CITY OF GREENVILLE
RECREATION AND PARKS

Greenville
NORTH CAROLINA
RECREATION AND PARKS

CONTRACT I – GENERAL

Boyd Lee Park
Sand Volleyball Courts

TECHNICAL SPECIFICATIONS AND BID SCHEDULE

NORTH CAROLINA PROFESSIONAL SEAL 13055 ENGINEER J. DWIGHT VERNELSON

October 18, 2019

Rivers Project No. 2017115.12

Drawing No. W-3845-CD

J. Dwight Vernelson, P.E.
Project Manager

10-18-19
Date

Marvin E. Garner, Jr. AICP
Sr. Project Manager

10-18-19
Date

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BID SCHEDULE

Item No.	Estimated Quantity	Unit	Description	Unit Price	Total Cost
1.	1	LS	Mobilization & Bonding (not to exceed 3% of total bid)		$ _____
2.	1	LS	Demolition, Clearing & Grubbing		$ _____
3.	740	LF	Silt Fence	$ _____	$ _____
4.	1	EA	Rock Check Dam	$ _____	$ _____
5.	340	LF	Orange Mesh Barrier Fence	$ _____	$ _____
6.	395	LF	2" PVC Water Main	$ _____	$ _____
7.	3	EA	2" Valve & Box	$ _____	$ _____
8.	1	EA	2" RPZ w/ Enclosure	$ _____	$ _____
9.	16	LF	15" RCP Storm Drain Pipe	$ _____	$ _____
10.	3	TN	Class B Rip-Rap w/ Filter Cloth	$ _____	$ _____
11.	128	SY	Concrete Parking Pad	$ _____	$ _____
12.	1	LS	Pavement Marking		$ _____
13.	5	EA	Concrete Parking Stops	$ _____	$ _____
14.	71	SY	Concrete Sidewalk & Ramp	$ _____	$ _____
15.	60	LF	Ramp Handrail	$ _____	$ _____
16.	65	SY	ABC Access Drive	$ _____	$ _____
17.	1	LS	Sand Volleyball Court Complex (complete)		$ _____
18.	1	LS	Seeding & Mulching		$ _____
19.	1	LS	Testing Allowance		$ 4,000.00

TOTAL BID $ _____

SECTION 01010 - PROJECT REQUIREMENTS

RELATED DOCUMENTS:

The general provisions of the Contract, including the General and Special Conditions and Division-1 Specification sections apply to work of this section.

GENERAL DESCRIPTION OF WORK:

The Work to be performed under these Contract Documents consists of the installation of four sand volleyball courts for the City of Greenville at Boyd Lee Park located on Corey Road in Greenville, North Carolina.

CONTRACT I – SAND VOLLEYBALL IMPROVEMENTS:

The Work to be performed under this Contract consists of the installation of sand volleyball court improvements, associated amenities and incidentals in Greenville, North Carolina.

OTHER CONSTRUCTION CONTRACTS:

Work at the site performed by others under separate contracts includes the following:

None.

COORDINATION:

Contractor shall plan, schedule, and coordinate his operations in a manner which will facilitate the simultaneous progress of the Work under other contracts of this project and work included under other contracts outside the scope of these Contract Documents.

WORK BY PUBLIC UTILITIES:

Installation of water service and meter by the local utility company, Greenville Utilities Commission upon application and payment of fees by Owner.

RESPONSIBILITY FOR MATERIALS AND EQUIPMENT:

Items Furnished by Contractor: Contractor shall be fully responsible for all materials and equipment which he has furnished, and shall furnish necessary replacements at any time prior to expiration of the Correction Period.

OFF SITE STORAGE:

Off-site storage arrangements shall be acceptable to Owner for all materials and equipment not incorporated into the work but included in Applications for Payment. Such off-site storage arrangements shall be presented in writing, and shall afford adequate and satisfactory security and protection. Off-site storage facilities shall be accessible to Engineer.

EQUIVALENT MATERIALS AND EQUIPMENT:

Requests for review of equivalency will not be accepted from anyone except Contractor, and such requests will not be considered until after the Contract has been awarded.

It is the intent of these specifications to insure that material and equipment of the highest reliability are supplied. The design of the overall product and selection of material and equipment included in these specifications have been based upon dimensions, structures, connection wiring, etc. required for the first manufacturer listed in every reference to a quality standard. If material or equipment of another manufacturer (including alternatives specifically referenced) is offered, the cost of any changes in structures, building, piping, wiring, etc., as well as any detailed drawings necessary to show such required changes, shall be borne by the Contractor with no additional cost to the Owner.

PREPARATION FOR SHIPMENT:

All materials shall be suitably packaged to facilitate handling and protection against damage during transit and storage. Painted surfaces shall be protected against impact, abrasion, discoloration, and other damage. All painted surfaces that are damaged prior to acceptance of equipment shall be repainted to the satisfaction of Engineer.

Each item, package, or bundle of material shall be tagged or marked as identified in the delivery schedule or on the Shop Drawings. Complete packing lists and bills of material shall be included with each shipment.

LAND FOR CONSTRUCTION PURPOSES:

Contractor will be permitted to use available land belonging to Owner, on or near the site of the Work, for construction purposes and for the storage of materials and equipment. The location and extent of the areas so used shall be as indicated on the drawings or will be as follows:

Contractor shall immediately move stored material or equipment if any occasion arises, as determined by Owner, requiring access to the storage area. Materials or equipment shall not be placed on the property of Owner until Owner has agreed to the location to be used for storage.

OPERATION OF EXISTING FACILITIES:

The existing scoreboard must be kept in continuous operation throughout the construction period. No interruption will be permitted which adversely affects the degree of service provided. Provided permission is obtained from OWNER in advance, portions of the existing facilities may be taken out of service for short periods corresponding with periods of minimum service demands.

Contractor shall provide temporary facilities and make temporary modifications as necessary to keep the existing facilities in operation during the construction period.

NOTICES TO OWNERS AND AUTHORITIES:

Contractor shall, as provided in General Conditions, notify owners of adjacent property and utilities when prosecution of the Work may affect them.

When it is necessary to temporarily deny access by owners or tenants to their property, or when any utility service connection must be interrupted, Contractor shall give notices sufficiently in advance to enable the affected persons to provide for their needs. Notices will conform to any applicable local ordinance and, whether delivered orally or in writing, will include appropriate information concerning the interruption and instructions on how to limit their inconvenience.

LINES AND GRADES:

All Work shall be done to the lines, grades, and elevations shown on the drawings.

Basic horizontal and vertical control points have been or will be established or designated by ENGINEER on the Drawings. These points shall be used as datum for the Work. All additional field survey, layout and measurement Work shall be performed by Contractor as a part of the Work.

Contractor shall provide an experienced instrument man, competent assistants, and such instruments, tools, stakes, and other materials required to complete the survey, layout and measurement Work. In addition, Contractor shall furnish, without charge, competent men from his force and such tools, stakes, and other materials as Engineer may require in establishing or designating control points, in establishing construction easement boundaries, or in checking survey, layout, and measurement Work performed by Contractor.

Contractor shall keep Engineer informed, a reasonable time in advance, of the times and places at which he wishes to do Work, so that horizontal and vertical control points may be established and any checking deemed necessary by Engineer may be done with minimum inconvenience to Engineer and minimum delay to Contractor.

Contractor shall remove and reconstruct Work which is improperly located.

LOCATION OF EXISTING FACILITIES:

Contractor shall be responsible for discovery of existing underground installations, in advance of excavating or trenching, by contacting all local utilities and by prospecting.

The Contractor shall notify NC One Call Center (NC One Call), Greensboro, North Carolina at least 72 hours prior to commencing construction in order that existing utilities in the area may be flagged or staked. Locations of existing utilities are valid only for 10 days after the date of location. The toll free number for NC One Call is 811.

This service will in no way relieve the Contractor of his responsibility to protect and maintain all existing utilities in an operational manner.

ALLOWANCES:

The Contract Price includes cash allowances for certain materials and portions of the work as follows:

Materials Testing

Testing Agency shall work for the Owner, but be paid by the Contractor.

CONNECTIONS TO EXISTING FACILITIES:

Unless otherwise specified or indicated, Contractor shall make all necessary connections to existing facilities including structures, drain lines, and utilities such as water, sewer, gas, telephone and electric. In each case, Contractor shall receive permission from Owner or the owning utility prior to undertaking connections. Contractor shall protect facilities against deleterious substances and damage.

Connections to existing facilities which are in service shall be thoroughly planned in advance, and all required equipment, materials and labor shall be on hand at the time of undertaking the connections. Work shall proceed continuously (around the clock) if necessary to complete connections in the minimum time. Operation of valves or other appurtenances on existing utilities, when required, shall be by or under the direct supervision of the owning utility.

UNFAVORABLE CONSTRUCTION CONDITIONS:

During unfavorable weather, wet ground, or other unsuitable construction conditions, the Contractor shall confine his operations to work which will not be affected adversely by such conditions. No portion of the Work shall be constructed under conditions which would affect adversely the quality or efficiency thereof, unless special means or precautions are taken by Contractor to perform the work in a proper and satisfactory manner.

CUTTING AND PATCHING:

As provided in General Conditions, Contractor shall perform all cutting and patching required for the Work, and as may be necessary in connection with uncovering Work for inspection or for the correction of defective Work.

Contractor shall perform all cutting and patching required for the installation of improperly timed Work, to remove samples of installed materials for testing, and to provide for alteration of existing facilities or the installation of new Work in existing construction.

Except when the cutting or removal of existing construction is specified or indicated, Contractor shall not undertake any cutting or demolition which may affect the structural stability of the Work or existing facilities without Engineer's concurrence.

Contractor shall provide all shoring, bracing, supports, and protective devices necessary to safeguard all Work and existing facilities during cutting and patching operations.

Materials shall be cut and removed to the extent indicated on the drawings or as required to

complete the Work. Materials shall be removed in a careful manner with no damage to adjacent facilities or materials. Materials which are not salvable shall be removed from the site by Contractor.

All Work and existing facilities affected by cutting operations shall be restored with new materials, or with salvaged materials acceptable to Engineer, to obtain a finished installation with the strength, appearance, and functional capacity required. If necessary, entire surfaces shall be patched and refinished.

CLEANING UP:

Contractor shall keep the premises free at all times from accumulations of waste materials and rubbish. Contractor shall provide adequate trash receptacles about the site, and shall promptly empty the containers when filled.

Construction materials, such as concrete forms and scaffolding shall be neatly stacked by Contractor when not in use. Contractor shall promptly remove splattered concrete, asphalt, oil, paint, corrosive liquids and cleaning solutions from surfaces to prevent marring or other damage.

Volatile wastes shall be properly stored in covered metal containers and removed daily.

Wastes shall not be buried or burned on the site or disposed of into storm drains, sanitary sewers, streams, or waterways. All wastes shall be removed from the site and disposed of in a manner complying with local ordinances and antipollution laws.

Adequate cleanup will be a condition for recommendation of progress payment applications.

APPLICABLE CODES:

References in the Contract Documents to local codes mean the North Carolina State Building Code, North Carolina Division of Environmental Management Regulations, Greenville Utilities and City of Greenville standards.

Other standard codes that apply to the Work are designated in the specifications.

REFERENCE STANDARDS:

Reference to the standards of any technical society, organization, or association, or to codes of local or state authorities, shall mean the latest standard, code, specification, or tentative standard adopted

and published at the date of receipt of bids, unless specifically stated otherwise.

ABBREVIATIONS AND SYMBOLS:

Abbreviations used in the Contract Documents are defined as follows:

AAMA	Architectural Aluminum Manufacturers Association
AASHTO	American Association of State Highway and Transportation Officials
ACI	American Concrete Institute
AFBMA	Antifriction Bearing Manufacturers Association
AGA	American Gas Association
AGMA	American Gear Manufacturers Association
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
AMCA	Air Moving and Conditioning Association
ANSI	American National Standards Institute
APA	American Plywood Association
ASCE	American Society of Civil Engineers
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASSE	American Society of Sanitary Engineering
ASTM	American Society for Testing and Materials
AWG	American Wire Gauge
AWPA	American Wood Products Association
AWWA	American Water Works Association
CISPI	Cast Iron Soil Pipe Institute
CRSI	Concrete Reinforcing Steel Institute
CS	Commercial Standard
DEM	Division of Environmental Management of the N.C. Department of Natural Resources and Community Development
DHI	Door and Hardware Institute
DHS	Division of Health Services of the N.C. Department of Human Resources
Fed Spec	Federal Specifications
FGMA	Flat Glass Marketing Association
IBBM	Iron Body, Bronze Mounted
IEEE	Institute Electrical and Electronics Engineers
IFI	Industrial Fasteners Institute
IPS	Iron Pipe Size
MIL	Military Specification
NAAMM	National Association of Architectural Metals Manufacturers
NCDOT	North Carolina Department of Transportation

NEC	National Electrical Code
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
NPT	National Pipe Thread
NR&CD	N.C. Department of Natural Resources and Community Development
PCI	Prestressed Concrete Institute
PS	Product Standard
SCPRF	Structural Clay Products Research Foundation
SMACNA	Sheet Metal and Air Conditioning Contractors National Association
SPI	Society of the Plastics Industry
SSPC	Steel Structures Painting Council
UL	Underwriters' Laboratories
US	U. S. Bureau of Standards
USBR	U. S. Bureau of Reclamation

PRECONSTRUCTION CONFERENCE:

Prior to the commencement of Work at the site, a preconstruction conference will be held at a mutually agreed time and place. The conference shall be attended by:

Contractor and his superintendent.

Principal Subcontractors.

Representatives of principal suppliers and manufacturers as appropriate.

Engineer and his Resident Project Representative.

Representatives of Owner.

Governmental representatives as appropriate.

Others as requested by Contractor, Owner, or Engineer.

Unless previously submitted to the Engineer, Contractor shall bring to the conference a tentative schedule for each of the following:

Progress.

Procurement.

Values for progress payment purposes.

Shop Drawings and other submittals.

The purpose of the conference is to designate responsible personnel and establish a working relationship. Matters requiring coordination will be discussed and procedures for handling such matters established. The agenda will include:

Contractor's tentative schedules.

Transmittal, review, and distribution of Contractor's submittals.

Processing applications for payment.

Maintaining record documents.

Critical Work sequencing.
Field decisions and Change Orders.

Use of premises, office and storage areas, security, housekeeping, and Owner's needs.

Major equipment deliveries and priorities.

Contractor's assignments for safety and first aid.

Engineer will preside at the conference and will arrange for keeping the minutes and distributing the minutes to all persons in attendance.

PROGRESS MEETING:

A progress meeting shall be held at least monthly and at other times requested by Engineer, or as required by progress of the work. The meeting shall be attended by the Contractor and his superintendent, representatives of the Owner, and others as requested by the Contractor, Owner or Engineer. The purpose of the meeting is to discuss whether each element of the work is proceeding ahead, on time, or behind schedule. Representatives at the progress meeting must be authorized to make decisions and to act on behalf of the organization they represent.

Engineer shall preside at the meetings and provide for keeping and distribution of the minutes. The purpose of the meetings will be to review the progress of the Work, maintain coordination of efforts, discuss changes in scheduling and resolve other problems which may develop.

The Contractor shall generate documentation to list and/or illustrate work/tasks begun or completed since the previous progress meeting, and work/tasks expected to begin or be completed in the next 30 days following the current progress meeting. Contractor shall provide sufficient copies of the documentation for distribution at the progress meeting. Contractor shall be prepared to discuss how behind-schedule work will be expedited and whether schedule revisions will be required to ensure that current and subsequent work will be completed within Contract time.

OTHER MEETINGS AND CONFERENCES:

The Owner and Engineer reserve the right to conduct other site meetings and conferences as necessary to monitor and facilitate the quality of the work and operation of the existing facility. Specific meetings and conferences have been outlined in individual specification sections. Other meetings and/or conferences may include, but not be limited to, pre-installation and pre-startup. These meetings and/or conferences shall be attended by the Contractor, the ENGINEER, the Owner, critical subcontractors, regulatory officials (if necessary), and representatives of manufacturers and suppliers as deemed necessary.

SITE ADMINISTRATION:

The general Contractor shall be responsible for all areas of the site used by him, by other contractors, and all subcontractors in the performance of the Work. He will exert full control over the actions of all employees and other persons with respect to the use and preservation of property and existing facilities, except such controls as may be specifically reserved to Owner or others. Contractor has the right to exclude from the site all persons who have no purpose related to the Work or its inspection, and may require all persons on the site (except Owner's employees and Engineer) to observe the same regulations as he requires of his employees.

NORMAL WORK HOURS:

Normal work hours shall be 8:00 AM to 5:00 PM, Monday through Friday with exception of Owner recognized holidays. Exceptions may be granted by the Owner on a case-by-case basis.

END OF SECTION 01010

SECTION 01150 - PAYMENT

RELATED DOCUMENTS:

The general provisions of the Contract, including the General, Special Conditions and Division-1 Specification sections apply to work of this section.

SCOPE:

This section covers methods of payment for items of Work under this Contract.

GENERAL:

The total Bid Price for each part of the Project shall cover all Work required by the Contract Documents. All costs in connection with the proper and successful completion of the Work, including furnishing all materials, equipment, supplies and appurtenances; providing all construction plant, equipment and tools; and performing all necessary labor and supervision to fully complete the Work shall be included in the unit and lump sum prices bid. All Work not specifically set forth as a pay item in the Bid Form shall be considered a subsidiary obligation of CONTRACTOR and all costs in connection therewith shall be included in the prices bid.

ESTIMATED QUANTITIES:

All estimated quantities stipulated in the Bid Form or other Contract Documents are approximate and are to be used only (a) as a basis for estimating the probable cost of the Work and (b) for the purpose of comparing the bids submitted for the Work. The actual amounts of work done and materials furnished under unit price items may differ from the estimated quantities. The basis of payment for work and materials will be the actual amount of work done and materials furnished. CONTRACTOR agrees that he will make no claim for damages, anticipated profits or otherwise on account of any difference between the amounts of work actually performed and materials actually furnished and the estimated amounts therefore. Payment will be made or lump sum prices adjusted according to unit prices bid and as described below.

MOBILIZATION AND BONDING:

Lump sum payment for initial moving of equipment and supplies to the job site, providing bonds, insurance and permits. One half the total amount will be paid with first partial payment after

construction begins, and the remaining one half with the second partial payment. The total amount for mobilization and bonding shall not exceed 3 percent of the total bid price for each part. *If the Contractor's bid cost for this item on the Bid Schedule exceeds 3% of the Contractor's Total Bid Price, then the bid cost for this item shall be corrected to equal 3% of the Contractor's Total Bid.*

DEMOLITION, CLEARING AND GRUBBING:

Payment shall be lump sum for various site work items shown on the plans including but not limited to demolition of existing site improvements, tree removal, stump removal, grubbing, topsoil stripping/stockpiling/redistribution after new construction, handling of deleterious matter and surface restoration for work associated with installing sand volleyball courts complete, and ready to use. Unless noted otherwise, removal of various items shall include off-site disposal.

SILT FENCE:

This item shall include installation of silt fence as shown on the project drawings. Includes posts, protective caps, wire fence, fabric, excavation, backfill, anchors, bracing, and minor grading as required or directed by the Engineer. Also includes fence maintenance during construction, removal and restoration of the area upon completion of project work. Payment shall be per linear foot of fence installed as indicated in the Bid.

ROCK CHECK DAM:

This item shall include installation of a rock silt check dam as shown on the project drawings. Payment shall be per each installed as indicated in the Bid.

ORANGE MESH BARRIER FENCE:

Includes posts, wire fence, fabric, excavation, backfill, anchors, bracing, and minor grading as required or directed by the Engineer. Also includes fence maintenance during construction, removal and restoration of the area upon completion of project work. Payment shall be per linear foot of fence installed as indicated in the Bid.

PVC WATER MAIN:

This item includes pipe, gaskets, fittings, pipe markers, detection tape, blocking, clearing and grubbing, temporary support of power or telephone poles, any ditch crossings not called out as a separate pay item, removal and disposal, trenching, embedment, backfill, dewatering, seeding and mulching, shoulder restorations, testing, disinfecting, flushing and associated taps. Pipe will be

measured horizontally through valves, fittings, specials, hydrants, casing, from the center line of intersecting pipe or to the end of new lines by the foot for each size and type listed in the proposal and installed. Prompt cleanup, testing, disinfection, seeding and mulching for all lines shall be a condition for payment. Delineation of this unit price item and adjacent lump sum items shall be as shown on the Contract Drawings.

VALVE AND BOX:

This item includes gate valve, restraining glands, gaskets, thrust blocking, and or restrained joint, valve box, cover, concrete valve box ring, extension stem if required and ancillary materials, as shown in the Contract Drawings. Measurement shall be per valve installed as permanent portions of the work. Payment shall be per each unit as indicated in the Bid Schedule. Delineation of this unit price item and adjacent lump sum items shall be as shown on the Contract Drawings.

RPZ BACKFLOW DEVICE:

This item includes furnishing and installation of reduced pressure zone backflow prevention device as shown on the drawings. This item shall also include furnishing and installing enclosure, concrete slab and all other appurtenances. Payment shall be per each installed by size as indicated in the Bid. Delineation of this unit price item and adjacent lump sum items shall be as shown on the Contract Drawings.

RCP STORM DRAIN:

This item includes pipe, excavation, installation and embedment of reinforced concrete storm drainage piping as shown on the drawings. Payment shall be per linear foot of piping installed by size as indicated in the Bid.

RIP-RAP CLASS B (with filter fabric):

This item includes excavation, furnishing and placing filter fabric and rip-rap material as shown on the drawings. Payment shall be per ton installed as indicated in the Bid.

ABC STONE ACCESS DRIVE:

This item includes excavation, furnishing, placement and compaction of ABC stone for new access drive to sand volleyball concrete structure at thicknesses as shown on the drawings. Payment shall be per square yard installed as indicated in the Bid.

CONCRETE PARKING PAD:

This item shall include preparation of subgrade, formwork, placement and finishing of concrete parking surface as shown on the plans. Payment shall be per square yard of concrete installed as indicated in the Bid.

PAVEMENT MARKINGS:

This item shall include painted pavement markings as shown on the drawings. Payment shall be lump sum as indicated in the Bid.

CONCRETE PARKING STOPS:

This item shall include installation of concrete parking stops (with pins) as shown on the drawings. Payment shall be per each installed as indicated in the Bid.

HANDICAP SIGN:

This item shall include signage for handicap parking spaces as shown on the drawings. Payment shall be per each installed as indicated in the Bid.

CONCRETE SIDEWALK AND RAMP:

This item shall include preparation of subgrade, formwork, placement and finishing of concrete in areas as shown on the plans. Payment shall be per square yard installed as indicated in the Bid.

RAMP HANDRAILS:

This item shall include furnishing and installation of aluminum handrails alongside ramps in areas as shown on the plans. Payment shall be per linear foot of handrail installed as indicated in the Bid.

SAND VOLLEYBALL COURT COMPLEX (complete):

This item shall include construction of the sand volleyball court, including furnishing and placement of all materials including excavation and grading; concrete formwork, reinforcing steel and concrete; fill material from borrow, grading and compaction; graded stone; sand; geo-fabric; fencing, gates and privacy screen; wood posts for volleyball nets; irrigation system including rotors, piping, valves, wiring, and controller; volleyball netting and accessories (slider assemblies,

antennae, boundary webbing, anchors, pole pads, etc.); external fill and finished grading as required. This item shall also include costs associated with all water, waste and drain plumbing pipe, valves and fittings (inside and around exterior of structure), shower station, drinking fountain, rock absorption chamber, and underdrain piping as shown on the plans. This item shall also include all concrete stoops, landing slabs, steps, and aluminum handrails for steps as shown on the plans. This item also includes furnishing of fill material, grading and compaction for all finished contouring exterior to the sand volleyball concrete containment structure. This item shall also include all costs associated with extending electrical power to and constructing the new electrical equipment rack, electrical enclosures, equipment, conduit and wiring as shown on the plans, including inspection fees, etc.

Payment for Sand Volleyball Court shall be lump sum as indicated in the Bid, and shall include all work shown on the plans for which payment is not otherwise provided in unit price items detailed above.

SEEDING & MULCHING:

This item shall include installation and maintenance of seeding, fertilizer and mulching all disturbed areas as specified. Payment shall be lump sum as indicated in the Bid.

TESTING ALLOWANCE:

The Testing Allowance is for testing of soils as specified in Division 2, testing of concrete specified in Division 3, etc. Payment will be made for actual amount invoiced by the Testing Company when authorized by the OWNER.

EARTH EXCAVATION:

Earth excavation is considered a subsidiary obligation and all costs shall be included in the appropriate bid items.

EROSION CONTROL MAINTENANCE:

Maintenance of sedimentation and erosion control measures, including removal of the measures at the completion of construction, is considered a subsidiary obligation and all costs shall be included in the appropriate bid items.

REMOVAL AND REPLACEMENT OF EXISTING FEATURES:

Removal and replacement of existing features such as mailboxes, paper boxes, signs, fences, sidewalks, grass, lawns, ornamental shrubs such as azaleas, dogwoods, crepe myrtles, etc., stone in front of mailboxes, removal and replacement of driveway pipe and replacement with new pipe if damaged, parallel pavement replacement along the length of the pavement, etc. is considered a subsidiary obligation and all costs shall be included in the base bid.

END OF SECTION 01150

SECTION 01300 - SUBMITTALS

PART 1 - GENERAL

RELATED DOCUMENTS:

The general provisions of the Contract, including the General and Special Conditions and Division-1 Specification sections apply to work of this section.

