mm) in length for linear materials.

D. Welding certificates.

E. The manufacturer’s submittal package shall be provided prior to installation.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.

B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."

C. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.

1. Include 10-foot (3-m) length of fence complying with requirements.
2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

D. The contractor shall provide laborers and supervisors who are thoroughly familiar with the type of construction involved and materials and techniques specified.

1.6 REFERENCES

A. ASTM B117 – Practice for Operating Salt-Spray (Fog) Apparatus.

B. ASTM B221 – Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles and Tubes.

C. ASTM D523 – Test Method for Specular Gloss.

D. ASTM D822 – Practice for Conducting Tests on Paint and Related Coatings and Materials using Filtered Open-Flame Carbon-Arc Light and Water Exposure Apparatus.

E. ASTM D1654 – Test Method for Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments.

F. ASTM D2244 – Test Method for Calculation of Color Differences from Instrumentally Measured Color Coordinates.

G. ASTM D2794 – Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).

H. ASTM D3359 – Test Method for Measuring Adhesion by Tape Test.

PART - 2 PRODUCTS

2.1 PRODUCT HANDLING AND STORAGE

A. Upon receipt at the job site, all materials shall be checked to ensure that no damage occurred during shipping or handling. Materials shall be stored in such a manner to ensure proper ventilation and drainage, and to protect against damage, weather, vandalism and theft.

2.2 ALUMINUM

A. Aluminum, General: Provide alloys and tempers with not less than the strength and durability properties of alloy and temper designated for each aluminum form required. Aluminum material for fence framework (i.e., tubular pickets, rails and posts) shall conform to the requirements of ASTM B221. The aluminum extrusions for posts and rails shall be Alloy and Temper Designation 6005-T5. The aluminum extrusions for pickets shall be Alloy and Temper Designation 6063-T5.

2.3 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

1. For aluminum, provide type and alloy as recommended by producer of metal to be welded and as required for strength and compatibility in fabricated items.

B. Concrete: Normal-weight, air-entrained, ready-mix concrete complying with requirements in Division 03 CONCRETE with a minimum 28-day compressive strength of 3000 psi (20 MPa), 3-inch (75-mm) slump, and 1-inch (25-mm) maximum aggregate size.

C. Nonshrink Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107 and specifically recommended by manufacturer for exterior applications.

2.4 GROUNDING MATERIALS

A. Retain this article if fences and gates require grounding for lightning protection. See Evaluations.

B. Grounding Conductors: Bare, solid wire for No. 6 AWG and smaller; stranded wire for No. 4 AWG and larger.

1. Material above Finished Grade: Aluminum.
2. Material on or below Finished Grade: Copper.
3. Bonding Jumpers: Braided copper tape, 1 inch (25 mm) wide, woven of No. 30 AWG bare copper wire, terminated with copper ferrules.

C. Grounding Connectors and Grounding Rods: Comply with UL 467.

1. Connectors for Below-Grade Use: Exothermic-welded type.
2. Grounding Rods: Copper-clad steel.

a. Size: 5/8 by 96 inches (16 by 2440 mm).

2.5 DECORATIVE ALUMINUM FENCES

A. Decorative Aluminum Fences: Fences made from aluminum extrusions.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

a. Ameristar Fence Products, Inc.
b. Alumi-Guard, Inc.
c. Carfaro, Inc.
d. Delair Group, L.L.C.
e. Elegant Aluminum Products, Inc.
f. Elite Fence Products, Inc.
g. Iron Eagle Industries, Inc.

h. Japra Group International.
i. Jerith Manufacturing Company, Inc.
j. Master Halco.
k. Merchants Metals; a division of MMI Products, Inc.
l. Royal Aluminum and Steel, Inc.
m. Specrail; a division of Porcelen LLC.

B. Posts: Square extruded tubes.

1. Line Posts: 2-1/2 by 2-1/2 inches (64 by 64 mm).
2. End and Corner Posts: 2-1/2 by 2-1/2 inches (64 by 64 mm).
3. Swing Gate Posts: 3 by 3 inches (76 by 76 mm)
4. Gate End Post: 2 by 2 inches (50 by 50 mm)

C. Post Caps: Aluminum castings that project at least 1/4 inch (6 mm) beyond posts.

D. Rails: Extruded-aluminum channels, 1-3/4 by 1-3/4 inches (44.45 by 44.45 mm), with 0.070-inch- (1.78-mm-) thick sidewalls and 0.070-inch- (1.78-mm-) thick top. Picket holes in rail shall be spaced 4.715” o.c.

E. Pickets: Extruded-aluminum tubes, 1 inch (25 mm) square, with 0.062-inch (1.57-mm) wall thickness.

1. Terminate tops of pickets at top rail for flush top appearance.
2. Picket retaining rods shall be 0.125” diameter galvanized steel.
3. High quality PVC grommets shall be supplied to seal all picket-to-rail intersections.
4. Picket Spacing: 3-3/4” (95.25 mm) clear, maximum.

F. Fasteners: Manufacturer's standard concealed fastening system.

G. Fasteners: All fasteners to be stainless steel. Bracket to rail attachments shall be made using specially designed one-way tamperproof security bolts with inverted “t-nuts”. Bracket to post connections shall be made using self-drilling hex-head screws.

H. Fabrication: Assemble fences into sections by fastening pickets to rails per manufacturer’s specifications and instructions.

I. Completed panels shall be capable of supporting a 300 lb. load (applied at midspan) without permanent deformation. Panels shall be bias able to a 25% change in grade.

J. Finish exposed welds to comply with NOMMA Guideline 1, according to manufacturer’s specifications.

K. Finish: Baked enamel or powder coating.

2.6 SWING GATES

A. Gate Configuration: Double leaf.

B. Gate Frame Height: Gate A and Gate B: 72 inches (1830 mm).

C. Gate Opening Width: Gate A: 120 inches overall (3048 mm), Gate B: 144 inches overall (3657.6 mm).

D. Aluminum Frames and Bracing: Fabricate members from square extruded-aluminum tubes 2 by 2 inches (50 by 50 mm).

E. Frame Corner Construction: Per manufacturer specifications].

F. Additional Rails: Provide as indicated, complying with requirements for fence rails.

G. Infill: Comply with requirements for adjacent fence.

H. Picket Size, Configuration, and Spacing: Comply with requirements for adjacent fence.

I. Hardware: All necessary gate hardware shall be identified and specified on manufacturer's gate drawings. Gate hardware shall be provided by the manufacturer of the gate and shall be installed per manufacturer's recommendations.

J. Cane Bolts: Provide for both leafs of double swing gate. Fabricated from 3/4-inch- (19-mm-) diameter, round steel bars, hot-dip galvanized after fabrication. Finish to match gates. Provide galvanized-steel pipe strikes to receive cane bolts in both open and closed positions.

K. Finish exposed welds to comply with NOMMA Guideline 1, according to manufacturer's specifications.

L. Galvanizing: For items other than hardware that are indicated to be galvanized, hot-dip galvanize to comply with ASTM A 123/A 123M unless otherwise indicated. For hardware items, hot-dip galvanize to comply with ASTM A 153/A 153M.

M. Aluminum Finish: Baked-enamel or powder coating.

2.7 ALUMINUM FINISHES

A. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 2 mils (0.05 mm). Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

1. Color and Gloss: black.

PART -3 EXECUTION

3.1 EXAMINATION

A. Verify that survey is specified in Division 01 Section "Execution" or is otherwise available. Consider using sleeves to leave voids in new concrete substrates.

B. Examine areas and conditions, with Installer present, for compliance with requirements for site clearing, earthwork, pavement work, construction layout, and other conditions affecting performance of the Work.

C. Do not begin installation before final grading is completed unless otherwise permitted by Architect.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 500 feet (152.5 m) or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.

1. Construction layout and field engineering are specified in Division 01 Section "Execution"

3.3 DECORATIVE FENCE INSTALLATION

A. Install fences according to manufacturer's written instructions.

B. Install fences by setting posts as indicated and fastening fence panels to posts with brackets supplied by manufacturer.

C. Post Excavation: Drill or hand-excavate holes for posts in firm, undisturbed soil. Excavate holes to a diameter of not less than 4 times post size and a depth of not less than 36 inches (914.4 mm).

D. Post Setting: Set posts in concrete at indicated spacing into firm, undisturbed soil.

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. Concrete Fill: Place concrete around posts and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.

a. Exposed Concrete: Extend 2 inches (50 mm) above grade. Finish and slope top surface to drain water away from post.

3. Posts Set in Concrete: Extend post to within 6 inches (150 mm) of specified excavation depth, but not closer than 3 inches (75 mm) to bottom of concrete.
4. Space posts uniformly at 8 feet (2.44 m) o.c.

3.4 GATE INSTALLATION

A. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary.

3.5 GROUNDING AND BONDING

A. Fence Grounding: Install at maximum intervals of 1500 feet (450 m) except as follows:

1. Fences within 100 Feet (30 m) of Buildings, Structures, Walkways, and Roadways: Ground at maximum intervals of 750 feet (225 m) or as otherwise recommended by manufacturer.

a. Gates and Other Fence Openings: Ground fence on each side of opening.

1) Bond metal gates to gate posts.

2) Bond across openings, with and without gates, except openings indicated as intentional fence discontinuities. Use No. 2 AWG wire and bury it at least 18 inches (460 mm) below finished grade.

E. Protection at Crossings of Overhead Electrical Power Lines: Ground fence at location of crossing and at a maximum distance of 150 feet (45 m) on each side of crossing.

F. Fences Enclosing Electrical Power Distribution Equipment: Ground as required by IEEE C2 unless otherwise indicated.

G. Grounding Method: At each grounding location, drive a grounding rod vertically until the top is 6 inches (150 mm) below finished grade. Connect rod to fence with No. 6 AWG conductor. Connect conductor to each fence component at the grounding location.

H. Bonding Method for Gates: Connect bonding jumper between gate post and gate frame.

I. Connections: Make connections so possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.

1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer in order of galvanic series.
2. Make connections with clean, bare metal at points of contact.
3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
4. Make aluminum-to-galvanized-steel connections with tin-plated copper jumpers and mechanical clamps.
5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

J. Bonding to Lightning-Protection System: If fence terminates at lightning-protected building or structure, ground the fence and bond the fence grounding conductor to lightning-protection down conductor or lightning-protection grounding conductor, complying with NFPA 780.

3.6 FIELD QUALITY CONTROL

A. Retain this article if specified grounding testing in this Section suits Project. If there is extensive electrical work and electrical Contractor will be responsible for significant testing, consider revising below so grounding-resistance testing is electrical Contractor's responsibility.

B. Grounding-Resistance Testing: Engage a qualified testing agency to perform tests and inspections.

1. Grounding-Resistance Tests: Subject completed grounding system to a megger test at each grounding location. Measure grounding resistance not less than two full days after last trace of precipitation, without soil having been moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural grounding resistance. Perform tests by two-point method according to IEEE 81.
2. Excessive Grounding Resistance: If resistance to grounding exceeds specified value, notify Project Engineer promptly. Include recommendations for reducing grounding resistance and a proposal to accomplish recommended work.

3. Report: Prepare test reports certified by a testing agency of grounding resistance at each test location. Include observations of weather and other phenomena that may affect test results.

3.7 ADJUSTING

A. Gates: Adjust gates to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.

B. Lubricate hardware and other moving parts.

END OF SECTION 32 31 19

SECTION 328200 – LANDSCAPE IRRIGATION PUMP

PART - 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Other technical specification divisions:

1. 32 84 00 Planting Irrigation

2. 33 21 16 Irrigation Water Wells

1.2 WORK INCLUDED

A. The work included in this Section consists of furnishing all labor, equipment, and materials and performing all operations necessary for the construction or installation of all piping, valves, valve boxes and appurtenances for the pump system, complete and ready for operation as shown on the Drawings and specified herein.

1.3 PERFORMANCE REQUIREMENTS

A. Location of Pump and Motor: Design location is approximate. Make minor adjustments as necessary to avoid plantings and obstructions such as signs and light standards. Retain first paragraph below if Contractor is required to assume responsibility for design.Retain paragraph below with one of last two paragraphs above.

B. Minimum Working Pressures: The required pump performance with a maximum of 12 ft. of suction lift is as follows:

1. Discharge pressure of 65 PSI

2. Maximum required flow of 50 GPM

3. Minimum required flow of 25 GPM.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated in the drawings and this specification. Include make and model numbers with model specifications.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers that include an installer certified by the Irrigation Association.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. The Contractor shall obtain from the pipe manufacturers a certificate of inspection to the effect that the pipe and fittings supplied for this Contract have been inspected at the plant and that they meet the requirements of these specifications.

D. All pipe and fittings shall be subjected to visual inspection at time of delivery, also just before they are lowered into the trench to be laid, and joints or fittings that do not conform to these specifications will be rejected and must be removed immediately by the Contractor. The entire product may be rejected when, in the opinion of the Owner, the methods of manufacture fail to secure uniform results, or where the materials used are such as to produce inferior pipe or fittings.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver piping with factory applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.

