TECHNICAL SPECIFICATIONS
FOR
CONSTRUCTION OF
IMPROVEMENTS TO THE

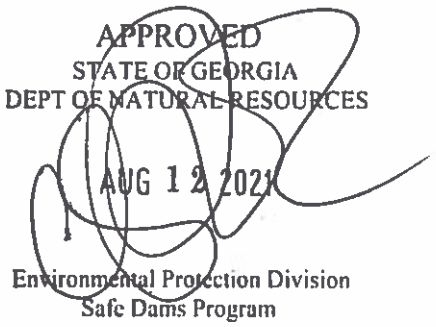
PHILLIPS LAKE DAM

IN
FAYETTE COUNTY, GEORGIA

FOR
FAYETTE COUNTY BOARD OF COMMISSIONERS

WALDEN, ASHWORTH & ASSOCIATES, INC.
CONSULTING ENGINEERS

December 2020
WA&A J.O. 3804600



WALDEN, ASHWORTH & ASSOCIATES, INC.
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SPECIFICATIONS FOR THE

REHABILITATION OF PHILLIPS LAKE DAM IN FAYETTE COUNTY, GEORGIA

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GENERAL REQUIREMENTS

PART 1 - GENERAL

1.01 SUMMARY OF WORK

A. Work Covered by Contract Documents:
1. It is the declared and acknowledged intention and meaning of these Contract Documents to provide and secure the construction of the
Phillips Lake Dam improvements as described in the plans and specifications complete and ready for use.
2. Work shall be done and materials furnished in strict conformity with Contract Documents.
3. Work includes following classes of construction:
a. Clearing and grubbing.
b. Demolition
c. Earthwork.
d. Erosion Control
e. Concrete Structures
f. Concrete Bridges
g. Road
4. Scope of work described may be varied by acceptance by Owner of alternate bids for the items indicated in the proposal form.

B. Notices to Utilities, Pipeline Companies, Various Engineering Offices:
1. Contractor shall give advance notice of construction to owners of utilities and pipelines and to various engineering offices as required, prudent or necessary.

C. Permits:
1. Permits and licenses of temporary nature necessary for prosecution of work shall be secured and paid for by Contractor.
2. Easements, right-of-way and instruments of permanent nature shall be secured and paid for by Owner.

D. Drawings: Accompanying these Specifications and forming an integral part thereof are Drawings listed on index sheet of Drawings.

1.02 TESTING LABORATORY SERVICES

A. The Owner will select and the Owner will pay for services of independent commercial testing laboratory to perform services specified in respective Specification Sections. Except, Contractor shall pay for services described below.

B. Contractor shall pay for services of independent commercial testing laboratory to perform

following:

1. Preliminary design mix proposed for use for portland cement concrete, asphaltic concrete, and other material mixes which require control by testing laboratory.
2. Additional samples and tests required for Contractor"s convenience or when initial tests indicate work does not comply with Contract Documents.

C. Reports of testing laboratory shall in no way relieve Contractor of his obligation to perform work in accordance with Contract Documents.

D. Laboratory Duties:
1. Cooperate with Engineer and Contractor.
2. Provide qualified personnel promptly on notice.
3. Perform specified inspections, sampling, and testing of materials and methods of construction:
   a. Comply with specified standards, ASTM, other recognized authorities, and as specified.
   b. Ascertain compliance with requirements of Contract Documents.
4. Promptly notify Engineer, Owner, and Contractor of irregularities or deficiencies of work which are observed during performance of services.
5. Promptly submit four copies of reports of inspections and tests:
   a. Owner: One copy.
   b. Engineer: One copy.
   c. Contractor: Two copies.
6. Perform additional services as required by Owner.
7. Laboratory is not authorized to:
   a. Revoke, alter, enlarge on, or release requirements of Contract Documents.
   b. Approve or accept any portion of work.
   c. Perform any duties of Contractor.

E. Contractor's Duties:
1. Cooperate with laboratory personnel, provide access to work, and to manufacturer's operations.
2. Provide samples of materials to be tested in required quantities.
3. Provide on site storage area for testing laboratory.
4. Furnish copies for mill test reports.
5. Furnish casual labor to provide access to work to be tested, to obtain and handle samples at site, and to facilitate inspections and tests.
6. Notify laboratory and Engineer 24 hrs. minimum, in advance of operations to allow for assignment of personnel and scheduling of tests.

1.03 CUTTING AND PATCHING

A. Contractor shall perform cutting, patching, or fitting of his work that may be required to make its several parts come together properly and fit it to receive or be received by work of others shown on, or reasonably implied by Drawings and Specifications for completed

a. Setting of control points (2) at site.
b. One temporary bench mark established at site.

2. These survey control points will be provided by Owner one time only, as scheduled and requested by Contractor.
3. It shall be Contractor's responsibility to preserve and maintain control points in good and usable conditions.
4. Re-establishments of these control points shall be at sole expense of Contractor.

E. Underground and Aboveground Utilities:
1. Underground utilities directly obstructing construction will be disrupted, abandoned, removed or temporarily or permanently relocated by arrangements between the Owner and the utility companies.
2. Pipe lines and other existing underground installations and structures in vicinity of work are shown on Drawings according to best information available to Owner.
3. Owner does not guarantee accuracy of such information.
4. Contractor shall accurately locate all underground pipe lines, conduits, cables and structures by contacting owners of underground installations and by prospecting in advance of trench excavation.
5. Repair of existing installations cut by Contractor shall be made at expense of Contractor, and shall be scheduled so as to cause least possible inconvenience to public and to owners of installations.
6. Delay or extra cost to Contractor caused by pipe lines, conduits, cables, or other underground structures or obstacles shall not constitute a claim for extra work, additional payment, or damages.
7. Aboveground utilities directly obstructing construction will be disrupted, abandoned, removed, or temporarily or permanently relocated by arrangements between the Owner and the utility companies, including telephone and power poles, except that aboveground utility poles and lines disrupted, abandoned, removed, or temporarily or permanently relocated for the convenience of the contractor shall be the responsibility and expense of the Contractor.