CONSTRUCTION SCHEDULE:

Before Work is started, Contractor for Contract of the project shall submit to Engineer for review three copies of the schedule of the proposed construction operations. Owner shall cooperate with Contractor in arrangements for continuity of service and operation of valves and other control facilities. The construction schedule shall indicate the sequence of the Work, the time of starting and completion of each part, the installation date for each major item of equipment, and the time for making connections to existing piping, structures, or facilities.

At least every 30 days the schedule shall be revised as necessary to reflect changes in the progress of the Work.

Owner may require Contractor to add to his plant, equipment, or construction forces, as well as increase the working hours, if operations fall behind schedule at any time during the construction period.

PROGRESS REPORTS:

A progress report shall be furnished to Engineer with each copy of the application for progress payment. If the Work falls behind schedule, Contractor shall submit additional progress reports at such intervals as Engineer may request.

Each progress report shall include sufficient narrative to describe current and anticipated delaying factors, their effect on the construction schedule, and proposed corrective actions. Any Work reported complete, but which is not readily apparent to Engineer, must be substantiated with satisfactory evidence.

SCHEDULE OF PAYMENTS:

Within 30 days after award of Contract, Contractor shall furnish to Engineer three copies of schedule of estimated monthly payments. The schedule shall be revised and resubmitted each time an application for payment varies more than l0 percent from the estimated payment schedule.

SURVEY DATA:

All field books, notes, and other data developed by Contractor in performing surveys required as part of the Work shall be available to Engineer for examination throughout the construction period. All such data shall be submitted to Engineer with the other documentation required for final acceptance of the Work.

SHOP DRAWINGS, MATERIAL CERTIFICATES AND PRODUCT DATA:

Engineering data covering all equipment and fabricated materials which will become a permanent part of the Work under this contract shall be submitted to Engineer for review prior to installation.

Shop drawings are technical drawings and data that have been specially prepared for this project.

Material Certificates are notarized statements by an official of the supplier certifying that the materials meet the specifications and are used in lieu of or in addition to shop drawings and product data.

Product data includes standard printed information on manufactured products that has not been specially-prepared for this project.

These data shall include drawings and descriptive information in sufficient detail to show the kind, size, arrangement and operation of component materials and devices; the external connections, anchorages and supports required; performance characteristics; and dimensions needed for installation and correlation with other materials and equipment.

All submittals, regardless of origin, shall be stamped with the approval of Contractor and identified with the name and number of the Contract, Contractor's name, and references to applicable specification paragraphs and Contract Drawings. Each submittal shall indicate the intended use of the item in the Work. When catalog pages are submitted, applicable items shall be clearly identified. The current revision, issue number, and date shall be indicated on all drawings and other descriptive data.

criteria, materials, catalog numbers, and similar data, and that he has reviewed or coordinated each submittal with the requirements of the Work and the Contract Documents.

Where indicated in the Specifications, each submittal shall include a statement prepared by the originator of the drawings and data, certifying compliance with the Contract Documents except for deviations which are specifically identified.

All deviations from the Contract Documents shall be identified on each submittal and shall be tabulated in CONTRACTOR's letter of transmittal. Such submittals shall, as pertinent to the deviation, indicate essential details of all changes proposed by Contractor (including modifications to other facilities that may be a result of the deviation) and all required piping and wiring diagrams.

Contractor shall accept full responsibility for the completeness of each submission, and, in the case of a resubmission, shall verify that all exceptions previously noted by Engineer have been taken into account. In the event that more than one resubmission is required because of failure of Contractor to account for exceptions previously noted, Contractor shall reimburse OWNER for the charges of Engineer for review of the additional resubmissions.

Any need for more than one resubmission, or any other delay in obtaining Engineer's review of submittals, will not entitle Contractor to extension of the Contract Time unless delay of the Work is directly caused by a change in the Work authorized by a Change Order or by failure of Engineer to return any submittal within 21 days after its receipt in Engineer's office.

Engineer's review of drawings and data submitted by Contractor will cover only general conformity to the drawings and specifications, external connections, and dimensions which affect the layout. Engineer's review does not indicate a thorough review of all dimensions, quantities, and details of the material, equipment, device, or item shown. Engineer's review of submittals shall not relieve Contractor from responsibility for errors, omissions, or deviations, nor responsibility for compliance with the Contract Documents.

Five copies (or one reproducible copy of large drawings) of each drawing and necessary data shall be submitted to Engineer. Engineer will not accept submittals from anyone but Contractor. Submittals shall be consecutively numbered in direct sequence of submittal and without division by subcontracts or trades. Resubmittals shall bear the number of the first submittal followed by a letter (A, B, etc.,) to indicate the sequence of the resubmittal.

When the drawings and data are returned marked DISAPPROVED or RESUBMIT, the corrections shall be made as noted thereon and as instructed by Engineer and five corrected copies (or one corrected reproducible copy) resubmitted.

When corrected copies are resubmitted, Contractor shall in writing direct specific attention to all revisions and shall list separately any revisions made other than those called for by Engineer on previous submissions.

When corrected copies are resubmitted, Contractor shall in writing direct specific attention to all revisions and shall list separately any revisions made other than those called for by Engineer on previous submissions.

When the drawings and data are returned marked APPROVED AS NOTED, APPROVED, or RECORD COPY, no additional copies need be furnished.

LAYOUT DATA:

Contractor shall keep neat and legible notes of measurements and calculations made by him in connection with the layout of the Work. Copies of such data shall be furnished to the Engineer or his Resident Project Representative for use in checking Contractor's layout as provided under Lines and Grades. All such data considered of value to Owner will be transmitted to Owner by Engineer with other records upon completion of the Work.

RECORD DRAWING:

Contractor shall keep one record copy of all specifications, drawings, addenda, modifications, and shop drawings at the site in good order and annotated to show all changes made during the construction process. These shall be available to the Engineer and shall be delivered to the Engineer upon completion of the project.

An updated record drawing shall be prepared by the Contractor and submitted to the Engineer as a condition for approval for any pay request which includes pay items for sanitary sewer or water items.

Complete record drawings shall be submitted to the Engineer and then approved by the Engineer before final payment is approved. Annotations on the drawings shall include the exact location of each service stub in relation to the next lowest manhole and centerline of street. Lengths, sizes and types of materials for mains and services shall also be shown.

CLARIFICATION/INFORMATION REQUEST REPORTS:

The Contractor, in requesting clarification, information, and/or deviation, shall prepare and submit to the Engineer a Request for Information (RFI). The RFI should include a detailed description of the request, and in the case of a clarification or deviation, any proposed changes requested to complete the Work. Multiple RFI's should be sequentially numbered and dated to logically track the submittals.
END OF SECTION 01300

SECTION 01400 - QUALITY CONTROL

PART 1 - GENERAL

RELATED DOCUMENTS:

The general provisions of the Contract; including the General and Special Conditions and Division-1 Specification sections apply to work of this section.

TESTING LABORATORY SERVICES:

All tests which require the services of a laboratory to determine compliance with the Contract Documents shall be performed by an independent commercial testing laboratory acceptable to Engineer. The laboratory shall be staffed with experienced technicians, properly equipped, and fully qualified to perform the tests in accordance with the specified standards.

Testing Laboratory Services for Materials Qualification: Contractor shall be responsible for all testing laboratory services in connection with concrete materials and mix designs, the design of asphalt mixtures, gradation tests for embedment, fill, and backfill materials, and all other tests and engineering data required for Engineer's review of materials and equipment proposed to be used in the Work. Contractor shall pay all costs for services for materials qualifications.

Testing Laboratory Services for Field Quality Control: The testing laboratory for field quality control shall be selected by and work for the Owner but be paid for by the Contractor from the testing allowance. A copy of the Testing Laboratory's monthly invoices shall be submitted to the Engineer for review prior to being included in the Contractor's monthly pay request. All charges of testing laboratories for field quality control tests made in the field or laboratory on concrete, asphalt mixtures, moisture-density (Proctor) and relative density tests on embedment, fill, and backfill materials, in-place field density tests on embedments and fills, and other materials and equipment, during and after their incorporation in the Work shall be paid by Contractor out of the testing allowance as discussed in SECTION 01010. The Contractor shall be responsible for scheduling of testing agency for field quality control. To verify that equipment, materials, and installations conform to the requirements outlined in the contract documents, the Contractor shall also schedule such additional testing as deemed necessary by the Engineer. Testing due to failed tests and wasted time due to improper scheduling by the Contractor will be paid for by the Contractor, not out of the testing allowance. Field sampling and testing will be performed by the testing laboratory personnel, in the general manner indicated in the specifications, with minimum interference with construction operations. Engineer shall determine the exact time and location of field sampling and testing, and

may require such additional sampling and testing as necessary to determine that materials and equipment conform with data previously furnished by Contractor and with the Contract Documents.

Arrangements for delivery of samples and test specimens to the testing laboratory will be made by Contractor. The testing laboratory shall perform all laboratory tests within a reasonable time consistent with the specified standards and shall furnish a written report of each test.

Contractor shall furnish all sample materials and cooperate in the sampling and field testing activities, interrupting the Work when necessary. When sampling or testing activities are performed in the field by testing laboratory personnel, Contractor shall furnish personnel and facilities to assist in the activities.

OWNER shall not require the Contractor to retain any testing laboratory against which Contractor has reasonable objection, and if at any time during the construction process the services become unacceptable to Contractor, he may request in writing that such services be terminated. The request must be supported with evidence of improper testing. If Engineer and Owner determine that sufficient cause exists, Contractor may terminate the services and engage a different testing laboratory.

Transmittal of Test Reports: Written reports of tests and engineering data furnished by Contractor for Engineer's review of materials and equipment proposed to be used in the Work shall be submitted as specified for Shop Drawings in Section 01300.

The testing laboratory will furnish four copies of a written report of each test performed by laboratory personnel in the field or laboratory. Three copies of each test report will be transmitted to the Engineer and one copy to Contractor within three days after each test is completed. Testing laboratory will provide Resident Inspector and Contractor copies of field reports and test results on a daily basis prior to leaving the site. Notify Engineer and Contractor immediately of failing test results.

END OF SECTION 01400

SECTION 01500 - TEMPORARY FACILITIES

RELATED DOCUMENTS:

The general provisions of the Contract, including the General and Special Conditions and Division-1 Specification sections apply to work of this section.

WATER:

All water required for and in connection with the Work to be performed and for any specified tests of piping, equipment, devices, etc., or for any other use as may be required for proper completion of the Work shall be provided by and at the expense of Contractor. No separate payment for water used or required will be made and all costs in connection therewith shall be included in the Bid.

POWER:

Contractor shall provide all power for operation of Contractor's equipment, or for any other use by Contractor.

SANITARY FACILITIES:

Contractor shall furnish temporary sanitary facilities at the site, as provided herein, for the needs of all construction workers and others performing work or furnishing services on the Project.
Sanitary facilities shall be of reasonable capacity, properly maintained throughout the construction period, and obscured from public view to the greatest practical extent. If toilets of the chemically treated type are used, at least one toilet will be furnished for each 20 men. Contractor shall enforce the use of such sanitary facilities by all personnel at the site.

MAINTENANCE OF TRAFFIC:

Contractor shall adhere to the requirements of the NCDOT and the City of Greenville with regard to traffic safety and traffic control devices. The Contractor shall perform all work in accordance with all federal, state and local laws. The City of Greenville has no responsibility for nor authority to enforce job safety requirements.

Contractor shall conduct his work to interfere as little as possible with public travel, whether vehicular or pedestrian. Whenever it is necessary to cross, obstruct, or close roads, driveways and walks, whether public or private, Contractor shall provide and maintain suitable and safe bridges,

detours, or other temporary expedients for the accommodation of public and private travel, and shall give reasonable notice to owners of private drives before interfering with them. Such maintenance of traffic will not be required when Contractor has obtained permission from the owner and tenant of private property, or from the authority having jurisdiction over public property involved, to obstruct traffic at the designated point.

In making open cut street crossings, Contractor shall not block more than one-half of the street at a time. Whenever possible, Contractor shall widen the shoulder on the opposite side to facilitate traffic flow. Temporary surfacing shall be provided as necessary on shoulders.

Temporary Bridges: Contractor shall construct substantial bridges at all points where it is necessary to maintain traffic across pipeline construction. Bridges in public streets, roads, and highways shall be acceptable to the authority having jurisdiction thereover. Bridges erected in private roads and driveways shall be adequate for the service to which they will be subjected. Bridges shall be provided with substantial guard rails and with suitably protected approaches. Foot bridges shall be not less than 4 feet wide, provided with handrails and uprights of dressed lumber. Bridges shall be maintained in place as long as the conditions of the Work require their use for safety of the public, except that when necessary for the proper prosecution of the Work in the immediate vicinity of a bridge, the bridge may be relocated or temporarily removed for such period as Engineer may permit.

Detours: Where required by the authority having jurisdiction thereover that traffic be maintained over any construction work in a public street, road, or highway, and the traffic cannot be maintained on the alignment of the original roadbed or pavement, Contractor shall, at his own expense, construct and maintain a detour around the construction work. Each detour shall include a bridge across the pipe trench and all necessary barricades, guard rails, approaches, lights, signals, signs, and other devices and precautions necessary for protection of the Work and safety of the public.

BARRICADES AND LIGHTS:

All streets, roads, highways, parking lots, sidewalks and other public thoroughfares which are closed to traffic shall be protected by effective barricades on which shall be placed acceptable warning signs. Barricades shall be located at the nearest intersecting public highway or street on each side of the blocked section.

All open trenches and other excavations shall have suitable barricades, signs, and lights to provide adequate protection to the public. Obstructions such as material piles and equipment shall be provided with similar warning signs and lights.

All barricades and obstructions shall be illuminated with warning lights from sunset to sunrise. Material storage and conduct of the Work on or alongside public streets and highways shall cause

the minimum obstruction and inconvenience to the traveling public.

All barricades, signs, lights and other protective devices shall be installed and maintained in conformity with applicable statutory requirements and, where within railroad and highway rights-of-way, as required by the authority having jurisdiction thereover.

FENCES:

All existing fences affected by the Work shall be maintained by Contractor until completion of the Work. Fences which interfere with construction operations shall not be relocated or dismantled until written permission is obtained from the owner of the fence, and the period the fence may be left relocated or dismantled has been agreed upon. Where fences must be maintained across the construction easement, adequate gates shall be installed. Gates shall be kept closed and locked at all times when not in use.

On completion of the Work across any tract of land, Contractor shall restore all fences to their original or to a better condition and to their original location.

PROTECTION OF PUBLIC AND PRIVATE PROPERTY:

Contractor shall protect, shore, brace, support, and maintain all underground pipes, conduits, drains, and other underground construction uncovered or otherwise affected by his construction operations. All pavement, surfacing, driveways, curbs, walks, buildings, utility poles, guy wires, fences, and other surface structures affected by construction operations, together with all sod and shrubs in yards and parking, shall be restored to their original condition, whether within or outside the easement or project area. All replacements shall be made with new materials.

No trees shall be removed outside of the designated clearing area, except where authorized by Engineer. Whenever practicable Contractor shall tunnel beneath trees in yards, sidewalks and parking lots when on or near the line of trench. Hand excavation shall be employed as necessary to prevent injury to trees. Trees left standing shall be adequately protected against damage by construction operations. Contractor shall be responsible for all damage to streets, roads, highways, shoulders, ditches, embankments, culverts, bridges, and other public or private property, regardless of location or character, which may be caused by transporting equipment, materials, or men to or from the Work or any part or site thereof, whether by him or his Subcontractors. Contractor shall make satisfactory and acceptable arrangements with the owner of, or the agency or authority having jurisdiction over, the damaged property concerning its repair or replacement or payment of costs incurred in connection with the damage. All fire hydrants and water control valves shall be kept free from obstruction and available for use at all times.

DAMAGE TO EXISTING PROPERTY:

Contractor will be held responsible for any damage to existing structures, Work, materials or equipment because of his operations and shall repair or replace any damaged structures, Work, materials, or equipment to the satisfaction of, and at no additional cost to, Owner.

Contractor shall protect all existing structures and property from damage and shall provide bracing, shoring, or other work necessary for such protection.

Contractor shall be responsible for all damage to streets, roads, curbs, sidewalks, highways, shoulders, ditches, embankments, culverts, bridges, or other public or private property, which may be caused by transporting equipment, materials, or men to or from the Work. Contractor shall make satisfactory and acceptable arrangements with the agency having jurisdiction over the damaged property concerning its repair or replacement.

TREE AND PLANT PROTECTION:

All trees and other vegetation which must be removed to perform the Work shall be removed and disposed of by Contractor; however, no trees or cultured plants shall be unnecessarily removed unless their removal is indicated on the drawings. All trees and plants not removed shall be protected against injury from construction operations.

PARKING:

Contractor for General Construction Contract shall provide and maintain suitable parking areas for the use of all construction workers and others performing work or furnishing services in connection with the Project as required to avoid any need for parking personal vehicles where they may interfere with public traffic, Owner's operations, or construction activities.

TEMPORARY DRAINAGE PROVISIONS:

Contractor shall provide for the drainage of stormwater and such water as may be applied or discharged on the site in performance of the Work. Drainage facilities shall be adequate to prevent damage to the Work, the site, and adjacent property.

Existing drainage channels and conduits shall be cleaned, enlarged or supplemented as necessary to carry all increased runoff attributable to Contractor's operations. Dikes shall be constructed as necessary to divert increased runoff from entering adjacent property (except in natural channels), to protect Owner's facilities and the Work, and to direct water to drainage channels or conduits. Ponding shall be provided as necessary to prevent downstream flooding.

NOISE CONTROL:

Contractor shall take reasonable measures to avoid unnecessary noise. Such measures shall be appropriate for the normal ambient sound levels in the area during working hours. All construction machinery and vehicles shall be equipped with practical sound muffling devices, and operated in a manner to cause the least noise consistent with efficient performance of the Work.

During construction activities on or adjacent to occupied buildings, and when appropriate, Contractor shall erect screens or barriers effective in reducing noise in the building; and shall conduct his operations to avoid unnecessary noise which might interfere with the activities of building occupants.

DUST CONTROL:

Contractor shall take reasonable measures to prevent unnecessary dust. Earth surfaces subject to dusting shall be kept moist with water or by application of a chemical dust suppressant. Dusty materials in piles or in transit shall be covered when practicable to prevent blowing.

Buildings or operating facilities which may be affected adversely by dust shall be adequately protected from dust. Existing or new machinery, motors, instrument panels or similar equipment, shall be protected by suitable dust screens. Proper ventilation shall be included with dust screens.

EROSION CONTROL:

The Contractor shall be familiar with the applicable provisions of the North Carolina Sedimentation Pollution Control Act of 1973, General Statues, Chapter 113A, Article 4. Contractor shall prevent erosion of soil on the site and adjacent property resulting from his construction activities. Effective measures shall be initiated prior to the commencement of clearing, grading, excavation, or other operation that will disturb the natural protection.

Work shall be scheduled to expose areas subject to erosion for the shortest possible time, and natural vegetation preserved to the greatest extent practicable. Temporary storage and construction buildings shall be located, and construction traffic routed, to minimize erosion. Temporary fast growing vegetation or other suitable ground cover shall be provided as necessary to control runoff. Disturbed ground surface shall be graded to prevent ponding of water, seeded, and mulched upon completion of backfilling operations.

POLLUTION CONTROL:

Contractor shall prevent the pollution of drains and watercourses by sanitary wastes, sediment, debris and other substances resulting from construction activities. No sanitary wastes will be permitted to enter any drain or watercourse other than sanitary sewers. No sediment, debris or other substance will be permitted to enter sanitary sewers and reasonable measures will be taken to prevent such materials from entering any drain or watercourse.

END OF SECTION 01500

SECTION 02210 - CLEARING, EXCAVATION AND TRENCHING

PART 1 - GENERAL

RELATED DOCUMENTS:

The general provisions of the Contract, including the General and Special Conditions and Division-1 Specification sections apply to work of this section.

DESCRIPTION OF WORK:

This section covers excavation work and shall include the necessary clearing, grubbing and preparation of the site; removal and disposal of all debris; excavation and trenching as required; the handling, storage, transportation and disposal of all excavated material; all necessary sheeting, shoring and protection work; preparation of subgrades; pumping and dewatering as necessary or required; protection of adjacent property; backfilling; pipe embedment; construction of fills and embankments; surfacing and grading; and other appurtenant work.

RELATED WORK SPECIFIED ELSEWHERE:

Storm Sewer System: Division-2

Concrete: Division-3

Pipe and Pipe Fittings: Division-15

QUALITY ASSURANCE:

Codes and Standards: Perform excavation work in compliance with applicable requirements of governing authorities having jurisdiction and the OSHA. Field and laboratory testing should be performed in accordance with applicable standards, except where more stringent requirements are shown or specified:

ASTM D 422	"Particle Size Analysis of Soil"
ASTM D 1556	"Density and Unit weight of soil in place Sand-Cone Method"

ASTM D 698	"Laboratory Compaction Characteristics of Soil Using Standard Effort"
ASTM D 2216	"Laboratory Determination of Water (Moisture) Content of Soil And Rock"
ASTM D 2487	"Classification of Soils for Engineering Purposes (Unified Soil Classification System)"
ASTM D 2922	"Density of Soil and Soil-Aggregate In Place by Nuclear Method"
ASTM D 2937	"Density of Soil In Place by the Drive-Cylinder Method"
ASTM D 3017	"Water Content of Soil and Rock In Place by Nuclear Method"
ASTM D 4318	"Liquid Limit, Plastic Limit, and Plasticity Index of Soils"
ASTM D 4718	"Correction of Unit Weight and Water Content for Soils Containing Oversize Particles"
ASTM D 4959	"Determination of Water (Moisture) Content by Direct Heating Method"
ASTM D 5519	"Particle Size Analysis of Natural and Man-Made Riprap Materials"

Testing and Inspection Service: The Owner shall select a testing laboratory to perform soil testing and inspection service for quality control testing during earthwork operations. The cost of testing and inspection shall be paid for out of the testing allowance as specified in Division-1. Testing agency shall be selected by and work for the Owner but be paid by the Contractor.

Testing laboratory shall test compaction of backfill placed in accordance with ASTM D 1556, D 2937, or D 2922 and 3017, based upon moisture-density relationships determined for each soil type by ASTM D 698.

All compaction tests performed in the field shall be based upon "field check points" or "one-point Proctor" data for similar laboratory compaction curves, and shall be molded dry of the optimum moisture content of an individual material.

Compaction testing utilizing ASTM D 2922 and D 3017 will provide correlation tests utilizing D 1556. The frequency of correlation tests will be determined by the Engineer.

Compaction Tests will be performed at the following locations and frequencies, unless otherwise directed by the Engineer.

Volleyball Court Subgrade: One test per lift for every 2500 sq.ft. of fill material placed, but no less than two tests per lift.

Trench Backfill: One test per lift for every 100 ft. or less, but no fewer than two tests per lift.

Foundation Wall Backfill: One test per lift for every 75 ft. or less, but no fewer than two tests per lift.

Foundation (Footing) Subgrade: Evaluation of foundation subgrades for adequate bearing capacities by performing Dynamic Hand Cone Penetrometer tests. Tests shall be provided at sufficient number of locations and extended to sufficient depths to confirm subsurface findings of design subsurface investigation as approved by the Engineer. Subsequent or intermediate testing of other foundation subgrades may be based on a visual comparison with tested subgrade when approved by the Engineer.

SUBMITTALS:

Test Reports-Excavating: Submit following reports directly to Engineer from the testing services, with copy to Contractor:

Test reports on borrow material

Verification of each footing subgrade

Field density test reports

One optimum moisture-maximum density curve for each type of soil encountered

Report of actual unconfined compressive strength and/or results of bearing test of each strata tested

JOB CONDITIONS:

Classification of Excavated Materials: No classification of excavated materials will be made. Excavation and trenching work shall include the removal and subsequent handling of all materials excavated or otherwise removed in performance of the Contract Work, regardless of the type, character, composition or condition thereof.

Unauthorized excavation consists of removal of materials beyond indicated subgrade elevations or dimensions without specific direction of Engineer. Unauthorized excavation, as well as remedial work directed by Engineer, shall be at Contractor's expense.

Under footings, foundation bases, or retaining walls, fill unauthorized excavation by extending indicated bottom elevation of footing or base to excavation bottom, without altering required top elevation. Lean concrete fill may be used to bring elevations to proper position, when acceptable to Engineer.

Elsewhere, backfill and compact unauthorized excavations as specified for authorized excavations of same classification, unless otherwise directed by Engineer.

Undercut Excavation: When excavation has reached required natural or undisturbed subgrade elevations, notify Engineer who will make an inspection of conditions. If unsuitable natural or undisturbed bearing materials are encountered at required subgrade elevations, carry excavations deeper and replace excavated material as directed by Engineer.

All subgrades of all structures must be inspected by soils testing lab prior to placement of stone.

Removal of unsuitable material and its replacement as directed will be paid on basis of contract price established in the Bid Schedule. Backfill placed during this project which has been compacted to less than specified compaction and requires removal and replacement, will not be considered as undercut.

Existing Utilities: Locate existing underground utilities in areas of Work. If utilities are to remain in place, provide adequate means of support and protection during earthwork operations.

Should uncharted, or incorrectly charted, piping or other utilities be encountered during excavation, consult utility Owner immediately for directions. Cooperate with Owner and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to satisfaction of utility Owner.

Do not interrupt existing utilities serving facilities occupied and used by Owner or others, during occupied hours, except when permitted in writing by Engineer and then only after acceptable temporary utility services have been provided.

Provide minimum of 48-hour notice to Engineer, and receive written notice to proceed before interrupting any utility.

Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility Owner for shut-off of services if lines are active.

Use of Explosives: The use of explosives is not permitted.

Protection of Persons and Property: Barricade open excavations occurring as part of this Work and post with warning lights.

Operate warning lights as recommended by authorities having jurisdiction.