B. Store plastic piping protected from direct sunlight. Support to prevent sagging and bending. Design Requirements:

PART - 2 PRODUCTS

2.1 POLYVINYL CHLORIDE PIPE AND FITTINGS:

A. Pipe:

1. Polyvinyl Chloride (PVC) plastic pipe 2-inches and larger in diameter shall conform to the requirements of ASTM Designation D 2241, Class 200 for a minimum pressure rating of 200 psi at 73.4 F. All PVC pipe shall bear the approval seal of the National Sanitation Foundation (NSF) for potable water pipe.

2. Polyvinyl chloride smaller than 2-inches shall conform to the requirements of ASTM Designation D 1785, Schedule 40 pipe with a minimum pressure rating of 200 psi at 73.4 for unthreaded pipe. Schedule 80 pipe shall be provided for threaded connections.

B. Fittings:

1. PVC pipe fittings 2-inches and larger shall be furnished by the manufacturer of the pipe with which they are used and conform to the requirements of ASTM Designation D 2467. All PVC pipe fittings shall bear the approval seal of the National Sanitation Foundation (NSF) for potable water pipe.

2. Fittings for PVC pipe smaller than 2-inches shall be Schedule 40 PVC with solvent weld joints and conform to the requirements of ASTM Designation D 2467 and D 2464 respectively.

C. Joints:

1. PVC pipe 2-inches and larger shall have provisions for expansion and contraction provided in the joints. All joints, except solvent weld and threaded joints, shall be a rubber ring push-on type joint.

2. Joints in PVC pipe smaller than 2-inches shall be solvent welded in accordance with the recommendations of the pipe manufacturer using the solvent welding compound furnished with the pipe.

D. Conduit: PVC - Schedule 40 with Underwriters' Laboratories label.

2.2 MANUFACTURER AND MODEL

A. The pump station for this project will be manufactured by Hoover Pumping Systems (Pompano Beach, Florida 954-971-7350), model number HCF-7.5CS-230/3-C,E-15,M,W,Z.

2.3 FIBERGLASS ENCLOSURE

A. The pump station shall be protected by a fiberglass enclosure with chemical and ultraviolet resistant open mold resin with exterior finish that is uniform in color and texture, reinforced with fiberglass and stiffeners for rigidity. The enclosure shall open clear of the equipment for ease of service with the aid of gas filled struts, a stainless steel hinge and latching lockable handle. The enclosure shall be of dimensions adequate to contain the pump system mounted on the skid as shown on the system detail.

2.4 MOUNTING ASSEMBLY

A. The pump station shall be mounted on a prefabricated aluminum or hot dipped galvanized skid. Pedestals shall be provided to mount the pump motor and control panel assemblies. The entire station shall be installed on a reinforced concrete slab sized as noted on the system detail.

2.5 PUMP AND MOTOR

A. The pump shall be a single-stage end-suction centrifugal type, with the liquid end mounted directly to the motor enclosure to allow rear pull out of the entire motor. A pressure sensor for loss of prime protection shall be mounted into the pump volute.

B. The system will be designed for operation at 3,450 RPM. The pump driving motor shall be of the squirrel cage induction type. The motor shall be suitable for full voltage starting at 60 Hz. The motor enclosure shall be totally enclosed fan cooled.

C. The main motor shall be rated at 7.5HP at 60 Hz. Motor will not exceed 10HP when only single phase electric service is available.

2.6 IRRIGATION PUMP CONTROL PANEL

A. The control panel assembly shall be Underwriters Laboratories listed in accordance with section 508A for “enclosed industrial control panels.” All control devices and electronic auto-sensory circuitry shall be housed in a self-contained weather-resistant NEMA 4 or 4X control cabinet. An electrical schematic shall be permanently mounted inside the cabinet. The control cabinet shall contain the following protection and control equipment:

B. Operation

1. The station operates as a clock start, clock retirement system. System features include Loss of Prime and No Flow protection. The system is equipped with ‘Loss Of Prime’ and ‘No Flow’ indicator lights, and a ‘Hand-Off/Reset-Auto’ (H-O-A) selector switch. The self-diagnostic control panel assembly includes LED status indicator lights for power failure, no flow, loss of prime, and pump run. Pump clock start relay, and auxiliary contacts are provided.

C. Clock Start

1. The pump starts when the irrigation controller (clock) begins a watering sequence.

D. Clock Retirement

1. The pump shuts off when the clock completes a watering sequence.

E. Loss of Prime Protection

1. If the pressure in the pump volute falls below 20 PSI for 45 seconds during pump operation, the pump will shut off and the 'Loss of Prime' light will turn on. The system will remain off until manually reset with the H-O-A selector switch.

F. No Flow Protection

1. If no flow is detected for 60 seconds during pump operation, the pump will shut off and the 'No Flow' light will turn on. The pump will remain off for 12 minutes and then will restart. The 'No Flow' light will remain on until manually reset with the H-O-A selector switch to notify the irrigation maintenance personnel of potential field valve failure.

G. Hand – Off / Reset – Auto Switch

1. The station is equipped with an H-O-A selector switch, which operates as follows:

a. Hand: Manual pump start. This position overrides all protective features and start controls.

b. Off / Reset: Pump will not run. This position resets all alarms

c. Auto: Pump will start automatically. In this position, all start controls and protective features are active.

H. Protection Equipment

1. Front operated main power disconnect

2. Time delayed motor starter fuses for motor short circuit protection

3. Full voltage class 10 IEC motor starter

4. Metal oxide varistors (MOV) for transient voltage suppression per phase

5. Fused control circuitry with blown fuse lighted indicator for each circuit

I. Specification

1. Electric service to be, in order of preference:

a. 460V 3-Phase (A, B, C, Ground)

b. 230V Closed-Delta 3-Phase (A, B, C, Neutral, Ground)

c. 208V Wye 3-Phase (A, B, C, Neutral, Ground)

d. 230V Open-Delta 3-Phase (A, B, C, Neutral, Ground)

e. 230V 1-Phase (A, B, Neutral, Ground)

f. 208V 1-Phase (A, B, Neutral, Ground)

2. Selection of 230V Open-Delta 3-Phase may require an increase in electrical equipment size to meet desired performance criteria.

2.7 PENETRATION STANDARD REQUIREMENTS

A. All control panel penetrations shall be performed by a licensed electrician to minimum NEMA 4X requirements, and compliant with International Electrotechnical Commissions (IEC) IP56 rating under its IP code, to protect against dust ingression and against any harmful effects from water projected in powerful jets from any direction and protection against corrosion.

2.8 FLOWMETER INLINE TURBINE

A. The flowmeter shall provide total and rate display with plus or minus 2% accuracy within its rated flow range at 14 to 228 psi. Reed switch provides pulse output. Body is constructed of cast iron with baked powder coating.

2.9 DISCHARGE PIPE MANIFOLD

A. The pipe discharge manifold shall be constructed of galvanized steel pipe with galvanized roll groove fittings. A flow-switch, pressure gauge and hose bib will be provided on the station discharge. A wafer type butterfly valve will be provided at pump station discharge.

2.10 INJECTION SYSTEM

A. An adjustable rate positive displacement pump shall be located inside the pump enclosure on or adjacent to the chemical tank connected to the pump system control panel and discharge pipe. The pump will have a pumping capacity of 6 to 30 gallons per day at up to 80 psi. The pump motor will be thermally protected and will stop pumping if the system backpressure exceeds the pump capacity. The tank will be made of polypropylene and have a capacity of 30 gallons with a refill hatch.

2.11 SUCTION LINE

A. The minimum size suction line shall be 3” diameter or larger as required for a maximum of 5 feet per second velocity flow. If a reducing fitting is required at the pump suction, an eccentric reducer shall be installed. Any above ground pipe at the pump system exposed to sunlight shall be schedule 40 galvanized steel with galvanized roll groove fittings. Suction pipe and fittings shall be HDPE heat fused.

2.12 WELL SOURCE

A. The pump suction line shall run from the pump to the customer supplied well tee with hot dipped galvanized or high density polyethylene HDPE piping. Swing check valve placed at the well tee.

2.13 IRRIGATION CONTROLLER

A. A Hunter ProC model 15 station irrigation controller and rain sensor shall be mounted on the pump system. The controller shall be powered from a fuse block in the pump system control panel. The controller shall activate the pump via a relay in the control panel.

PART - 3 EXECUTION

3.1 PREPARATION

A. All components shall be subject to inspection and approval by the Owner after delivery and no broken, cracked, misshapen, or otherwise damaged or unsatisfactory material shall be used. During shipping, delivery and installation of pump system shall be handled in such a

manner as to ensure a sound undamaged condition. When a defect is discovered, the injured portion shall not be installed.

B. At threaded joints between PVC and metal pipes, the metal shall contain the socket end and the PVC side the spigot. A metal spigot shall not, under any circumstances be screwed into a PVC socket.

3.2 DELIVERY, CONCRETE PAD AND INSTALLATION

A. The pump station manufacturer shall deliver the pump station to the site and place the station on a concrete pad poured by others to the manufacturer's specifications. The station shall be bolted to the pad using four 3/8" stainless steel machine bolt concrete anchors with 3/8" hex head stainless steel machine bolts and washers.

3.3 INTAKE LINE INSTALLATION

A. Intake line shall be installed to a water depth sufficient to meet intake requirements specified in the plans and manufacturer specifications.

3.4 ELECTRICAL HOOKUP

A. Electrical hookup shall be performed by a licensed electrician to minimum NEMA 4X requirements, and compliant with International Electrotechnical Commissions (IEC) IP56 rating under its IP code.

3.5 START UP, CALIBRATION, ON SITE TRAINING AND OPERATION MANUAL

A. The pump station manufacturer shall return to the project when the station is completely installed to start and calibrate the pump station. At the owner's request the pump station manufacturer shall also return to the site one time to provide on-site training to the owner's representative. The station manufacturer shall provide a bound operating manual. This operation manual shall not be generic for all voltages, hoses, and equipment options, but shall have all relevant information about the specific station and the equipment options actually built into the pump station.

3.6 FIELD QUALITY CONTROL

A. Flushing:

1. All lines shall be flushed prior to connection to the irrigation main line.

2. Flushing shall be terminated at the direction of the Owner.

3. The Contractor shall dispose of the flushing water without causing a nuisance or property damage.

B. Pressure and Leakage Testing:

1. General: All pumps, gauges and measuring devices shall be furnished, installed and operated by the Contractor and all such equipment, devices and their installation shall be approved by the Owner. All pressure and leakage testing shall be done in the presence of a representative of the Engineer as a condition precedent to the approval and acceptance of the system. Pressure and leakage testing shall be performed after installation of the pipe and before the sprinkler heads are installed. The open ends of the pipe shall be provided with temporary caps to permit testing.

2. Allowable Limits for Leakage of Pressure Piping: The hydrostatic pressure tests shall be performed as here-in-above specified and no installation, or section thereof, will be accepted until the leakage is less than the number of gallons per hours as determined by the formula:

$$L = \frac{SD(P)1/2}{133200}$$

in which,
L = Allowable leakage, in gallons per hour
S = Length of pipe being tested in feet
D = Nominal pipe diameter; in inches
P = Average test pressure during the test, in psi gauge

a. Water shall be supplied to the line during the test period as required to maintain the test pressure as specified. The quantity used, which shall be compared to the above allowable quantity, shall be measured by pumping form the calibrated container.

b. Where leakage exceeds the allowable limit, as specified herein-before, the defective pipe or joints shall be located and repaired. If the defective portions cannot be located, the Contractor shall remove and reconstruct as much of the work as is necessary in order to conform to the specified limits. No additional payment will be made for the correction of defective work, or to damage to other parts of the work resulting from such corrective work.

C. Training of Maintenance Personnel in Operation and Maintenance of System: The Contractor shall provide for training of Owner's maintenance personnel in the operation and maintenance of the system. The training program shall be conducted for a period of not less than four hours.

3.7 WARRANTEE

A. Prior to shipping, the manufacturer shall flow test the system and submit a certified report to the designer stating the system is within 1% + or – of the specified flow rate and pressure, and meets the operational requirements.

B. The manufacturer of the pumping station shall warrant all components for a period of one (1) year from date of manufacture.

END OF SECTION 32 82 00

SECTION 328400 - PLANTING IRRIGATION

PART - 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Other technical specification divisions:

1. 32 82 00 Landscape Irrigation Pump

2. 32 91 13 Reinforced Sod

3. 32 92 23 Sodding

4. 32 93 00 Trees, Shrubs, & Groundcovers

5. 33 21 16 Irrigation Water Wells

1.2 PROJECT DESCRIPTION

A. The irrigation installation contractor, hereafter referred to as the “Installer,” shall provide all materials, labor, tools, equipment, construction permits, inspections and all other items required for the execution and completion of the irrigation work for areas of the project as herein specified and indicated in the Contract Documents.

B. The completed system shall be fully operational from the electric irrigation controllers, wires and valves indicated in the contract documents. The system shall apply a uniform amount of water to the coverage areas. All equipment shall be installed and operated per the manufacturer's specifications.