F. Restoration:
1. Items disturbed or removed as the result of performing the required work or for the convenience of the Contractor or to expedite his operations including electrical work, lawns, landscaping, paving, roads, walks, trees, shrubs and fencing shall be restored, repaired, patched, reinstalled or replaced with new work and refinished, as appropriate, so as to be left in as good condition as existing before commencing work and such restoration shall be considered incidental to the work.
2. Existing work to be altered, extended, removed or disturbed that is found to be defective in any way shall be reported to Engineer before it is disturbed.
3. Materials and workmanship used in restoring work shall conform in type and quality to the original existing construction.

1.05 REGULATORY REQUIREMENTS

A. Where references are made on the drawings or in the specifications to codes they shall be considered an integral part of the Contract Documents as though reproduced therein.

B. References to codes are considered to be the latest revision at the time of bid unless specific dates are referenced.

C. Materials and equipment with testing categories established by UL or FM shall bear inspection label.

1.06 DEFINITIONS

A. Specification Sentence Structure:
   1. Simple imperative mood of sentence structure is used in Specification section which places verbs as first word in sentence.
   2. Verb defines action to be performed by Contractor and replaces phrases as "shall" or "shall be".

B. Provide:
   1. Furnishing of labor, material, equipment, transportation and services required for completed installation.
   2. "Provide" is used to obtain emphasis and brevity and replaces such phrases as "Contractor shall", "by Contractor", "furnish labor and materials", etc.

C. Incidental, Incidentals, Incidentals To:
   1. Minor work related and necessary to a main bid item of work or to the job as a whole.
   2. No additional, extra, separate payment, or other compensation will be made for incidental work.

1.07 CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

A. Temporary Utilities:
   1. Contractor shall make arrangements required with local utility companies for obtaining temporary electric power and water service and shall bear expenses involved.
   2. Contractor shall be responsible for connections, necessary extensions, and remove same upon completion of work.
   3. Temporary utilities provided by Contractor shall be incidental to work.

B. Temporary Sanitary Facilities:
   1. Contractor shall provide and maintain sanitary facilities at locations satisfactory to Owner for use by employees of Contractor and Engineer.
   2. They shall be well ventilated, but provide proper concealment, and shall be kept scrupulously clean at all times by Contractor.
   3. Facilities shall be removed and site restored to its original condition upon completion of work.

4. Such facilities shall conform to requirements of state and local health authorities, ordinances, and law.

C. Safety and Inconvenience to Public:
1. Safety of public and convenience of traffic shall be regarded as of prime importance.
2. Traffic along and across roadway shall be provided for, as well as ingress and egress to private property as specified herein, or as directed by the Owner.
3. Operations shall be planned and executed in manner that will cause minimum interference with traffic.
4. Approval of proposed plan of operation, sequence of work, and methods of providing for safe passage of traffic shall be secured from the Owner before it is placed into operation.
5. If reviewed plan does not accomplish intended purpose during construction due to weather or other conditions affecting safe handling of traffic, necessary changes therein to correct unsatisfactory conditions shall immediately be made.
6. Work such as backfilling of excavation, repair to roads and drives, and cleanup or other such operations shall follow as closely as practical to laying or installing operations, in such manner that the public is not unnecessarily inconvenienced nor hazard to public safety created.
7. If work forces or equipment are insufficient to such degree that the public is inconvenienced, measures shall be taken to remedy problem.
8. The Owner may require such changes in work forces and equipment necessary to prevent or remedy unnecessary inconveniences to public or hazard to public safety.
9. Notice of such required changes will be made in writing.
10. At night or otherwise, equipment not in use shall be stored so as not to interfere with safe passage of traffic.
11. Flagmen shall be provided and maintained at such points and for such periods of time as may be required to provide for safety and convenience of public travel and Contractor's personnel, and as directed by the Owner.
12. Public safety shall be direct responsibility of Contractor.
13. Contractor shall provide barricades, lights, and warning and detour signs as required.

1.08 MATERIAL AND EQUIPMENT

A. General:
1 Contractor is responsible to immediately notify Engineer of any material or equipment delivery dates contrary to construction schedule.
2. No extension in contract period will be considered unless the Engineer is notified immediately that there could be delay in receiving some item.
3. Contractor shall use only new materials in permanent structure.
4. Finished work shall not include material used for temporary purposes.
5. Where materials or equipment are specified by trade or brand name, it is not intention of Owner to discriminate against equal product of another

manufacturer, but rather to set definite standard of quality or performance, and to establish equal basis for evaluation of proposals.

6. Items identified by manufacturer's name and model designation or their equal shall be complete in every respect and shall be provided as specified unless an acceptable substitution or alternate is provided. However, no substitution of products is permitted after the construction contract has been awarded unless the product is not available.
7. To utilize alternate item equal to that specified, Contractor shall submit evidence that material is equal in quality, workmanship, performance, function, and strength characteristics as items specified by named manufacturer.
8. Where called for in these specifications, Contractor shall submit test data of independent testing laboratory to show compliance with characteristics specified.
9. Where materials are specified in the various sections to comply with ANSI, ASTM, AWWA, or UL, proof of compliance shall be submitted. Label or listing of specified agency will be acceptable evidence. Written certificate from nationally recognized testing organizations may be submitted in lieu of label or listing.
10. When Contractor submits substitute materials, equipment, components or systems, Contractor shall have full responsibility for design approaches, for equivalent performance and for strength and quality characteristics of alternate or substituted items.
11. Review by Owner or Engineer or their failure to take exceptions on shop drawings or other review documents, shall not relieve Contractor of his responsibility for substituted item meeting equivalent characteristics required by Contract Documents.
12. Review by Owner or Engineer will determine whether design concept, finish and appearance requirements of Contract Documents are met by the substituted item and no substituted item shall be installed which changes the design concept or appearance of the work without prior acceptance by the Engineer or Owner.

B. Storage of Materials:

1. Water-tight storage facilities of suitable size, with floors raised above ground, shall be provided for types of materials liable to damage from exposure to weather.
2. Other materials shall be stored on blocks off ground.
3. Materials shall be so placed as to permit easy access for proper inspection and identification.
4. Material which has deteriorated, become damaged, or otherwise unfit for use shall not be used in work.
5. Upon completion of work, or when directed, Contractor shall remove storage facility construction from site.