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

Perform excavation within drip-line of large trees to remain by hand, and protect the root system from damage or dryout to the greatest extent possible. Maintain moist condition for root system and cover exposed roots with burlap. Paint root cuts of 1" diameter and larger with emulsified asphalt tree paint.

PART 2 - PRODUCTS

DEFINITIONS:

Satisfactory soil materials are defined as those complying with ASTM D 2487 soil classification groups GW, GP, GM, GC, SM, SW and SP.

Provisionally satisfactory soil materials are defined as those complying with ASTM D 2487 soil classification group SC. Provisionally satisfactory soil materials are moisture sensitive soils which are expected to required moisture conditioning, particularly in wetter times of the year, in order be considered satisfactory. If proper densities cannot be achieved by moisture conditioning prior to backfill, the soils shall be deemed unsatisfactory and replaced with satisfactory materials at no additional cost to the OWNER.

Unsatisfactory soil materials are defined as those complying with ASTM D 2487 soil classification groups ML, MH, CL, CH, SC, OL, OH and PT.

GENERAL MATERIALS:

Volleyball Court Sand Media: Washed or natural sand.

Grade	Gravel	V. Course	Course	Medium	Fine	V. Fine	Clay+Silt
Millimeter	2.0	1.0	0.5	0.25	0.15	0.05	N/A
Screen	#10	#18	#35	#60	#100	#270	N/A
% Passing	<2	<15	(combined 78% - 100%)			<5	<3

Clean Sand (other uses): Washed or natural sand with less than 10 percent by weight passing the No. 200 sieve.

Engineering Fabric: For use in soil stabilization, provide synthetic fabric as specified in NCDOT Standard Specifications for Roads and Structures Section 1056 Type 2.

Filter Cloth: For use under granular fill, provide spun woven synthetic fiber; 20 oz/sy; burst strength of 500 psi, vertical water flow of 265 gpm/sy.

Granular Fill (Granular Embedment and Stabilization Material): Granular fill or embedment material shall be crushed rock or gravel, shall be free from dust, clay or trash, and shall be #67 or #57 stone as defined in ASTM C 33 except that larger stone may be used for stabilization if approved by the Engineer.

Aggregate Base Course Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, crushed slag, natural or crushed sand as specified in NC DOT Standard Specifications for Roads and Structures, Section 1010, Type A.

Fill Material (Backfill): All material deposited in trenches shall be satisfactory soils free from rocks or stones larger than 2 inches, brush, stumps, logs, roots, debris and organic or other objectionable materials, and shall be wetted or dried as required and thoroughly mixed to ensure uniform moisture content.

Select Backfill: Job excavation or borrow material consisting of coarse sands and fine sands with not more than 15% by weight passing the no. 200 sieve. This does not include clays, silts, organic soils or any materials not acceptable as fill material. Select backfill must receive prior approval from the Engineer before use. (ASTM D2321 Class II)

PIPE EMBEDMENT:

Embedment materials both below and above the bottom of the pipe, classes of embedment to be used and placement and compaction of embedment materials shall conform to the requirements shown on the drawings and to the following supplementary requirements.

Embedment materials shall contain no cinders or other material which may cause pipe corrosion.

Class A Arch Encasement is not required unless improper trenching or unexpected trench conditions require its use as determined by the Engineer.

Class C Bedding shall be used for all reinforced and nonreinforced concrete pipelines.

Class C bedding shall include granular fill compacted from 4" below the pipe to 1/6 of the outside diameter of the pipe and satisfactory backfill embedment compacted to at least 12" above the top of the pipe as shown on the drawings.

Class D Bedding shall be used for all PVC gravity sewer and PVC drainage pipe.

Class D bedding shall include granular embedment from 4" below the pipe to the top of the pipe and at least 12" of compacted select backfill embedment above that as shown on the drawings.

Class E Bedding shall be used for all PVC pressure pipe.

Class E embedment shall include select backfill embedment compacted from 4" below the pipe to at least 12" above the pipe as shown on the drawings.

PART 3 - EXECUTION

GENERAL REQUIREMENTS:

Excavation shall provide adequate working space and clearances for the Work to be performed therein and for installation and removal of concrete forms. In no case shall excavation faces be undercut for extended footings.

Subgrade surfaces shall be clean and free of loose material of any kind when concrete is placed thereon.

Backfilling and construction of fills and embankments during freezing weather shall not be done except by permission of the Engineer. No backfill, fill or embankment materials shall be installed on frozen surfaces, nor shall frozen materials, snow or ice be placed in any backfill, fill or embankment.

SITE PREPARATION, CLEARING AND GRUBBING:

All sites to be occupied by permanent construction or embankments shall be cleared of all logs, trees, roots, brush, tree trimmings and other objectionable materials and debris. All stumps shall be grubbed. Subgrades for fills and embankments shall be cleaned and stripped of all surface vegetation, sod, and organic topsoil. All waste materials shall be removed from the site and disposed of by and at the expense of the Contractor.

Contractor shall demolish, remove and dispose of all exercise equipment, landscape timbers, mulch, signage and concrete as designated on the drawings.

Clear and grub the entire width of the permanent right of way. All other clearing shall be performed as necessary for access, stringing of pipeline materials, and construction of the pipeline and appurtenant structures.

Burning on Site: Burning is not permitted on the site.

PRESERVATION OF TREES:

No trees shall be removed outside of excavated or filled areas, unless their removal is authorized by the Owner. Trees left standing shall be adequately protected from permanent damage by construction operations.

UNAUTHORIZED EXCAVATION:

Except where otherwise authorized, shown or specified, all materials excavated below the bottom of concrete walls, footings, slabs on grade and foundations shall be replaced by, and at the expense of, the Contractor, with concrete placed at the same time and monolithic with the concrete above.

DEWATERING:

Dewatering equipment shall be provided to remove and dispose of all surface and ground water entering excavations, trenches or other parts of the work. Water removed by dewatering operations shall be disposed of in accordance with the N.C. Sedimentation Pollution Control Act. Each excavation shall be kept dry during subgrade preparation and continually thereafter until the structure to be built, or the pipe to be installed therein, is completed to the extent that no damage from hydrostatic pressure, flotation or other cause will result.

All excavations for concrete structures or trenches which extend down to or below ground water shall be dewatered by lowering and keeping the ground water level beneath such excavations, 12

inches or more below the bottom of the excavation for trenches, and 24 inches or more for structures. Well pointing will be required for dewatering pipe trenches ahead of trenching and pipe laying, so that excavations are free from ground water.

Surface water shall be diverted or otherwise prevented from entering excavated areas or trenches to the greatest extent practicable without causing damage to adjacent property.

The Contractor shall be responsible for the condition of any pipe or conduit which he may use for drainage purposes, and all such pipe or conduit shall be left clean and free of sediment.

Temporary sediment basins shall be installed as necessary for dewatering operations, to prevent discharge directly into surface waters.

The Contractor shall be responsible for installation and proper abandonment of all temporary dewatering wells. The wells shall be installed and abandoned in accordance with applicable well abandonment regulations. Where applicable, the work shall be by a certified well driller familiar with the proper procedures, notification, and documentation for installation and closeout of wells.

SHEETING AND SHORING:

Except where banks are cut back on a stable slope, excavation for structures and trenches shall be sheeted, braced and shored as necessary to prevent caving or sliding.

Trench sheeting shall not be pulled before backfilling unless the pipe strength is sufficient to carry trench loads based on trench width to the back of sheeting, nor shall sheeting be pulled after backfilling. Where trench sheeting is left in place, such sheeting shall not be braced against the pipe, but shall be supported in a manner which will preclude concentrated loads or horizontal thrusts on the pipe. Cross braces installed above the pipe to support sheeting may be removed after pipe embedment has been completed.

Steel sheet piling shall be furnished, installed and left in place at the locations indicated on the drawings and elsewhere as required to limit the extent of excavations for the deeper structures and necessary backfill under adjacent shallower structures, and to protect adjacent structures and facilities from damage due to excavation and subsequent construction. No additional payment above the Contract amount will be made for such sheet piling as indicated or required.

STABILIZATION:

Subgrades for concrete structures and trench bottoms shall be firm, dense and thoroughly compacted and consolidated; shall be free from mud and muck; and shall be sufficiently stable to remain firm and intact under the feet of the workmen.

Subgrades for concrete structures or trench bottoms which are otherwise solid, but which become mucky on top due to construction operations, shall be reinforced with crushed rock or gravel. The stabilizing material shall be spread and compacted to a depth of not more than 4 inches; if the required depth exceeds 4 inches, the material shall be furnished and installed as specified for granular fills. The finished elevation of stabilizing subgrades shall not be above subgrade elevations indicated on the drawings.

EARTH FILLS AND EMBANKMENTS:

General: Fills and embankments shall be constructed to lines and grades indicated on the drawings. To the maximum extent available, excess suitable material obtained from structure and trench excavation shall be used for the construction of fills and embankments. Additional material shall be provided by the Contractor as required or obtained from borrow pits where indicated on the drawings.

All material placed in fills and embankments shall be free from rocks or stones larger than 6 inches in their greatest dimension, brush, stumps, logs, roots, debris and organic or other deleterious materials. No rocks or stones shall be placed in the upper 18 inches of any fill or embankment. Rocks or stones within the allowable size limit may be incorporated in the remainder of fills and embankments provided they are distributed so that they do not interfere with proper compaction.

Subgrade Preparation: After clearing, grubbing, demolition and topsoil stripping of the fill or embankment site, the subgrade shall be leveled and rolled so surface materials of the subgrade will be as compact and well bonded with the first layer of the fill or embankment as specified for subsequent layers.

Placement and Compaction: All fill and embankment materials shall be placed in approximately horizontal layers not to exceed 8 inches in uncompacted thickness. Material deposited in piles or windrows by excavating and hauling equipment shall be spread and leveled before compaction.

Moisture content of the material shall be within 2% of the material's optimum compaction moisture. The material in each layer shall be wetted or dried as required and thoroughly mixed to ensure uniform moisture content and adequate compaction. Each layer shall be thoroughly compacted to 95 percent of maximum density at optimum moisture content as determined by ASTM D 698. If the material fails to meet the density specified, compaction methods shall be altered.

GRANULAR FILLS:

Granular fills shall be provided where indicated on the drawings. Granular fills shall be placed on suitably prepared subgrades and compacted by vibration. Minimize construction traffic on placed volleyball court sand media to avoid compaction.

EXCAVATION FOR STRUCTURES:

Conform to elevations and dimensions shown within a tolerance of plus or minus 0.10', and extending a sufficient distance from footings and foundations to permit placing and removal of concrete formwork, installation of services, other construction and for inspection.

In excavation for footings and foundations, take care not to disturb bottom of excavation. Trim bottoms to required lines and grades to leave solid base to receive other work.

Except where exterior surfaces are specified to be dampproofed, monolithic concrete manholes and other concrete structures, or parts thereof, which do not have footings that extend beyond the outside face of exterior walls, may be placed directly against excavation faces without the use of outer forms, provided that such faces are stable.

ROADWAY EXCAVATION:

Excavation for the roadways, drives and parking areas shall conform to the lines, grades, cross sections and dimensions indicated on the drawings and shall include the excavation of all unsuitable material from the subgrade. After shaping to line, grade and cross section, the subgrade shall be compacted to a depth of at least 6 inches to 98 percent of maximum density at optimum moisture content as determined by ASTM D 698. This operation shall include any reshaping and wetting or drying required to obtain proper compaction. All soft or otherwise unsuitable material shall be removed and replaced with suitable material.

Provide a proofrolling of the compacted aggregate base course with a heavy roller or loaded dump truck (+25 tons) in the presence of the Engineer's Representative. The proofrolling shall be covered by the wheels of the proofroller operating at a speed between 2-1/2 and 3-1/2 miles per hour.

Any areas that rut or pump excessively shall be scarified, dried, and recompacted, or shall be undercut and backfilled with select backfill or coarse aggregate base course as directed by the Engineer.

After undercut and backfill operations are complete, a final proofrolling of the undercut areas will be performed in the presence of the Engineer's Representative.

DITCH EXCAVATION:

The excavation shall be done to the lines, grades, typical sections, and details shown on the plans or established by the Engineer. All work covered by this section shall be coordinated with the grading, construction of drainage structures, excavation of borrow and material sources, and other work along the project, and shall be maintained in a satisfactory condition so that adequate drainage is provided at all times. The ditches shall be maintained by the Contractor until the final acceptance of the project. Any roots which protrude into the ditch shall be trimmed flush with the sides of the ditch. Inlet and outlet ditches for pipe lines shall be completed before the pipe is installed unless otherwise permitted by the Engineer.

TRENCH EXCAVATION:

Trenches shall be excavated so that pipes can be laid straight at uniform grade, without dips or humps, between the terminal elevations indicated on the drawings.

Minimum Cover: Where pipe grades or elevations are not definitely fixed by the Contract drawings or profiles, trenches shall be excavated to a depth sufficient to provide a minimum depth of backfill cover over the top of the pipe of 36 inches.

Limiting Trench Widths: Trenches shall be excavated to a width which will provide adequate working space and sidewall clearances for proper pipe installation, jointing and embedment. However, the limiting trench widths from the bottom of the trench to an elevation one foot above the top of installed pipe, and the minimum permissible sidewall clearances between the installed pipe and each trench wall shall be as follows:

Nominal Pipe Size (inches)	Minimum Trench Width (inches)	Maximum Trench Width (inches)
Less than 18	Pipe O.D. Plus 18	Pipe O.D. Plus 24
18 through 27	Pipe O.D. Plus 24	Pipe O.D. Plus 30
28 through 42	Pipe O.D. Plus 24	Pipe O.D. Plus 36
43 through 60	Pipe O.D. Plus 30	Pipe O.D. Plus 36

Stipulated minimum sidewall clearances are not minimum average clearances but are minimum clear distances which will be required.

Cutting trench banks on slopes to reduce earth load to prevent sliding and caving shall be done only in areas where the increased trench width will not interfere with surface features or encroach on right-of-way limits. Slopes shall not extend lower than one foot above the top of the pipe.

Unauthorized Trench Widths: Where, for any reason, the width of the lower portion of the trench, as excavated at any point, exceeds the maximum permitted in the foregoing tables, either pipe of adequate strength, special pipe embedment, or arch concrete encasement, as required by loading conditions and with the concurrence of the Engineer, shall be furnished and installed by and at the expense of the Contractor.

Mechanical Excavation: The use of mechanical equipment will not be permitted in locations where its operation would cause damage to trees, buildings, culverts, or other existing property, utilities, or structures above or below ground. In all such locations, hand excavating methods shall be used.

Only rubber-tired equipment will be permitted on paved streets unless specifically allowed by the Owner and Engineer on a case-by-case basis.

Mechanical equipment used for trench excavation shall be of a type, design, and construction, and shall be so operated that the rough trench excavation bottom elevation can be controlled, that uniform trench widths and vertical sidewalls are obtained at least from an elevation one foot above the top of the installed pipe to the bottom of the trench, and that trench alignment is such that pipe when accurately laid to specified alignment will be centered in the trench with adequate clearance between the pipe and sidewalls of the trench. Undercutting the trench sidewall to obtain clearance will not be permitted.

Where soil conditions permit, trenches for pipe 12 inches or less in diameter may be excavated by trenching equipment comparable to a Cleveland JS36. Trenchers shall be capable of being leveled on sloping ground. Trench depths for proper pipe grade according to profiles, elevations, dimensions, etc., on plans must be complied with even if a trencher is utilized.

Concrete and asphalt pavement over trenches excavated for pipelines shall be removed so that the width at any point is not greater than the top edge of the trench. Trench width at the bottom shall not be greater than at the top and no undercutting will be permitted. Pavement cuts shall be made to and between straight or accurately marked curved lines which, unless otherwise required, shall be parallel to the centerline of the trench.

Pavement removed for connections to existing lines or structures shall not be of greater extent than necessary for the installation.

Where the trench parallels the length of concrete walks and the trench location is all or partially under the walk, the entire walk shall be removed and replaced. Where the trench crosses drives, walks, curbs, or other surface construction, the surface construction shall be removed and replaced between existing joints or between saw cuts as specified for pavement.

Excavation Below Pipe Subgrade: Where required, pipe trenches shall be excavated below the underside of the pipe, to provide for the installation of granular embedment.

Bell Holes shall provide adequate clearance for tools and methods used in installing pipe. No part of any bell or coupling shall be in contact with the trench bottom, trench walls or granular embedment when the pipe is jointed.

PIPE EMBEDMENT:

Placement and Compaction: Granular embedment material shall be spread and the surface graded to provide a uniform and continuous support beneath the pipe at all points between bell holes or pipe joints. It will be permissible to slightly disturb the finished subgrade surface by withdrawal of pipe slings or other lifting tackle.

After each pipe has been graded, aligned and placed in final position on the bedding material or trench bottom and shoved home, sufficient pipe embedment material shall be deposited and compacted under and around each side of the pipe and back of the bell or end thereof to hold the pipe in proper position and alignment during subsequent pipe jointing and embedment operations.

Embedment material shall be deposited and compacted uniformly and simultaneously on each side of the pipe to prevent lateral displacement.

Hand placed embedment shall be compacted to the top of the pipe in all areas where compacted backfill is specified.

Whenever crushed rock is used as embedment for 36 inch and larger pipe, the portion above the bottom of the pipe shall be vibrated with a mechanical probe type vibrator during placement to ensure that all spaces beneath the pipe are filled.

TRENCH BACKFILL:

A layer of backfill material not more than 8 inches deep may be placed over concrete arch encasement or concrete reaction blocking after the concrete has reached its initial set, to aid curing. No additional backfill shall be placed over arch encasement or blocking until the concrete has been in place for at least 3 days.

Backfill compacted to 95 percent of maximum density at optimum moisture content as determined by ASTM D 698 will be required for the full depth of the trench above the embedment in the following locations:

Where beneath pavements, surfacings, driveways, curbs, gutters, walks or other surface construction or structures

Where in street, road or highway shoulders

Where beneath fills or embankments

In established lawn areas

In addition to the above, the final one foot below soil subgrade for slabs and paved areas shall not have compaction less than 98 percent of the Standard Proctor Maximum dry density, as determined by ASTM D 698.

In other areas the backfill shall be compacted to 90 percent or equal to existing.

Where the trench for one pipe passes beneath the trench for another pipe, backfill for the lower trench shall be compacted to the level of the bottom of the upper trench.

Job excavation material may be used for compacted backfill when the job excavated material is finely divided and free from debris, organic material, cinders or other corrosive material, and stones larger than 3 inches in greatest dimension. Masses of moist, stiff clay shall not be used. Each layer of material shall have the best practicable moisture content for satisfactory compaction. The material in each layer shall be wetted or dried as required and thoroughly mixed to ensure uniform moisture content and adequate compaction. Backfill materials shall be placed in uniform layers not exceeding 8 inches in uncompacted thickness. Increased layer thickness may be permitted for noncohesive material if the Contractor demonstrates to the satisfaction of the Engineer that the specified compacted density will be obtained.

The method of compaction and the equipment used shall be appropriate for the material to be compacted and shall not transmit damaging shocks to the pipe.

The top portion of backfill beneath established lawn areas shall be finished with not less than 4 inches of topsoil corresponding to, or better than, that underlying adjoining lawn areas.

STRUCTURE BACKFILL:

The quality and moisture content of materials for backfill around and outside of structures shall conform to the requirements for fill materials. Backfill materials shall be deposited in layers not to exceed 8 inches in uncompacted thickness and compacted to at least 95 percent of maximum density, within 2% of the material's optimum moisture content as determined by ASTM D 698. Compaction of structure backfill by rolling will be permitted provided the desired compaction is obtained and damage to the structure is prevented. Compaction of structure backfill by inundation with water will not be permitted.

No backfill shall be deposited or compacted in water. Particular care shall be taken to compact structure backfill which will be beneath pipes, drives, roads, parking areas, walks, curbs, gutters or other surface construction or structures. In addition, wherever a trench is to pass through structure backfill, the structure backfill shall be placed and compacted to an elevation not less than 12 inches above the top of pipe elevation before the trench is excavated. Compacted areas, in each case, shall be adequate to support the item to be constructed or placed thereon.

AGGREGATE BASE COURSE PLACEMENT:

After completion of construction and final grading of roadway subgrade, place aggregate base course (ABC) in uniform layers and compact to 98 percent compaction as determined by ASTM D 698.

FINAL GRADING AND PLACEMENT OF TOPSOIL:

After other outside work has been finished, and backfilling and embankments completed and settled, all areas which are to be graded shall be brought to grade at the indicated elevations, slopes and contours. All cuts, fills, embankments and other areas which have been disturbed or damaged by construction operations shall be surfaced with topsoil to a depth of at least 4 inches. Topsoil shall be of a quality at least equal to the existing topsoil in adjacent areas, free from trash, stones and debris, and well suited to support plant growth.

Use of graders or other power equipment will be permitted for final grading and dressing of slopes, provided the result is uniform and equivalent to hand work. All surfaces shall be graded to secure effective drainage. Unless otherwise indicated, a slope of at least one percent shall be provided.

Final grading and surfacing shall be smooth, even and free from clods and stones larger than one inch in greatest dimension, weeds, brush and other debris.

DISPOSAL OF EXCESS EXCAVATED MATERIALS:

Insofar as needed, suitable excavated materials shall be used in fills and embankments.

All unused suitable excess excavated materials together with all debris, stones, logs, stumps, roots and other unsuitable materials shall be removed from the site and disposed of by, and at the expense of, the Contractor.

TESTS:

As stipulated in the quality control section, all tests required for preliminary review of materials shall be made by an acceptable independent testing laboratory at the expense of the Contractor. Moisture-density (Proctor) tests and relative density tests on the materials, and all in-place field density tests, shall be paid for out of the testing allowance.

END OF SECTION 02210

SECTION 02735 - STORM SEWER SYSTEM

PART 1 - GENERAL

RELATED DOCUMENTS:

The plans and general provisions of the Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

DESCRIPTION OF WORK:

The extent of storm sewer system work is shown on the drawings.

Storm sewer system work includes, but is not limited to, all of the following:

Storm sewer conduits

Underdrain Piping

Rip Rap

Related Work Specified Elsewhere:

Clearing, Excavation & Trenching: See Division-2

Earthwork: See Division-2

Pipe and Pipe Fittings: See Division-15

Comply with the requirements of applicable Division-2 sections for excavation and backfilling required in connection with storm sewer system work.

Comply with requirements of applicable Division-3 sections for concrete work required in connection with storm sewer system work.

SUBMITTALS:

Shop Drawings: Submit shop drawings, product data or material certificates for the materials including details of underground structures, metal accessories, fittings, connections and any variations from those details shown on the drawings.

PART 2 - PRODUCTS

CONDUIT MATERIALS:

General: Furnish fittings, transitions and end caps of the same type and class of material as the conduit, or of material having equal or superior physical and chemical properties as acceptable to the Engineer.

Reinforced Concrete Pipe (RCP): ASTM C 76, Class III unless otherwise noted, with "O" ring compression gasket joints complying with ASTM C 443. ConSeal, Henry, Sealing Systems or approved equal Preformed Plastic for Pipe Joint ASTM C990 may be used with approval of the Engineer.

Perforated Polyvinyl Chloride (PVC) Underdrain Pipe: PVC pipe and fittings shall be manufactured from Type 1, Grade 1, Polyvinyl Chloride in conformance with ASTM D 1784. Underdrain PVC pipe shall be per ASTM D 3034 - SDR 35, or ASTM F 758, cement joint.

Solid Wall Polyvinyl Chloride (PVC) Pipe: PVC pipe and fittings shall be manufactured from Type 1, Grade 1, Polyvinyl Chloride in conformance with ASTM D 1784. Pipe for drainage, waste and vent shall be PVC-DWV, ASTM D 2665. For drainage, waste and vent piping, fittings patterns shall be per ASTM D 3311.

PART 3 - EXECUTION

INSPECTION:

Contractor must examine the areas and conditions under which storm sewer is to be installed and notify the Engineer in writing of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Engineer.

INSTALLATION OF CONDUIT (PIPE):

General: Perform excavation, trenching and backfilling as specified in appropriate Division-2 sections and as detailed on the plans. Conduct backfill operations of open-cut trenches closely following laying, jointing and bedding of pipe, and after initial inspection and testing are completed.

Inspect conduit before installation to detect any apparent defects. Mark defective materials with white paint and promptly remove from the site.

Particular care shall be taken to prevent damage to pipe and fitting linings and coatings. Pipe shall be protected during handling against impact shocks and free fall. Proper facilities shall be provided for lowering sections of pipe into trenches.

Installation: Lay conduit beginning at the low point of a system, true to the grades and alignment indicated with unbroken continuity of invert. The line and invert grade of each pipe shall be checked from top line carried on batter boards not over 24' apart or by a laser and target. The pipe shall be laid true to line and grade on a bed which is uniformly firm throughout its entire length and carefully shaped to fit the outside of the pipe for at least 10% of its outside diameter. Place bell ends of conduit or the groove end of concrete facing upstream.

Cross above or below other pipe a minimum of 6" unless otherwise directed by the Engineer. Bell holes shall be excavated for each joint to assure bedding supports the barrel of the pipe and to facilitate making a perfect joint. Preparatory to making pipe joints, all surfaces of the portion of the pipe to be jointed or of the factory-made jointing materials shall be clean and dry.

Joints shall be constructed in accordance with manufacturer's installation instructions. All Bell & Spigot joints shall be thoroughly cleaned. Joint lubricant, supplied by the manufacturer, shall be liberally applied to entire interior bell and gasket on spigot prior to assembly.

Embedment: Comply with Division 2.

Backfilling: Comply with Division 2.