C. The Installer shall verify prior to starting the irrigation system installation that the electrical circuits for the irrigation equipment are to be installed, available and coordinated with the site electrical, utility or general contractor as indicated in the irrigation contract documents.

D. All work shall comply with city and county construction, safety and health codes for water supplies, electrical circuits, and the installation of irrigation systems.

1.3 GUARANTEE AND MAINTENANCE

A. All materials shall be new and fully guaranteed for one year to be without defect, and of commercial irrigation quality or better. The installed system is guaranteed by the Installer for one year from date of written acceptance to give uniform distribution and even coverage.

B. Maintenance of the system includes raising and lowering of heads, cleaning and adjustment of heads, raising and lowering of trenches, replacement of sod when required, and assurance that the system will give full and adequate coverage. Maintenance of the system shall be provided by the Installer at no charge until one full year after final written acceptance.

1.4 SUBMITTALS

A. The system design is based on the operating characteristics of the irrigation equipment listed in the contract documents. Therefore, all submittals must meet or exceed the operational

characteristics of the equipment listed in the contract documents. Provide six bound copies of irrigation equipment submittals for review prior to purchasing irrigation equipment.

1.5 SPECIAL REQUIREMENTS

A. Comply with all local and state codes, ordinances, safety orders, and regulations of all legally constituted authorities having jurisdiction over this work, including but not limited to electrical and plumbing installations. The installer shall acquire an irrigation system construction permit if required by the local building and permitting agency.

B. The Installer shall make sufficient provisions that the owner's property will not be damaged by any construction operation. Any damage as a result of the installer's work shall be brought back to the original condition by the installer, including but not limited to soils, slopes, drainage, paving, structures, grasses, plants, trees or utilities. The installer shall assure any existing irrigation systems remain operational during this phase as required by Contract Documents.

C. The Installer shall schedule all work so that there is no conflict with the visitors, staff of the owner or utility services at the property. Utilities are not indicated in the irrigation contract documents. The Installer shall verify the location of all utilities in the field according to state law.

D. The Installer shall provide updated AutoCAD drawing files of the irrigation installation "as built" irrigation plan to the Owner at 50% and 100% project milestones. The "as built" plans shall be prepared in accordance with section 3.8.C of these specifications.

PART - 2 PRODUCTS

2.1 POLYVINYL CHLORIDE PIPE AND FITTINGS

A. PVC pipe shall be continuously permanently with the following information: name, pipe size, type of pipe and material Schedule, ASTM standard number, and the NSF (National Sanitation Foundation) seal.

B. All irrigation mainline shall be Schedule 40 PVC pipe; lateral line piping shall be Class 200 PVC pipe. All irrigation sleeving shall be Schedule 40 PVC pipe.

C. All PVC solvent weld and threaded nipples shall be Schedule 80.

D. Use solvent weld pipe and fittings for 2" pipe sizes and less. Use solvent weld by threaded outlet service tees with schedule eighty thread by thread nipples at each control valve service tee location for all pipe sizes.

E. Use gasket joint pipe and Sch. 40 gasket joint fittings for 3" pipe sizes and greater.

F. Provide concrete formed and poured thrust blocks at each directional joint and fitting on mainline pipe. Thrust blocks shall be minimum one cubic foot of concrete and poured against a virgin soil wall.

2.2 WIRE, CABLE & SPLICE MATERIAL

A. All remote control valve wire, cable and wire splice material shall be provided as necessary and as indicated on the irrigation Contract Documents.

2.3 SPRINKLER HEADS

A. Sprinkler heads, bodies, swing joints, and nozzles shall be provided as indicated on the irrigation Contract Documents.

B. Install all heads on playing surfaces of sports fields so that the cap is ½" below the final turf layer level to minimize potential injury to athletes.

2.4 VALVES AND VALVES BOXES

A. All irrigation valves shall be provided as indicated on the irrigation plans. Field adjust locations as needed. Adjust valve locations that conflict with focal points, traffic lanes, or athletic playing surfaces in the field. Locate valve boxes adjacent sports fields to minimize the potential for injury to athletes.

B. All electric control and quick coupler valves shall be installed with a minimum of 2" horizontal clearance of the valve box sides, and the valve stem shall have a 4" minimum and 6" maximum vertical clearance of the valve box lid for ease of valve services.

C. Isolation valves 2.5" and less shall be bronze thread on type gate valves with wheel operation handle.

D. Isolation valves 3" and larger shall be cast iron push on or mechanical gasket joint valves with a wheel handle. All isolation valves shall be mounted in plastic black color 10" round valve boxes with 6" drain pipe extension as needed.

E. Electric Control Valve Boxes shall be minimum 20" x 15" rectangular size and plastic material. Quick Coupler Valve Boxes shall be minimum 10" round size and plastic material. Install top of lid 1" above finished grade, to be flush with top of sod or mulch layer, for each valve location shown on the drawings. Do not install any two valves in the same box. Manufacturer's specification and installation instructions for control valves shall become a part of these specifications.

PART - 3 EXECUTION

3.1 EXCAVATION, BACKFILL, AND SAFETY PRECAUTIONS

A. All excavation in this contract shall be unclassified and is to include earth, loose rock, rock or any combination thereof, in wet or dry state. The Installer may use a vibratory plow to pull irrigation pipes into the ground for the system.

B. It shall not be necessary for the Installer to remove any turf or sod before trenching or pulling.

C. All trenches shall be backfilled with the materials removed and shall conform to adjacent grades without dips, sunken areas, humps, or other irregularities.

D. The Installer shall take precautions to avoid accidental injury to persons and pedestrians in the project area. At no time shall equipment or materials be stored on walkways. Materials, pipes and other items shall be stored in one designated, and approved, storage area away from pedestrian traffic.

E. All suitable backfill material shall be loaded into the trench in four-inch lifts. Each lift shall be tamped or flooded in order to prevent after settling. The Installer may leave a three-inch soil layer over trenches to accommodate for initial settling. After initial settling, and prior to

establishment of the surface treatment, all excavated areas shall be hand raked to leave the soil grade in as good or better condition than before excavation.

F. Should settlement of the grade over irrigation trenches occur, the Installer shall be required to remove surface vegetation, refill soil to proper grade, and replace the surface treatment without extra cost to the owner. In turf areas where excavated settling is less than one inch, the Installer may bring the settled area back to grade with a sand top-dress process. The Installer shall perform this work as necessary during the guarantee period.

G. Existing trees and shrubs shall not be damaged. Route all trenches outside of tree drip lines to minimize damage to existing tree roots. When necessary, the Installer shall excavate under or around any major tree roots. Major tree roots shall not be cut.

H. It is understood that the piping layout is diagrammatic and piping shall be routed around existing underground pipes or utilities in such a manner as to avoid damage to these elements. The Installer shall have all existing pipes and utility lines located within the work area before any trenching. Any damage and subsequent repair of streets, walks, pipes, and utility lines shall be the responsibility of the Installer.

3.2 PIPE INSTALLATION

A. The piping between the source of water supply and the electric control valves which is under constant pressure is hereinafter referred to as the "main line" in this project. The piping on the discharge side of the control valve that connects the sprinkler heads to the valve is hereinafter referred to as the “lateral line”.

B. All electric control valves, drain valves, isolation valves and quick coupler valves shall be installed on the main line. Maintain at least 18” of fill over all main line pipes. Maintain at least 12” of fill over all lateral line pipes.

C. All lumber, rubbish, and large rocks shall be removed from the excavated trenches. Wedging or blocking pipe is not permitted. Do not glue and install PVC pipe when temperature is 32 degrees F. or below. Install solvent weld fittings and pipes level and plumb in all directions. Backfill trenches with 4” soil lifts and compact or water jet each lift to remove air pockets in soil backfill.

D. Provide one cubic foot minimum concrete thrust block at each directional fitting on the mainline. Thrust block shall be formed and poured against a wall of virgin soil.

3.3 PVC PIPE AND FITTING ASSEMBLY

A. Cleaning: All foreign matter or dirt shall be removed from inside and outside of pipe before gluing, and piping shall be kept clean by approved means during and after installation of pipe.

B. All glue joints shall be made using PVC primer and PVC medium bonded cement as recommended by the manufacturer.

C. Flush all pipelines with water within twenty-four hours of installation to remove excess glue that may collect at pipe joints and fittings.

D. All threaded fittings on the main line side of the control valves shall be made watertight with the use of Teflon tape preparation.

3.4 CONTROL VALVE WIRING

A. Wire from the electric irrigation controller to the control valves, and wire splices, shall be supplied in accordance with the irrigation Contract Documents.

B. No conduit is required for the control wires when they are laid in trenches provided for main line piping as indicated on the drawings. Where control wires are installed remotely of mainline piping, install control wires in wire conduit, and provide a continuous strip of metal detector tape 12” above the topside of the wire conduit.

C. At the connections of the control wires to the control valves, create a wire expansion coil by turning each wire around a 1" pipe ten times.

D. The Installer shall make all provisions for mounting and wiring in the controller and the control wires as indicated on the Contract Documents.

3.5 FINAL ADJUSTMENT

A. The system shall be completely flushed to remove any and all debris from the lines prior to mounting the sprinkler heads onto the flex joints and/or swing joints.

B. After all sprinkler heads have been properly mounted and top of sprinkler bodies are flush with surrounding grade, install all sprinkler nozzles and adjust for proper radius and arc of throw.

C. Adjust each control valve flow stem to the proper operating position for the valve zone flow demand. This position is found by turning the flow control stem down until the spray of the sprinklers is slightly reduced.

3.6 PRESSURE TESTING PROCESS

A. Once the mainline and irrigation valves have been installed; the Installer shall center load the mainline piping leaving all mainline connections and joints exposed and visible for inspection.

B. The Installer shall mount a water pressure gauge on a quick coupler key for verification of the pressure test process. The Installer shall isolate no more than 1000’ of the mainline for any one test. The Installer shall charge the mainline with 90 PSI static water pressure. The mainline shall remain isolated and pressurized for two hours under the Owner’s supervision.

C. If more than ONE (1) PSI water pressure drop occurs during the testing process, the Installer shall repair the leak and repeat the test process.

D. The Owner shall notify the Installer upon successful completion of the test process. Upon notification of completion of testing, the Installer may completely backfill and cover the mainline.

3.7 PRELIMINARY INSPECTION

A. Upon completion of all previous items, the Installer shall inspect the system. The Installer shall provide two assistants and two 2-way radios to help in the operation of the system.

B. Should any items be found which do not meet the requirements of the drawings or these specifications they will be flagged and listed on a preliminary inspection punch list. The Installer shall provide a sufficient amount of wire flags at the inspection to flag all punch list items.

C. Prior to the preliminary inspection of the irrigation system the Installer shall provide the completed AutoCAD drawing file and scaled plot of the AutoCAD "as built" drawing showing to scale accurate locations of mainlines, valves and electrical splices as installed in the construction phase. The as built plan shall indicate at least two exact measurements from the material's location to a fixed object or other irrigation system component.

3.8 FINAL INSPECTION

A. The Installer shall make all repairs listed on the preliminary inspection punch list and complete all pressure tests prior to requesting the final inspection. Provide a list of completed punch list items and the results of the entire pressure test process to the Owner.

B. After all corrected punch lists and pressure test reports have been submitted, the Installer may request a final inspection of the irrigation system operation. If all items are found to be complete and in proper working order the Owner will issue a letter of substantial completion.

C. If all items are not completed and are not in proper working order at the time of the final inspection, the Installer shall be responsible for the cost of any additional site visits by the Owner, including travel expenses.

3.9 GUARANTEE AND MAINTENANCE

A. After receipt of the letter of substantial completion, the Installer shall guarantee for one year all materials and workmanship within the system as these specifications call for.

B. During the guarantee and maintenance period, the Installer shall return to the site at the request of the owner to repair any elements or materials in the system that have failed, fallen out of adjustment, or have broken due to work performed during installation. The Installer shall provide all labor and materials to bring the system back to a full and correct operational condition.

C. The Installer shall also make any repairs to the turf or shrub areas where the finished grade has changed due to settling trenches.

D. At the end of the guarantee and maintenance period, the Owner shall inspect the system to make sure that the guarantee and maintenance provisions have been complied with.

3.10 CONTRACTOR USE OF PREMISES

A. Confine operations at site to areas permitted by:

1. Law

2. Ordinances

3. Permits

4. Contract Documents.

B. Do not unreasonably encumber job site with materials or equipment.

C. Do not load any part of structures with weight that will damage or endanger the structure.

D. Assume full responsibility for protection and safekeeping of products stored on premises.

E. Move any stored products that interfere with operations of Owner or other contractor.

F. Maintain ‘good housekeeping’ at all times around the site.

G. Use of site: Comply with Owner’s requirements for:

1. Access and egress procedures.

2. Requirements for identification of workers.

3. Prohibition against firearms.

4. Restrictions on watercraft.

5. Procedures for transportation of workers.

6. Requirements for security inspections of:

a. Storage facilities.

b. Vehicles.

c. Tool boxes and lunch pails.