C. Construction Equipment:

1. Construction equipment provided at the work site shall be in prime working condition.
2. Inoperative and poorly operating construction equipment shall be promptly repaired or replaced.

3. Construction equipment which constantly breaks down or turns out work which does not meet requirements of the Specifications shall be replaced.
4. No extension of contract time will be allowed for delays resulting from equipment breakdowns or shortages.

1.09 PROJECT CLOSEOUT

D. Cleaning:
1. Contractor shall keep site and structure or facilities thereon, free from accumulations of waste materials, debris, or rubbish caused by his employees or work.
2. At completion of work, he shall remove from site his tools, surplus of materials and debris, and shall leave site and his work reasonably clean.
3. Areas disturbed during construction operations shall be restored generally to match conditions existing prior to start of work.

E. Project Record Documents:
1. Contractor shall provide and maintain in proper order and in good condition in field office at project site, one complete set of blueprints of working drawings.
2. On this set of Drawings, Contractor shall neatly inscribe and print by red pencil final location, sizes and types of various items of work such as pipe, valves, manholes, equipment, control devices, access openings, structures and other facilities.
3. At completion of work, and before final acceptance, this set of prints shall be delivered to Owner.

END OF SECTION
01 11 00

SECTION 01 22 00

UNIT PRICES

PART 1 - GENERAL

1.1 MEASUREMENT AND PAYMENT

A. It is intent of the Proposal that the aggregate bid amount as submitted shall cover all work required by Contract Documents in place, complete, and ready for use.

B. Unit prices in the Proposal include all costs to fully complete the work in place, including providing all labor, materials, tools, equipment, services, supplies, incidentals, and all necessary operations.

C. No costs in connection with work required by the Contract Documents for proper and successful completion of the Contract will be paid outside of or in addition to prices submitted in Proposal.

D. Work not specifically set forth in Proposal as pay items shall be considered subsidiary obligations of Contractor and costs shall be included in prices named in Proposal.

E. Method of measurement and basis of payment shall be as stipulated in following paragraphs.

1.2 ROCK EXCAVATION

A. Where necessary to excavate rock material in quantities of more than 1 cubic yard at a specific location, such material will be measured for payment as an extra or additional payment to ordinary excavation included in other pay items.

B. Measurement of rock excavation volume in cubic yards (CY) will be made by profiling the average top elevation of rock visible at sides of excavation, presuming the level to which rock is removed at 0.5 feet below sewer or structure invert, and presuming trench width over its entire length to be the maximum trench bottom width permitted. At structures and miscellaneous construction, the actual necessary rock volume removed, as determined by the Engineer, will be measured.

C. In areas of rock excavation, the Contractor shall not backfill or otherwise cover adjacent exposed rock until the Engineer has completed rock excavation measurement.

D. Payment will be by unit price which shall be full compensation for labor, materials, tools, equipment, incidentals and operations necessary to completely remove rock encountered including hauling and disposal of rock.

1.3 EARTHWORK

A. Additional Alluvial Excavation:
   1. This item will be measured by number of cubic yards for all classes of material excavated from its original position below the planned excavation as shown on the drawings and disposed of as required.
   2. Measurement will be based on quantities derived from proposed contours, grades, sections and typical sections shown on drawings and final excavated grades.
   3. This item will be paid for by unit price which shall be full compensation for labor, tools, equipment, incidentals and operations necessary to complete excavations and to backfill the excavation to the planned elevations.
   4. Includes excavation, loading, free hauling, dumping or spreading, compacting and off-site disposal of unsuitable materials and backfilling with compacted material.

1.4 STONE RIP-RAP

A. Additional Stone Rip-Rap:
   1. This item will be measured by installed ton and will be paid for by unit price.
   2. Certified signed delivery and weight tickets from supplier shall be submitted.
   3. Quantity of stone is subject to verification by Owner and shall not include rejected stone.
   4. Payment shall be full compensation for operations, materials, and labor required for complete installation of rip-rap in excess of that indicated on drawings.
   5. Expense of testing of scales and weighing of stone shall be borne by Contractor.

END OF SECTION
01 22 00

SECTION 01 25 13

SUBSTITUTIONS AND PRODUCT OPTIONS

PART 1 - GENERAL

1.01 PRODUCT OPTIONS

A. For any products specified only by reference standards, select any product meeting standards, by any manufacturer.

B. For products specified by naming several products or manufacturers, select any product and manufacturer named.

C. When products are specified by only one manufacturer's model or performance criteria with reference to other acceptable manufacturers, select any product and manufacturer named.

D. For products not specified or indicating option of selecting equivalent products by stating "or equal" or other language, Contractor must submit request, as required for substitutions, for any product or manufacturer not specifically named.

1.02 SUBSTITUTIONS

A. Where materials or equipment are specified by a trade or brand name, it is not the intention to discriminate against equivalent product of another manufacturer.

B. Materials specified are to define standard of quality or performance and to establish basis for evaluation of proposals.

C. During bidding period, Engineer will not consider requests from bidders and manufacturers for substitutions.

D. After award of Contract, Engineer will consider formal requests, only from the Contractor, for substitution of products in place of those specified.

E. Submit requests for substitutions including complete data and samples substantiating compliance of proposed substitution with Contract Documents.

F. When requested, Contractor shall submit test data from independent testing laboratory to show compliance with performance characteristics specified.

G. Materials proposed for substitution must meet or exceed specified requirements as described in these specifications.

H. Engineer's decisions of acceptance or rejection of substitution will be final.

I. In making request for substitutions, for materials, equipment, or systems, Contractor represents that:
   1. He has personally investigated proposed product or method, and determined that it is equal or superior in all respects to that specified.
   2. He will provide same guarantee for substitution as for product or method specified.
   3. He will coordinate installation of accepted substitutions into work making such changes as may be required for work.
   4. He will have full responsibility for alternate design approaches, for equivalent performance, and for strength and quality characteristics of components.

J. Substitutions will not be considered if:
   1. They are indicated or implied on shop drawings or project data submittals without formal request.
   2. Acceptance will require substantial revision of Contract Documents.
   3. Additional cost to Owner is involved.