Cleaning Conduit: Clear the interior of conduit of dirt and other superfluous material as the work progresses. Maintain a swab or drag in the line and pull past each joint as it is completed. In large, accessible conduit, brushes and brooms may be used for cleaning. Place plugs in the ends of uncompleted conduit at the end of the day or whenever work stops. Flush lines between manholes if required to remove collected debris.

Interior Inspection: Inspect conduit to determine whether line displacement or other damage has occurred. A light held in a manhole shall show a full circle of light when viewed from the adjoining end of the line. Make inspections after lines between manholes, or manhole locations, have been installed and approximately two feet of backfill is in place and at completion of the project. If the

inspection indicates poor alignment, debris, displaced pipe, infiltration or other defects, take whatever steps are necessary to correct such defects to the satisfaction of the Engineer.

Connection to Existing Structures: Pipe connections to existing structures shall be made in such manner that the finished work will conform as nearly as practicable to the essential applicable requirements specified for new structures, including all necessary concrete work, cutting and shaping.

END OF SECTION 02735

SECTION 02810 - IRRIGATION SYSTEM

PART 1 - GENERAL

RELATED DOCUMENTS:

Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

SUMMARY:

This Section includes piping, valves, sprinklers, specialties, controls, and wiring for automatic control irrigation system.

Related Sections include the following:

Clearing, Excavation & Trenching: Section 02210

Pipe and Pipe Fittings: Section 15060

Electrical: Section 15100

DEFINITIONS:

Circuit Piping: Downstream from control valves to sprinklers, specialties, and drain valves. Piping is under pressure during flow.

Drain Piping: Downstream from circuit-piping drain valves. Piping is not under pressure.

Irrigation Main Piping: Downstream from point of connection to water distribution piping to, and including, control valves. Piping is under water-distribution-system pressure.

The following are industry abbreviations for plastic materials:

PE: Polyethylene plastic

PVC: Polyvinyl chloride plastic

PERFORMANCE REQUIREMENTS:

Design for 100 percent water-coverage of sand court.

Location of Sprinklers and Specialties: Locations of sprinklers and valves are indicated on the drawings.

The site water distribution system static pressure was approximately 54 psi as measured at a hydrant at the park entrance. The measured residual pressure available at the same hydrant was approximately 37 psi with an approximate flow of 840 gpm at a hydrant located at the intersection of Corey Road (NCSR 1709) and Worthington Road (NCSR 1711). Pressure and flow readings performed and recorded by Greenville Utilities Commission on April 24, 2015.

CONTRACTOR shall determine if booster pump is required and if so, then CONTRACTOR shall supply the booster pump and enclosure.

SUBMITTALS:

Product Data: Include pressure ratings, rated capacities, and settings of selected models for the following:

Water regulators
General-duty valves
Specialty valves
Control-valve boxes
Sprinklers
Irrigation specialties
Controllers (include wiring diagrams)
Control cables (include splice kits and conduit)
Booster pump and enclosure (if required)

Shop Drawings: Show irrigation system piping, including plan layout, and locations, types, sizes, capacities, and flow characteristics of irrigation system piping components. Include water meters, backflow preventers, valves, piping, sprinklers and devices, accessories, controls, and wiring. Shown areas of sprinkler spray and overspray. Show wire size and number of conductors for each control cable.

Coordination Drawings: Show piping and major system components. Indicate interface and spatial relationship between piping, system components, adjacent utilities, and proximate structures.

Field quality-control test reports.

Operation and Maintenance Data: For irrigation systems, to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 1 Section, include data for the following:

Automatic-control valves
Sprinklers
Controllers
Booster Pumps (if required)

QUALITY ASSURANCE:

Electrical Components, Devices and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

DELIVERY, STORAGE, AND HANDLING:

Shipping, storage, and handling pipe and equipment to prevent damage and to prevent entrance of dirt, debris, and moisture.

Store plastic piping protected from direct sunlight. Support to prevent sagging and bending.

PART 2 - PRODUCTS

PIPES, TUBES AND FITTINGS:

PVC Pipe: ASTM D 1785, PVC 1120 compound, Schedule 40.

PVC Socket Fittings, Schedule 40: ASTM D 2466.

PVC Pipe: ASTM D 1785, PVC 1120 compound, Schedule 80.

PVC Socket Fittings, Schedule 80: ASTM D 2467.
PVC Threaded Fittings: ASTM D 2464.

PVC, Pressure-Rated Pipe: ASTM D 2241, PVC 1120 compound, SDR 21.

PVC Socket Fittings, Schedule 80: ASTM D 2467.
PE, Controlled OD Pipe: ASTM F 771 and ASTM D 3035, PE 3408 compound, DR 9.
PE Socket Fittings: ASTM D 2683.
PE Butt-Fusion Fittings: ASTM D 3261.

GENERAL-DUTY VALVES:

See Section 15100.

SPECIALTY VALVES:

Bronze Automatic Control Valves: Cast-bronze body, normally closed, diaphragm type with manual flow adjustment, and operated by 24-V ac solenoid.

Plastic Automatic Control Valves: Molded-plastic body, normally closed, diaphragm type with manual flow adjustment, and operated by 24-V ac solenoid.

Manual Drain Valves: Manual drain valve shall be angle valve and shall be installed as required to adequately drain the system.

Quick-Couplers: Factory-fabricated, bronze or brass, two-piece assembly. Include coupler water-seal valve; removable upper body with spring-loaded or weighted, rubber-covered cap; hose swivel with ASME B1.20.7, 3/4-11.5NH threads for garden hose on outlet; and operating key.

CONTROL-VALVE BOXES:

Plastic Control-Valve Boxes: Box and cover, with open bottom and opening for piping; designed for installing flush with grade. Include size as required for valves and service.

Shape: as required to fit equipment
Sidewall Material: HDPE resin
Cover Material: HDPE resin

Lettering: IRRIGATION

SPRINKLER ROTORS:

Description: Brass or plastic housing and corrosion-resistant interior parts designed for uniform coverage over entire spray area indicated, at available water pressure.

Rotors shall be Rainbird 3504 Professional Grade Rotor, or approved equal.

- Top-adjust arc adjustment 40 - 360 degrees.
- Reversing Full-and Part-circle adjustment 40° – 360°.
- Adjustable throw distance 19 - 32 ft.
- Pressure rating: 25 - 55 psi
- Flow rate: 0.54 – 4.6 GPM
- Radius adjustment screw allows up to 35 percent radius reduction without changing nozzles.
- Top-adjust arc adjustment requiring only a flat-blade screwdriver.
- Water-lubricated gear-drive design for durable, reliable operation.
- Quick check arc/fast forward.
- Self-adjusting stator does not require replacement when changing nozzles.
- Easily removable filter screen.
- Nozzle removal feature.
- Arc setting factory preset at 180° for installation convenience.

AUTOMATIC-CONTROL SYSTEM:

Manufacturers: Four zone automatic sprinkler timer with flexibility of three (3) programs and four (4) start times per program, and one-touch manual watering. Rainbird, ESP-TM2-4, 120 volt, or approved equal.

- Suitable for indoor or outdoor installations.
- Manual Watering option for all stations, a single station or an individual program.
- Compatible with WiFi Module (for future purchase by Owner) to enable remote programming, operation and alerts.
- Permanent Days Off (for Odd, Even or Cyclic programming).
- External battery back-up not required. Nonvolatile memory permanently saves the current programming and a 10 year life lithium battery maintains the controllers time and date during power outages.

Control Enclosure: Plastic wall-mount cabinet with door.

Control Transformer: 24-V secondary, with primary fuse.

Controller Stations for Automatic Control Valves: Each station is variable from approximately (1 minute to 6 hours. Include manual or automatic operation of each station.

Surge Protection: Metal-oxide-varistor type on each station and primary power.

Wiring: UL 493, Type UF-B multiconductor, with solid-copper conductors and insulated cable; suitable for direct burial.

Feeder-Circuit Cables: No. 12 AWG minimum, between electrical supply and controller.

Low-Voltage, Branch-Circuit Cables: No. 14 AWG minimum, between controllers and automatic control valves; color-coded different from feeder-circuit-cable jacket color; with jackets of different colors for multiple-cable installation in same trench.

Splicing Materials: Manufacturer's packaged kit consisting of insulating, spring-type connector or crimped joint and epoxy resin moisture seal; suitable for direct burial.

PART 3 - EXECUTION

EARTHWORK:

Refer to Division 2 Section for excavating, trenching, and backfilling.

Install warning tape directly above pressure piping, 12 inches (300 mm) below finished grades, except 6 inches (150 mm) below subgrade under pavement and slabs.

Install piping and wiring in sleeves under walls, sidewalks, roadways, parking lots, and railroads.

Install piping sleeves prior to new construction.

Drain Pockets: Excavate to sizes indicated. Backfill with cleaned gravel or crushed stone, graded from 3/4 to 3 inches (19 to 75 mm), to 12 inches (300 mm) below grade. Cover gravel or crushed stone with sheet of asphalt-saturated felt and backfill remainder with excavated material.

Provide minimum cover over top of underground piping according to the following:

Irrigation Main Piping: Minimum depth of 36 inches
Circuit Piping: 12 inches
Drain Piping: 12 inches

PREPARATION:

Set stakes to identify locations of proposed irrigation systems.

PIPING APPLICATIONS:

Install components having pressure rating equal to or greater than system operating pressure.

Piping in control-valve boxes and aboveground may be joined with flanges instead of joints indicated.

Underground Branches and Offsets at Sprinklers and Devices: Schedule 80, PVC pipe; threaded PVC fittings; and threaded joints.

Option: Plastic piping manufactured for this application may be used instead of pipe and fittings specified.

Risers to Aboveground Sprinklers and Specialties: Schedule 80, PVC pipe and socket fittings; and solvent-cemented joints.

Drain Piping: Use the following piping materials:

All Sizes: Schedule 40, PVC pipe and socket fittings; and solvent-cemented joints

Transition Fittings: Use transition fittings for plastic-to-metal pipe connections according to the following:

Couplings:

Underground Piping NPS 1-1/2 (DN 40) and Smaller: Manufactured fitting or coupling.
Underground Piping NPS 2 (DN 50) and Larger: AWWA transition coupling.

Fittings:

Aboveground Piping: Plastic-to-metal transition fittings.
Underground Piping: Union with plastic end of same material as plastic piping.

PIPE INSTALLATION:

Location and Arrangement: Drawings indicate location and arrangement of piping systems. Install piping as indicated unless deviations are approved on Coordination Drawings.

Install piping at minimum uniform slope of 0.5 percent down toward drain valves.

Install piping free of sags and bends.

Install groups of pipes parallel to each other, spaced to permit valve servicing.

Install fittings for changes in direction and branch connections.

Install unions adjacent to valves and to final connections to other components.

Lay piping on solid subbase, uniformly sloped without humps or depressions.

VALVE INSTALLATION:

Underground Gate Valves: Install in valve box with top flush with grade.

Install valves and PVC pipe with restrained, gasketed joints.

Underground Curb Stops: Install in service box with top flush with grade.

Underground, Manual Control Valves: Install in manual control-valve box.

Control Valves: Install in control-valve box.

Rotor Riser Ball Valves: Install in-line in rotor riser pipe as indicated on drawings.

Drain Valves: Install in control-valve box.

SPRINKLER INSTALLATION:

Flush circuit piping with full head of water and install sprinklers after hydrostatic test is completed.

Install sprinklers as indicated on drawings.

Locate part-circle sprinklers to maintain a minimum distance of 4 inches (100 mm) from walls and 2 inches (50 mm) from other boundaries, unless otherwise indicated.

AUTOMATIC-CONTROL SYSTEM INSTALLATION:

Install wall-mountable controller inside separate rack-mounted electrical enclosure.

Install control cable in same trench as irrigation piping and at least 2 inches below (or beside) piping. Provide conductors of size not smaller than recommended by controller manufacturer.

FIELD QUALITY CONTROL:

Manufacturer's Field Service: Engage a factory-authorized service representative to inspect (test, and adjust) field-assembled components and equipment installation, including connections, (and to assist in field testing). Report results in writing.

Perform the following field tests and inspections and prepare test reports:

Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.

Operational Test: After electrical circuitry has been energized, operate controllers and automatic control valves to confirm proper system operation.

Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

Remove and replace units and retest, reinspect as specified above.

STARTUP SERVICE:

Engage a factory-authorized service representative to perform startup service.

Verify that controllers are installed and connected according to the Contract Documents.

Verify that electrical wiring installation complies with manufacturer's submittal and installation requirements in Division 16 sections.

Complete startup checks according to manufacturer's written instructions.

ADJUSTING:

Adjust settings of controllers.

Adjust automatic control valves to provide flow rate of rated operating pressure required for each sprinkler circuit.

Adjust sprinklers so post-mounting does not interfere with operation.

CLEANING:

Flush dirt and debris from piping before installing sprinklers and other devices.

DEMONSTRATION:

Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain controller and automatic control valves.

END OF SECTION 02810

SECTION 02831 - GALVANIZED CHAIN LINK FENCING AND GATES

PART 1 - GENERAL

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

DESCRIPTION OF WORK:

Extent of chain link fences and gates is indicated on drawings.

QUALITY ASSURANCE:

Provide chain link fences and gates as complete units controlled by a single source including necessary erection accessories, fittings, and fastenings.

SUBMITTALS:

Product Data: Submit manufacturer's technical data, and installation instructions for metal fencing, fabric, gates and accessories.

PART 2 - PRODUCTS

GENERAL:

Dimensions indicated for pipe, are outside dimensions, exclusive of coatings.

STEEL FABRIC:

Fabric: No. 9 ga. (0.148" plus or minus 0.005") size steel wires, 2" mesh, with top selvages knuckled. Fabric shall be one-piece fabric width, 72" high unless otherwise noted on the drawings.

Furnish one-piece fabric widths for fencing up to 12' high.

Fabric Finish: Galvanized, ASTM A 392, Class I, with not less than 1.2 oz. zinc per sq. ft. of surface.

Fabric Finish: Minimum 7 mil polyvinyl chloride (PVC) plastic resin finish over galvanized steel wire. Color as selected by Owner from manufacturer's standard color selection. Comply with ASTM F 668, Class 2, except provide fabric with diameter (gage) of core wire equivalent to fabric diameter specified when measured prior to application of non-metallic coating.

FRAMING AND ACCESSORIES:

Steel Framework, General: Galvanized steel, ASTM A 120 or A 123, with not less than 1.8 oz. zinc per sq. ft. of surface.

Fittings and Accessories: Galvanized, ASTM A 153, with zinc weights per Table I.

Steel Framework Finish: Provide framework, fittings and accessories in accordance with manufacturer's standard thermally bonded polyvinyl chloride (PVC) plastic resin finish over galvanizing, not less than 10 mils (0.010") thick. Color to match chain link fabric.

End, Corner and Pull Posts: Minimum sizes and weights as follows:

Over 6' fabric height, 2.875" OD steel pipe, 5.79 lbs. per lin. ft., or 3.5" x 3.5" roll-formed sections, 4.85 lbs. per lin. ft.

Line Posts: Space 10' o.c. maximum, unless otherwise indicated, of following minimum sizes and weights:

Over 8' fabric height, 2.875" OD steel pipe, 5.79 lbs. per lin. ft. or 2.25" x 1.875" H-sections. 3.26 lbs. per lin. ft.

Gate Posts: Furnish posts for supporting single gate leaf, or one leaf of a double gate installation, for nominal gate widths as follows:

Leaf Width	Gate Post	lbs/lin. ft.
Up to 13'	4.000" OD pipe	9.11

Top Rail: Manufacturer's longest lengths, with expansion type couplings, approximately 6" long, for each joint. Provide means for attaching top rail securely to each gate corner, pull and end post.

1.66" OD pipe, 2.27 lbs. per ft. or 1.625" x 1.25" roll-formed sections, 1.35 lbs. per ft.

Tension Wire: 7-gage, coated coil spring wire, metal and finish to match fabric.

Locate at bottom of fabric.

Wire Ties: 11 ga. galvanized steel to match fabric core material.

Post Brace Assembly: Manufacturer's standard adjustable brace at end and gate posts and at both sides of corner and pull posts, with horizontal brace located at mid-height of fabric. Use same material as top rail for brace and truss to line posts, with 0.375" diameter rod and adjustable tightener.

Post Tops: Provide weathertight closure cap with loop to receive toprail; one cap for each post.

Stretcher Bars: One-piece lengths equal to full height of fabric, with minimum cross-section of 3/16" x 3/4". Provide one stretcher bar for each gate and end post, and 2 for each corner and pull post, except where fabric is integrally woven into post.

Stretcher Bar Bands: Space not over 15" o.c., to secure stretcher bars to end, corner, pull, and gate posts.

GATES:

Fabrication: Fabricate perimeter frames of gates from metal and finish to match fence framework. Assemble gate frames by welding or with special fittings and rivets for rigid connections, providing security against removal or breakage connections. Provide horizontal and vertical members to ensure proper gate operation and attachment of fabric, hardware and accessories. Space frame members maximum of 8' apart unless otherwise indicated.

Provide same fabric as for fence, unless otherwise indicated. Install fabric with stretcher bars at vertical edges and at top and bottom edges. Attach stretcher bars to gate frame at not more than 15" o.c.

Install diagonal cross-bracing consisting of 3/8" diameter adjustable length truss rods on gates to ensure frame rigidity without sag or twist.

Swing Gates: Fabricate perimeter frames of minimum 1.90" OD pipe.

Gate Hardware: Provide hardware and accessories for each gate, galvanized per ASTM A 153, and in accordance with the following.

Hinges: Size and material to suit gate size, non-lift-off type, offset to permit 180 degree gate opening. Provide 1- 1/2 pair of hinges for each leaf over 6' nominal height.

Latch: Forked type or plunger-bar type to permit operation from either side of gate, with padlock eye as integral part of latch.

Keeper: Provide keeper for vehicle gates, which automatically engages gate leaf and holds it in open position until manually released.

Double Gates: Provide gate stops for double gates, consisting of mushroom type flush plate with anchors, set in concrete, and designed to engage center drop rod or plunger bar. Include locking device and padlock eyes as integral part of latch, permitting both gate leaves to be locked with single padlock.

PRIVACY SCREEN:

Provide vinyl coated polyester mesh fabric privacy screen with 4-inch reinforced edges on all sides to be attached to galvanized chain-link fence fabric and gates. Privacy screen heights over 8 feet shall be provided with a black center reinforcement binding strip. Stimpson black military grade grommets shall be spaced at 24 inches on all sides and center binding (where required).

Privacy screen shall provide 80% privacy blockage. Screen shall be manufactured to be 48 inches height and 4-inches shorter than fence segment length to be covered.

Privacy screen shall be rated for UV protection, a 7-10 year life expectancy and have a 5-year manufacturer's warranty.

Provide 16 gauge galvanized steel hog rings to secure privacy screen to galvanized chain-link fence fabric.

PART 3 - EXECUTION

INSTALLATION:

Do not begin installation and erection before final grading is completed, unless otherwise permitted.

Excavation: Drill or hand excavate (using post hole digger) holes for posts to diameters and spacings indicated, in firm, undisturbed or compacted soil.

If not indicated on drawings, excavate holes for each post to minimum diameter recommended by fence manufacturer, but not less than 4 times largest cross-section of post.

Unless otherwise indicated, excavate hole depths approximately 3" lower than post bottom, with bottom of posts set not less than 36" below finish grade surface.

Setting Posts: Center and align posts in holes 3" above bottom of excavation.

Place concrete around posts and vibrate or tamp for consolidation. Check each post for vertical and top alignment, and hold in position during placement and finishing operations.

Unless otherwise indicated, extend concrete footings 2" above grade and trowel to a crown to shed water.

Top Rails: Run rail continuously through post caps, bending to radius for curved runs. Provide expansion couplings as recommended by fencing manufacturer.

Center Rails: Provide center rails where indicated. Install in one piece between posts and flush with post on fabric side, using special offset fittings where necessary.

Brace Assemblies: Install braces so posts are plumb when diagonal rod is under proper tension.

Tension Wire: Install tension wires before stretching fabric and tie to each post with not less than 6 ga. galvanized wire. Fasten fabric to tension wire using 11 ga. galvanized steel hog rings spaced 24" o.c.

Fabric: Leave approximately 2" between finish grade and bottom selvage, unless otherwise indicated. Pull fabric taut and tie to posts, rails, and tension wires. Install fabric on security side of fence, and anchor to framework so that fabric remains in tension after pulling force is released.

Stretcher Bars: Thread through or clamp to fabric 4" o.c., and secure to posts with metal bands spaced 15" o.c.

Gates: Install gates plumb, level, and secure for full opening without interference. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary.

Tie Wires: Use U-shaped wire, conforming to diameter of pipe to which attached, clasping pipe and fabric firmly with ends twisted at least 2 full turns. Bend ends of wire to minimize hazard to persons or clothing.

Tie fabric to line posts, with wire ties spaced 12" o.c. Tie fabric to rails and braces, with wire ties spaced 24" o.c. Tie fabric to tension wires, with hog rings spaced 24" o.c.

Fasteners: Install nuts for tension bands and hardware bolts on side of fence opposite fabric side. Peen ends of bolts or score threads to prevent removal of nuts.

Privacy Screen: Install mesh fabric screen to fence fabric in accordance with manufacturer's recommendation.

END OF SECTION 02831

SECTION 02910 - EROSION AND POLLUTION CONTROL

PART 1 - GENERAL

RELATED DOCUMENTS:

The general provisions of the Contract, including the General and Special Conditions and Division-1 Specification sections apply to work of this section.

DESCRIPTION OF WORK:

The extent of the work required under this section is that required to minimize water, air, and noise pollution and soil erosion and siltation.

Temporary erosion control measures which may be necessary include, but are not limited to, temporary berms, dikes, dams, drainage ditches, silt basins, silt ditches, perimeter swales, slope drains, structures, vegetation, mulches, mats, netting, gravel or any other methods or devices that are necessary to control or restrict erosion. Temporary erosion control measures may include work outside the right-of-way or construction limits where such work is necessary as a result of construction such as borrow pit operations, haul roads, plant sites, equipment storage sites and disposal of waste or debris. The Contractor shall be liable for all damages to public or private property caused by silting or slides originating in waste areas furnished by the Contractor.

RELATED WORK SPECIFIED ELSEWHERE:

Clearing, Excavation and Trenching: Section 02210

Storm Sewer System: Section 02735

Fertilizing, Seeding and Mulching: Section 02920

QUALITY ASSURANCE:

Codes and Standards:

North Carolina Sedimentation Pollution Control Act of 1973 and the Rules and Regulations promulgated pursuant to the provisions of said act.

City of Greenville Soil Erosion and Sedimentation Control Ordinance.

"Standard Specifications for Roads and Structures", North Carolina Department of Transportation (DOT).

In the event of conflict between the regulations listed above and the requirements of these specifications, the more restrictive requirement shall apply.

SANCTIONS:

Failure of the Contractor to fulfill any of the requirements of this section may result in the OWNER ordering the stopping of construction operations in accordance with the General Conditions until such failure has been corrected. Such suspension of operations will not justify an extension of Contract time nor additional compensation.

Failure on the part of the Contractor to perform the necessary measures to control erosion, siltations, and pollution will result in the Engineer notifying the Contractor to take such measures. In the event that the Contractor fails to perform such measures within 24 hours after receipt of such notice, the Owner may suspend the work as provided above, or may proceed to have such measures performed with other forces and equipment, or both. The cost of such work performed by other forces will be deducted from monies due the Contractor on his contract.

PART 2 - PRODUCTS

SILT FENCES:

Posts: Wooden posts shall be a minimum of 4" in diameter and 6' in length. Posts shall be of creosote or pentachlorophenol treated southern pine.

Steel posts shall be 5' in height and be of the self-fastener angle steel type.

Posts shall be spaced at 8' max. when silt fence is backed with wire mesh, and 7' when no wire mesh is used or as required by the Engineer.

Woven Wire: Woven wire fencing shall conform to ASTM A116 for Class 3 galvanizing. Fabric shall be a minimum of 32" in width and shall have a minimum of 6 line wires with 12" stay spacing. The top and bottom wires shall be 10 gauge while the intermediate wires shall be 12-1/2 gauge. Wire fabric shall be fastened to wood posts with not less than #9 wire staples 1-1/2" long.

Fabric: Provide woven synthetic fiber designed specifically for silt fence conforming to NCDOT Standard Specifications for Roads and Structures Section 1056, Type 3 in Table 1056-1. Minimum roll width shall be 36".

DRAINAGE STONE:

Class I material NCDOT No. 57 or No. 5 as required.

RIP RAP:

Class I and Class II in accordance with NCDOT specifications.

Class B Erosion Control Stone may be used in lieu of Class I Rip Rap.

FILTER CLOTH:

For use under rip rap provide spun synthetic fiber; 10 oz/sy; burst strength of 500 psi, vertical water flow, 265 gpm/sy; Trivera 1135, MIRAFI 140 or approved equal.

MATTING FOR EROSION CONTROL:

Matting for erosion control shall be excelsior matting in accordance with NCDOT SPECIFICATIONS SECTION 1631, DITCH LINER AND EROSION CONTROL BLANKET. Other acceptable material manufactured especially for erosion control may be used when approved by the Engineer in writing before being used.

TEMPORARY SEEDING:

Temporary seeding, when required, shall be performed in accordance with the recommendations contained in "Guide for Sediment Control on Construction Sites in North Carolina", published by the Soil Conservation Service and Section 02920 of these specifications.

PART 3 - EXECUTION

GENERAL:

The Contractor shall take whatever measures are necessary to minimize soil erosion and siltation, and water, air, and noise pollution caused by his operations. The Contractor shall also comply with the applicable regulations of all legally constituted authorities relating to pollution prevention and control. The Contractor shall keep himself fully informed of all such regulations which in any way affect the conduct of the Work, and shall at all times observe and comply with all such regulations. In the event of conflict between such regulations and the requirements of the specifications, the more restrictive requirements shall apply.