7. Safety and fire prevention requirements.

8. Pollution control regulations.

9. Weather emergency procedures.

H. Lunch area: Locate all break areas outside the immediate view of the public, guests, or employees.

I. And such other rules and procedures as the Owner may establish from time to time for it is entire property, job site, and the project.

J. The Maintenance /Equipment Yard: Submit for Owner’s review location(s) desired for storage and staging yard: yard location shall be within the site area.

3.11 OWNER’S RIGHT TO ACCESS FOR OBSERVATION OR OTHER WORK

A. Owner reserves the right of access to any part of the Work, at any time, for the purpose of observation, or to install other work, either with its own forces or with other contractors. Such access is not to be construed to mean partial occupancy by Owner, and claim for additional compensation by the Contractor because of such access.

B. Cooperate with Owner during Owner’s access for observation of work, and coordinate work with the Owner’s requirements.

C. Work shall not be allowed unless the Owner is present on the site to observe the operations. Any work done without the proper observation will be subject to removal/replacement as required by the Owner at no additional cost to the Owner.

3.12 PREMIUM TIME WORK

A. Premium time work within the scope of the project shall be deemed to be included in the Contract Price and the responsibility of the Contractor, with no claims for premium time recognized as legitimate Contract Price change.

3.13 WORK DONE OUTSIDE NORMAL HOURS

A. Contractor shall notify Owner in writing forty-eight (48) hours in advance of any of the Contractor's personnel or subcontractor's personnel working or having cause to be on the premises beyond normal working hours.

B. During any work performed outside the normal hours as defined within the GENERAL CONDITIONS FOR THE CONTRACT FOR CONSTRUCTION by either the Contractor or the Contractor's subcontractor, the Contractor shall have on-site, full time, EITHER THE PROJECT MANAGER OR THE SENIOR PROJECT SUPERINTENDENT in order to supervise the work of their own forces or subcontractors. Should the noted representative NOT be on-site during this work, the Owner or Construction manager reserves the right to order the work stopped. All costs associated with this representative(s) shall be a part of the base Scope of Work.

C. All night work shall be requested in writing a minimum of 48 hours in advance. Approval of work is at the discretion of the Owner.

D. A minimum of 10 foot-candles of temporary lighting is to be provided in all areas where work is performed.

E. No Work is to proceed without prior approval of the Owner.

F. Noise levels to be kept to a satisfactory level to avoid impacting adjacent properties.

END OF SECTION 32 84 00

SECTION 329223 – SODDING

PART - 1 GENERAL

1.1 WORK INCLUDED

A. The work specified in this section consists of the establishing of a strand of grass, within the areas indicated on the Contract Documents, by the furnishing and placing of grass, sod, fertilizing, watering and maintaining the sodded areas to assure a healthy stand of grass.

1.2 SUBMITTALS

A. Contractor shall submit product certifications of sod, manufactured topsoil, and fertilizers.

B. A certification of sod quality by the producer shall be delivered to the Owner or his representative ten days prior to use.

1.3 WARRANTY

A. All sodded areas are to be fully grassed and show satisfactory growth by the end of the maintenance period.

B. Any areas that are bare, dead or not showing satisfactory growth, as determined by the Engineer, prior to final acceptance, shall be treated to establish satisfactory growth and shall be warrantied for an additional 90 days. Treatments may consist of but not limited to: fertilization, watering, herbicide application or re-sodding.

C. “Satisfactory growth” is defined as even plant growth in healthy, well rooted, even-color condition free of bare spots, open joints, weeds, and surface irregularities.

D. Areas that are re-sodded shall use the same sod as specified in Part-2 of this specification and the plans.

PART - 2 PRODUCTS

2.1 GRASS SOD

A. Grass sod shall be one of the following as shown on the plans:

1. St. Augustine `Floratam'

2. Argentine Bahia

3. Bermuda ‘Celebration’

B. Sod shall be well matted with grass roots. The sod shall be live, fresh and uninjured at the time of planting. It shall be free of weeds and other grasses. It shall have a soil mat of sufficient thickness adhering firmly to the roots to withstand all necessary handling. The sod shall be planted as soon as possible after being dug and shall be shaded and kept moist until it is planted.

2.2 MANUFACTURED TOP SOIL

A. Provide a clean manufactured top soil for areas sodded with the Bermuda ‘Celebration’ consisting of 90 percent clean sand and 10 percent organic content. Organics shall be partially

decomposed moss peat of native peat.

2.3 FERTILIZER

A. Commercial fertilizers shall comply with the state fertilizer laws.

B. The numerical designations for fertilizer indicate the minimum percentages (respectively) of (1) total nitrogen, (2) available phosphoric acid and (3) water-soluble potash contained in the fertilizer.

1. The chemical designation of the pre-fertilizer shall be 9-18-10.

2. The chemical designation of the post-fertilizer shall be 12-8-8.

C. At least 50 percent of the phosphoric acid shall be from normal super phosphate or an equivalent source which will provide a minimum of two units of sulfur. The amount of sulfur shall be indicated on the quantitative analysis card attached to each bag or other container.

2.4 WATER FOR GRASSING

A. The water used in the sodding operations may be obtained from any approved spring, pond, lake, stream or municipal water system. The water shall be free of excess and harmful chemicals, acids, alkalies, salt, or any substance which might be harmful to plant growth or obnoxious to traffic. Water shall be provided and paid for by the Contractor, who shall also furnish adequate watering equipment.

PART - 3 EXECUTION

3.1 PREPARATION OF GROUND

A. Examine areas to be planted for compliance with requirements and other conditions affecting the performance. Proceed with installation only when unsatisfactory conditions have been corrected.

B. The area over which the sod is to be placed shall be scarified or loosened to a suitable depth and then raked smooth from rocks or stones. Where the soil is sufficiently loose, the Owner or his representative, at this discretion, may authorize elimination of ground preparation.

C. For areas to be sodded with the Bermuda ‘Celebration’, place a minimum 3 inch depth of manufactured topsoil to meet finished grade after a light rolling. Grade to a uniform surface plane with a loose uniform fine texture. Laser grade to within ½ inch of the proposed finished elevation. Remove all ridges and fill depressions to meet a uniform, smooth finished grade. Do not spread topsoil if sub-grade is muddy or excessively wet.

D. Before laying sod, obtain written acceptance of finish grading.

E. Moisten prepared areas before laying sod if soil is dry. Water thoroughly and allow surface to drain before laying sod. Do not create a muddy soil.

3.2 APPLICATION OF FERTILIZER

A. Immediately before laying sod, apply the pre-fertilizer at a rate of 400 pounds per acre. Spread with a spreading device capable of uniformly distributing the fertilizer at the specified rate.

B. On steep slopes, where the use of a machine for spreading or mixing is not practicable, the fertilizer shall be spread by hand and raked in.

C. Two weeks after the sod has been laid, the post-fertilizer shall be spread uniformly over the area sodded at the rate of 500 pounds per acre, by a spreading device capable of uniformly distributing the material at the specified rate.

3.3 PLACING SOD

A. The sod shall be placed on the prepared surface, with edges in close contact and shall be firmly and smoothly embedded by light tamping with appropriate tools.

B. Where sodding is used in drainage ditches, the setting of the pieces shall be staggered areas, the offsets of individual strips shall not exceed 6 -inches. In order to prevent erosion caused by vertical edges at the outer limits, the outer pieces of sod shall be tamped so as to produce a feather edge effect.

C. On steep slopes, the Contractor shall, if so directed by the Owner or his representative, prevent the sod from sliding by means of wooden pegs driven through the sod blocks into firm earth, at suitable intervals.

D. Sod which has been cut for more than 72 hours shall not be used unless specifically authorized by the Owner or his representative after his inspection thereof. Sod which is not planted within 24 hours after cutting shall be stacked in an approved manner and maintained and properly moistened. Any pieces of sod which, after placing, show an appearance of extreme dryness shall be removed and replaced by fresh, uninjured pieces.

E. Sodding shall not be performed when weather and soil conditions are, in the Owner's opinion, unsuitable for proper results.

F. Immediately after laying sod, lawn areas shall be rolled with a lawn roller customarily used for such purposes, then water thoroughly. Top dress with clean sand as necessary to fill in voids between sod panels or to even out inconsistencies in the sod surface.

3.4 WATERING

A. The area on which the sod is to be placed shall contain sufficient moisture, as determined by the Owner or his representative, for optimum results. After being placed, the sod shall be kept in a moist condition to the full depth of the rooting zone for at least 2 weeks. Thereafter, the Contractor shall apply water as needed until the sod roots and starts to grow until final acceptance of the project.

3.5 MAINTENANCE

A. The Contractor shall, at his expense, maintain the sodded areas in a satisfactory condition beginning from immediately after planting until final acceptance of the project. Such maintenance shall include mowing and repairing of any damaged areas and replacing areas in which the establishment of the grass stand does not appear to be developing satisfactorily.

B. Bermuda turf areas must be maintained for a minimum of 60 days from planting, but maintenance must continue until a healthy, well rooted, even colored, viable turf is established. Maintenance includes watering, fertilizing, weeding, mowing, trimming, and any other operations required to establish a healthy, viable turf.

C. Replanting or repair necessary due to the Contractor's negligence, carelessness or failure to provide appropriate maintenance shall be at the Contractor's expense.

END OF SECTION 32 92 23

SECTION 329300 – TREES, SHRUBS, AND GROUNDCOVERS

PART - 1 GENERAL

1.1 WORK INCLUDED

A. The work included in this Section consists of furnishing, planting, watering, fertilizing, pruning, and mulching all plants of the species, size and quality in the locations indicated on the Drawings and Specifications or as directed by the Owner or the project Landscape Architect.

B. Further, the work shall include the maintaining of all plants and planting areas until acceptance by the Owner, and the fulfilling of all warranty provisions as herein specified.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. The following other related sections:

1. Section 32 84 00 Irrigation

2. Section 32 91 13 Reinforced Sodding

3. Section 32 92 23 Sodding

1.3 SUBMITTALS

A. Qualifications Data:

1. Prior to starting work, the nurseryman or landscaper shall provide a list of three planting projects completed in the past two years with names and location of project, owner and owner's representative in charge of project. This information must prove the nurseryman or landscaper is qualified to provide satisfactorily for this project.

2. The nurseryman or landscaper shall provide evidence of the onsite planting foreman's experience. Should there be a change of foremen, additional evidence of experience shall be provided.

B. Product Data:

1. Plant Materials: It is best that a nursery visit be performed with the owner’s representative before the purchase and delivery of plant materials for the project. Trees will be tagged specifically for this project and sample shrub material photographed as approved. If a nursery visit cannot be performed, color photographs of sample plant material may be provided. Photographs must be submitted in a digital format of each required species. Photographs must depict the true size and condition of the plant material to be furnished. Photographs shall include a measuring rod our other measuring devise showing the size of the plant. Each photograph shall include the botanical name of the species depicted in the photograph. I either case, final approval of plant material will be performed at the time of delivery. Plants must meet requirements in Part 2.

2. Fertilizer: Provide product label of the chemical composition of fertilizer to be used in the installation of each type of plant.

3. Pesticides and Herbicides: Provide product label and manufacture's application instructions to be used.

4. Organic Additive: Provide type and composition of organic material to be used as part of the Standard Planting Mix as defined in Part 2. Provide sample of one cubic foot for approval.

5. Mulch: Provide type and composition of mulch to be used. Provide sample of one cubic foot for approval.

6. Provide soil test confirming soil pH, fertility, and organic composition for topsoil to be used.

C. Submit planting schedule showing scheduled dates for each type of planting in each area of site. Submit revised schedule when departure from the original schedule is necessary.

D. Maintenance Instructions: Submit typewritten instructions recommending procedures to be established by Owner for maintenance of landscape work for one full year. Submit 10 days prior to final inspection date.

E. Record Drawings: Submit drawings clearly showing all changes made during execution of the Work.

1.4 DELIVERY, STORAGE AND HANDLING

A. Transportation and Inspection: Plant transportation shall comply with all Federal and State regulations therefore and, upon delivery at the site, all plants shall be inspected for conformity to Specifications and for handling damage. Rejected plants shall be immediately removed from the site by the Contractor. In addition, any required inspection certificates shall accompany each shipment, and shall be filed with the Owner or the project Landscape Architect.

B. Balled and Burlapped Materials: The root ball of these plants shall be properly protected until they are planted. The plant shall be handled and delivered with roots adequately protected against drying out by means of moist straw, or other approved material. Shipping containers shall be opened and inspected by the Contractor upon arrival and shall be dampened if necessary. Plants which are not to be immediately planted shall be "heeled-in", in an approved manner, in moist earth or other suitable medium, and shall be properly cared for until planting.

1.5 SUBSTITUTIONS

A. Plants specified on the Drawings shall be used unless sufficient evidence is submitted to Owner or the project Landscape Architect indicating plant is unavailable. Alternate material may be used only upon receipt of Field Order of Change Order authorization.

B. No substitutions shall be made without written approval of the Owner or the project Landscape Architect.

1.6 ADJUSTMENTS AND ALTERATIONS

A. Substitutions of container grown material may be substituted for any other root classification

types, with approval by the Owner or the project Landscape Architect, when all other requirements and specifications are adhered to.