K. Should substitution be accepted under provisions of above clauses, and this substitution subsequently proves defective or otherwise unsatisfactory for service for which it was intended, within guarantee period, Contractor shall replace defective material with material specified.

L. Review of Owner or Engineer, their approval or their failure to take exceptions to substitutions or other review documents, shall not relieve the Contractor of his responsibility for item actually meeting performance or other requirements of Contract Documents.

PART 2 – PRODUCTS – NOT APPLICABLE

PART 3 – PRODUCTS – NOT APPLICABLE

END OF SECTION
01 25 13

SECTION 01 29 73

SCHEDULE OF VALUES

PART I - GENERAL

1.01 DESCRIPTION

A. Submit to Engineer schedule of values, at least ten days prior to submitting first application for payment.

B. Upon request by Engineer, support values given with data that will substantiate their correctness.

C. Submit quantities of designated materials.

D. Use schedule of values only as basis for Contractor's application for payment.

1.02 FORM OF SUBMITTAL

A. Submit typewritten schedule of values on 8 1/2 in. x 11 in. white paper.

B. Use Table of Contents of this specification as basis for format for listing costs of work.

1.03 PREPARING SCHEDULE OF VALUES

A. Itemize separate line item cost for each of following general cost items:
   1. Performance and Payment Bonds.
   2. Field supervision and layout.
   3. Temporary facilities and controls.

B. Itemize separate line item cost for work required by each section of this specification.

C. Breakdown installed costs into:
   1. Delivered cost of product.
   2. Total installed cost with overhead and profit.

D Make sum of total costs of items listed in schedule equal to total Contract Sum.

1.04 REVIEW AND RESUBMITTAL

A. After review by Engineer, revise and resubmit schedule as required.

B. Resubmit revised schedule in same manner.

END OF SECTION
01 29 73

SECTION 01 31 19

PROJECT MEETINGS

PART 1 - GENERAL

1.01 PRE-CONSTRUCTION MEETING

A. Owner will schedule meeting within two days after date of notice to proceed.

B. Attendance:
1. Owner.
2. Engineer and his consultants.
3. Contractor.
4. Major subcontractors.

C. Minimum Agenda:
1. List of major subcontractors.
2. Tentative construction schedule
3. Critical work sequencing.
4. Designation of responsible personnel.
5. Processing of field decisions and Change Orders.
6. Adequacy of distribution of Contract Documents.
7. Submittal of shop drawings, project data, and samples.
8. Procedures for maintaining record documents.
9. Use of premises.
10. Storage areas.
11. Owner's requirements.
12. Safety and first-aid procedures.
13. Security procedures
14. Housekeeping procedures.

1.02 PROGRESS MEETINGS

A. Contractor shall schedule regular meetings at the job site biweekly or weekly if job progress dictates.

B. Attendance:
1. Engineer and his consultants.
2. Contractor.
3. Owner or his representative.
4. Subcontractors as pertinent to agenda.
5. Representatives of other regulatory agencies as pertinent to agenda.

C. Minimum Agenda:

1. Review work progress.
2. Note field observations, problems, and decisions.
3. Identify problems which impede planned progress.
4. Review off-site fabrication problems.
5. Revise construction schedule as indicated.
6. Review submittal schedules, expedite as required to maintain schedule.
7. Maintaining of quality and work standards.
8. Review proposed changes for effect on construction schedule and completion date.

PART 2 - MATERIALS - NOT APPLICABLE

PART 3 - EXECUTION - NOT APPLICABLE

END OF SECTION
01 31 19

SECTION 01 3213

CONSTRUCTION SCHEDULE

PART 1 - GENERAL

1.01 DESCRIPTION

A. Provide projected construction schedule for entire work.

B. Revise monthly.

1.02 FORM OF SCHEDULE

A. Prepare by bar chart method.

B. Arrange by chronological order by beginning of each item of work.

1.03 CONTENT OF SCHEDULES

A. Provide complete sequence of construction by activity:
   1. Shop drawings, product data, and samples: Submittal dates and dates reviewed copies will be required.
   2. Product procurement and delivery dates.
   3. Dates for beginning and completion of each element of construction.

B. Identify work of separate phases or other logically grouped activities.

C. Show projected percentage of completion for each item of work as of first day of each month.

D. Provide sub-schedules to define critical portions of entire schedule.

1.04 UPDATING

A. This schedule when reviewed by Owner and Project Manager shall be updated prior to each application for payment.

B. Show all changes occurring since previous month’s submission of updated schedule.

C. Indicate progress of each activity.

D. Show completion dates.

1.05 SUBMITTALS

A. Contractor shall submit schedule of his planned operations for work within 10 days after receipt of notice to proceed.

B. Engineer will review schedules and return review copy within ten days after receipt.

C. If required, resubmit within seven days after return of review copy.

D. Submit periodically updated schedules accurately depicting progress to first day of each month.

E. Submit the number of copies required by Contractor plus four copies to be retained by Engineer.

1.06 DISTRIBUTION

A. Distribute copies of reviewed schedules to:
1. Engineer.
2. Job-site file.
3. Subcontractors.
4. The Owner or his representative.

B. Instruct recipients to report any inability to comply. Provide detailed explanation with suggested remedies.

PART 2 - MATERIALS - NOT APPLICABLE

PART 3 - EXECUTION - NOT APPLICABLE

END OF SECTION
01 32 13

SECTION 01 33 23

SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

PART 1 - GENERAL

1.01 DEFINITIONS

A. Shop drawings: Reinforcement and similar construction and assembly details, drawings, diagrams, material and equipment schedules and other data specially prepared for work by Contractor, subcontractor, manufacturer, supplier or distributor to illustrate some portion of work.

B. Product Data: Manufacturer's instructions and recommendations, illustrations, standards, schedules, performance charts, instructions brochures, diagrams, and other information furnished by Contractor to illustrate material, product, or system for some portion of work.

C. Samples: Physical examples which illustrate materials, equipment and workmanship and establish standards by which work will be judged.

D. Miscellaneous Submittals. Interim erection designs and operations plans, work schedules, warranties, maintenance agreements, bonds, project photographs, survey data, and reports, work records, certificates, testing reports, and similar information applicable to work.