EROSION AND SILTATION CONTROL:

The CONTRACTOR shall exercise every reasonable precaution throughout the life of the project to prevent the eroding of soil and the silting of rivers, streams, lakes, reservoirs, other water impoundments, ground surfaces or other property.

Prior to suspension of operations on the project or any portion thereof, the Contractor shall take all necessary measures to protect the construction area, including but not limited to borrow sources, soil type base course sources and waste areas from erosion during the period of suspension.

Provide diversion ditches and berms as necessary to prevent concentrated flow of water across disturbed areas.

Stockpile excavated material on the opposite side of the utility trenches from the watercourses to the extent that is possible.

In the event that stockpiles are placed on the watercourse side of the trench, provide silt fence or silt berms with stone filter outlets along the entire length of the stockpile that is on the watercourse side

of the trench. Upon the completion of backfilling, the measures shall be removed and the site graded to its natural grade or as shown on plans.

Maintain natural buffer zones along all watercourses sufficient to retain all visible siltation within the first 25 percent of the buffer width.

Provide a settling basin with a gravel filter outlet for all water pumped from trenches or dewatering equipment. Pumping of that water directly into any stream, pond or watercourse is prohibited.

Tamp, fertilize, seed and mulch the disturbed areas as soon as practicable after line is installed and, in all cases, no later than 30 days after completion of the line segment or work at a particular site.

When construction operations are suspended for more than 30 days, provide temporary seeding and mulching of all disturbed areas including those areas in which further construction is necessary.

Erosion control measures installed by the Contractor shall be acceptably maintained by the Contractor.

Silt fences shall be provided where shown on the drawings and/or as necessary to prevent erosion.

Catch basins and drop inlets shall be protected from silt by placing straw bales or silt fence around the openings until vegetative cover is established.

Temporary rock check dams shall be constructed where shown on the drawings and/or as necessary.

Seeding for erosion control shall be performed in accordance with Section 02920. Matting shall be installed where shown on the drawings or where required for erosion control. Install matting in accordance with NCDOT SPECIFICATIONS SECTION 1631, DITCH LINER AND EROSION CONTROL BLANKETS.

STREAM OR DITCH CROSSINGS:

Perform in accordance with details shown on plans. Complete crossing in one working day. Carefully stabilize disturbed slopes by tamping with equipment buckets and mechanical or hand tamping. Distribute topsoil evenly on slopes and tamp.

Where matting is required for erosion control, cover the entire length of the channel disturbed by excavation. Install matting immediately after fertilizing and seeding of the disturbed channel lining.

Where rip rap is required, carefully place at least one foot thick over filter cloth.

Fertilize, seed, and mulch each crossing's slopes as soon as practicable after completing the crossing and in no case more than two weeks after disturbance of the slopes.

WATER AND AIR POLLUTION:

The Contractor shall exercise every reasonable precaution throughout the life of the project to prevent pollution of rivers, streams, and water impoundments. Pollutants such as chemicals, fuels, lubricants, bitumens, raw sewage, and other harmful waste shall not be discharged into or alongside of rivers, streams, or impoundments, or into natural or manmade channels leading thereto.

The Contractor shall comply with all State or local air pollution regulations throughout the life of the project.

DUST CONTROL:

The Contractor shall control dust throughout the life of the project within the project area and at all other areas affected by the construction of the project, including, but not specifically limited to, unpaved secondary roads, haul roads, access roads, disposal sites, borrow and material sources and production sites. Dust control shall not be considered effective where the amount of dust creates a potential or actual unsafe condition, public nuisance, or condition endangering the value, utility or appearance of any property.

NOISE CONTROL:

The Contractor shall exercise every reasonable precaution throughout the life of the project to prevent excessive and unnecessary noise. The Contractor shall choose his methods so as to minimize the disturbance of area residents.

END OF SECTION 02910

SECTION 02920 - FERTILIZING, SEEDING AND MULCHING

PART 1 - GENERAL

RELATED DOCUMENTS:

The general provisions of the Contract, including the General and Special Conditions and Division-1 Specification sections apply to work of this section.

DESCRIPTION OF WORK:

Permanent Seeding: Permanent seeding is required for all areas disturbed by construction, except for areas covered by structures, pavements, etc.

Temporary Seeding: Temporary seeding of disturbed areas shall be performed whenever one or more of the following conditions exist.

The ENGINEER determines temporary seeding is necessary to prevent or stop erosion of disturbed areas.

Work is suspended or delayed on any portion of the project for 15 days and the potential for erosion exists.

Whenever permanent seeding is delayed beyond that required by the Contract Documents.

QUALITY ASSURANCE:

Codes and Standards: In general, follow procedures and guides published by the Soil Conservation Service, United States Department of Agriculture.

PART 2 - PRODUCTS

FERTILIZER:

Provide commercial fertilizer conforming to statutory requirements and all rules and regulations adopted by the North Carolina Board of Agriculture.

LIMESTONE:

Provide dolematic or hydrated limestone conforming to all statutory requirements and all rules and regulations adopted by the North Carolina Board of Agriculture.

SEED:

Provide seed conforming to all statutory requirements and all rules and regulations adopted by the North Carolina Board of Agriculture.

Provide seed in accordance with requirements shown below. Deliver to site in original containers, labeled to show that the requirements of the N.C. Seed Law are met.

Quality of seed shall conform to the following:

Common Name	Minimum Pure Live Seed %	Maximum Total Other Crop Seed %	Maximum Total Weed Seed %
Grasses			
Pensacola Bahiagrass	70	2.00	1.00
Fescue Tall (KY.-31)	80	2.00	1.00
Centipede	80	2.00	1.00
Kobe Lespedeza	80	2.00	1.00

Seeding containing prohibited noxious weed seed shall not be accepted. Seed shall be in conformance with state seed law restrictions for restricted noxious weeds.

If seed of the accepted quality cannot be bought, secure prior approval before making changes or exceptions.

MULCH:

Mulch for erosion control shall consist of grain straw or other acceptable material, and shall have been approved by the Engineer before being used. All mulch shall be reasonably free from mature seedbearing stalks, roots, or bulblets of Johnson Grass, Nutgrass, Sandbur, Wild Garlic, Wild Onion, Bermuda Grass, Crotalaria and Witchweed, and free of excessive amount of restricted noxious weeds as defined by the North Carolina Board of Agriculture at the time of use of the mulch. Also there shall be compliance with all applicable State and Federal domestic plant quarantines. Straw mulch that is matted or lumpy shall be loosened and separated before being used.

Material for holding mulch in place shall be asphalt or other approved binding material applied in accordance with this section.

MATTING:

Use matting on seeded areas where slope is steeper than two-horizontal to one-vertical (2:1 slope). Matting shall comply with NCDOT SPECIFICATIONS SECTION 1631, DITCH LINER AND EROSION CONTROL BLANKETS.

PART 3 - EXECUTION

GENERAL:

Follow procedures set forth in the publication "Guide for Sediment Control on Construction Sites in North Carolina" by the United States Department of Agriculture, Soil Conservation Service, and as specified herein.

Scarify soil to a depth of three (3) inches and work into a satisfactory seed bed by discing, use of cultipackers, harrows, drags and other approved means.

Preparation outlined above shall not be done when the soil is frozen, wet or otherwise in an unfavorable condition.

Begin and complete seeding operations as outlined below as soon as possible after final grading is completed, but in no event later than 30 days after completion of final grading.

Distribute lime and fertilizer uniformly over seed bed and harrow, rake or otherwise work same into seed bed.

Distribute seed uniformly over seed bed. Cover seed lightly after seeding.

No lime, fertilizer or seed shall be applied during a strong wind, when soil is wet or otherwise unworkable. Should rain follow seeding before rolling is begun, the bed shall not be rolled.

PERMANENT SEEDING:

Apply dolematic limestone at the rate of 2 tons per acre. If hydrated lime is used, follow recommendation from soil test. Cost of the test shall be borne by the Contractor.

Apply 10-10-10 fertilizer outside of NCDOT right-of-way at a rate of 1,000 pounds per acre.

Apply 10-20-20 fertilizer within NCDOT right-of-way at a rate of 500 pounds.

Provide permanent seeding in accordance with the following schedule:

Planting Date	Seeding Mixture and Rate
Outside NCDOT R/W:	
March through August	50#/acre Tall Fescue 10#/acre Centipede 25#/acre Bermudagrass (hulled)
September through February	75#/acre Tall Fescue 35#/acre Bermudagrass (hulled)
Within NCDOT R/W:	
January through December	50#/acre Fescue, Ky-31 25#/acre Pensacola Bahiagrass 5#/acre Centipede

TEMPORARY SEEDING:

Seed in accordance with Soil Conservation Service recommendations with regard to seed type, rate of application, fertilizer, etc.

APPLICATION OF MULCH:

Apply mulch immediately after permanent seeding at a uniform rate sufficient to achieve approximately 80% coverage of ground surface. Care must be taken to prevent the mulch from being applied too thickly and smothering the seedlings. Mulch for temporary seeding should be applied based upon the recommendations of the Soil Conservation Service for the particular type of seed to be used.

Mulch Anchoring:

On ground slopes less than 4%, anchor mulch with a straight blade disk or anchoring tool. Press mulch into soil about three inches. Operate equipment across slopes.

On ground slopes greater than 4%, apply asphalt with suitable applicator at a rate of not less than 150 gallons per ton of mulch.

Peg and twine anchoring may be used on steep slopes. Drive 8" wood stakes every 3 to 4 feet in all directions. Stretch in a crisscross and square in all directions. Secure twine around pegs and drive pegs flush with surface.

MATTING:

Install matting as shown on the drawings and in accordance with NCDOT SPECIFICATIONS SECTION 1631, DITCH LINER AND EROSION CONTROL BLANKETS.

REPAIR AND MAINTENANCE:

Maintain the grass on the area for a period of 90 days after the grass growth appears. Reseed bare areas and repair all eroded areas during that period.

Repairs: Inspect all seeded areas and make necessary repairs or reseedings within the planting season, if possible. If stand should be over 60% damaged, re-establish following original lime, fertilizer and seeding recommendations.
All areas which do not exhibit satisfactory ground cover within 45 days of seed application shall be replanted.

END OF SECTION 02920

SECTION 03305 - CONCRETE

PART 1 - GENERAL

RELATED DOCUMENTS:

Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division - 1 Specification Sections apply to work of this section.

DESCRIPTION OF WORK:

Concrete work includes, but is not specifically limited to concrete piers, pipe encasement, pipe blocking, manhole inverts, concrete slabs, retaining walls, concrete curbs and gutters, concrete drives, walks and other concrete items required in the project.

RELATED ITEMS SPECIFIED ELSEWHERE:

Clearing, Excavation and Trenching: Section 02210

QUALITY ASSURANCE:

Codes and Standards: AC1 301 "Specifications for Structural Concrete for Buildings"; AC1 347 "Recommended Practice for Concrete Formwork", AC1 304 "Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete"; comply with applicable provisions except as otherwise indicated.
Workmanship: The Contractor is responsible for correction of concrete work which does not conform to the specified requirements, including strength, tolerances and finishes. Correct deficient concrete as directed by the Engineer.

Concrete Testing Service: Employ a testing laboratory acceptable to the Engineer to perform material evaluation tests and to design concrete mixes at Contractor's expense.

Certificates of material properties and compliance with specified requirements may be submitted in lieu of testing. Certificates of compliance must be signed by the materials producer and the Contractor.

PART 2 - PRODUCTS

PART 2 - PRODUCTS

CONCRETE MATERIALS:

Portland Cement: ASTM C150, Type 1, unless otherwise acceptable to the Engineer.

Aggregates: ASTM C33, except local aggregates of proven durability may be used when acceptable to the Engineer.

Water: Clean, potable.

Design Strength: 4000 psi for retaining walls, wall footings; 3000 psi for sidewalks, curb and gutter, drives, parking slab, etc.; 3,000 PSI with 3/8" aggregate for masonry fill; 2500 psi for pipe blocking and encasement.

No admixtures containing calcium chloride may be used. Use Pozzolith by Master Builders, Plastiment or Plasticrete by Silka and Chemstrong A, R, or W by Castle Chemical Company or approved equal.

Air-Entraining Admixture: ASTM C260. Only use admixtures having neutralized vensol resins. Use MB-VR by Master Builders, SIKA AER by Sika Chemical Company, or CASTLE VR by Castle Chemical Company, or approved equal.

Use air-entraining admixture in all concrete, providing not less than 4% nor more than 8% entrained air.

Water-Reducing Admixture: ASTM C494, Type A, D, and E. Only use admixtures which have been tested and accepted in mix designs, unless otherwise acceptable.

Mortar: Mortar used for sewer structures shall conform to ASTM Specification C-144 as to aggregate and strength. Mortar shall be prepared from cement in perfect condition and shall be prepared in box for that purpose. No mortar that has stood beyond 45 minutes shall be used. Proportion by volume for different kinds of work shall be:

Brick Masonry	1 part cement to 2 parts sand
Jointing	1 part cement to 1 part sand

Concrete: Concrete shall be only plant-mixed or transit-mixed concrete conforming to ASTM C-94 for Ready-Mix Concrete.

FORM MATERIALS:

Provide form materials with sufficient stability to withstand pressure of placed concrete without bow or deflection.

Exposed Concrete Surfaces: Acceptable panel-type to provide continuous, straight, smooth, as-cast surfaces. Use largest practical sizes to minimize form joints.

Unexposed Concrete Surfaces: Suitable material to suit project conditions.

CURING COMPOUND:

Liquid membrane forming curing compound shall comply with ASTM C300, Type I Class A, minimum 22% solids.

REINFORCING MATERIALS:

Reinforcing Bars: ASTM A615, Grade 60

Welded Wire Fabric: ASTM A185.

JOINT MATERIALS:

Self-Expanding Cork Joint Filler: Provide resilient and non- extruding type premolded cork units complying with ASTM D1752, Type III.

Water Stop: PVC meeting Corps of Engineers CRD-C572 with center bulb.

PART 3 - EXECUTION

FORMING AND PLACING CONCRETE:

Ready-Mixed Concrete: ASTM C94. Furnish delivery tickets for each load showing amount of each material in the batch, time batched, date, job.

Formwork: Construct so that concrete members and structures are of correct size, shape, alignment, elevation and position, complying with ACI 347. Provide 3/4" chamfer on all exposed corners.

Provide openings in formwork to accommodate work of other trades. Accurately place and securely support items built into forms.

Clean and adjust forms prior to concrete placement. Apply form release agents or wet forms, as required. Retighten forms during and after concrete placement if required to eliminate mortar leaks.

Reinforcement: Position, support and secure reinforcement against displacement. Locate and support with metal chairs, runners, bolsters, spacers and hangers, as required. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.

Install welded wire fabric in as long lengths as practicable, lapping at least one mesh.

Joints: Provide construction, expansion, weakened-plane (contraction), isolation, and control joints as indicated or required. Locate construction joints so as to not impair the strength and appearance of the structure. Place isolation and control joints in slabs-on-ground to stabilize differential settlement and random cracking.

Provide expansion and weakened-plane (contraction) joints where shown or required. Construct weakened-plane joints for a depth equal to at least 1/4 concrete thickness, either tooled, or with inserts unless otherwise shown. Tool edges of joints where slabs, walks, drives, curbs and gutters, etc. are constructed or replaced.

Place construction joints at the end of pours and at locations where placement operations are stopped for more than 1/2 hour, except where such pours terminate at expansion joints. Construct joints as shown or, if not shown, use standard metal keyway sections.

Provide premolded joint filler for expansion joints abutting curbs, manholes, and other fixed objects. Locate at 20' o.c. for pavement lanes unless otherwise specified.

Installation of Embedded Items: Set and build into the work anchorage devices and other embedded items required for other work that is attached to, or supported by cast-in-place concrete. Use setting diagrams, templates and instructions provided by others for locating and setting.

Chamfer exposed corners and edges as indicated, using wood, metal, PVC or rubber chamfer strips fabricated to produce uniform smooth lines and tight edge joints. Chamfer 3/4" unless otherwise noted.

Concrete Placement: Comply with ACI 304, placing concrete in a continuous operation within planned joints or sections. Do not begin placement until work of other trades affecting concrete is completed.

Consolidate placed concrete using mechanical vibrating equipment with hand rodding and tamping, so that concrete is worked around reinforcement and other embedded items and into all parts of forms.

Protect concrete from physical damage or reduced strength due to weather extremes during mixing,

placement and curing.

In cold weather comply with ACI 306.

In hot weather comply with ACI 305.

CONCRETE FINISHES:

Exposed-to-view Surfaces: Provide a smooth rubbed finish for exposed formed concrete surfaces and surfaces that are to be covered with a coating or covering material applied directly to concrete. Remove fins and projects, patch defective areas with cement grout, and rub smooth.

Slab Trowel Finish: Apply trowel finish to interior monolithic slab surfaces that are exposed-to-view or are to be covered with resilient covering, paint or other thinfilm coating. Consolidate concrete surface by finish troweling, free of trowel marks, uniform in texture and appearance.

Drives, Walks, Curbs and Gutter Finishing: After striking-off and consolidating, smooth the concrete surface by screeding and floating. Work edges of slabs, gutters, and other formed joints with an edging tool to a 1/2" radius.

After floating and when excess moisture or surface sheen has disappeared, complete surface finishing as follows:

> Broom finish, by drawing a fine-hair broom perpendicular to line of traffic, as acceptable to the Engineer.

Curing: Begin initial curing as soon as free water has disappeared from exposed surfaces. Where possible, keep continuously moist for not less than 72 hours. Cure formed surfaces by moist curing until forms are removed. Continue curing by use of moisture-retaining cover or membrane-forming curing compound. Apply curing compound according to manufacturer's instructions and Federal Specification TT-C-00800. Provide protections as required to prevent damage to exposed concrete surfaces.

END OF SECTION 03305

SECTION 10990 - MISCELLANEOUS SPECIALTIES

PART 1 - GENERAL

RELATED DOCUMENTS:

Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division-1 specification sections, apply to work of this section.

DESCRIPTION OF WORK:

Location of specialty items and extent of work is shown on the drawings.

The type of specialty required include the following:

Volleyball Nets
Volleyball Net Antennae
Net Slider Attachment System
Pole Pads
Adjustable Boundary Line Kits
Aluminum Handrails

QUALITY ASSURANCE:

Manufacturer's Qualifications: The manufacturers shall have at least two years of successful experience in manufacturing and operation of the specialty item. The item shall be a standard product of the manufacturer.

Unless otherwise acceptable to the Engineer, furnish all units of each specialty by one manufacturer for the entire project.

In addition to the requirements of these specifications, comply with manufacturer's recommendations for all phases of the work, including preparation of the substrate, installation of anchors and application of materials.

SUBMITTALS:

Shop Drawings shall be submitted according to the requirements of Division-1 specifications.

Operation and Maintenance Manuals shall be submitted according to the requirements of Division-1 specifications.

Provide colors and textures for each specialty item as selected by the Owner from manufacturer's standard colors and patterns.

DELIVERY, STORAGE AND HANDLING:

Do not deliver specialty items until construction is ready for their installation. Items shall be clearly identified and properly packaged to prevent damage during delivery, handling and storage.

PART 2 - PRODUCTS

GENERAL:

The general equipment stipulations shall apply to all equipment furnished under this section.

VOLLEYBALL ACCESSORIES:

Volley ball Nets: Provide four (4) nets, 32 feet (L) x 39 inches (H) and constructed of #42 knotted nylon netting with 4-inch net tapes of 22 oz. ultraviolet and mildew resistant vinyl. Nets shall meet AVP, NCAA and NVL standards. Top & bottom lines shall be 42 feet galvanized steel cables. Provide side tie rope tensioners, rope ratchets, and 1-1/8-inch maple wooden dowels on both ends of nets. Net color to be selected by Owner.

Provide 6–foot long (2-piece) net antennae with antenna sleeve for each end of each net. Antenna sleeves shall have a minimum 96 square inches of velcro with double enclosure to secure antenna sleeve to net.

Nets shall be PBN4 Professional Pro Beach Power Net from Volleyball USA, or approved equal.

Net Slider Attachment System: For each net, provide two (2) adjustable slider attachments with worm gear winch. Tracks shall be stainless steel tracks for attachment to wood or steel poles to allow easy net set up when poles are within 50 feet of each other. Eye bolts connect to stainless steel slider bars which connect to the track with stainless steel bearings. Net adjustment range from 8'2" down to 7 feet. Provide self-drilling hex head low profile stainless steel wood screws to secure sliders to wood posts.

Stainless steel winch shall be designed to operate crescent or socket wrench to provide excellent tension for top of net. Rope ratchet tensioner provides the tension for bottom of net.

Net slider attachment system shall be from Volleyball USA, or approved equal.

Pole Pads: For each net post, provide a 2-inch thick pad measuring 6 feet (H) x 38 inches (W). Pads shall be constructed of 18 oz. ultraviolet treated mildew resistant vinyl exterior with a 2-inch thick polyfoam padding. Pads shall be double stitched with ultraviolet and mildew resistant stitching. Pads shall have six (6) 2-inch (W) x 6-inch (L) velcro straps for attachment. Pad color to be selected by Owner.

Pole pads shall be VBSP Volleyball Standard Pad from Volleyball USA, or approved equal.

Adjustable Boundary Line Kits: For each court (4), provide 2-inch heavy duty ultraviolet treated webbing to mark boundaries of the sand courts. Adjustment buckles allow for court size adjustment from 30-ft (W) x 60-ft (L) to 26-ft (W) x 52-ft (L).

Boundary webbing shall be provided with zinc plated steel corner rings and center court marking, hand winders for storage of webbing, adjustment buckles, plastic corner sand stakes, and 2-ft bungee cords for securing webbing corner rings to stakes. Webbing color to be selected by Owner.

Boundary line kits shall be 2-Inch Pro Adjustable Boundary Lines from Volleyball USA, or approved equal.

ALUMINUM HANDRAILS:

Aluminum railings shall be provided as indicated on the drawings. Unless otherwise indicated on the drawings, all railings provided under this section shall be of the same type and design.

All welding of aluminum shall be performed in accordance with recommendations of the American

Welding Society. Welds shall be free of porosity, cracks, holes, and flux.

All fasteners used in connection with aluminum railings shall be stainless steel.

Aluminum Railings: All aluminum railings shall be fabricated from 1-1/2 inch Schedule 40 pipe with wall thickness of at least 1/8 inch and shall be provided with a powdercoat finish.

Connections: All angles, offsets, or other changes in alignment in pipe railings shall be made with R & B Wagner railing ells and welding connectors. All fittings and connections in prefabricated aluminum railings shall be as recommended by the railing manufacturer. Field joints in welded railings shall be made with R & B Wagner "Double-Lock Splice-Lock", at least 3-3/4 inches long. Welding connectors and splice locks shall be installed in accordance with the manufacturer's recommendations. Other methods of making connections and changes in alignment will be considered, provided complete information covering the proposed method is submitted to the Engineer for review.

Fabrication: Railings shall be smooth, with all projecting joints and sharp corners ground smooth. Welded joints shall be flush type. Members shall be neatly coped and continuously welded or mechanically connected at all junctions. Top rails shall run continuously over posts. All rails and posts shall be in the same plane, and shall not be offset. All welding shall be done neatly and substantially by a process (i.e., TIG or MIG) producing a smooth weld. All weld spatter and burrs shall be removed, and all welds shall be thoroughly brushed with a stainless steel power wire brush.

Sleeves for fixed handrail posts shall be fabricated from Schedule 40 black steel pipe. Sleeves shall provide at least 1/4 inch clearance all around each post and shall be the length indicated on the drawings, but in no case less than 6 inches.

PART 3 - EXECUTION

VOLLEYBALL ACCESSORIES:

All volleyball netting, slider assemblies and boundary kits shall be installed in accordance with manufacturer's instructions.

ALUMINUM HANDRAILS:

When railings are assembled, all posts shall be plumb and longitudinal members shall be parallel with each other and with the floor surface or slope of stairs. In any section or run of railing, the centerlines of all members shall be in true alignment lying in the same vertical plane.

Suitable wall brackets shall be provided where shown or required. Wall brackets shall be securely anchored to walls with AISI 300 Series stainless steel bolts and expansion anchors.

All posts in fixed handrail sections shall be rigidly attached to the supporting structure. Unless otherwise noted, posts shall be attached to concrete structures by setting in sleeves. Sleeves shall be rigidly supported in accurate alignment in the forms and shall be positioned vertically so that the top of each sleeve is held down below the finished concrete surface. The position of all sleeves shall be carefully measured before railings are fabricated. When the railing is set, the posts shall be wedged in accurate alignment, and the annular space between the posts and sleeves shall be filled with handrail-setting cement. The top surface of the cement shall be finished smooth and shall slope away from the post. Where so indicated, attachments shall be made with flanges or other special attachments or anchorages. Maximum spacing for posts shall be 5 feet for aluminum railings.

Handrails in outdoor locations shall have slip joints at least every 30 feet to permit expansion and contraction. The gap at each slip joint shall not be less than 1/8 inch nor more than 3/8 inch.

After installation, railings shall be checked for final alignment, using a tightly drawn wire for reference. The maximum misalignment tolerance for railings shall be 1/8 inch in 12 feet. Bent, deformed or otherwise damaged railings shall be replaced.

END OF SECTION 10990

SECTION 15010 - PRESSURIZED PIPING GENERAL PROVISIONS

PART 1 - GENERAL

RELATED DOCUMENTS:

The general provisions of the Contract, including the General and Special Conditions and Division 1 - Specification sections apply to work of this section.

DESCRIPTION OF WORK:

Work under this section includes all material certificates, shop drawings, disinfection of all wetted parts of the potable water total system and field testing of all pipe, pipe fittings, piping specials and valves in all sections of Division 15 necessary to complete and make serviceable the pressurized piping system.