B. Quantity Adjustments: Should materials in excess of quantities estimated be required, in opinion of the Owner, the Contractor shall provide extras at same unit prices; should quantities less than estimated be required, similarly, credits shall be given to the Owner. The Contractor shall not install extra or omit materials unless authorized by written order.

C. Alterations: The Owner or its agent also reserves the right to make alteration of the Drawings and work throughout the Contract, if an equitable negotiation can be made with the Contractor.

1.7 WARRANTY

A. The Contractor shall warranty all planting work for a period of 180 days after the date of provisional acceptance, during which period the Contractor shall continue maintenance of the plants. This warranty period is also considered the establishment period.

B. During the warranty period, the Contractor shall replace at no cost to the Owner any plant required under the Contract that dies or is not established, if the causes for such defects are traced to negligence or to Contractor's or workmanship by the Contractor. Any plants missing or defective due to Contractor's negligence shall be furnished or replaced in a manner satisfactory to the Owner or the project Landscape Architect. In case of any doubt as to the condition and satisfactory establishment of a plant, the Owner or the project Landscape Architect may allow such a plant to remain through another establishment (180 days) period at which time the plant in question, if found to be in a non-thriving condition, shall be replaced by the Contractor at no cost to the Owner.

C. Replacement of Defective Plants: Any plants showing indication of probable non-survival or lack of health and vigor, or which do not exhibit the characteristics and conditions such as to still qualify for minimum grade as originally specified and, in the opinion of the Owner or its agent, will not recover and be within grade by the end of the establishment period, shall be replaced by the Contractor with a plant of the specified grade, within a period of one week from the item of written notice to him from the Owner.

D. The Owner reserves the right to hold the counting of the establishment period until such time as the Contractor performs the responsibilities set out in these paragraphs, such as the weeding of the beds and individual plants, watering, etc. When the Contractor has satisfactorily rectified these conditions the Owner will resume counting the establishment period.

PART - 2 PRODUCTS & MATERIALS

2.1 GENERAL:

A. Plants Required: The Contractor shall furnish all plants, trees and shrubs of the species and in the quantities shown on the Drawings and listed in the Proposal.

B. Nomenclature: All trees, shrubs and plants shall be true to name as established by the American Joint Committee on Horticultural Nomenclature publication "Standard Plant Names". The designated authority for the identification of all material shall be the two publications of L.H. Bailey, "Hortus II" and "Manual of Cultivated Plants", and all specimens shall be true to type, name, etc., as described therein.

C. Grade Standards and Quality: All plants shall be nursery grown and shall comply with all

required inspection, grading standards and plant regulations as set forth in the Florida Department of Agriculture "Grades and Standards For Nursery Plants".

1. The minimum grade for all trees and shrubs shall be Florida No. 1 unless otherwise indicated and all plants shall be sound, healthy and vigorous, well branched and shaped within normal habit of growth, of proper color, and densely foliated when in leaf. They shall have healthy, well developed root systems and shall be free of disease and insect pests, eggs or larvae.

2. All plants shall conform to the measurements specified or indicated by all code requirements and the desires of the owner. Plants larger than specified may be used if approved by the Owner or the project Landscape Architect, but use of such plants shall not increase the Contract price. The spread of roots or ball of earth for larger plants shall be increased in proportion to the size of the plant.

3. In the event that it becomes apparent that any nursery supplying plants for this work has knowingly and consistently represented the grade of plants as being higher than the actual grade as determined by the plant list according to "Grades and Standards for Nursery Plants", all plants already delivered from such source shall be removed from the job at the Contractor's expense, and no further plants will be acceptable form such nursery until written evidence is submitted and confirmed that all material for delivery has been inspected and approved by the Owner or the project Landscape Architect as being of the grade as represented.

D. Contract grown plant materials or specimen plant materials: Shall be tagged with sealing tag at place of growth after visual approval of both the Owner's representative and nurseryman or landscaper. Plants shall be tagged soon after contract is signed, not longer than 90 days; at the sizes which will be contract size within completion time of the Contract. All other material of landscape size will be tagged by Contractor after three sample plants have been approved at place of growth, to show typical range of acceptance. Contractor shall insure that purchased materials receive proper and normal maintenance by nurseryman during growing period.

E. Material Quantities:

1. Materials List: Major materials and components of work will be categorized and listed in Drawings. Other material indicated in Specifications or Drawings may be necessary to complete components as listed and/or complete entire job.

2. Discrepancies: Each item or component has been estimated in quantity units common to landscape construction trade. If quantities of plants or other materials appear to be in conflict, insufficient or in excess, prior to submitting bid proposals notify Owner promptly for clarification.

2.2 PLANT MATERIALS:

A. Designation: With reference to method of cultivation, root system status, etc., plants for landscaping shall be classified under the following designations:

1. Balled-and-Burlapped (B&B)

2. Wired Balled-and Burlapped) (WB&B)

3. Container-Grown (CG)

4. Collected Plants (C)

5. Bare Root (BR)

B. Balled and Burlapped:

1. Balled and burlapped plants shall be dug with firm natural root balls of earth, meeting the size requirements of the Florida Department of Agriculture "Grades and Standards For Nursery Plants". The root ball of these plants shall be properly wrapped with burlap sack material and remain protected and wet until they are planted. The plant shall be handled only by the earth ball and not by the plant itself. All balled and burlapped plants which cannot be planted immediately upon delivery shall be set on the ground and shall be well protected with soil, wet moss, or other acceptable material. The plants shall be set with the burlap cover intact and with the burlap showing, until inspection.

2. As a specific requirement, balled and burlapped materials, 1 1/2-inches or more in caliper, shall be root pruned at least 45 days before being dug and such fact shall be certified on accompanying invoices.

3. All burlap shall be made of all natural non-synthetic fibers so as to be rottable once permanently planted.

C. Wired Balled and Burlapped: Plants grown in soil of a loose texture which does not readily adhere to the root system, or in the case of large plants or trees, shall have sound hog wire placed around the burlapped ball before the plant is removed from the excavation. The wire shall be looped and tightened until the burlapped ball is substantially packaged so as to prevent loosening of the soil around the roots during handling. Wire balled and burlapped plants shall otherwise comply with the requirements for balled and burlapped plants described in 2.02-B above.

D. Container Grown Plants:

1. Container grown plants shall have been grown in a container large enough and for sufficient time for the root system to have developed enough to hold its soil together firm and whole. No plants shall be loose in the container. Plants which have become pot bound or for which the top system is too large for the size of the container, will not be acceptable.

2. All containers shall be cut and opened fully, in a manner such as will not damage the root system. Container grown plants shall not be removed from the container until immediately before planting when all due care shall be taken to prevent damage to the root system.

E. Collected Plants: If collected plants are specified, the Owner’s representatives shall be given at least two days notice, before the digging. Collected plants shall be dug with a root spread at least one-third greater than nursery-grown plants of the same species and size. No collected plant shall be planted before the Owner's inspection and acceptance at the planting site.

F. Bare Root Plants:

1. No bare root plants shall be used unless specifically required by the Owner.

2. Plants designated as bare-root shall have a spread at least 1/3 greater than the equivalent balled and burlapped plant. The root system shall be well spread, fibrous and

typical of a healthy specimen of the species. These plants shall be dug and delivered with roots adequately protected against drying out by means of moist straw or other approved material. Shipping containers shall be opened and inspected by the Contractor upon arrival and shall be dampened if necessary. Plants which are not to be immediately planted shall be "heeled-in", in an approved manner, in moist earth or other suitable medium, and shall be properly cared for until planting.

3. Deciduous bare root plants shall be handled only when in a dormant or stripped condition and any evidence of fresh growth shall be cause for rejection.

4. Bare root or collected plants shall not be substituted without receipt of a Change Order.

G. Palms:

1. All plants of the palm species shall have the roots adequately wrapped before transporting except when they are container grown. Burlapping will not be required if the palm is carefully dug from marl or heavy soil that adheres to the roots and retains its shape without crumbling. During transporting and after arrival, root balls of palms shall be carefully protected from wind and exposure to the sun. After delivery to the job site, if the palm is not planted within 24 hours, the root ball shall be covered with a moist material.

2. All moving of palms shall be in accordance with the provisions for Heavy Trunk Palms, as prescribed in "Florida Grades and Standards for Nursery Plants, Part II".

2.3 PLANTING MATERIALS:

A. Topsoil:

1. Topsoil shall be a friable loam, typical of cultivated topsoils locally, containing at least 5 percent decayed organic matter (humus). It shall be taken from a well drained, arable site. It shall be reasonably free of weeds, subsoil, stones, earth, clods, sticks, roots or other objectionable extraneous matter or debris. It shall not contain toxic materials and shall have an acidity range of ph 6.5 to 7.5.

2. Prior to being delivered to the planting site the topsoil shall have been approved by the Owner’s representative. Representative samples shall be tested for acidity, fertility and general texture of a recognized commercial or governmental agency and copies of the testing agency's findings and recommendations shall be furnished to the Owner’s representative by the Contractor.

B. Fertilizer: Fertilizer shall be complete balanced fertilizer and shall contain the following minimum percentages by weight of primary nutrients.

1. Nitrogen (N) - 8 percent

2. Phosphorus (P) - 10 percent

3. Potassium (K) - 10 percent

4. Sulfur (S)– 6 percent

5. Iron (Fe) – 3 percent

6. Manganese (Mn) – 2 percent

7. Magnesium (Mg) – 2 percent

8. Or other analysis as may be approved by the Owner or Landscape Architect.

C. Standard Planting Mixture:

1. Planting mixture shall consist of approximately four parts of native soil and one part pulverized peat, sterilized manure, or approved decomposed compost. To each cubic yard of this mix, shall be added and incorporated by thoroughly mixing fertilizer specified above.

2. Acceptable artificially prepared planting compost material, approved by Owner, will be permitted, in lieu of the pulverized peat or sterilized manure, in the prepared natural topsoil mixture for use as backfill material.

3. Palm Trees Mixture: For heavy trunk trees of the palm species, silica sand will generally be permitted, without additives, for the planting backfill material. Planting mix as referred to in the preceding paragraph 1 will also be acceptable.

D. Water: The water used in the planting operations may be obtained from any approved spring, pond, lake, stream or municipal water system. The water shall be free of excess and harmful chemicals, acids, alkalies, salt, or any substance which might be harmful to plant growth or obnoxious to traffic. Water shall be provided and paid for by the Contractor, who shall also furnish adequate watering equipment

E. Wrapping Material: Wrapping material shall be first quality, heavy, waterproof crepe paper, or other approved material manufactured for this purpose.

F. Stakes and Ties: Stakes and tree ties shall be provided in accordance with the requirements of Section 3.02 E hereinafter.

G. Mulch: Wood Mulch shall be non-dyed wood chips, clean, bright and free of weeds, moss, sticks and other debris. Other types of mulch may also be acceptable. Submit sample for Owner's approval.

H. Peat: Peat shall be shredded or ground, natural, partially decomposed organic matter, slightly acid and free from grass, sedges, rushes and low in firm, woody material content, specifically termed peat humus.

PART - 3 EXECUTION

3.1 PREPARATION

A. Underground Obstructions:

1. The Contractor shall fully acquaint himself with the related irrigation, paving, site grading, water supply, electrical supply and other utilities to preclude any misunderstanding and to facilitate a trouble-free installation. It shall be the responsibility of the Contractor to obtain all such information as it is made available. Drawings and specifications of related work may be obtained from the Owner.

2. In the event that rock, underground construction work, utility lines or obstructions out of the ordinary are encountered in any plant pit excavation, alternative plant locations shall be selected by the Owner or the project Landscape Architect. Where locations cannot be

changed and the obstructions may be removed or moved, the obstructions, shall be removed to a depth of not less than 3-feet below grade and no less than 6-inches below bottom of balls or roots when plant is properly set at the required grade.

B. Excavation of Planting Beds and/or Plant Holes: A minimum 12" of planting mixture for shrub beds and 6-8" planting mixture for ground cover beds is required.

1. Where excavation encounters materials which are unsuitable for plant growth, all of said unsuitable material shall be removed and replaced with planting mixture at the direction of the Owner's representative.

2. In roadway medians and parking lot islands, all lime rock shall be removed, compacted base broken up, and lime rock replaced with topsoil.

3. Where excavation encounters materials which are suitable for plant growth, the plant hole excavations shall be roughly cylindrical in shape, with the sides approximately vertical with bottom of excavation slightly raised at center to provide proper drainage. Loosen hard subsoil in bottom of excavation.

4. For balled and burlapped (B&B) trees and shrubs, make excavations at least twice as wide as the ball diameter and equal to the ball depth, plus the following allowance for setting of ball on a layer of compacted backfill. Allow for 6-inch setting layer of planting soil mixture, or as detailed.

5. For container grown stock, excavate as specified for balled and burlapped stock, adjusted to size of container width and depth.

C. Plant Bed Preparation:

1. Inspection: Examine substrates and conditions under which products of this section are to be installed and verify that the work may properly commence. Do not proceed with the work until unsatisfactory conditions have been fully resolved.