1.02 CONTRACTOR'S RESPONSIBILITY

A. Prepare separate listing, organized by specification section number sequence, showing principal submittals and dates required for coordination of work.

B. Submit listing within 10 days after notice to proceed.

C. Review, stamp with his approval, and submit with reasonable promptness and in orderly sequence to cause no delay in work, shop drawings, product data, samples, and miscellaneous work related items as described in various specification sections.

D. Shop drawings schedules, and interim erection sketches prepared by Contractor, his subcontractors, or vendors are for the Contractor's use and benefit, to indicate his approach to fulfilling design concept.

E. By approving and submitting shop drawings, Contractor represents that he has determined and verified all measurements at job site, field construction criteria, sequences of erection, access ports, catalog numbers, and similar data.

F. Contractor is responsible for dimensions at the job site, quantities, coordinating component parts and trades to effect unified construction and implement construction techniques, safety of incremental units, and satisfactory performance of work in accordance with Contract Documents.

G. Delays caused by failure of Contractor to check shop drawings and to stamp with his approval shall be Contractor's responsibility.

H. Where literature is submitted covering a group or series of similar items, items intended for use shall be clearly indicated, identified, and labeled.

I. Coordinate preparation and processing of submittals with performance of work to avoid delays.

J. Coordinate and sequence different categories of submittals for same work and interfacing units for work.

K. No extension of time will be allowed because of failure to properly coordinate and sequence submittals.

L. Do not proceed with purchasing, fabrication, and delivery of work related to submittal until submittal procedure has been completed.

M. Contractor's responsibility for errors and omissions in submittals is not relieved by Engineer's review of submittals.

N. Request changes separately.

O. Submit shop drawings showing revisions to equipment layouts or modifications to work because of use of substitution items.

P. Contractor's responsibility for deviations in submittals from Contract Document requirement is not relieved by Engineer's review of submittal unless Engineer gives written acceptance of specific deviation.

1.03 SPECIFIC CATEGORY REQUIREMENTS

A. General: Except as otherwise indicated in the individual work sections, comply with general requirements specified herein for each indicated category of submittal. Submittals shall contain:

1. The date of submittal and the dates of any previous submittals.

2. The Project title.

3. Numerical submittal numbers, starting with 1.0, 2.0, etc. Revisions to be

numbered 1.1, 1.2, etc.

4. The Names of:

   a. Contractor
   b. Supplier
   c. Manufacturer

5. Identification of the product, with the Specification section number, permanent equipment tag numbers and applicable Drawing No.

6. Field dimensions, clearly identified as such.

7. Relation to adjacent or critical features of the Work or materials.

8. Applicable standards, such as ASTM or Federal Specification numbers.

9. Notification to the Engineer in writing, at time of submissions, of any deviations on the submittals from requirements of the Contract Documents.

10. Identification of revisions on resubmittals.

11. A 6 x 3-inch blank space for Contractor and Engineer stamps.

12. Contractor's stamp, initialed or signed, certifying to review of submittal, verification of products, field measurements and field construction criteria and coordination of the information within the submittal with requirements of the Work and of Contract Documents.

13. Submittal sheets or drawings showing more than the particular item under consideration shall have all but the pertinent description of the item for which review is requested crossed out.

1.04 ROUTING OF SUBMITTALS

A. Submittals and routine correspondence shall be routed as follows:

1. Supplier to Contractor (through representative if applicable)

2. Contractor to Engineer

3. Engineer to Contractor

4. Contractor to Supplier

PART 2 - PRODUCTS

2.01 SHOP DRAWINGS

A. Unless otherwise specifically directed by the Engineer, make all shop drawings accurately to a scale sufficiently large to show all pertinent features of the item and its method of connection to the Work.

B. Submit all shop assembly drawings electronically as a PDF file.

2.02 ENGINEER'S RESPONSIBILITY

A. Review and return submittals within 10 working days.

B. Engineer review is interim review of project against design concept and shall not be construed as acceptance of work or as waiver of Contract Document requirements.

C. Review of separate items does not constitute review of assembly in which item functions.

D. Request changes for items at variance with design concept.

E. Affix shop drawing stamp with initials or signature.

F. Return submittals to Contractor for distribution.

2.03 RESUBMISSION REQUIREMENTS

A. Shop Drawings:
1. Revise initial shop drawings as required and resubmit.
2. Indicate on drawings changes made other than those requested by Engineer.

B. Product Data and Samples: Submit new data as required for initial submittal.

C. Submit all shop assembly drawings electronically as a PDF file.

D. A PDF for all submittals will be returned to the Contractor.

2.04 MANUFACTURER'S LITERATURE

A. Where content of submitted literature from manufacturers includes data not pertinent to this submittal, clearly indicate which portion of the contents is being submitted for the Engineer's review.

B. Submit the number of copies which are required to be returned plus one which will be retained by the Engineer or submit electronically as a PDF file.

2.05 SAMPLES

A. Samples shall illustrate materials, equipment or workmanship and established standards by which completed work is judged.

B. Unless otherwise specifically directed by the Engineer, all samples shall be of the precise article proposed to be furnished.

C. Submit all samples in the quantity which is required to be returned plus one sample which will be retained by the Engineer.

2.06 COLORS

A. Unless the precise color and pattern is specifically described in the Contract Documents, wherever a choice of color or pattern is available in a specified product, submit accurate color charts and pattern charts to the Engineer for review and selection.

B. Unless all available colors and patterns have identical costs and identical wearing capabilities, and are identically suited to the installation, completely describe the relative costs and capabilities of each.

PART 3 - EXECUTION

3.01 CONTRACTOR'S COORDINATION OF SUBMITTALS

A. Prior to submittal for the Engineer’s review, the Contractor shall use all means necessary to fully coordinate all material, including the following procedures:

1. Determine and verify all field dimensions and conditions, catalog numbers and similar data.

2. Coordinate as required with all trades and all public agencies involved.

3. Submit a written statement of review and compliance with the requirements of all applicable technical Specifications as well as the requirements of this Section.

4. Clearly indicate in a letter or memorandum on the manufacturer's or fabricator's letterhead, all deviations from the Contract Documents.