RELATED WORK SPECIFIED ELSEWHERE:

Pipe and Pipe Fittings: Section 15060

Valves: Section 15100

Piping Accessories: Section 15120

QUALITY ASSURANCE:

Codes and Standards: Comply with the provisions of the following codes and standards except as otherwise shown or specified.

AWWA: All applicable standards

North Carolina Department of Environment and Natural Resources: All rules and regulations

PART 2 - PRODUCTS

All products that are in contact with raw water or potable water shall have NSF 14, 15, 61 or other

appropriate NSF approval.

PART 3 - EXECUTION

DISINFECTION OF NEW WATER SYSTEMS:

Before being placed into service, and before certification of completion by the Engineer, all new water systems, or extensions to existing systems, or valved section of such extensions, or any replacement in the existing water system, or any exposed section of the existing system shall be disinfected according to the requirements of the North Carolina Department of Environment and Natural Resources which are quoted for reference.

".1001 DISINFECTION OF NEW SYSTEMS

(a) All interior surfaces of new potable water supply systems, including wells, filters, storage tanks and distribution lines shall be thoroughly disinfected by means of hypochlorite or chlorine solutions, after which bacteriological test samples shall be collected.

(b) After disinfection the water supply shall not be placed into service until bacteriological test results of representative water samples analyzed in an approved laboratory are found to be satisfactory."

".1003 DISINFECTION OF STORAGE TANKS AND DISTRIBUTION SYSTEMS

(a) Water distribution systems, including storage tanks and water mains, after flushing to remove sediment and other foreign matter, and after testing for leaks, shall be disinfected by the addition and thorough dispersion of a chlorine solution in concentrations sufficient to produce a chlorine residual of at least 50 milligrams per liter (or ppm) in the water throughout the distribution system, including all water mains and storage tanks.

(b) The chlorine solution shall remain in contact with interior surfaces of the water system for a period of 24 hours. Then the water system shall be flushed with fresh water from an approved water source until the chlorine solution is dispelled.

(c) Representative samples of the water shall then be collected. If bacteriological tests of the samples indicate that the water quality is satisfactory, the water mains and

storage tanks may be placed in service.

(d) In unusual situations where large volume tanks are involved and where there is not sufficient water available to fill the tank or there is not available a suitable drainage area for the chlorinated water, an alternate disinfection procedure for tanks may be proposed. Such proposal must be submitted in writing completely describing the proposed disinfection procedure and substantiating the need for an alternate procedure in the particular circumstance. Such alternate procedure must be approved before being implemented. The conclusion of the department shall be final."

At locations where new waterlines are to be tied into the existing system, or services installed after disinfection of the main line, the interior of all new fittings and valves required shall be bathed with a concentrated chlorine solution at the time of installation. Water shall be flushed through the new valve a sufficient time to wash out the chlorine solution before closing the valve and installing additional pipe. The new valve shall remain closed until the new section of pipe to be installed has passed all tests.

The discharge of any disinfectant shall not be within 1,000 feet of any river, stream or tributary. Discharge shall be overland only. If this is not practicable, a method such as dechlorination by the addition of sulfur dioxide or sodium metabisufite approved by NCDENR–Division of Water Quality in writing shall be allowed. Flushing and disinfection plan shall be submitted to DWQ for approval.

The Contractor shall be required to make arrangements for having tests conducted. All expenses incurred in making tests shall be borne by the Contractor and should be included in his bid.

Engineer shall be notified by Contractor 24 hours in advance of taking bacteria samples. Samples shall be taken at locations no greater than 0.5 miles apart.

TESTING NEW PRESSURE LINES:

Each section of new piping and service lines shall be tested by the Contractor to a hydrostatic pressure of 150 psi for water lines or 50 psi above or 1.5 times the working pressure for sewer force mains whichever is greater. Each section of replacement lines shall be tested to existing system pressure. The Contractor is required to furnish all pumps, gauges, instruments, test equipment and personnel required for the tests, and make provisions for removal of test equipment and draining of pipes after tests have been made. All tests shall be made in the presence of the Engineer.

The pressure tests shall be sustained for not less than 2 hours and as long as the Engineer may require to assure that:

No air pockets are in the line.

No broken pipe or defective materials are in the line.

No leaking joints have been made.

Before applying the specified test pressure, all air shall be expelled from the pipe and service lines. If outlets are not available at high places, the Contractor shall make the necessary taps at points of highest elevation before the test is made. After the test has been completed, corporation cocks shall be installed at these points and marked by the installation of a valve box.

Pipes entering tanks shall be closed off with blind flanges. Contractor shall make provisions for tapped flanges at all pipes ending in tanks.

Tests may be made of isolated portions of such piping as will facilitate general progress of the installation. Any revisions made in the piping systems will subsequently necessitate retesting of such affected portions of the piping systems.

Do not test against closed valves or gates at pressures higher than the allowable seating pressures for individual valves. Contractor may test open valves at pressures up to that specified for the valve bodies. In sections of the line where the test pressures are greater than the allowable seating pressures for the valves, the Contractor shall provide temporary plugs to test against.

Prior to pressure testing of buried piping, backfill shall have been placed and tamped to provide adequate side support for all pipe and fittings, and reaction backing shall have been in place at least 5 days. Trenches shall be sufficiently open for joint inspection prior to backfill.

Any defective material or defects in workmanship that develop during the tests shall be remedied and the subject piping shall be retested.

All piping systems shall be thoroughly flushed by providing a velocity of 2 feet per second in the line being flushed.

The leakage tests which may be performed at the same time as the pressure tests, shall be sustained for not less than 2 hours. The leakage shall be defined as the quantity of water that must be supplied into the newly laid pipe or any valved section thereof to maintain the specified leakage test pressure after the air in the pipe line has been expelled and the pipe has been filled with water.

All visible leaks are to be repaired regardless of the allowance used for testing.

No pipe line installation will be accepted if the leakage is greater than that determined by the following formula:

$$L = \frac{ND\,(SQRT\,P)}{7{,}400}$$

L = allowable leakage in gallons per hour
N = number of joints in length of pipe line tested
D = nominal diameter of pipe in inches
P = average test pressure during leakage test in pounds per square inch
SQRT = Square root

TABLE I

ALLOWABLE LEAKAGE - Gallons per hour per 1000 ft. of pipe at 150 psi

Diameter (inches)	18' Joints	20' Joints
2	0.18	0.17
4	0.37	0.33
6	0.55	0.50
8	0.74	0.66
10	0.92	0.83
12	1.10	0.99
16	1.47	1.32

END OF SECTION 15010

SECTION 15060 - PIPE AND PIPE FITTINGS

PART 1 - GENERAL

RELATED DOCUMENTS:

The general provisions of the Contract, including the General and Special Conditions and Division-1 Specification sections apply to work of this section.

DESCRIPTION OF WORK:

The extent of work under this item includes providing and installing all pipe and pipe fittings as shown on the drawings and described herein necessary to make complete and serviceable the piping system.

RELATED WORK SPECIFIED ELSEWHERE:

Clearing, Excavation and Trenching: Section 02210

Pressurized Piping General Provisions: Section 15010

Valves: Section 15100

Pipe Accessories: Section 15120

QUALITY ASSURANCE:

General: Class numbers or pressure rating shall be clearly marked on the pipe and fittings at the factory.

All potable water piping shall be NSF International approved, and shall bear NSF-pw logos.
Codes and Standards: Comply with the provisions of the following codes and standards except as otherwise shown or specified.

AWWA: All applicable standards

North Carolina Department of Environment and Natural Resources: All rules and

regulations

SUBMITTALS:

Material Certificates: Provide notarized materials certificates signed by the material manufacturer. Certify that each material item complies with the specified requirements, and was purchased for this project.

PART 2 - PRODUCTS

TEST PLUGS, THRUST RINGS AND WATER STOP:

All MJ and flanged pipe entering tanks and wet wells shall have flanges drilled and tapped for test plugs. Threads shall be protected from damage with styrofoam.

All wall sleeves and wall pipes shall have integral cast water stops or ductile iron water stop ring with continuous weld on both sides. Thrust rings shall be steel or ductile iron welds continuous and sized for the designed test pressure loads.

SMALL DIAMETER PRESSURE PIPE (SMALLER THAN 3"):

PVC Pipe and Fittings: PVC pipe and fittings shall be manufactured from Type 1, Grade 1, Polyvinyl Chloride in conformance with ASTM D 1784.

2" PVC Pipe shall be Thinwall PVC with integral bell conforming to ASTM D 2241, Cell Class 12454B, SDR21, Class 200.

1" PVC Pipe shall conform to the requirements of ASTM D 1785 schedule 40 and 80 pipe, unless otherwise noted. Fittings shall conform to the requirements of ASTM D 2466 for Schedule 40 and ASTM D 2467 for Schedule 80.

Galvanized Iron Pipe and Fittings: Piping designated "G.I.P." or "Galvanized Iron Pipe" on the drawings shall be Schedule 40 galvanized steel, threaded joint piping conforming to ASTM Specification A 53, or latest revision thereof. Fittings for such pipe shall be malleable iron, ASTM A 47 galvanized in accordance with ASTM A 153. Joints in galvanized threaded joint pipe shall be made with Standard Taper Pipe Thread ANSI B2.1. Seat threads not less than 4 full threads.

DRAIN WASTE VENT PIPING:

Pipe for drainage waste and vent shall be PVC-DWV, ASTM D 2665. For drainage, waste and vent piping, fittings shall be drainage pattern ASTM D 2165.

MISCELLANEOUS MATERIALS:

Pipe Insulation: Pipe insulation shall be molded, heavy-density, one-piece, 1"thick insulation made from inorganic glass fibers bonded with a thermo-setting resin.

Provide self-sealing adhesive and butt-strips for ease of installation.

Aluminum roll jacketing shall be provided to prevent exposure to elements and puncture. Jacketing shall be manufactured of aluminum alloy conforming to ASTM B209. Provide smooth finish free of corrugations. Jacketing shall have an integrally bonded moisture barrier over the entire surface in contact with the insulation. Provide 0.016" thick jacketing for all piping applications.

Insulation shall be easily removed and re-installed for accessibility to pipe, fittings, valves, etc.

Heat Trace Tape: Heat tape and controls shall provide safe and reliable heat tracing for freeze protection of pipes, valves, tanks or other similar exterior applications. The tape and controls shall be capable of maintaining 150 degree maximum pipe temperature at the appropriate voltage as indicated by the drawings. Tape shall be self-regulating to prevent over-temperature, and shall be easily field spliced to the desired length. Provide terminations, splice, tee and seal kits as required.

Cut-In Sleeve: The spigot end of the cut-in sleeve shall have the same outside diameter as adjoining pipe. Cut-in sleeve shall have mechanical joint end with ring, bolts and gasket included.

Thread Lubricant: Non-hardening, non-poisonous; Crane Thread Lubricant, Grinell Sprinkler Pipe Joint Compound, Permacel Ribbon Dope, John Crane.

Thread-Tape: Teflon - John Crane "Thread Tape", Garlock "Plasti- Thread", Hoke "EZ Seal", or equal.

Solvent-Weld Cement and Primers: Primers for solvent-weld PVC joints shall conform to the requirements of ASTM F 656. Solvent-weld cement shall confirm to the requirements of ASTM D 2564. For chemical piping use only solvent weld cement without fumed silica, Oatey Industrial Grade Low VOC Heavy-duty Gray, made by Oatey Corporation.

Nipples shall be of the same material and composition as pipe used. They shall be extra heavy weight when unthreaded shoulder is less than 1". No running thread nipples shall be used.

Flanges: Provide either flat-face or raised-face as required to match flange face on valves and equipment.

Bolts: Hex-head machine bolts, ASTM A 307, Grade B, with heavy hex nuts.

Bolts in contact with soil shall be high-strength, heat-treated, low alloy cast iron tee-head bolts with hexagon nuts, coated with rust-inhibitor lubricant after threading; ASA 21.11.

Gaskets: For ductile iron and steel pipe, use either rubber or nonasbestos full faced gasket, 1/8" thickness. For plastic pipe, use red sheet rubber.

PART 3 - EXECUTION

GENERAL:

Adherence to Standards and Instructions: All pipe, of whatever material, shall be transported, handled, stored and installed in keeping with applicable AWWA, ASTM, etc. standards and manufacturer's instructions for the particular pipe material involved. For PVC piping system, the latest edition of the CHEMTROL PLASTIC PIPING HANDBOOK as published by Nibco, Inc. shall be the project reference manual and instructions contained therein shall be followed.

Responsibility for Materials: During loading, transportation, unloading and storage, every precaution shall be taken to prevent injury to pipe, fittings and accessories and to keep them from dirt and foreign matter at all times. Particular care shall be taken to prevent damage to pipe and fitting linings and coatings. Pipe shall be protected during handling against impact shocks and free fall. Pipe shall be kept clean at all times, and no pipe shall be used in the work that does not conform to the appropriate specifications.

Shut-off valves and unions or flanges shall be provided at each branch or in supply and return to each item of equipment such as pumps, tanks, coils, etc. Valves and unions or flanges shall be suitably located to isolate each unit, branch circuit or section of piping to facilitate maintenance and/or removal of all equipment and apparatus. This requirement applies whether specifically shown on the drawings or not.

Provide drain valves or tees with plugs at low points of each system to enable complete drainage.

Provide caps or plugs for open ends of pipe lines and equipment during installation to keep dirt and other foreign matter out of pipe and equipment.

Provide necessary temporary cross-connections, valves, over-size flushing connections, pumps, etc. as required to thoroughly flush systems.

Expansion: All piping mains, branches and runouts shall be so installed as to allow for free expansion and contraction without developing leaks or undue stressing of pipe. Stresses shall be within allowable limits of ASA Code B31.1 for pressure piping.

EXTERIOR:

General Pipe Laying: All pipe, special castings, valves, fittings and the bells and/or spigots of same shall be thoroughly cleaned of all earth or other foreign matter before being fitted together. The spigot end shall be adjusted in the bell of the pipe, special casting or valve to allow for uniform gasket space, and the pipe shall be completely forced home and held there.

No pipe shall be laid except in the presence of the Engineer or his representative, without special permission from the Engineer. Prior to being lowered into the trench, each joint of pipe shall be carefully given a final inspection to see that each is clean, sound and free of defects. Damaged sections shall be repaired to the satisfaction of the Engineer or removed from the Site.

Pipe shall be laid to profile as shown on plans. Contractor shall be required to shoot existing grade and top of pipe every 50 feet and record elevations in fieldbook to document compliance with this requirement. Field books shall be available to Engineer during construction for review and turned over to Engineer monthly with each pay request as a condition of payment.

Pipe shall be laid accurately to the line and grade as designated on the job plans. Bell holes shall be excavated for each joint to assure bedding supports the barrel of the pipe and to facilitate making a perfect joint.

Pipe shall be laid in perfect alignment between turns. No abrupt changes, either in grade or alignment, will be acceptable. At such locations where alignment changes are indicated on the plans, fittings and adjacent pipe shall be self restrained by harnesses, special fittings or external blocking.

Cross above or below existing pipe a minimum of 12" unless otherwise directed by the ENGINEER. Cross below existing storm drain pipe a minimum of 24".

Separation of Water Mains from Sewer Lines: The water mains shall be laid at least 10 feet, horizontally, from any existing or proposed sewer lines. Should local conditions prevent a lateral

separation of 10 feet, a water main may be laid closer than 10 feet to a sewer line if, the elevation of the top (crown) of the sewer line is at least 18" below the bottom (invert) of the water main.

Whenever water mains must cross over sewer lines, the water main shall be laid at such an elevation that the top of the sewer line is at least 18" below the bottom of the water main.

When it is impossible to obtain proper horizontal and vertical separation as stipulated above, or whenever the sewer line is above the water main and within 10 feet horizontally, both the water main and sewer line shall be constructed of ductile iron pipe for 10 feet in each direction and shall be pressure tested to water main standards to assure watertightness.
During construction of the line work the lines shall be kept free from debris. Trenches shall be kept free from water, and when work is not in progress, all open ends of pipe and fittings shall be securely closed so that no trench water, earth or other substances will enter the pipe or fittings. At the end of each day's work, the pipe shall be inspected to insure that dirt, water and other materials have not entered the pipe.

Deflecting Pipe: Pipe shall be deflected where shown on the plans and according to the pipe manufacturer's recommendations. Ductile Iron Pipe should be limited to 3 degrees per joint except that specially prepared may be deflected 5 degress per joint where recommended by the manufacturer. PVC Pipe should be limited to 1 degree per joint in the bell but the pipe may be bent within the tolerences recommended by the pipe manufacturer.

PIPE INSIDE BUILDINGS, VAULTS AND OTHER STRUCTURES:

General: Install pipe and tubing in a neat and workmanlike manner as shown or indicated on the drawings. Where pipe, conduit or tubing is shown as a schematic layout on the drawings, the Contractor shall submit a system mock-up of the piping arrangement subject to the approval of the Engineer.

Provide tags to identify pipe or tubing which will pass through walls or concealed areas. Joints or connections for pipe and tubing shall not occur in wall or hidden areas.

Give careful consideration to clearances under beams, over windows, etc. to provide maximum headroom in all cases and to the locations of lines and type of fittings used to obtain these clearances. Ascertain ceiling heights, size of structural members at and adjacent to piping work. Coordinate piping work with other mechanical work and electrical work.

Cut pipe accurately or furnish in accurate lengths to measurements established at the building, work into place without springing or forcing and properly clear all windows, doors and other openings. Cutting or other weakening of the building structure to facilitate piping installation will not be permitted unless approved by the Engineer. Ream all piping to remove burrs and install so as to

permit free expansion and contraction without causing damage. Make all changes in direction with fittings, and changes in main sizes through eccentric reducing fittings except where specifically designated otherwise.

Interior drain piping shall be installed at a pitch not less than 1/8" to the foot and shall be suspended with hangers as hereinafter specified. All changes in direction of suspended drain piping shall be made with approved long-sweep drainage fittings. All offsets shall be made with 45 degree fittings, except as otherwise noted. Due allowance for expansion shall be made in all lines.

PIPING JOINTS AND CONNECTIONS:

Mechanical and Push-on Type Joints: Make up with Style A plain rubber molded gaskets, unless otherwise specified. Preparatory to making pipe joints, all surfaces of the portion of the pipe to be jointed or of the factory-made jointing materials shall be clean and dry. Gaskets, whether for the mechanical joint type or push joint type, shall be clean, flexible and, where lubrication is required, be lubricated with a lubricant recommended by the manufacturer. Provide special joints capable of up to 5 degrees deflection per joint where shown on the drawings.

Flanged Fittings and Pipe Work: The Contractor shall be required to place all flanged pipe, valves, fittings, etc. in absolutely true alignment, so that faces of all connecting flanges will be true and fair before bolting same together to guarantee that no strains will be imposed on same, other than those due to hydrostatic pressure. All flanged pipe, valves, fittings, etc. shall be securely supported against settlement and misalignment with such lasting material and in such manner as will meet the approval of the Engineer.

Screw thread joints shall be made up with teflon tape or pipe dope applied to male threads only. Threads exposed after joints are made up shall be mopped with the pipe dope to prevent rust.

PVC Pipe Joints: Install 2" and larger pressure water service piping using gasketed joints. Install smaller pressure water service piping using solvent weld joints. Install pipe for chemical service with solvent weld joints below grade and threaded connections above grade. Install drainage, waste, and vent piping using solvent weld joints.

Install PVC piping below grade using solvent weld joints and above grade using threaded connections unless otherwise shown or indicated on the drawings. Only use a strap wrench when putting together threaded PVC pipe and fittings. In no case shall a Stillson wrench be applied. Make up joints until tight but do not stretch or distort plastic pipe. Use teflon thread lubricant or other material as a joint compound.

EXPANSION BENDS, LOOPS, AND ANCHORS:

Pipe expansion, in general, is to be absorbed in bends, swing joints, expansion loops and offsets as indicated on the drawings. All piping mains, branches and runouts shall be so installed as to allow for free expansion and contraction without developing leaks or undue stressing of pipe. Stresses shall be within allowable limits of ASA Code B31.1 for pressure piping.

MISCELLANEOUS PIPE INSTALLATION REQUIREMENTS:

Pipe shall be installed as specified, as indicated on the drawings or, in the absence of detail piping arrangement, in a manner acceptable to the ENGINEER.

Connections to existing mains shall use mechanical joint (DIP) cut in sleeves.

In all piping, insulating fittings shall be provided to prevent contact of dissimilar metals wherever copper tubing or fittings are connected to iron or steel pipe or fittings.

Buried PVC piping shall be "snaked" in the trench and shall be kept as cool as possible during installation. PVC pipe shall be kept shaded and shall be covered with backfill immediately after installation.

PAINTING:

Paint all exposed above ground (or below ground in vaults) ferrous metal pipe, fittings, etc. with two coats of asphalt varnish such as 667 Utility Black by Tnemec, unless otherwise directed by the ENGINEER.

Paint all exposed threads of galvanized pipe with cold galvanized compound.

THRUST RESTRAINT:

All plugs, caps, tees and bends deflecting 11-1/4 degrees or more shall be provided with concrete reaction blocking to prevent movement. Blocking shall be placed between solid earth and the fitting to be anchored. The blocking shall be placed such that pipe and fitting joints are accessible for repair and/or future connections. Where space limitations will not permit installation of concrete blocking, where necessary to insure accessibility, where shown on the drawings or if approved by the ENGINEER, pipe and fittings shall be self restrained in lieu of concrete blocking. Pipe shall be designed to carry additional stresses of thrust restraint. Details pertinent to such self- restraining harness, tie rods, special pipe, etc. including design criteria and computations, must be submitted to

the ENGINEER for evaluation prior to incorporating such devices into the work.

Thrust restraint with an anchor ring shall be used where shown on the drawings and at terminal pipes. In cases where terminal pipes are preceded by a reducer, additional methods of restraint must be used for the reducer.

Reaction Backing: The area of bearing of the concrete backing on the earth in each instance shall be at least equal to that shown in the drawings. Details of placement are shown in the drawing.

TESTING PIPING SYSTEMS:

See Section 15010

DISINFECTION OF PIPING SYSTEMS:

See Section 15010

END OF SECTION 15060

SECTION 15100 - VALVES

PART 1 - GENERAL

RELATED DOCUMENTS:

The general provisions of the Contract, including the General and Special Conditions and Division-1 Specification sections apply to work of this section.

DESCRIPTION OF WORK:

The extent of work covering valves includes furnishing, installing and making operational all valves as indicated on the drawings and specified herein.

RELATED WORK SPECIFIED ELSEWHERE:

General Provisions: Section 15010

Pipe and Pipe Fittings: Section 15060

Piping Accessories: Section 15120

QUALITY ASSURANCE:

Codes and Standards: Comply with the provisions of the following codes and standards except as otherwise shown or specified.

AWWA: All applicable standards

SUBMITTALS:

Shop Drawings: Submit shop drawings for all valves, operators and special items including torque tubes, supports and brackets.

PART 2 - PRODUCTS

GATE VALVES:

Buried Service Resilient Seated: Valves shall conform as a minimum to AWWA C509 or C515, and be mechanical joint with ends adapted to the pipe or fitting to be installed. Valves shall be non-rising stem and open counter-clockwise with a 2" square operating nut. Valves shall be ductile iron body, with O-ring packing. Seating shall use compression closure. Gate shall be of a true bi-directional, mirror image design. Valves shall have a smooth bottom design, with all iron surfaces, internal and external, coated with a minimum of 8 mil thickness of epoxy.

BALL VALVES:

Brass Ball Valves: Brass ball valves shall be two-piece construction, standard port with lever handle, and located where shown or called for. Valves shall be 1600 Series as manufactured by ITT Grinnell, Nibco, Watts or equal

TEMPORARY BLOW-OFF VALVE:

Valve for Blow-off Valve assembly shall conform to Cast Iron Gate Valve in this section. Additional material for complete installation shall include the following.

1. Thrust collar with anchor ring
2. Six (6) linear feet of ductile iron pipe
3. 45 degree M.J. elbow
4. PVC water main, length required to open into roadside drain.

BACKFLOW PREVENTER:

Backflow preventer shall consist of an internal pressure differential relief valve located in a zone between two positive seating check modules with captured springs and silicone seat discs. Seats and seat discs shall be replaceable in both check modules and the relief valve. There shall be no threads or screws in the waterway exposed to line fluids. Service of all internal components shall be through a single access bronze cover secured with stainless steel bolts. The assembly shall include two resilient seated isolation valves, four resilient seated test cocks and an air gap drain fitting.

Backflow preventer shall be Watts Series 009 of size required and shall meet the requirements of: USC; ASSE Std. 1013; AWWA Std. C511-92; CSA B64.4.

MISCELLANEOUS:

Valve Box: Furnish with each valve for underground installation one gray iron screw type adjustable valve box and cover suitable for H-20 loading. The cover shall have cast on the upper surface in raised letters the label "WATER" or "SEWER", as appropriate. Set the valve box in a concrete pad. Supply with each valve box a bottom, middle and top section and cover, all of gray iron conforming to ASTM A48, Class 30 iron. Use valve box model #8550 by East Jordan Iron Works (Valve #4 thru #0200), Bingham and Tayler, Tyler Union or equal as approved by the Engineer.

Any valve box extensions are required to be made of the same material as the valve box. PVC pipe will not be allowed.

Backflow Preventer Enclosure: Furnish fiberglass enclosure with full anchor flange, full hinge, locking mechanism, drain, and spray foam insulation for frost protection. Secure to concrete slab with anchor bolts as recommended by manufacturer. Color to be grey or tan.

PART 3 - EXECUTION

GENERAL:

Install valves in the locations as shown on the drawings, plumb and centered and in absolutely true alignment. Support valves against settlement and misalignment with a suitable, lasting material as approved by the Engineer.