2. Herbicide Application: All existing grass or other herbaceous material within the limits of the planting beds, as delineated on the Landscape Drawings, shall be sprayed with the herbicide "Roundup" as manufactured by Monsanto (or approved equal). Such spraying shall be in full accordance with the manufacturer's instructions. Extreme care shall be taken to avoid overspray.

3. Preparation of Planting Soil: Before mixing, clean topsoil of roots, plants, sods, stones, clay lumps, and other extraneous materials harmful or toxic to plant growth. Mix specified soil amendments and fertilizers with topsoil to a minimum depth of 6-inches using a rototiller or similar equipment. Delay mixing of fertilizer if planting will not follow placing of planting soil within a few days.

3.2 PLANTING

A. Time of Planting: Plant under favorable weather conditions. At option of and under full responsibility of the Contractor, planting operations may be conducted under unreasonable conditions without additional compensation.

B. Removal from Containers:

1. All containers shall be cut and opened fully, in a manner such as will not damage the root system.

2. Container grown plants shall not be removed from the container until immediately before planting, and with all due care to prevent damage to the root system.

C. Setting Trees and Shrubs:

1. Orientation: Place each plant in vertical position and rotate to obtain best visual appearance and proper relationship to nearby buildings or adjacent plants.

2. Root and Ball Preparation: Remove container from plants and lightly scarify roots in several places before placement. After placement, loosen binding from top and sides of balled and burlapped plants and remove box or platform and surplus bindings. Spread roots of bare root plants in natural manner and cut cleanly any that have been broken.

3. Crown to Grade Relationships: After settlement, crown of plant shall remain about 2-inches above average finished grade with compacted planting soil sloping away from trunk or stem and blending with finished grade.

4. Sloping Plant Beds for Positive Drainage: When plant beds are adjacent to buildings, curbs, pavement, or other water holding obstructions, grade bed before planting to create positive surface drains away from plants and buildings.

5. Placement: Set balled and burlapped stock on layer of compacted planting soil mixture, plumb and in center of pit or trench with top of ball at same elevation as adjacent finished landscape grades. When set, place additional backfill around base and eliminate voids and air pockets. When excavation is approximately two-thirds full, water thoroughly before placing remainder of backfill. Repeat watering until no more is absorbed. Water again after placing final layer of backfill.

6. The backfill shall be made with prepared planting mixture as specified hereinbefore and shall be firmly rodded and watered-in, so that no air pockets remain. The quantity of water applied immediately upon planting shall be sufficient to thoroughly moisten all of the backfilled earth. Plants shall be kept in a moistened condition for the duration of the planting period.

7. A water ring 6-inches in width shall be formed making a water collecting basin with an inside diameter equal to the diameter of the excavated hole. The water ring shall be maintained in an acceptable condition from the time of planting until the end of the required establishment period. The basin shall be level and, on steep slopes, shall be excavated in such a manner as will allow the base of the plant to be at approximate grade level.

D. Setting Groundcovers:

1. Shaping Bed: Finish grade per Drawings to required contours and provide positive surface drainage.

2. Spacing of Plants: Unless otherwise specified, center to center spacing of plants refers to planting bed surface plane, not a horizontal plane.

3. Root Preparation: Remove container plants and scarify roots in several places before placing in position. Spread roots of bare root plants in normal position.

4. Position of Plants: Place each plant to provide its best cover to ground; on steep slopes this may mean axis of plant is not vertical.

5. Crown to Grade Relationships: Place crown high enough so that plant will not be smothered by mulch. Slope planting mix upward from finished grade to meet crown.

6. Backfill and Watering: Fill over and around roots with planting soil mixture and firmly compact. Soak bed thoroughly with water soon after planting.

7. Dish Top of Backfill to Allow for Mulching: For spring planting, provide additional backfill berm around edge of excavations to form shallow saucer to collect water. On slopes, provide berm only on downhill sides of excavation.

E. Staking and Guying of Trees: The Contractor is wholly responsible for the stability and plumb condition of all trees and shrubs. A method of the staking of trees have been provided on the Drawings and specified herein. If the Contractor would prefer to use an alternate method, he shall submit for approval procedures he will use for the maintaining the stability and plumb condition of all trees and palms.

1. Small Trees: For trees and shrubs of less than 1-inch caliper, the size of stakes and the method of tying shall be such as to rigidly support the staked plant against damage caused by wind action or other effects. These trees shall be staked with two 2-inch wide stakes, set at least 24-inches in the ground and extending to the crown of the plant. The plant shall be firmly fastened to the stakes with two strands of 1½'' synthetic strapping.

2. Large Trees: All trees larger than 1" caliper, other than palm trees, shall be guyed from at least three points with 1½'' synthetic strapping. Guying shall be anchored to 2-inch by 4-inch stakes, 24-inches long, driven into the ground at least 2-feet and sufficient that the top of the stake is at least 3-inches below the finished ground level. Each guy wire shall be clearly visible which may require flagging with bright survey ribbon in three places 12" apart.

3. Palm Trees: Palms shall be braced with three 2-inch by 4-inch wood braces, toe-nailed to cleats which are securely banded at two points to the palm, at a point 1/3 the height of the trunk. The trunk shall be padded with five layers of burlap under the cleats. Braces shall be approximately 120 degrees apart and secured underground by 2-inch by 4-inch by 24-inch stake pads.

F. Pruning:

1. All broken or damaged roots shall be cut off smoothly and the Contractor shall prune, thin out and shape plants in accordance with standard horticulture practice.

2. Pruned trees shall retain required height and spread. Remove only injured or dead branches, unless otherwise directed by the Owner's representative. Prune trees and shrubs to retain natural character and accomplish their use in the landscape design.

3. Remove and replace excessively pruned or malformed stock resulting from improper pruning.

G. Fertilizer: Fertilizer shall be applied at the following rates:

1. Trees: two (1) pound per inch of caliper if less than 6" D.B.H. or five (2) pounds per inch if over 6" D.B.H.

2. Shrubs: two (2) pounds per one hundred (100) sq. feet.

3. Groundcovers: two (2) pounds per one hundred (100) sq. feet.

4. Vines: two (2) pounds per one hundred (100) sq. feet.

5. Annuals: (1-1/2) pounds per (100) sq. feet.

H. Mulch Placement:

1. Herbicide Placement: Those areas designated to receive mulch shall be treated with pre-emergence herbicide, rate specified by the manufacturer or by a licensed professional. Pre-emergence herbicide shall be applied prior to mulch installation. Manufacturer's instructions for timing related to fertilizing and installing plant materials shall be followed.

2. Planting Beds: Place mulch to the required uniform depth soon after planting to prevent drying of planting soil around roots. When other operations such as top dressing or fertilizing do not necessitate delay, mulch promptly after planting; do not delay more than three days after plants have been set.

3. Mulch Types and Depths:

a. Trees and Shrubs: Heavy layer of wood mulch to a depth as shown on the plan details level with adjacent grades.

b. Groundcover: Provide depth as shown on plan details. Work into top of backfill and finish level with adjacent grades.

I. Watering: The Contractor shall continue watering for as long as is necessary to properly establish the new plantings. Care shall be taken to prevent staining of new construction where temporary well water is used.

J. Pest Control: Set up a good spray program to guard against scales, borers, foliar feeders, aphids, mites, leaf-spot and dieback, nematodes and canker-producing fungi.

3.3 FIELD QUALITY CONTROL

A. Before Planting: Contractor shall familiarize himself with the location of all underground and above-ground improvements and take care not to disturb improvements during his installation operations. Contractor shall repair or replace at Contractor’s sole expense improvements damaged by his installation operations.

B. During Planting:

1. Report of Unfavorable Conditions: Promptly notify the Owner of inadequate soil drainage, depth, utility lines conflict, or other adverse conditions for plant materials.

2. Remove dead and unsatisfactory plants promptly upon discovery during periodic visits. Mark location safely to facilitate future replacement.

3. Request an owner inspection near end of Warranty period. When all plants are acceptable, Contractor will be notified of Warranty compliance.

4. Cleaning:

a. Clean adjacent surfaces to plant beds at end of each workday and before onset of inclement weather to prevent staining by, or tracking of materials, and inhibiting

circulation of work.

b. During landscape work, store materials and equipment where directed. Keep pavements clean and work area in an orderly condition.

c. Protect landscape work and materials from damage due to landscape operations, operations by other contractors and trades and trespassers. Maintain protection during installation and maintenance periods. Treat, repair or replace damaged landscape work.

5. The Contractor shall be responsible for preservation of all public and private property and shall protect carefully from disturbance or damage all land monuments and property marks until the Contractor has witnessed or otherwise referenced their location and shall not move them until directed.

6. Maintenance of Traffic:

a. The Contractor shall control his operations and those of his subcontractors and all suppliers, to assure the least inconvenience to the traveling public. Under all circumstances, safety shall be the most important consideration. The Contractor shall keep roads, streets, or highways open to all traffic and shall provide such maintenance as may be required to traffic. The Contractor shall furnish, erect, and maintain barricades, warning signs, flagmen, and other traffic control devices in reasonable conformity with the manual of Uniform Traffic Control Devices for Streets and Highways (published by the United States Government Printing Office), unless otherwise specified herein. The Contractor shall also construct and maintain in a safe condition any temporary connections necessary for ingress to and egress from abutting property or intersecting roads, streets or highways.

b. Beginning date of Contractor's responsibility: The Contractor's responsibility for maintenance of traffic shall begin on the day he starts work on the project or on the first day contract time is charged, whichever is earlier. His responsibility at this date is to notify the Owner of the dates when traffic will be affected and where it will be affected and the steps he will take to maintain traffic safety.

c. Sections not requiring traffic maintenance: In general the Contractor will not be required to maintain traffic over those portions of the project where no work is to be accomplished or where construction operations will not affect existing roads. The Contractor, however, shall not obstruct nor create a hazard to any traffic during the prosecution of the work and shall be responsible for repair of any damage to existing pavement of facilities caused by his operations.

d. No waiver of liability: The Contractor shall conduct his operations in such a manner that no undue hazard will result due to the requirements of this section, and the procedures and policies described therein shall in no way act as a waiver of any of the terms of the liability of the Contractor or his surety.

C. After Planting:

1. Maintenance:

a. Maintenance shall begin immediately after each plant is installed and shall continue until the completion of the warranty period. Plants shall be watered, mulched, weeded, pruned, sprayed, fertilized, cultivated and otherwise maintained and protected for the duration of the establishment period.

b. Additional Fertilizing: Prior to the Final Acceptance, the Contractor shall make an additional application of fertilizer. This application shall be a top dressing and shall be applied to all beds, plants, trees, etc., which were a part of his Contract.

c. Settled plants shall be reset to proper grade position, planting saucer restored and dead material removed. Guys shall be tightened and repaired.

d. His responsibility for protection against all damage shall include the providing of protection including the posting of approved warning signs and barricades, as might be necessary. He shall repair, restore or replace any plants or planting areas which might become damaged as a result of any negligence by him in complying with these requirements. As a specific requirement of these conditions, the Contractor shall be responsible for assuring that all plants at the time of final inspection, exhibit the characteristics and qualifications required for the grade of plant as originally specified.

e. The Contractor shall remove all guying at the end of the warranty period.

3.4 INSPECTIONS

A. Provisional Inspection:

1. Observation of Landscape Materials:

a. Materials Specified as Requiring Approval: Secure representative samples and arrange for Owner 's Representative to observe; if disapproved, submit additional samples until approved; keep approved sample for reference until near end of project before incorporating it in work. Sample approval does not assure approval of material as installed.

b. Other Materials: Will be observed upon Contractor’s request; otherwise, observation may take place anytime. Sample approval does not assure approval of materials. Maintain sample(s) for reference.

2. Right of Rejection: The Owner shall have the right to reject any and all work and materials which, in its opinion, do not meet the requirements of these specifications.

3. Observation and Provisional Acceptance:

a. Observation: When the landscape work is completed, the Owner’s representative will, upon request, make an observation to determine acceptability. The landscape work may be reviewed for acceptance in parts, provided the work offered for inspection is complete, and that the area comprises one complete unit or area of substantial size.

b. Non-compliance: Where landscape work does not comply with the requirements, replace rejected work and continue specified maintenance until re-observed by the Owner’s representative and found to be acceptable. Remove rejected plants and materials promptly from project site.

c. Standard for Acceptance of Plantings: Each plant shall be of proper species, size, grade, and meet the requirements as stated on the plans and in the written specifications, properly installed and maintained in good health. All water saucers and beds shall be neatly formed and mulched and free of weeds and erosion

damage.

B. Final Inspection: At the end of the warranty period, inspection of plants will be made by the Owner's representative upon written notice requesting such inspection, submitted by the Contractor at least three days before the anticipated inspections. All defects discovered shall be repaired or replaced by the Contractor before final acceptance.

3.5 CLEANING ADJUSTMENT AND RESTORATION

A. Cleaning up the Site: Upon completion of any landscape project the Contractor must thoroughly clean up the project site. In addition to removing all equipment, unused materials, deleterious material, and surplus excavated material, the Contractor shall fine grade all disturbed areas and the areas adjacent to the new plantings to provide a neat and uniform site. All damaged or altered existing structures, as a result of the landscape work, shall be corrected.