B. Each and every copy of the shop drawings and data shall bear the Contractor's stamp showing that they have been so checked. Shop drawings submitted to the Engineer without the Contractor's stamp will be returned to the Contractor for conformance with this requirement.

C. The Owner may back charge the Contractor for costs associated with having to review a particular shop drawing, product data or sample more than two times to receive a "No

Exceptions Taken" mark.

D. Grouping of Submittals

1. Unless otherwise specifically permitted by the Engineer, make all submittals in groups containing all associated items.

2. No review will be given to partial submittals of shop drawings for items which interconnect and/or are interdependent. It is the Contractor's responsibility to assemble the shop drawings for all such interconnecting and/or interdependent items, check them and then make one submittal to the Engineer along with Contractor's comments as to compliance, non-compliance or features requiring special attention.

E. Schedule of Submittals: Within 30 days of Contract award and prior to any shop drawing submittal, the Contractor shall submit a schedule showing the estimated date of submittal and the desired approval date for each shop drawing anticipated. A reasonable period shall be scheduled for review and comments. Time lost due to unacceptable submittals shall be the Contractor's responsibility and some time allowance for resubmittal shall be provided. The schedule shall provide for submittal of items which relate to one another to be submitted concurrently.

3.02 TIMING OF SUBMITTALS

A. Make all submittals far enough in advance of scheduled dates for installation to provide all required time for reviews, for securing necessary approvals, for possible revision and resubmittal, and for placing orders and securing delivery.

B. In scheduling, allow sufficient time for the Engineer's review following the receipt of the submittal.

3.03 REVIEWED SHOP DRAWINGS

A. Engineer Review

1. Allow a minimum of 10 working days for the Engineer’s initial processing of each submittal requiring review and response, except, allow longer periods where processing must be delayed for coordination with subsequent submittals. The Engineer will advise the Contractor promptly when it is determined that a submittal being processed must be delayed for coordination. Allow a minimum of two weeks for reprocessing each submittal. Advise the Engineer on each submittal as to whether processing time is critical to progress of the Work, and therefore the Work would be expedited if processing time could be foreshortened.

2. Acceptable submittals will be marked **"No Exceptions Taken"**. A copy will be retained by the Engineer and a PDF copy will be returned to the Contractor.

3. Submittals requiring minor corrections before the product is acceptable will be marked **"Make Corrections Noted"**. The Contractor may order, fabricate and ship the items included in the submittals, provided the indicated corrections are made. Drawings must be resubmitted for review and marked **"No Exceptions Taken"** prior to installation or use of products.

4. Submittals marked **"Revise and Resubmit"** must be revised to reflect required changes and the initial review procedure repeated.

5. The **"Rejected"** notation is used to indicate products which are not acceptable. Upon return of a submittal so marked, the Contractor shall repeat the initial review procedure utilizing acceptable products.

B. No work or products shall be installed without a drawing or submittal bearing the **"No Exceptions Taken"** notation. The Contractor shall maintain at the job site a complete set of shop drawings bearing the Engineer's stamp.

C. Substitutions: In the event the Contractor obtains the Engineer's approval for the use of products other than those which are listed first in the Contract Documents, the Contractor shall, at the Contractor's own expense and using methods approved by the Engineer, make any changes to structures, piping and electrical work that may be necessary to accommodate these products.

D. Use of the **"No Exceptions Taken"** notation on shop drawings or other submittals is general and shall not relieve the Contractor of the responsibility of furnishing products of the proper dimension, size, quality, quantity, materials and all performance characteristics, to efficiently perform the requirements and intent of the Contract Documents. The Engineer's review shall not relieve the Contractor of responsibility for errors of any kind on the shop drawings. Review is intended only to assure conformance with the design concept of the Project and compliance with the information given in the Contract Documents. The Contractor is responsible for dimensions to be confirmed and correlated at the job site. The Contractor is also responsible for information that pertains solely to the fabrication processes or to the technique of construction and for the coordination of the work of all trades.

3.04 RESUBMISSION REQUIREMENTS

A. Shop Drawings

1. Revise initial drawings as required and resubmit as specified for initial submittal, with the resubmittal number shown.

2. Indicate on drawings all changes which have been made other than those requested by the Engineer.

B. Project Data and Samples: Resubmit new data and samples as specified for initial submittal, with the resubmittal number shown.

END OF SECTION
01 33 23

SECTION 01 35 53

SECURITY

PART 1 - GENERAL

1.01 SECURITY PATROL

A. The Owner will not provide security for construction site.

B. Security shall be the responsibility of contractor.

PART 2 – PRODUCTS – NOT APPLICABLE

PART 3 – EXECUTION – NOT APPLICABLE

END OF SECTION
01 35 53

SECTION 01 70 00

CONTRACT CLOSE-OUT

PART I - GENERAL

1.01 CLOSE-OUT TIMING

A. Upon receiving the Engineer's Final Certificate, Contractor shall prepare, assemble and transmit the items listed herein to Owner and the Engineer.

B. Unless additional quantities are specified elsewhere, submit items in duplicate.

C. Documents, tools, equipment, demonstrations and other closing requirements shall be submitted or performed and accepted prior to Date of Final Acceptance.

1.02 DETAIL REQUIREMENTS

A. Maintenance manuals: Submit bound loose leaf maintenance manuals for mechanical and electrical equipment for fixtures, finish hardware, equipment, finishes requiring special treatment and as otherwise required in the specifications. Label manuals with embossed plastic tape. Include name of project, nature of information, Contractor/Subcontractor and name and address of local parts supplier and service organization.

B. Operation manuals: Submit bound loose leaf operation manuals for mechanical, electrical and elevator equipment. Assemble and submit manuals as indicated for maintenance manuals or include therewith.

C. Record drawings: Submit for mechanical and electrical work covered by subsequent construction or requiring the removal of finish material should maintenance be necessary. Drawings shall be numbered consecutively, and shall be laid out to show locations of subject elements, with base lines or dimensions enabling exposure to elements with least disturbance to finish surfaces.

D. Inspection reports: Submit certificates from applicable local governmental agencies that the construction has been inspected as required by laws or ordinances and that the building is approved for occupancy.