Clean valve interior of all foreign matter before installation. Tighten stuffing boxes and inspect valve in open and closed position to assure that all parts are working properly.

BURIED SERVICE VALVES:

Install valve boxes for gate valves as indicated on the drawings. Adjust length of valve box to bring valve box cover to finished grade elevation. Center valve box over operating nut so that it fits around the stuffing box and rests on the valve bonnet. Align valve box so that it is plumb. Place and compact material in layers around valve box so as to prevent misalignment or shifting of the valve box or cover. Pour a concrete pad around the cover as shown on the drawings. Furnish tee handle valve wrenches as necessary to provide at least one wrench of proper dimensions to enable

convenient operation of every buried valve.

END OF SECTION 15100

SECTION 15120 - PIPE ACCESSORIES

PART 1 - GENERAL

RELATED DOCUMENTS:

The general provisions of the Contract, including the General and Special Conditions and Division-1 Specification sections apply to work of this section.

DESCRIPTION OF WORK:

The extent of work covering pipe accessories includes furnishing, installing, and making operational all accessories as indicated on the drawings and specified herein.

RELATED WORK SPECIFIED ELSEWHERE:

General Provisions: Section 15010

Pipe and Pipe Fittings: Section 15060

Valves: Section 15100

QUALITY ASSURANCE:

Codes and Standards: Comply with the provisions of the following codes and standards except as otherwise shown or specified.

AWWA: All applicable standards

Manufacturer's Capabilities: Supplier of accessory items shall be regularly engaged in the manufacture of products of types and sizes required, and which have been in satisfactory use for not less than one year in similar service.

SUBMITTALS:

Shop Drawings: Submit shop drawings or product data for all accessory items.

PART 2 - PRODUCTS

GENERAL:

Provide factory-fabricated piping accessories as hereinafter specified for use in the service indicated. Provide products of the type and pressure-rating indicated for each service or, if not indicated, provide proper selection as determined by the piping system installer to comply with installation requirements. Provide sizes and connections matching pipe, tube, valve and equipment connections.

PIPE LOCATION SYSTEM:

Provide and install an early warning detection tape to facilitate the location of buried pipe. For detection of non-metallic pipe, provide tape with a metalized core for easy detection with pipe location equipment. Install detection tape not more than 18" below finished grade and not more than 6" to either side of the centerline of the pipe. Provide a taping system such as Terratape by Griffolyn Company or equal.

Non-metallic pipe installed in straight lines between manholes, inlets or vaults need not be protected by tape with metalized core, but warning tape shall still be provided.

PART 3 - EXECUTION

GENERAL:

Install all piping accessories as shown on the drawings complying with all applicable portions of SECTION 15060 - PIPE AND PIPEFITTINGS, manufacturers' instructions and as directed. Provide accessories of the sufficient size and ratings if not shown to complete and make ready for service all piping systems.

Touch-up paint all surfaces where the primer paint has been damaged or scarred during installation. Comply with Division-9 Painting.

All ferrous-metal surfaces for underground installation shall be coated with a bitumastic paint.

END OF SECTION 15120

SECTION 15400 - PLUMBING

PART 1 - GENERAL

RELATED DOCUMENTS:

The general provisions of the Contract including the General and Special Conditions and Division-1 Specification sections apply to work of this section.

SCOPE:

This section covers furnishing and installation of materials, devices, appliances, fixtures, equipment and appurtenances required for complete plumbing systems as specified herein and as indicated on the drawings.

Principal items of work to be performed, and materials, equipment, devices and appliances to be furnished and installed hereunder, include the following:

Drainage and vent piping systems, with connections to each fixture and piece of equipment requiring a waste or vent connection.

Cold water supply piping systems, including connections to each fixture and piece of equipment requiring water.

Plumbing fixtures, except as specified hereinafter.

CODES AND ORDINANCES:

Plumbing work shall be performed in accordance with the North Carolina Building Code and all other applicable codes and ordinances which pertain to such work. In case of conflict between these specifications and any applicable code or ordinance, the latter shall govern. In the absence of an applicable plumbing code or ordinance, plumbing work shall conform to the provisions of the National Uniform Plumbing Code.

DRAWINGS AND DATA:

Complete specifications, data, and drawings covering all materials, fixtures, and equipment shall be submitted in accordance with the submittals section.

PART 2 - MATERIALS

FLOOR DRAINS:

Floor drains shall be as manufactured by Josam, Smith, Wade, or Zurn. Similar and equivalent products of other manufacturers may be provided.

Floor drains shall be of the types and sizes indicated on the drawings. Floor drains shall be carefully adjusted to the correct elevation for proper drainage. Except at floor drains having integral traps, each floor drain shall be provided with a "P" trap installed as close to the drain as possible.

PLUMBING FIXTURES AND ACCESSORIES:

Plumbing fixtures and accessories shall be provided as indicated on the drawings and as listed herein.

Supports and Fastenings: Fixtures and accessories shall be supported securely and rigidly. Exposed heads of bolts shall be hexagonal with rounded chromium-plated tops. Chromium-plated hexagonal cap nuts shall be provided to conceal the ends of bolts where exposed.

Fasteners for mounting accessories shall be concealed, galvanized, and shall be suitable toggle bolts or expansion anchors.

Supply Piping: All exposed supply piping to plumbing fixtures shall be chromium-plated brass or copper.

Potable Water Piping: PVC schedule 40 or service tubing conforming to ASTM D2737, SDR 7.3, NSF approved.

Sewer Drainage Piping: Piping & fittings shall be Schedule 40 PVC-DWV conforming to ASTM D 2665-85.

WATER FOUNTAIN:

Water fountain shall be pedestal mounted bottle filler with bi-level drinking fountain model GYQ84 as manufactured by Murdock, or approved equal.

Construction shall be 12 gage, all stainless steel with 18 gage stainless steel fountain bowls. Pedestal shall have four mounting holes. Access covers shall be secured with vandal-resistant stainless steel screws. Bottle filler shall be activated by a pushbutton. Unit shall contain a 100 mesh inlet strainer, lead and cyst filter, underground freeze resistant valves, and laminar flow

spout. Self-closing pushbuttons, needing less than 5 pounds force, shall activate internally mounted valves with adjustable stream regulators. Bubblers shall be stainless steel with non-squirt feature and operate on water pressure range of 20-105 psig.
Fountain shall be certified to ANSI A117.1, Public Law 111-380 , NSF/ANSI 61, Section 9. Fixture shall meet adult ADA and ADA Standing Person requirements when mounted appropriately.

The finish shall be an over-baked powder coat, with manufacturer's full range of standard colors available for Owner's selection.

OUTDOOR SHOWER STATION:

The outdoor shower shall be a dual station Model M-PCS24 Foot & Shower column station as manufactured by Murdock Mfg, or approved equal.

Unit shall include two shower heads and two footwash heads located on opposite sides of the unit from each other. Unit shall be pre-piped and hydrostatically tested. Valves shall have internally mounted metering valves, pushbutton operated and requiring less than five pounds of force to activate. Timing shall be adjustable from 5-60 seconds. Shower heads shall be chrome plated brass with 2.5 GPM flow restrictors and include an adjustable spray pattern from a coarse stream to a fine mist.

Unit shall be constructed of heavy duty 14 gage type 304 stainless steel polished to a satin finish with vandal resistant fasteners and shall include a ¼ inch thick stainless steel bottom plate, providing secure mounting for shower.

All water-contacting components shall be NSF-61 certified, and the plumbing shall be equipped with a shut off and drain down for winterization purposes.

The finish shall be an over-baked powder coat, with manufacturer's full range of standard colors available for Owner's selection.

PART 3 - INSTALLATION

PIPING SYSTEMS:

Drainage and Vent Piping: Drainage and vent piping shall be installed where required and shall, in general, conform to the locations indicated on the drawings. Horizontal soil and waste pipes shall have a grade of 1/4 inch per foot wherever possible, but in no case shall the slope toward the drainage outlet be less than 1/8 inch per foot.

Building Water Supply Piping: Cold water supply piping shall be installed where required and shall, in general, conform to the locations indicated on the drawings. Suitable connections shall be made to each fixture and piece of equipment requiring water.

Air chambers or other acceptable water hammer prevention devices shall be provided on all water supply lines at fixtures and at tops of all risers. Each air chamber shall consist of a piece of pipe not less than 12 nominal pipe diameters in length, with the top end capped and soldered.

CLEANING AND ADJUSTING:

Immediately prior to the final inspection of the work, all parts of the installation shall be thoroughly cleaned. All equipment, pipe, drains, valves and fittings shall be cleaned. All flush valves and other devices shall be adjusted for quiet operation. All drains shall be checked for proper operation.

SEWERS AND DRAINS:

All drainage lines shall be laid on uniformly descending grades. Trenching, embedment and backfilling shall be as specified in the excavation section.

Pipe having premolded joints shall be stored and handled so that the joints are not damaged. Joint surfaces shall be properly lubricated immediately before the pipe is installed.

END OF SECTION 15400

The Specification Sections applying to the Electrical Work for the Boyd Lee Park Sand Volleyball Courts– Greenville, North Carolina are as follows:

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Ronald E. Pledger

8/15/2019

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SECTION 16100
GENERAL ELECTRICAL REQUIREMENTS

NOTE: This City of Greenville is adding a beach Volleyball Court to Boyd Lee Park in Greenville, N.C. This electrical work is for power to an irrigation control panel at the proposed volleyball court.

The Electrical Contractor must organize his work and secure materials in a manner that will expedite the project, thus completing the project on schedule. Conditions of the Contract, Form of Construction Contract, Notice to Bidders, Supplementary General Conditions, General Specifications and all of which are a part of these specifications.

The Contractor shall refer to the Notice to Bidders and General Conditions of the Contract, Form of Construction Contract, Instructions to Bidders, Supplementary General Conditions, General Specifications and all Division 16 Electrical Specifications, all of which are a part of these specifications.

This electrical work shall be a prime general contract for all work.

PART I GENERAL

1.01 These specifications and the accompanying plans are intended to describe the installation of a complete electrical system in this facility complex. The work to be done under these specifications shall include the furnishing of all labor, equipment and materials required to provide a complete and working electrical system as shown on the plans and as outlined in these specifications.

PART 2 GENERAL

2.01 The contract shall include all labor, materials, permits, etc. necessary for the completion of the work. All materials, shall be new except as specifically noted, and shall have Underwriter's Laboratory approval or other third party agencapproval or U.L. re-examination listing,and shall be installed in accordance with the best practice by experienced mechanics.

2.02 The electrical plans are diagrammatic only and are not intended to show all details of the work. The location of all conduit work is approximate and the Electrical Contractor shall make any necessary changes in the location to avoid piers, beams, footings, plumbing, duct and other obstructions at no additional cost to the Owner.

2.03 The spirit as well as the letter of the plans and specifications shall be followed and all work shall be executed according to the true intent and meaning of plans and specifications, both of which are intended to include everything requisite for a complete electrical system.

2.04 The Electrical Contractor shall comply with all state and Underwriter's requirements, ordinances or rules governing work of the character including the current edition of the National Electrical Code and OSHA.

2.05 Should any error or omission exist in either or both of these plans and specifications, or conflict one with the other, the Contractor shall not avail himself of such unintentional error, omission or conflict, but shall have same explained and adjusted before signing the contract or proceeding with the work, otherwise, he shall at his expense supply the proper materials and labor to make good any damage to or defect in his work caused by such error, omission, or conflict.

PART 3 SAMPLES

3.01 All materials, equipment and accessories entering into the work area are subject to the approval or disapproval of the Engineer. No samples are required to be submitted with bid documents. Name of equipment suppliers shall be provided on the Bid Form where required.

3.02 The samples required by the Engineer shall be submitted after the award of the contract and acceptance of the Contractor's bond. All samples shall be delivered to a location designated by the Engineer.

3.03 No inspection or test shall be made except upon formal notice to the Engineer from the Contractor by letter or telegram. Contractor shall furnish all labor and appliances for tests and shall meet all expenses of said test.

3.04 In all cases where devices or part of the equipment is herein referred to in the singular number, it is intended that such referred shall apply to as many devices as are required to complete the installation.

PART 4 SPECIAL CONDITIONS

4.01 Everything necessary for the completion and successful operation of the work, whether or not here definitely specified or indicated on the drawings, shall be furnished and installed as well and faithfully as if so indicated and specified.

4.02 Contractor shall store all materials in trailers each night. No materials shall be left in the facility.

4.03 System voltage shall be the following:

A. Boyd Lee Park Irrigation – 120 VAC VAC single phase 2 wire, 60 Hertz.

PART 5 PAINTING

5.01 All factory finished metal surfaces damaged during installation shall be restored to their original condition.

PART 6 SUPERVISION AND SUPERINTENDENCE

6.01 This Contractor shall during the progress of the work, maintain a competent Superintendent who shall not be changed except if he proves unsatisfactory to the Contractor or the Engineer.

6.02 Efficient supervision shall be given to the work.

PART 7 WORKMANSHIP

7.01 Only the finest quality workmanship shall be acceptable and any shoddy work shall be removed without delay and such materials shall not be re-used without the consent of the Engineer.

7.02 The Electrical Contractor's Foreman shall be thoroughly experienced in the installation of electric wiring as covered by the plans and specifications and he shall remain on the job continually while the work is in progress. His qualifications, and ability shall be acceptable to the Engineer.

PART 8 INSPECTION AND TESTS

8.01 The system shall be installed in strict accordance with the regulations of the local and State Codes and Ordinances.

8.02 The final inspection and tests shall be made only after the Engineer shall be satisfied that the work described in these specifications has been completely installed in accordance with the spirit and intent of these specifications. The acceptance of the work shall not in any way prejudice the rights to demand the replacement of defective materials or workmanship. The Electrical Contractor shall furnish instruments, special apparatus, and expert service to make all necessary tests to show that the system is absolutely clear of improper grounds and short circuits and to demonstrate that the entire equipment as to capacity, quality, and completeness is properly installed to meet all requirements of these specifications and defects shall be remedied without delay. Contractor shall inform all local inspectors of work phases accomplished and shall acquire all phasing permits and final approval from all local authorities.

PART 9 VISIT TO SITE

9.01 All bidders shall visit the site and thoroughly familiarize themselves with the existing conditions before submitting their bids. No allowances will be made for a lack of knowledge of existing conditions.

PART 10 GUARANTEES

10.01 The Contractor shall deliver the system to the Owner in first class operating condition in every respect and shall guarantee as specified in Instructions to Bidders and General Conditions of the Contract for one full year after final payment.

PART 11 LIQUIDATED DAMAGES

11.01 Refer to Suplementary General Conditions.

PART 12 COORDINATION

12.01 The electrical work is part of the general construction Contract.

PART 13 FEE AND PERMITS

13.01 Contractor shall acquire and pay for all fees and permits required by authorities.

PART 14 CONTRACTOR DEFINED

14.01 The words "Contractor", “contractor" and "Electrical Contractor" as used in this section are synonymous.

PART 15 ACCEPTANCE

15.01 The entire system will be accepted as unit. There will be no partial acceptance.

PART 16 DAMAGES

16.01 This contractor shall be responsible for damage to the work of others or the property and any damage by this contractor shall be repaired or replaced by this contractor at no cost to the Owner. This Contractor shall provide barricades where his work may endanger the public safety.

PART 17 RECORD DRAWINGS

17.01 The contractor shall furnish to the Engineer drawings of any arrangements installed differently from those shown on the Engineer's contract drawings.

PART 18 SUBSTITUTE MATERIALS

18.01 A 10 day prior approval before the bid date shall be required for any substitutions than the materials listed in the specifications.

PART 19 SPECIAL REQUIREMENTS

19.01 Adherence to special requirements for seismic protection per latest issue of the N.C. Building code shall include:

A. Electrical equipment and raceways will not become mobile and be displaced from its location. Must be anchored and secured to wall and floor to meet standard perpendicular forces.

*****END OF SECTION*****

SECTION 16111
CONDUIT

PART 1 GENERAL

1.01 WORK INCLUDED

A. Metallic Conduit and Fittings

1.02 REFERENCES

A. UL6A (ReplacesWWC-540C) - Specifications for Rigid Aluminum Conduit

B. ANSI/NEMA FB 1 - Fittings and Supports for Conduit and cable assemblies.

C. UL 360-82 liquid tight flexible conduit.

PART 2 PRODUCTS

2.01 RIGID STEEL CONDUIT PVC COATED:

A. Rigid steel conduit: ANSI C80:1; FS WW C 581. Conduits shall be rigid steel hot dipped galvanized zinc, metallized, sherradized mild steel, Schedule 40 size, threaded, manufactured in accordance with Underwriter's Laboratory standard and so labeled. Rigid galvanized conduit shall include a PVC jacket. PVC jacket shall have a minimum thickness of 15-20 mills.

B. ACCEPTABLE MANUFACTURERS:

1. OCAL
2. Robroy
3. Pittsburgh Conduit Company
4. Or equal

C. Fittings and Conduit Bodies: ANSI/NEMA FB1; threaded style.

2.02 PLASTIC CONDUITS AND FITTINGS:

A. Conduit NEMA TC2: 40 PVC manufactured in accordance with Underwriter's Laboratory Standard and UL listed.

B. Fittings and conduit bodies TC3.

C. Acceptable Manufacturers:

1. Allied

2. Carbon

3. FRE Conduit

2.03 FLEXIBLE NONMETALLIC LIQUIDTIGHT CONDUIT & FITTINGS

A. Conduit FS-WW-C-566

B. Fittings and conduit bodies: ANSI (NEMA FB)

2.03 CONDUIT SUPPORTS

A. Conduit Clamps, Straps, and Supports: malleable iron for riser assemblies.

2.04 CONDUIT FITTINGS

A. All conduit fitting with PVC coated rigid galvanized conduits shall be PVC coated.

PART 3 EXECUTION

3.01 CONDUIT SIZING, ARRANGEMENT, AND SUPPORTS

A. Size conduit for conductor type installed. 3/4" (20mm) minimum size.

B. Arrange conduit to present a neat appearance.

C. Route exposed conduit above accessible ceilings parallel and perpendicular to walls and adjacent piping.

D. Maintain minimum 6" clearance between conduit and piping. Maintain 12" (300mm) clearance between conduit and heat sources such as flues, steam pipes, and heating appliances.

E. Paralleled conduit shall be run straight and true with offsets uniform and symmetrical. Conduit terminals, boxes and cabinets shall be rigidly secured with double locknuts, one inside and one outside and bushings. Insulated bushings of the plastic type shall be used on all conduits 3/4" trade size and larger. Lacquer coating of conduits shall be removed where ground clamps are to be installed.

F. Group conduit in parallel runs where practical and use conduit rack constructed of steel channel with conduit straps or clamps. Provide space for 25 percent additional conduit.

G. Do not fasten conduit with wire or perforated pipe straps. Remove all wire used for temporary conduit support during construction, before conductors are pulled.

H. Exposed conduit shall be securely fastened in place in accordance with the latest issue of the NEC. Horizontal and vertical conduit runs may be supported by one-hole malleable straps, clampbacks or other approved device with suitable bolts, expansion shields where needed or beam clamps for mounting to building structure or special brackets. Adjustable hangers may be used to suspend conduits when separately located. The required strength of the supporting equipment shall be based on the combined weight of conduits, hangers and cables.

3.02 CONDUIT INSTALLATIONS ABOVE GRADE

A. Cut conduit square using a saw or pipe cutter; de-burr cut ends.

B. Bring conduit to the shoulder of fittings and couplings and fasten securely.

C. Use conduit hubs or sealing locknuts for fastening conduit to cast boxes, and for fastening conduit to sheet metal boxes in damp or wet locations.

D. Install no more than the equivalent of four 90 degree bends between boxes.

E. Use conduit bodies to make sharp changes in direction.

F. Use hydraulic one shot conduit bender or factory elbows for bends in conduit larger than 2" (50 mm) size.

G. Avoid moisture traps where possible; where unavoidable, provide junction box with drain fitting at conduit low point.

H. Use suitable conduit caps to protect installed conduit against entrance of dirt and moisture.

I. Provide No. 12 AWG insulated conductor or suitable pull string in empty conduit, except sleeves and nipples.

J. Where conduit penetrates fire-rated walls and floors, provide mechanical fire-stop fittings with UL listing fire rating equal to wall or floor rating.

K. Use conduit hubs of seealing locknuts for fastening conduit to cast boxes, and for fastening conduit to sheet metal boxes in damp or wet locations.

L. Provide No. 12 AWG insulated conductor or suitable pull string in empty conduit, except sleeves and nipples.

M. Conduit couplings for CRC and PVC shall be in accordance with the NEC.

3.03 UNDERGROUND RACEWAYS

A. Raceways run external to building foundation walls (with the exception of branch circuit raceways), shall be direct burial conforming to the specifications and plans.

1. Raceways must have a minimum cover of thirty (30) inches, (Unless Noted otherwise) except for raceways containing circuits with voltages above 600 volts, which-must have a minimum cover of thirty (48) inches.

2. Raceways shall be of a type approved by the NEC as "suitable for direct burial."

B. Branch circuit raceways run underground external to building foundation walls shall be run in raceways installed in accordance with the NEC, and shall be of a type approved by the NEC as "suitable for direct burial." Minimum raceway size shall be 1 inch.

C. All underground raceways shall be identified by UNDERGROUND LINE MARKING TAPE located directly above the raceway at 6 to 8 inches below finished grade. Tape shall be permanent, bright-colored, continuous printed, plastic tape compounded for direct burial not less than 6 inches wide and 4 mils thick. Printed legend shall be indicative of general type of underground line below.

D. Raceways run underground internal to building foundation walls shall be of a type and installed by a method approved by the NEC.

E. Where underground raceways are required to turn up into cabinets, equipment, etc., and on to poles, the elbow required and the stub-up out of the slab or earth shall be of rigid aluminum.

F. The raceway system shall not be relied on for grounding continuity. See Section 16450, GROUNDING AND BONDING, for clarification.

G. Where raceways pass through a "below grade" wall from a conditioned interior building space, said raceways shall be sealed utilizing fittings similar and equal to OZ/GEDNEY type "FSK" thru-wall fitting with "FSKA" membrane clamp adapter if required.

3.04 DUCTBANK

A. Excavation and backfill shall include compaction in 6 inch layers to 95% except heavy-duty, hydraulic-operated compaction equipment shall not be used.

B. Cut trenches neatly and uniformly, sloping uniformly to required pitch.

C. Pitch ducts to drain towards manholes and handholes and away from buildings and equipment. Minimum slope shall be 4 inches in 100 feet. Where necessary to achieve this between manholes, slope ducts from a high point in the run to drain in both directions.

D. Direct Burial – nonmetallic ducts shall be supported on plastic separators coordinated with duct size and spacing. Separators shall be spaced close enough to prevent sagging and deforming of ducts. Do not use steel or tie wires in such a way as to form conductive or magnetic loops around ducts or duct groups.

E. Install waterproof, 130-pound tensile test marking cord (marked at least every foot), equivalent to Greenlee No. 435, in all ducts, including spares, after thoroughly rodding, clearing and swabbing all lines free of any and all obstructions.

F. Seal all ducts at terminations, using sealing compound and plugs, as required to withstand 15 psi minimum hydrostatic pressure.

3.05 RECONDITIONING OF SURFACES:

A. Unpaved surfaces disturbed during the installation of duct or direct burial conduit shall be restored to their original elevations and condition. Sod or topsoil shall be preserved carefully and replaced after the backfilling is completed. Sod that is damaged shall be replaced by sod of quantity equal to that removed. Where the surface is disturbed in a newly seeded area, the restored surface shall be re-seeded with the same quantity and formula of seed as that used in the original seeding. Compaction shall be in 6" layers.

B Paved surfaces that are cut in this work shall be restored to their original condition. Material shall be compacted in 6" layers to 90% compaction and 2" asphalt repairs completed.

C. All sidewalks, curbs, etc. shall be cut and replaced in this contract for conduit installation.

3.06 CABLE PULLING

A. Cables shall be pulled down grade with the feed-in point at the point of the highest elevation. Flexible cable feeds shall be used to convey cables through the opening and into the duct runs. Cable lubricants shall be soapstone, graphite, or talc for rubber or plastic jacketed cables. Cable pulling tensions shall not exceed the maximum pulling tension recommended by the cable manufacturer. If basket-grip type cable pulling devices are used to pull cable in place, cut off the section of cable under the grip before splicing and terminating.

3.07 SCHEDULE OF CONDUIT INSTALLATION

A. Unless otherwise specified or shown on the drawings, all exposed exterior raceways shall be heavy wall, rigid galvanized conduit w/PVC jacket, ANSI C80.1.

B. Exterior installation underground conduit system shall be schedule 40 PVC direct burial

*****END OF SECTION*****

SECTION 16123
WIRE AND CABLE

PART I GENERAL

1.01 WORK INCLUDED

A. Building Wire

B. Cable

C. Wiring connections and terminations

1.02 REFERENCES

A. NEMA WC-5 thermoplastic insulated wire and cable for the transmissions and distribution of Electrical Energy

1.03 SUBMITTALS

A. None

PART 2 PRODUCTS

2.01 BUILDING WIRE

A. Thermoplastic insulated Building Wire - NEMA WC 5

B. Feeders and Branch circuits larger than 8 AWG: copper stranded conductor, 600 volt insulation, THHN/THWN.

C. Branch circuit 10 AWG and Smaller copper solid conductor, 600 volt insulation, THHN/THWN.

D. Control Circuits Discrete: Copper, stranded conductor 600 volts insulation, 14 AWG THWN.

E. Control Circuits Analog: 4-20 ma conductors shall be #16 AWG twisted pair shielded cables with tape shield, drain wires, and outer thermoplastic jacket.