B. Cleaning up of Right-of-Way: Upon completion of the work, and before the establishing period starts, the Contractor shall remove from the right-of-way and adjacent property all falsework, equipment, surplus and discarded materials, rubbish and temporary structures; shall restore in an acceptable manner all property, both public and private, which has been damaged during the prosecution of work, and shall leave the waterways unobstructed and the roadway in a neat and presentable condition throughout the entire length of the work under the Contact. The placing of materials of any character, rubbish or equipment, on abutting property, with or without the consent of the property owners, shall not constitute satisfactory disposal. The Contractor will be allowed to temporarily store equipment, store equipment, surplus materials, etc., within the limits of work only if approved by the Owner in writing, but no discarded equipment or materials, or rubbish shall be placed on such site.

C. Restoration:

1. When or where direct or indirect damage or injury is done to public or private property by or on account of any act, omission, neglect, or misconduct in the execution of the work, or in consequence of the non-execution thereof by the Contractor, he shall restore, at his own expense, such property to a condition similar or equal to that existing before such damage or injury was done, by repairing, rebuilding, or otherwise restoring as may be directed, or he shall make good such damage or injury in an acceptable manner.

2. Work that is to remain in place which is damaged or defaced by reasons of work performed under this Contract shall be restored at no additional cost to the Owner.

END OF SECTION 32 93 00

SECTION 33 10 00 - WATER UTILITIES

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope: The work under this Section includes providing a complete system of water distribution piping including continuous pipeline identification, valves, backflow preventers, fittings and other appurtenances.

1.2 RELATED SECTIONS

A. Section 31 23 19 – Dewatering.

B. Section 31 20 00 - Earthmoving.

1.3 REFERENCED STANDARDS

A. All Referenced Standards are contained within the Miami-Dade WASD Engineering Standards for Public Works & Utilities Systems, Latest Edition.

1.4 SUBMITTALS

A. Shop Drawings: Submittals shall be made in conformance with requirements of the Contract. In general, the following shop drawings shall be submitted to the Owner for approval prior to construction:

1. Mill test certificates or certified test reports on pipe
2. Details of restrained joints and flexible joints
3. Specifications for pipe linings and coatings
4. Fittings
5. Valves and valve boxes
6. Joint lubricant
7. Pipe laying schedule showing thrust restraint measures (restrained joints and/or thrust blocking) for each pipe section, valve and fitting location.
8. Temporary plug and anchorage system for hydrostatic pressure test
9. Tapping sleeves and valves
10. Air release valves
11. Marking tape and detector wire
12. Bridge pipe supports (where applicable)
13. Fire hydrant assemblies
14. Service connection assemblies
15. Back Flow Preventer

B. LEED Submittals:

1. Credit MR 5.1 and MR 5.2: Product data for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and fraction by weight that is considered regional.

1.5 QUALITY ASSURANCE

A. Pipe Inspection: The Contractor shall obtain from the pipe manufacturer's certificate of inspection to verify that the pipe and fittings supplied for this Contract have been inspected at the plant and that they meet the requirements of these specifications. All

pipe and fittings shall also be subjected to visual inspection at time of delivery by rail or truck, also just before they are lowered into the trench to be installed. Joints or fittings that do not conform to these specifications will be rejected and must be removed from the job site immediately by the Contractor. The entire product of any plant may be rejected when, in the opinion of the Owner, the methods of manufacture fail to secure uniform results, or where the materials used are such as to produce inferior pipe or fittings.

B. Prevention of Electrolysis: Where deemed necessary, electrolytic action through the contact of dissimilar metals, shall be prevented by either:

1. The separation of one material from the other by means of an insulating or dielectric coupling, or
2. The use of alternative materials, as directed by the Owner.

C. NSF Standard 61: All new and relocated project components that will come into contact with drinking water or drinking water treatment chemicals (except components that will come into contact with raw water prior to its treatment by reverse osmosis) shall be in conformance with American National Standards Institute/NSF International (ANSI/NSF) Standard 61.

D. NSF Standards: All drinking water treatment chemicals supplied under this project except fluoridation chemicals shall be in conformance with ANSI/NSF Standard 60. All fluoridation chemicals supplied under this project shall be in conformance with ANSI and American Water Works Standards B 701, B 702 or B 703 as applicable.

E. AWWA Standards: All pipe, pipe fittings, pipe joint packing and jointing material, valves, fire hydrants, and meters installed under this project will conform to American Water Works Association (AWWA) standards.

F. Lead: All pipe and pipe fitting installed under this project will contain no more than 8% lead, and any solder or flux used in this project will contain no more than 0.2% lead.

G. Pipe Color: All potable water pipe and pipe fitting installed under this project shall be color code per requirements of 62-555.320 of F.A.C. with blue as predominant color.

1.6 PERMITS

A. General: Contractor shall comply with all conditions of all project permits.
B. Copies: Contractor shall maintain copies of all permits on-site and available at all times for inspection by regulatory agencies throughout the course of the work.

1.7 JOB CONDITIONS

A. Water in Excavation: Water shall not be allowed in the trenches while the pipes are being installed and/or tested. The Contractor shall not open more trench than the available pumping facilities are able to dewater. The Contractor shall assume responsibility for disposing of all water so as not to injure or interfere with the normal drainage of the area in which he is working. In no case shall the pipelines being installed be used as drains for such water, and the ends of the pipe shall be kept properly and adequately blocked during construction by the use of approved stoppers and not by improvised equipment. All necessary precautions shall be taken to prevent the entrance of mud, sand, or other foreign matter into the pipelines. If, on completion of the work, it is determined that any such material has entered the pipelines, it must be removed as directed by the Owner so that the entire system will be left clean and unobstructed.

B. Dewatering: Pipe and utility trenches shall be dewatered as required in Section 31 23 19 - Dewatering. A permit will be required for dewatering. See Section 31 23 19 for additional information.

PART 2 - PRODUCTS

2.1 PRODUCTS, GENERAL

A. All products shall conform with the Town of Medley and Miami-Dade WASD Engineering Standards for Public Works and Utilities Systems, Latest Edition.

PART 3 - EXECUTION

3.1 EXECUTION, GENERAL

A. Execution shall conform with the Town of Medley and Miami-Dade WASD Engineering Standards for Public Works and Utilities Systems, Latest Edition.

END OF SECTION 33 10 00

SECTION 33 30 00 - SANITARY SEWARAGE UTILITIES

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Section shall include, but not be limited to the construction and installation of a gravity sanitary sewerage collection system and wastewater pumping station, including all labor, equipment, materials and all incidentals required to install manholes, gravity sewer mains, service laterals, and testing, including all appurtenances as shown on the drawings and as specified herein.

B. The work shall include, but not be limited to polyvinyl chloride (PVC) pipe and fittings, precast concrete manholes, sheeting, bracing, excavation, backfilling, dewatering where required, grading and drainage, slope protection, concrete work, Rip-Rap, compaction, grass restoration, pavement restoration where required, and all other work incidental to the project.

1.2 RELATED SECTIONS

A. Section 31 10 00 - Earthwork.

B. Section 31 23 19 - Dewatering.

D. Section 31 25 00 – Erosion and Sedimentation Control.

1.3 REFERENCED STANDARDS

A. All Referenced Standards are contained within the Town of Medley and Miami-Dade WASD Engineering Standards for Public Works and Utilities Systems, Latest Edition.

1.4 SUBMITTALS

A. Procedures:
   1. Submit product data, shop drawings, samples, testing laboratory reports, etc. in a timely manner and in accordance with the general requirements of the Contract and Section 2.16 of the City of Miramar Engineering Standards for Public Works & Utilities Systems, Latest Edition and as noted in Section 1.4.B.

B. Product Data:

   1. Submit manufacturer's detailed product literature, which shall include, where applicable, mill test reports, equipment capacity data, manufacturer’s literature that notes compliance with the reference standards including, but not limited to, product type, pressure rating, schedule, class, grade, and all other information pertinent to the installation.
   2. The data to be submitted shall include, but not be limited to:

      a. Polyvinyl Chloride (PVC) Pipe (ASTM D 3034) or (ASTM F 949)
      b. Ductile Iron Pipe.
      b. Precast Concrete Manhole Sections (ASTM C 478)
      c. Concrete Mix (ASTM C 94, Type II Cement)
      d. Concrete Coatings
      e. Manhole Joint Sealant

f. Manhole Reinforcement
g. Resilient Manhole Connectors (ASTM C 928)
h. Manhole Frames and Covers
i. Manhole Adjustment Rings

1.5 QUALITY ASSURANCE

A. Inspection and Certification of Pipe and Fittings:

1. All pipe, pipe fittings and appurtenances to be installed under this specification are subject to being inspected and tested for compliance with these specifications at the manufacturer's facility by an independent testing laboratory selected by the Owner. The manufacturer's cooperation shall be required in these inspections.

2. The Contractor shall obtain a certificate of inspection from the pipe manufacturer stating that the pipe and fittings supplied for this project has been inspected and tested at the point of origin, and that they meet or exceed the requirements set forth in these specifications.

3. The cost of the inspections and tests, if required, shall be borne by the Contractor. Letters of certification shall be furnished to the Owner for all inspections and tests, prior to installation of the pipe.

1.6 PERMITS

A. Contractor shall comply with all conditions of Florida Department of Environmental Protection (FDEP) wastewater collection permit.

B. Contractor shall maintain copies of all permits on-site and available for inspection by Regulatory agencies throughout the course of work.

C. FDEP permit approval shall be coordinated through the City of Miramar Utility Department.

1.7 HANDLING AND STORAGE OF PIPE, CONCRETE PRODUCTS AND APPURTENANCES

A. All pipe, pipe fittings, manhole sections, grade rings and cast iron rings and covers shall be loaded and unloaded by lifting with hoists or skidding in order to avoid shock or damage. Precast concrete manholes and manhole sections shall be handled with lift rings only. Under no circumstances shall pipe, fittings or concrete products be dropped, or moved in such a manner that would cause damage to the products.
1. Pipe, fittings and concrete products shall not be rolled or skidded into or against pipe or concrete products on the ground.
2. Slings, hooks, pipe tongs and other lifting devices shall be padded and used in such a manner as to prevent damage to pipe or other construction products.
3. Stored materials shall be kept safe from damage. The interior of all pipe, fittings, manholes etc. shall be kept free from dirt, oil, grease and foreign matter at all times.

B. The Contractor shall cover stored PVC pipe to prevent exposure to ultraviolet radiation.

C. Pipe gaskets shall be used in the work on a first-in, first-out basis.

1. Gaskets for mechanical joint and push-on joint ductile iron pipe shall be stored in a cool, dry location, out of direct sunlight.
2. Gaskets shall be stored in such a manner so as to prevent coming into contact with petroleum products.

D. Mechanical joint bolts and push-on joint locking segments shall be handled and stored in such a manner that will ensure proper use in respect to pipe types and sizes.

E. The contractor shall physically inspect all precast structures for cracks, exposed reinforcement and/or any other physical damage prior to installation. Any structure, exhibiting damage or manufacturing defects shall be rejected and immediately removed from project site.

PART 2 - PRODUCTS

2.1 PRODUCTS, GENERAL

A. All Products shall conform with the Town of Medley and Miami-Dade WASD Engineering Standards for Public Works and Utilities Systems, Latest Edition.

PART 3 - EXECUTION

3.1 EXECUTION, GENERAL

A. Execution shall conform with the Town of Medley and Miami-Dade WASD Engineering Standards for Public Works and Utilities Systems, Latest Edition.

END OF SECTION 33 30 00

SECTION 33 41 00 – CULVERTS AND STORM SEWERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including Conditions of the Contract and Division 01 Specification Sections, apply to this Section.

1.2 SCOPE OF WORK

The work to be performed under this section shall include the furnishing and installing storm drainage pipe and appurtenances, excavation, backfilling, modifications to existing drainage structures, and other incidental work in connection with this construction.

1.3 RELATED WORK

A. Section 31 20 00: Earth Moving
B, Section 33 30 00: Sanitary Sewer Collection System

1.4 REFERENCED STANDARDS

A. AASHTO M 294: Specification for corrugated Polyethylene Pipe, 12 – 36 In. Diameter, Type S and SP. ASTM F 477: Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
B. Florida Department of Transportation: Standard Specifications for Road and Bridge Construction –Latest Edition.
C. Florida Department of Transportation: Roadway and Traffic Design Standards.
D. Town of Medley Engineering Standards.
E. Miami-Dade County Engineering Standards

1.5 SUBMITTALS

A. General: Submit shop drawings in accordance with the General Conditions and Division 1 showing the structures and materials to be used and manufacturer's certificates (for pipe, curing compound, gaskets, bituminous coating, fasteners) showing compliance with the specifications.

1.6 QUALITY ASSURANCE

A. General: A Testing Laboratory provided on-site by the Owner will make such tests as are required by the project plans and specifications. The Contractor shall schedule his work so as to permit a reasonable time for testing before placing succeeding lifts and shall keep the laboratory informed of his progress. Costs for all testing requested by the Owner, and meeting the minimum requirements, shall be paid for by the Owner.