E. Warranties: In accord with Contract Conditions, Contractor shall furnish his warranty and shall require each subcontractor to furnish his warranty, in writing, on the form bound hereinafter. Assemble, bind, label and transmit warranties as required for other manuals above. Unless specifically indicated, warranties shall begin on the Date of Engineer's Final Certificate and shall continue for one year. Warranties shall state the Date of Engineer's Final Certificate and the date on which the warranty expires.

F. Keys: Deliver at Date of Engineer's Final Certificate. Tag each key to indicate lock which key operates. Accompany keys with final hardware schedule, as specified in Finish Hardware Schedule.

G. Coordinate demonstrations and trial runs of equipment for Owner's designated personnel and complete such demonstrations prior to Date of Final Acceptance.

PART 2 – PRODUCTS – NOT APPLICABLE

PART 3 – EXECUTION – NOT APPLICABLE

END OF SECTION
01 70 00

SECTION 01 71 23

CONSTRUCTION SURVEYING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surveyor qualifications

B. Submittals

C. Survey reference points

D. General survey requirements

E. Surveys for measurement and payment (where applicable)

F. Survey documentation of the Work

1.02 SURVEYOR QUALIFICATIONS

A. Record survey drawings for review and approval shall be performed by an independent surveying firm with a Registered Land Surveyor (RLS) licensed and registered in the State of Georgia, retained by the Contractor, and acceptable to the Owner and Engineer.

B. Qualifications documentation shall be provided for the proposed RLS, as described in subsection 1.03.A of this Section.

C. Day to day surveying for Contractor's control purposes may be performed by Contractor's own surveyors.

1.03 SUBMITTALS

A. Submit qualifications documentation for proposed RLS. Information shall include: name, address, telephone number, and photocopy of registration of RLS.

B. Submit record survey drawings, certified by the RLS, along with computer files on diskette in AutoCAD, latest format. Redline mark-ups of the Contract Drawings are not acceptable. A digitized tracing of a manually drawn record survey drawing, derived from non-digital surveying techniques, is also not acceptable.

1.04 SURVEY REFERENCE POINTS

A. The Owner's surveyor has established benchmarks and horizontal control for the Work. Control datum for survey is that indicated on the Drawings.

B. Contractor's RLS shall establish additional temporary benchmarks and horizontal control points as required.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 GENERAL SURVEY REQUIREMENTS

A. Utilize recognized engineering survey practices appropriate for obtaining the information specified.

B. Protect and preserve permanent reference points during construction.

C. Promptly report to Engineer the loss or destruction of any reference point or relocation required because of changes in grades or other reasons. Replace dislocated reference points based on original survey control. Make no changes without prior written notice to Engineer.

D. Establish elevations, lines and levels required for all items of the Work.

3.02 SURVEYS FOR MEASUREMENT AND PAYMENT

A. Contractor shall perform surveys to determine quantities for unit price items, including control surveys to establish measurement reference lines. Notify Engineer prior to starting surveys.

B. Contractor shall submit calculations and certify the correctness of quantities for payment purposes. County will confirm quantities prior to payment.

3.03 SURVEY DOCUMENTATION OF THE WORK

A. Maintain a complete and accurate log of control and survey work as it progresses.

B. Record survey drawings shall be prepared to fully document the Work, as specified in individual specification sections.

C. Contractor's RLS shall prepare and certify the record survey drawings.

END OF SECTION
01 71 23

SECTION 01 78 00

OPERATING AND MAINTENANCE

PART 1 - GENERAL

1.01 OPERATING AND MAINTENANCE MANUALS

A. Accumulate during progress of work, in triplicate, service manuals, parts lists, and operating instructions pertaining to equipment and materials covered by contractual agreement.

B. Bind and organize with index tabs according to specification section sequence.

C. Include in mechanical equipment information as follows:
1. List of manufacturers, model numbers, and catalog sheets.
2. Control diagrams, composite wiring diagrams.
3. Parts list and predicted life of parts subject to wear.
4. Operating instruction, lubrication, and maintenance instructions.
5. Test data and performance curves.
6. Trouble shooting recommendations.

D. Submit to Engineer prior to final acceptance.

1.02 OPERATIONAL TESTS AND ADJUSTMENTS

A. After completion of work and before final acceptance, Contractor shall notify Engineer when he is ready for operational tests.

B. Perform tests in presence of Owner and Engineer and at time designated by Engineer.

C. Perform operational tests to satisfactorily demonstrate suitability for use of each entire system.

D. In event system is incomplete and tests cannot be consecutively performed, complete work and reschedule tests.

E. Adjustments or repairs may be directed by Engineer and shall be performed by Contractor.

F. Provide instruments, facilities, and labor to properly conduct test and make necessary alterations.

G. Arrange to have present, equipment manufacturers, start-up, representative of each major

piece of equipment at time of operational tests and notify Engineer and Owner.

H. Perform test on component parts of plumbing and mechanical systems as outlined in respective technical sections.

1.03 OPERATING AND MAINTENANCE INSTRUCTION

A. Arrange for installer or manufacturer's representative to instruct Owner's personnel on equipment requiring operation and maintenance.

B. Provide instruction as indicated in respective technical sections.

C. Review maintenance manuals, materials, spare parts, tools, lubricants, identification systems, control sequences, hazards, and cleaning procedures.

D. Demonstrate start-up, shut-down, emergency operations, noise and vibration adjustments, safety, and similar operations.