2.02 CONDUCTORS

A. All conductors shall be tinned soft or annealed copper wire of the quality manufacturers in accordance with ASTM Specifications. Cutting away of strands to permit inserting into lugs will not be tolerated.

B. All wiring shall be color coded by pigmentation. Not tape color coding is acceptable.

C. Conductor sizes shall be American Wire gauge sizes as indicated and stranded construction. All wires to be factory marked with stamping every two feet indicating size, type, voltage, rating and manufacturer's name. Wire shall be factory color coded, except for feeder wire. Color coding shall be as follows:

277/480 vac, 3 phase, 4 wire: Phase A (1) Brown, Phase B (2) Orange, Phase C (3) Yellow, Neutral (N) Gray, and ground (G) Green

120/230 VAC 1 phase 3 wire: Phase A (1) Black, Phase B (2) Red, Neutral (N) White, and Ground (G) Green.

The system grounding conductor shall be colored green. Note the green coding required by NEC of conductors intended solely for the grounding purposed. In multi-conductors, the group shall be color coded. All color coding shall be by pigmentation. Surface colored wires will not be accepted.

D. Low Voltage Conductors: Twisted pair shielded 16 AWG with inner jacket, flame retardant, aluminum tape, outer thermoplastic jacket wet or dry and drain wires.

2.03 ACCEPTABLE MANUFACTURERS

A. Phelps Dodge

B. Houston

C. Southwire

PART 3 GENERAL

3.01 GENERAL WIRING:

A. Use no wire smaller than 12 AWG for power and lighting circuits.

B. Place an equal number of conductors for each phase of a circuit in same raceway or cable.

C. Splice only in junction or outlet boxes.

D. Neatly train and lace wiring inside boxes, equipment and panelboards.

E. Each feeder conductor in pull box or panel containing more than one home run shall be identified by non-magnetic metal tag. Tags shall be one inch in diameter and have stamped numbers and letters 1/2" high. Tape with printed numbers, etc., type identifiers shall be acceptable for branch circuits wiring. Engraved plastic laminated plates for panelboards, switchgear, transformers, etc., will be required. Embossed plastic adhesive tape will not be acceptable for temporary use during construction. Thoroughly wipe wire and cable with alcohol to clean surface before applying tape type identifiers.

3.02 WIRING INSTALLATION IN RACEWAYS

A. Pull all conductors into a raceway at the same time. Use UL listed wire pulling lubricants for pulling 4 AWG and larger wires.

B. Install wire in raceway after all Mechanical work likely to injure conductors has been completed.

C. As far as practicable, all feeder cables shall be continuous from origin to panel termination without running splices in intermediate pull boxes or splicing chambers. Sufficient slack shall be left at the termination to make proper connections. Unless otherwise noted, each conduit raceway shall contain only those conductors constituting a single feeder circuit. All cable terminals, taps and splices shall be made secure. Where conductors are to be connected to metallic surfaces, the coated surfaces for the metal shall be polished before installing the connector. Marlin twine shall be used to bind cable groups together.

D. Completely and thoroughly swab raceway system before installing conductors.

3.03 CABLE INSTALLATION

A. Use suitable cable fittings and connectors.

3.04 WIRING CONNECTIONS AND TERMINATIONS

A. Splice only in accessible junction boxes, outlets, or handholes if necessary, avoid splicing if possible.

B. Power and Lighting circuits #10 AWG and smaller shall have solid copper conductors. Conductor sized #8 AWG and larger shall have Class B stranded

conductors #10, #12, AWG, Copper and smaller shall be spliced by twisting securely and by means of mechanical connector plugs gum rubber tape, friction tape or approved plastic tape. The contractor shall use Ideal "Wire nuts" for lighting fixture lead splices to branch circuit conductors. As an option, the contractor may use ideal "wire nuts" or T & B "Piggy" connectors for branch circuits splices (#10 and #12) in junction boxes and lighting fixtures. Solderless mechanical connectors for splices and taps provided with U.L. approved insulating covers may be used instead of mechanical connectors plus tape.

C. Use mechanical or compression connectors for copper wire splices and taps #8 AWG and larger. All joint splices and taps and other sections of wiring requiring taping shall be taped with at least two layers of approved gum rubber tape which shall be laid on with half lap followed by at least one layer of friction or plastic tape laid on with half lap. The intent of this specifications is that the taping shall be neatly done and form a permanently secured insulation equal to 150 percent of the insulation value of the conductor.

D. Thoroughly clean wires before installing lugs and connectors.

E. Make splices, taps and terminations to carry full ampacity of conductors without perceptible temperature rise.

F. Terminate spare conductors with electrical tape.

G. When the conductor length from the panel to first outlet on a 120 V circuit exceeds 50 feet, the branch circuit conductors from the panel to the first outlet shall not be smaller than #10 AWG.

3.05 FIELD QUALITY CONTROL

A. Field inspection and testing shall be performed.

B. Inspect wire and cable for physical damage and proper connection.

C. Torque test conductor connections and terminations to manufacturer's recommended value.

D. Perform continuity test on all power and equipment branch circuit conductors. Verify proper phasing connections.

E. Branch circuit voltage drop shall not exceed (3%) three percent. The maximum total voltage drop on both feeders and branch circuits shall not exceed (5%) five percent.

F. FEEDER INSULATION RESISTANCE TESTING

1. All current carrying phase conductors and neutrals shall be tested as installed, and before connections are made, for insulation resistance and accidental grounds. This shall be done with a 500 volt megger. The procedures listed below shall be followed:

   a. Minimum readings shall be one million (1,000,000) or more ohms for #6 wire and smaller, 250,000 ohms or more for #4 wire or larger, between conductors and between conductor and the grounding conductor.

   b. After all fixtures, devices and equipment are installed and all connections completed to each panel, the contractor shall disconnect the neutral feeder conductor from the neutral bar and take a megger reading between the neutral bar and the grounded enclosure. If this reading is less than 250,000 ohms, the contractor shall disconnect the branch circuit neutral wires from this neutral bar. He shall then test each one separately to the panel and until the low readings are found. The reconnect and retest until at least 250,000 ohms from the neutral bar to the grounded panel can be achieved with only the neutral feeder disconnected.

   c. The contractor shall send a letter to the engineer certifying that the above has been done and tabulating the megger readings for each panel. This shall be done at least four (4) days prior to final inspection.

   d. At final inspection, the contractor shall furnish a megger and show the engineers that the panels comply with the above requirements. He shall also furnish a hook-on type ammeter and a voltmeter and take current and voltage readings as directed by the representatives.

3.06 WIRE AND CABLE INSTALLATION SCHEDULE

A. Exposed Interior Locations: Building wire in raceways.

B. Concealed Interior Locations: Building wire in raceways.

C. Exterior Locations: Building wire in raceways.

*****END OF SECTION*****

SECTION 16130
BOXES

PART 1 GENERAL

1.01 WORK INCLUDED

A. Wall and ceiling outlet boxes

B. Pulling and junction boxes

1.02 RELATED WORK

A. Section 16141 General Purpose Wiring Devices

1.03 REFERENCES

A. ANSI/NFHA OS 1 Metal outlet boxes, device boxes, covers and box supports

B. UL Standard 886

C. FED. SPEC. W-C-583B

PART 2 PRODUCTS

2.01 OUTLET BOXES

A. Sheet metal outlet boxes: ANSI/ NEMA OS 1; galvanized steel with 1/2 inch (13mm) male fixture studs where required. Boxes shall be at least 2-1/2" deep and of sufficient size to accommodate devices noted. Boxes for fixtures shall have mounting lugs or ears for covers. Wall switch outlet boxes shall be set as indicated above finished floor. Where located near doors, they shall be installed on the lock side of the door.

B. Cast metal boxes: cast ferroalloy, deep type, threaded hubs (surface mounted installation).

C. ACCEPTABLE MANUFACTURERS

1. RACO

2. STEEL CITY

3. APPLETON

2.02 OUTLET BOXES - SHEET METAL

A. Sheet Metal Outlet Boxes: ANSI/NEMA OS 1. galvanized steel with 1/2 inch (13 mm) male fixture studs where required. Boxes shall be at least 2-1/2" deep and of sufficient size to accommodate devices noted. Boxes for fixtures shall have mounting lugs or ears for covers. Wall switch outlet boxes shall be set as indicated above finished floor. Where located near doors, they shall be installed on the *lock* side of the door.

B. ACCEPTABLE MANUFACTURERS

1. RACO

2. STEEL CITY

3. APPLETON

2.03 PULL AND JUNCTION BOXES:

A. Sheet metal junction boxes: ANSI/NEKA OS I

1. Pull and junction boxes shall be fabricated from galvanized sheet steel not less than 16 gauges thick with covers held in place by corrosion resisting machine screws. Boxes shall be furnished and installed where indicated on the plans and where necessary to facilitate cable pulling and splicing. Box size shall be as required by NEC for the number of conduits and conductors entering and leaving it. Where feeder splices are to be made, box shall be large enough to provide ample work space. Boxes shall be installed in locations approved by the Engineer. Exposed junction boxes 4-11/16" x 4" x 4" shall be covered with Bowers #649 and #469 "blank Box covers" respectively.

2.04 CABLE BOXES:

A. The electrical contractor shall furnish and install junction boxes, pull boxes, cable support boxes, and wiring troughs as shown on the drawings, herein specified or otherwise required. All boxes shall be of the code gauge galvanized steel with screw covers fastened with corrosion resistant machine screws and they may be painted or treated to resist corrosion in addition. Boxes shall be supported independently of conduits entering them. Brackets, rod hangers, bolts or other suitable supporting methods may be used.

2.05 JUNCTION BOXES – STRUCTURE/WELLS

A. Junction boxes in structure and wells as designed for interconnection to pump power or control cable shall be stainless steel construction rated NEMA 4-x as designated on the drawings.

B. Junction boxes shall be utilized 304 (19-8) stainless steel screws for all mounting.

C. Hubs for all conduit entry shall similarly be rated for NEMA 4-x.

2.06 ACCEPTABLE MANUFACTURERS

1. Carlon

2. Crouse Hinds

3. Or equal

PART 3 EXECUTION

3.01 COORDINATION OF BOX LOCATIONS

A. Provide electrical boxes as shown on drawings and as required for splices, taps, wire pulling, equipment connections and code compliance.

B. Electrical box locations shown on contract drawings are approximate unless dimensioned. Verify locations of outlets in work areas prior to rough-in. owner reserves the right to make minor changes in the location of any switch or box without additional cost prior to installation.

C. Locate and install boxes to allow access. Where installation is inaccessible, coordinate locations and sizes of required access doors.

D. Locate and install to present a neat appearance.

E. Before any outlet box or switch for use by other trades is set, the exact location required shall be obtained from the contractor installing the equipment. If not adhered to, the Electrical contractor shall be responsible for changes at no cost to the owner or other trades.

3.02 OUTLET BOX INSTALLATION

A. Provide surface mounted cast metal outlet boxes for devices as per drawings

B. Provide recessed sheet metal outlet boxes with masonry plaster ring.

C. Provide knockout closures for unused openings.

D. Support boxes independently of conduit.

E. Use multiple-gang boxes where more than one device is mounted together; do not use e\sectional boxes. Provide barriers to separate wiring of different voltage.

F. Coordinate mounting heights and locations of outlets mounted in enclosures or cabinets.

G. Position outlets to locate luminaries as shown on Room Floor Plans.

H. Provide surface mounted boxes when designated; secure boxes to wall and accurately position.

I. Provide cast outlet boxes in interior or exterior locations exposed to the weather and wet locations. All surface outlet boxes interior shall also be cast metal.

J. Align wall mounted outlet boxes for switches, timers and similar devices.

K. Provide stainless steel bolts and screws in corrosion resistant applications.

3.03 PULL AND JUNCTION BOX INSTALLATION

A. Install pull boxes and junction boxes above in unobtrusive locations.

B. Support pull and junction boxes independent of conduit.

C. Provide stainless steel bolts and screws in corrosion resistant applications.

D. Junction boxes exterior or interior shall be stainless steel NEMA 4-X.

*****END OF SECTION*****

SECTION 16134
OUTLET BOXES

PART 1 GENERAL

1.01 WORK INCLUDED

A. Outlet Boxes

1.02 RELATED WORK

A. Section 16141 - Wiring Devices

B. Section 16147 - Plate Covers

PART 2 COVERS

2.01 MATERIALS

A. Boxes: Hot dipped galvanized, designed for masonry installation 1.25 oz. per sq. f t. (381 g/sq. m), or cadmium plated, conform to UL requirements.

B. Exterior Boxes: Cast ferroalloy metal, shallow type.

C. For ceilings: 4.5 inch (115 mm) octagonal boxes cast ferroalloy for receiving three or less 3/4" (19mm) conduit.

D. Surface mounted: 4 inch (102 mm) square cast ferroalloy.

E. Wiring devices to have #302 stainless steel plates (see 16141).

PART 3 INSTALLATION

A. Surface mount outlet boxes for surface mounted conduits.

B. Do not use sectional or handy boxes unless specifically requested.

*****END OF SECTION*****

SECTION 16141
GENERAL PURPOSE WIRING DEVICES

1.0 GENERAL

1.01 WORK INCLUDED

A. Wall Switches. (General Purpose)

B. Receptacles (General Purpose)

C. Device Plates and Box Covers.

1.02 REFERENCES

A. FS W-C 596 - Electrical Power Connector, Plug, Receptacle and Cable Outlet.

B. FS W-S-896 - Switch, Toggle.

C. NEMA WD 1 - General Purpose Wiring Devices.

1.03 SUBMITTALS

A. Provide product data showing configuration, finishes, dimensions and manufacturer's instructions.

PART 2 PRODUCTS

2.01 WALL SWITCHES

A. Wall Switches for General Purpose lighting circuits NEMA WD; 1, AC general use snap switch with toggle handle, rated 20 amperes and 120-277 volts AC. Handle: Ivory plastic.

B. Toggle switches shall be of the grounding type with hex head grounding screw, rated 20A 120/277 volt AC only. All switches shall have quiet operating mechanisms without the use of Mercury switches. All switches shall be listed by an "approved" third party agency, approved for the voltage and amperage indicated.

2.02 ACCEPTABLE MANUFACTURERS - WALL SWITCHES (INDUSTRIAL SPECIFICATION GRADE)

A. Toggle Switches.

1. Hubbell 1221-1 single pole 20 ampere.

2. Bryant 4901-1 ampere.

3. Slater Medalist 720-AG-IV 20 ampere

4. Or Equal

2.03 RECEPTACLES (Industrial Specification Grade)

A. Convenience Receptacle Configuration: NEMA WD 1; Type 5-20 R Ivory Plastic Face.

1. Duplex receptacles shall be of the grounding type, arranged for back and side wiring, with separate single or double grounding terminals. Receptacles shall be straight blade, rated 20A., 125 volt and the face configuration shall conform to the NEMA Standard No. WDI.101968, and shall be "approved" third-party listed. Self grounding or automatic type grounding receptacles are not acceptable in lieu of receptacles with separate grounding screw lugs and a direct, green insulated conductor connection to the equipment grounding system.

2. Receptacles shall be specification grade, mounted vertically. Receptacles mounted over Counter, back-splashes, etc., shall be mounted horizontally.

3. Special wiring devices shall be shown on the drawings with complete description thereof.

2.04 GFCI RECEPTACLES

A. Exterior receptacles shall be ground fault interrupting and be made in conformance with NEMA WD-1-1.10. Models shall be UL listed "Hospital Grade" and Certified IT "corrosion resistant" enduring the 500 hour ASTM B-117-73 salt spray (fog) test. Receptacles shall be NEMA 5-20R configuration rated for 20 amperes and 125 volts AC and be ivory in color.

2.05 ACCEPTABLE MANUFACTURERS RECEPTACLES (GFCI)

A. Leviton 6398-HGI

B. Hubbell GF-8300I

C. Or Equal

PART 3 EXECUTION

3.01 INSTALLATION

A. Install galvanized steel plates on junction boxes.

B. Install devices and wall plates flush and level.

END OF SECTION

SECTION 16147
PLATE COVERS

PART 1 GENERAL

1.01 WORK INCLUDED

A. Plate Covers.

1.02 RELATED WORK

A. Section 16141 – General Purpose Wiring Devices

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Hubbell

B. Bryant

C. Leviton

2.02 MATERIALS

A. Stainless Steel: Type 302 or 304, No. 4 finish, 0.040 inch (1mm) thick, accurately die cut, protected with release paper. Screws shall be slotted head oval screws to match the material of the plate.

B. Cast Metal: Die cast profile, ribbed for strength, flash removed, primed with gray enamel, furnished complete with four mounting screws for exposed work.

C. Gaskets: Resilient rubber or closed cell foam urethane.

D. Steel: Hot dip galvanized, 1.25 oz./sq. ft. (381 g/sq.m) min.

2.03 PLATES

A. Flush Mounting Plates: Beveled type with smooth rolled outer edge, stainless steel.

B. Surface Box Plates: Beveled type with smooth rolled outer edge, stainless steel.

C. Where two-gang boxes are required for single gang devices, provide special plates with device opening in one-gang and second gang blank.

D. Weatherproof plates: Exterior mounted switch and receptacle plates and those noted as weatherproof shall be weatherproof cast metal cover plates, standard size, single or ganged as indicated on the drawings and shall be "approved" third party listed as "raintight while in use".

PART 3 EXECUTION

3.01 INSTALLATION

A. Install coverplates on wiring devices.

B. All exterior plates and interior as designated shall be raintight while in use designated to fit the cast metal boxes.

*****END OF SECTION*****

SECTION 16160
CABINETS AND ENCLOSURES

PART 1 GENERAL

1.01 WORK INCLUDED

A. Hinged Cover Enclosures

B. Cabinets

1.02 REFERENCES

A. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts maximum).

B. ANSI/NEMA ICS I - Industrial Control and Systems.

C. ANSI/NEMA ICS 6 - Enclosures for Industrial Control Equipment and Systems.

1.03 SUBMITTALS

A. Shop drawings for equipment panels: Include wiring schematic diagrams, wiring diagram, outline drawings and construction diagram as described in ANSI/NEMA ICS 1.

PART 2 PRODUCTS

2.01 HINGED COVER ENCLOSURES

A. Construction: NEMA 250; Type 3R steel.

B. Finish: Manufacturer's standard enamel finish.

C. Covers: Continuous hinge, held closed by flush latch operable by key.

D. Panel for mounting terminal blocks for electrical components.

2.02 CABINETS

A. Cabinet Boxes: Nema 3R or Galvanized steel with removable end walls, sized as indicated. Provide 3/4 inch (19 mm) thick plywood backboard painted matte white for mounting equipment.

B. Cabinet Fronts: Steel surface type with concealed hinge and flush lock (keyed to match branch circuit panelboard); finish in gray baked enamel.

C. All exterior cabinets shall be stainless steel construction type 5, 3R, 12.

2.03 FABRICATION

A. Shop assembled enclosures and cabinets housing terminal blocks or electrical components in accordance with ANSI/NEMA ICS 6.

B. Provide knockouts on enclosures.

C. Provide protective pocket inside front covers with schematic diagram, connection diagram, and layout drawings of control wiring and components within enclosure.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install cabinets and enclosures plumb; anchor securely to wall and structural supports at each corner, minimum.

B. Provide accessory feet for free-standing equipment enclosures.

C. Install trim plumb.

*****END OF SECTION*****

SECTION 16190
SUPPORTING DEVICES

PART 1 GENERAL

1.01 WORK INCLUDED

A. Conduit and equipment supports

B. Fastening hardware

1.02 RELATED WORK

A. Section 16111 - Conduit

1.03 QUALITY ASSURANCE

A. Support systems shall be adequate for weight of equipment and conduit, including wiring, which they carry. Conduit shall be supported in a method and at a spacing as approved by the NEC, except as designated otherwise.

PART 2 PRODUCTS

2.01 MATERIAL

A. Support Channel: stainless steel.

B. Hardware: Corrosion resistant stainless steel bolts.

C. Aluminum mounting plates.

PART 3 EXECUTION

3.01 INSTALLATION

A. Fasten hanger rods, conduit clamps, and outlet and junction boxes to building structure using expansion anchors and preset inserts.

B. Use toggle bolts or hollow wall fasteners in hollow masonry, plaster, or gypsum board partitions and walls; expansion anchors or preset inserts in sold masonry walls; self-drilling anchors or expansion anchor on concrete surfaces; sheet metal screws in sheet metal studs; and wood screws in wood construction.

C. Do not fasten supports to piping; ductwork, mechanical equipment or conduit.

D. Do not use powder actuated anchors.

E. Do not drill structural steel members.

F. Fabricate supports from structural steel or steel channel, rigidly welded or bolted to present a neat appearance. Use hexagonal bolts with spring lock washers under all nuts.

G. Support lighting fixtures directly from ceiling structural support system. Support fixtures from its four corners directly to building structure.

H. Conduit shall be supported by approved pipe straps or clamps:

*****END OF SECTION*****

SECTION 16195
ELECTRICAL IDENTIFICATION

PART 1 GENERAL

1.01 WORK INCLUDED

A. Nameplates and tape labels.

B. Wire and cable markers.

C. Conduit color coding.

1.02 RELATED WORK

A. Section 16120 - Wire & Cable.

1.03 SUBMITTALS

A. Include schedule for nameplates and tape labels.

PART 2 PRODUCTS

2.01 MATERIALS

A. Nameplates: Engraved three-layer laminated plastic, blue surface with white core for 120/230 volt equipment. Black surface with white core for 277/480 volt equipment. Include equipment name, amperage, voltage, and phase.

B. Wire and Cable Markers: Metal tags, split sleeve or tubing type.

C. Self sticking vinyl cloth wire markers.

PART 3 EXECUTION

3.01 INSTALLATION

A. Degrease and clean surfaces to receive nameplates and tape labels.

B. Install nameplates and tape labels parallel to equipment lines.

C. Secure nameplates to equipment fronts using screws or rivets. Secure nameplate to inside face of recessed panelboard doors in finished locations. Adhesive to secure plates will not be allowed.

D. Embossed tape will not be permitted for any application.

E. Clean wire and cable with alcohol to receive self sticking wire markers.

3.02 WIRE IDENTIFICATION

A. Provide wire markers on each conductor in panelboard gutters, pull boxes, outlet and junction boxes, and at load connection. Identify with branch circuit or feeder number for power and lighting circuits, and with control wire number as indicated on schematic and interconnection diagrams for control wiring.

3.03 NAMEPLATE ENGRAVING SCHEDULE

A. Provide nameplates to identify all electrical distribution and control equipment, and loads served. Letter height: 1/4 inch (6 mm) for distribution and control equipment identification. Provide with equipment, voltage, amperage, and phase.

3.04 CONDUIT RUNS AND CONDUIT IDENTIFICATION

A. All empty conduit runs and conduit with conductors identified for future use shall indicate where they terminate. Identification shall be by tags with string or wire attached to conduit or outlet. List amperage, voltage, and phase (i.e. 200 amperage 277/480 VAC, 3 phase)

3.05 OUTLET, JUNCTION, AND PULL BOXES

A. All outlet boxes, junction boxes, and pull boxes shall have their covers and exterior visible surfaces painted with colors to match the surface color scheme outlined above. This would include covers on boxes above left out and other type accessible ceilings.

*****END OF SECTION*****

SECTION 16450
GROUNDING

PART 1 GENERAL

A . Power system grounding.

1.02 RELATED WORK

A. Section 16111 - Conduit.

B. Section 16120 - Wires and Cables.

1.03 REFERENCES

A. None

1.04 REGULATORY REQUIREMENTS

A. All grounding shall be in accordance with the requirements of the latest edition of the National Electric Code. The Contractor shall furnish and install complete and effective grounding for the entire electrical system. Use proper grounding locknuts, bonding type bushings where required, or their suitable devices required.

1.05 TESTS

A. Measure ground grid resistance with earth test megger and install up additional ground rods and conductors as required until resistance to ground is 25 ohms or less.

PART 2 PRODUCTS

2.01 GROUND BUS

A. 2 X 1/4 inch (50 X 6 mm) copper minimum, mounted on insulating standoffs, complete with lugs for connecting grounding cables.

B. Green equipment grounding conductors carried throughout all conduit runs. Ground conductor shall run from panel ground to equipment.

C. The raceway shall not be relied on for ground continuity.

PART 3 EXECUTION

3.01 POWER SYSTEM GROUNDING

A. Circuit Grounding: Install grounding bushings, grounding studs, and grounding jumpers at pullboxes and panelboxes.

B. Equipment Grounding Conductors: Provide green insulation, size correlated with overcurrent device protecting the wire, attach to grounding bushings on conduit, to lugs on boxes, and other enclosures. Connection to neutral only at service neutral bar. Maintain grounding and neutral separation throughout system from this point.

C. Furnish and install double locknuts and insulating bushings, on all conduits entering outer boxes, panelboards, junction boxes, etc., made up tight to insure a continuous ground of minimum resistance from main distribution point on the raceway system. One locknut shall be used on boxes with treated hubs.

D. All non-current carrying equipment shall be bonded together and grounded. All metal outlet and pull boxes shall have jumper and ground screw. All receptacles and switches shall use jumper and ground screw.

The main electrical service shall be grounded by three (3) means:

To the cold water main, if metallic and in direct contact with the earth for at least 10 feet as per NEC 250-81.

To the steel frame of the building, provided the building is effectively grounded.

To ground rod(s). Ground rods shall be 10 feet long and ¾ inches in diameter and shall be copper clad steel construction. All ground connections shall be accessible.

The ground resistance of any "made" electrode shall be measured by an earth megger device and it shall be 25 ohms or less as per NEC 250-84.

Boxes with concentric, eccentric, or oversized knockouts shall be provided with bonding bushings and jumpers. The jumper shall be sized per NEC tube 250-94 and lugged to the box.

*****END OF SECTION*****