1.7 PERMITS

A. Contractor shall comply with all requirements of the project permits during construction.
B. Copies: Contractor shall maintain a copy of all permits on-site and available for review by any regulatory agency throughout the course of the work.

PART 2 - PRODUCTS

2.1 INLETS, MANHOLES and JUNCTION BOXES

A. FDOT Standard Specifications, Section 425, Section 449 and Section 949.
B. FDOT Design Index.
C. Miami-Dade WASD specifications and details.

2.2 PIPE

A. Reinforced Concrete Pipe: FDOT Standard Specifications, Section 449.
B. Polyvinyl Chloride Pipe: FDOT Standard Specifications, Section 948-1.
C. High Density Polyethylene Pipe (HDPE): FDOT Standard Specifications, Section 948-2.

2.3 PIPE GASKETS

Pipe Gaskets: Pipe gaskets shall conform to the requirements of FDOT Standard Specifications, Section 942.

2.4 JOINT MATERIALS

A. Joint materials shall be as specified in FDOT Specifications Section 430-7 through 430-11 for the particular type of pipe and conditions of usages as specified.

B. All concrete pipe joints shall be wrapped with a three foot wide strip of FDOT approved filter fabric, with the ends taped and overlapped a minimum of one foot.

2.5 PLASTIC FILTER FABRIC

A. Filter Fabric: Plastic filter fabric shall conform to Section 985 of the FDOT Standard Specifications, unless otherwise designated on the Drawings.

2.6 POLYVINYL CHLORIDE GRAVITY PIPE & FITTINGS

A. Refer to Section 33 30 00 - Sanitary Sewage Collection System.

2.7 HIGH DENSITY POLYETHYLENE PIPE & FITTINGS (HDPE)

A. HDPE pipe shall have a corrugated exterior, smooth interior and silt tight push on joints. HDPE fittings shall conform to AASHTO M294. Gaskets shall be installed by the pipe manufacturer in accordance with ASTM D2321. Perforated pipe shall have a filter sock.

PART 3 - EXECUTION

3.1 PREPARATION

A. Pipe Trenches:

1. Pipe trenches shall be of necessary widths for the proper laying of the pipe and the banks shall be as nearly vertical as practicable. In paved areas the trench shall be vertical and sheets, if required; the clearance between the pipe and trench wall or back of sheeting shall not exceed 18 inches. The bottom of the trenches shall be excavated to a depth of the outside bottom of the pipe barrel. Any over excavation shall be replaced with suitable compacted material. Excavation for inlets and other appurtenances shall be sufficient to provide a clearance between their outer vertical

surfaces and the face of the excavation or sheeting, if used, of not less than 12 inches.

2. Soft, spongy, or otherwise unstable material encountered below the established grade of the excavation which will not provide a firm foundation for subsequent work shall be removed and replaced as directed. Unless otherwise directed, all such unstable materials shall be removed for the full width of the excavation and replaced with approved fill material.

3. Where sheeting and bracing are necessary to prevent caving of the trench sidewalls, and to safeguard the workmen, the trench or excavation for other structures shall be dug to such width that the proper allowance is made for the space occupied by the sheeting and bracing to provide clearance as specified above.

3.2 INSTALLATION

A. Installation of Inlets, Manholes and Junction Boxes: FDOT Standard Specifications, Section 425.
B. Installation of Pipe Culverts: FDOT Standard Specifications, Section 430.
C. Backfilling for Pipe Culverts: Earth Moving Section 31 20 00

1. After the pipe has been installed, approved selected material from excavation at a moisture content which will facilitate compaction shall be placed along side of the pipe in layers not exceeding 6 inches loose measure in depth. Care shall be taken to insure thorough compaction of the fill of the haunches of the pipe. Each layer shall be thoroughly compacted by rolling or tamping with mechanical rammers. This method of fill and compacting shall be continued until the fill is 12 inches above the pipe, then the remainder of the backfill shall be placed in lifts not exceeding 9 inches. The operation of heavy equipment shall be conducted so that no damage to the pipe will result. Backfill material 12 inches and above the top of the pipe shall be compacted to a density as shown on the Drawings. Selected material for backfill shall not contain any stones or rock larger than 3 inches.

3.3 LAMPING

A. After the pipe has been installed and the compacted backfill placed up to top of subgrade or final grade, “lamp” in the presence of the Owner’s Representative the installed drainage pipe between manholes, inlets or other structures in order to ascertain that they are clear and to correct alignment. The diameter of lamp image shall have no vertical reduction from that of the pipe inside vertical diameter and not more than 20 percent horizontal reduction.

B. Provide assistance to the Owner or his representative as necessary to lamp the pipes. If lamping indicates any faulty installation of the pipe, or dirt or debris in the pipe or structures, clean, repair or replace the pipe at no additional cost to the Owner.

END OF SECTION 33 41 00

SECTION 32 46 26
GEOTEXTILE FABRIC

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work included in this section consist of furnishing and installing filter fabric consisting of Geotextile Non-Woven fabric as shown on the Drawings and specified herein.

1.02 RELATED WORK

A. Section 02100: Clearing and Grubbing

B. Section 02120: Earthwork

C. Section 02225: Excavating and Backfilling for Utilities

1.03 REFERENCED STANDARDS

A. AASHTO M 288: Geotextiles

B. Florida Department of Transportation: Standard Specification for Road and Bridge Construction 2004.

C. FDOT 2008 Design Standards

D. Miami – Dade RER and Engineering Standards.

1.04 SUBMITTALS

A. Submit product data, certifications, etc., in accordance with General Conditions.

B. Submit product data specification sheets for Geotextile Fabric.

C. Submit product data and certification of quality by producers prior to installation.

1.05 QUALITY ASSURANCE

A. A testing laboratory provided on-site by the Owner will make such tests as are deemed advisable. The Contractor shall schedule his work so as to permit a reasonable time for testing before proceeding with the work and shall keep the laboratory informed of his progress. Costs for all testing requested by the Owner, and meeting the minimum requirements, and shall be paid for by the Owner.

1.06 PERMITS

A. Contractor shall comply with the permit requirements of all jurisdictional agencies during construction.

B. Contractor shall maintain a copy of all permits on-site and available for review by any regulatory agency throughout the course of the work.

1.07 JOB CONDITIONS

A. Existing Drainage System: Maintain operational, prevent siltation and flooding.

B. Cleanup: Maintain surface grade within 400 feet of pipe laying operating.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Materials shall be in conformance with applicable AASHTO design standards and 2008 FDOT Standard Design Index 199.

PART 3 - EXECUTION

3.01 PREPARATION

A. Construct trenches in accordance with Section 02225.

3.02 INSTALLATION

A. Soil Separation Fabric: The geotextile shall be placed on the finished subgrade or in underdrain trench before the granular base or underdrain rock is placed and compacted. No equipment shall be allowed to operate directly on the bare geotextile. The geotextile shall be placed symmetrically about the trench centerline. At the end of each roll or piece of geotextile there shall be a two-foot overlap of the material. Special care shall be taken by the Contractor in placing the geotextile on the finished surface to ensure that the geotextile is laid flat and free from wrinkles.

If the geotextile is damaged in any way the Contractor shall place a patch of the same material over the damaged area. The patch shall have a two foot overlap in every direction around the damaged area. The Contractor shall not receive extra compensation for any necessary patching.

If it is necessary to overlap rolls or pieces of a geotextile along the longitudinal edge, eighteen (18) inches of overlap shall be used. The Contractor shall not receive extra compensation for any overlaps. No longitudinal overlaps shall occur between the toes of ballast of any track.

The weight and any other physical properties shall be as specified by the Engineer.

Trench Underdrain:

1. Filter Fabric: Filter fabric shall be laid in the trench prior to placement of rock and underdrain pipe and shall completely encase the pipe and drainage material as shown on the Drawings. The Contractor shall submit an 8 ounce non-woven fabric for approval.

3.03 BACKFILLING FOR GEOTEXTILE FABRIC

A. Backfill on geotextile fabric consistent with Section 02225.

END OF SECTION

SECTION 33 49 00 – DRAINAGE STRUCTURES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including Conditions of the Contract and Division 01 Specification Sections, apply to this Section.

1.2 DESCRIPTION

A. General: Construction of inlets, manholes, and junction boxes shall conform to the requirements of Section 425 of the FDOT Standard Specifications for Road and Bridge Construction.

B. Scope: Construct drop inlets, manholes, junction boxes, shoulder gutter inlets, and yard drains from reinforced concrete, conforming to ASTM C 478. Furnish and install the necessary metal frames and gratings. Also, adjust those structures shown in the plans to be adjusted or which are required to be adjusted for the satisfactory completion of the work.

1.3 RELATED WORK

A. Section 31 23 19: Dewatering
B. Section 31 20 00: Earth Moving
C. Section 03 30 53: Miscellaneous Cast-in-Place Concrete Work

1.4 REFERENCED STANDARDS

A. ASTM A 48:Specification for Gray Iron Castings

B. ASTM C 478: Specification for Precast Reinforced Concrete Manhole Sections

C. Federal Specification: SS-S-00211

D. Florida Department of Transportation Specifications for Road and Bridge Construction – Latest Edition.

1.5 SUBMITTALS

A. Submit shop drawings for all drainage structures, inlets, manholes, headwalls, mitered end sections and other appurtenances.

1.6 QUALITY ASSURANCE
(Not Used)

1.07 PERMITS
(Not Used)

PART 2 - PRODUCTS

2.1 MANHOLES

A. Manholes shall be constructed of concrete and shall have cast iron frames and covers.

Steps or rungs shall not be constructed in manholes unless indicated on the Drawings.

B. Concrete: Concrete for manholes shall be made from Type I cement, 4,000 psi.

C. Frames and Covers: The manhole frames and covers shall be of gray cast iron conforming to ASTM A 48, Class 30. The cover shall be a custom make, identification number USF 170-E. The frames and covers shall be set so that the top of the cover will be flush with or higher than finished grade or as directed. Frames shall be suitable for the future addition of cast iron rings for upper adjustment of top elevation.

D. Precast Concrete Manholes: Precast concrete manholes shall be constructed in accordance with ASTM C 478 and as shown on the Drawings of concrete attaining a minimum compression strength of 4,000 psi in 28 days using Type I cement. Details of design and construction shall be approved by the Owner prior to construction.

E. Joints are to be sealed with preformed flexible plastic joint sealer conforming to Federal Specifications SS-S-00211, “Ram-Nek”, as manufactured by K. T. Snyder Co., Houston, Texas.

PART 3 - EXECUTION

3.1 EXCAVATION FOR APPURTENANCES

A. Excavation for manholes and similar structures shall be made to a size that will allow at least 12 inches in the clear between their outer surfaces and the embankment or sheeting or shoring which may be used to hold and protect the banks.

B. Keep excavation free of water during the construction process, refer to Section 31 23 19, Dewatering. Build facilities to the line and grade shown on the drawings. Grade the excavation bottom to provide a smooth, firm and stable foundation underneath the facility. Remove large gravel or cobbles encountered in the excavation bottom from beneath the facility (minimum 6” below structure bottom) and replace with clean, compacted granular material to provide uniform support and a firm foundation.

3.2 MANHOLES AND INLETS

A. Construct in accordance with the detailed drawings, of the size and shape indicated, and at the location and grade shown on the plans, with flow channels having smooth and carefully shaped bottoms and built-up sides.

B. Hand-work the invert so as to provide channels conforming in size and shape to the lower portions of the inlets and outlets. Vary channels uniformly in size and shape from inlet to outlet. Smoothly and accurately shape the invert channel.

C. Set each section of precast manholes and inlets and make a watertight joint. Use sections of various heights in order to bring the top of the cover to the required elevation.

D. Join precast concrete manhole and inlet sections with “Ram-Nek” flexible plastic gaskets.

E. Set tops, frames and covers securely to elevations shown on the drawings. Clean and scrape them prior to installation to ensure a satisfactory fit.

F. Watertightness of manholes and inlets shall be observed. Repair any visible leakage after dewatering is stopped.

3.3 BACKFILLING

A. Backfilling around manholes and inlets shall be accomplished in the same manner as the connected pipe in accordance with Section 31 23 00, Excavating and Backfilling.

3.4 RESTORATION OF DAMAGED SURFACES, STRUCTURES, AND PROPERTY

A. Where pavement, trees, shrubbery, fences or other property or surface structures have been damaged, removed or disturbed by the Contractor, whether deliberately or through failure to carry out the requirements of the Contract Documents, State laws, municipal ordinances or the specific direction of the Owner, or through failure to employ usual and reasonable safeguards, such property and surface structures shall be replaced or repaired at the expense of the Contractor to a condition equal to that before work began within a time frame approved by the Owner.

3.5 CLEAN-UP

A. The Contractor shall maintain the site of the work in a neat condition. The Contractor shall remove all excess materials, excess excavated materials and all debris resulting from his operations.

END OF SECTION 33 49 00