E. Review maintenance and operation procedures in relationship to extended warranties and service agreements.

PART 2 – PRODUCTS – NOT APPLICABLE

PART 3 – EXECUTION – NOT APPLICABLE

END OF SECTION
01 78 00

SECTION 02 40 00

DEMOLITION AND STRUCTURE MOVING

PART 1 GENERAL

1.01 SUMMARY

A. Section includes demolition and removal and/or abandonment of:

1. Asphalt and concrete pavement
2. Subsurface utilities (including storm drain structures, inlets and pipes)
3. Concrete curbs, gutters and walkways
4. Fencing
5. Retaining walls
6. Power and light poles
7. Other facilities and above-grade structures (concession buildings, restroom buildings, batting cages, goal posts, scoreboards, dugouts, bleachers, batting cages, scorer's booths, storage structures)

B. Related Sections:

1. Section 31 23 17 – Excavating and Backfilling for Structures
2. Section 31 23 33 – Trenching and Backfilling

1.02 REFERENCES

A. Code of Federal Regulations Publications (CFR)

1. United States Department of Labor

a. 29 CFR 1926, Safety and Health Regulations for Construction

1.03 SUBMITTALS

A. Prepare and submit a Demolition Plan prior to commencement of demolition. The Demolition Plan shall include the following information at a minimum:

1. Description of methods, equipment and tools to be used for demolition and relocation work.

2. Methods for protecting existing adjacent pavement, utilities, structures, and other facilities to remain in place.

3. Sequence of demolition, on-site relocations, and off-site removal of demolition materials.

B. Submit written certification of proper transport and final disposal of demolition materials to a permitted waste disposal facility.

1.04 QUALITY ASSURANCE

A. Conform to applicable local, state, and federal regulations (including 29 CFR 1926, Part T – Demolition) related to operation of equipment and tools, protection of persons and property, and environmental controls.

B. Notify affected utility companies before starting work and comply with their requirements.

1.05 PROJECT CONDITIONS

A. Work with Owner and Engineer to coordinate schedule for demolition, relocations, and removals.

B. During demolition, relocations and removal, use all procedures necessary to assure that no portion of the structures, either that to be removed or to remain, become a hazard to persons by instability or other condition.

C. Notify all local, state, and federal agencies having jurisdiction and complete all necessary forms required for demolition and disposal.

D. Demolition and relocations shall be performed in a manner that will not disturb existing pavement, utilities, structures, and other facilities not indicated to be removed.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 PREPARATION FOR DEMOLITION

A. By careful study of the Drawings and these Specifications, and coordination with the Owner and Engineer, determine the location and extent of demolition to be performed.

B. Excavate for removal of buried structures and piping as specified in Sections 31 23 17 and 31 23 33.

C. If not indicated to be removed, shut off, cap, and otherwise protect existing public utility lines in the area of demolition in accordance with the requirements of the Owner and Engineer, utility owner, or public agency having jurisdiction (as applicable).

D. Barricade the work areas from pedestrian and vehicular traffic. Post "No Trespassing" and other necessary warning signs around the work areas during the entire duration of demolition work. Maintain barricades and signs during the construction period.

3.02 ASPHALT AND CONCRETE REMOVAL

A. Existing asphalt and concrete shall be cut and removed as specified herein and as shown on the Drawings.

B. Where portions of pavement and walkways are to be removed, cut asphalt and concrete in uniform line at the designated limits of removal. Use an adequately powered, water-cooled, mechanical saw with a diamond-edge blade or abrasive wheel, unless otherwise approved by the Owner and Engineer.

C. Break up and remove asphalt and concrete at the designated locations and to the required limits.

D. At limits of asphalt and concrete remaining in place, maintain cuts in good order until adjacent construction is completed.

3.03 REMOVAL AND ABANDONMENT OF SUBSURFACE UTILITIES

A. Remove or abandon designated existing subsurface utilities, including storm drain structures, inlets and pipes, and other utilities as indicated on the Drawings and specified in the following paragraphs.

B. Remove existing subsurface drainage and other utility structures. Removal work shall be accomplished using methods and equipment which will prevent damage to adjacent structures not indicated to be removed.

C. Where applicable, piping shall be removed back to the nearest joint from the limit of removals indicated on the Drawings, unless otherwise directed by the Owner and Engineer.

D. Cap sanitary sewer, potable water lines and other designated utilities at exposed ends of pipes to be abandoned in-place. Capping of pipelines shall be performed in accordance with requirements of the local jurisdiction and other applicable local codes and standards.

E. If damaged during pipe cutting and removals, the exposed ends of existing pipes to remain in place shall be repaired as necessary to provide a smooth end at right angles to the axis of the piping. The repair work shall be accomplished using materials and methods approved by the Owner and Engineer at no additional cost to the Project.

F. When septic tanks are encountered, the contents of each tank shall first be completely removed, then demolished and completely removed. Provide documentation on the removal and disposal of the tank contents. Removal and disposal of contents shall meet the requirements of the State Department of Health and local health authorities. All open wells located within the property must be filled with gravel and covered with a reinforced four (4) inch concrete slab in accordance with Georgia D.O.T. Standard 9031H.

G. Manhole frames, covers, drainage grates and all other iron castings shall be disposed off-site or salvaged for reuse by the Owner. All structures that will not be salvaged shall be demolished as required and removed from the Site. Disposal of structures and iron castings shall be as specified in subsection 3.09.

3.04 REMOVAL OF CURBS, GUTTERS AND WALKWAYS

A. Cut and remove existing concrete curbs, gutters and walkways where indicated on the Drawings.

B. Saw cut concrete at the limits of removal as approved by the Owner and Engineer. Use an adequately powered, water-cooled, mechanical saw with a diamond-edge blade or abrasive wheel.

C. Break up and remove concrete using suitable tools and equipment. Maintain saw cuts in good order until new curb and gutter and new walkway construction work is completed (as applicable).

3.05 REMOVAL OF FENCING

A. Remove fencing (including fabric, posts and accessories) at locations indicated on the Drawings.

B. Remove fence posts and concrete footings to full depth.

3.06 REMOVAL OF RETAINING WALLS

A. Where portions of retaining walls are to be removed, make a vertical cut at designated limits using tools and methods that will not damage existing wall structures to remain. Provide protection of existing structures as required to prevent damage or disturbance.

B. Break up and remove the sections of the walls to the limits indicated on the Drawings.

C. Excavate and remove walls and footings to full depth.

3.07 REMOVAL OF POWER AND LIGHT POLES

A. Coordinate with the local utility owner for de-energizing of power lines on poles to be removed within the designated limits of construction as indicated on the Drawings.

B. After power lines are de-energized, designated power and light poles shall be removed and disposed off-site as specified in the following paragraphs.

C. Remove luminaires, pole hardware, wiring, cables, other devices and accessories.

D. Excavate and remove power and light poles to full depth, including concrete foundations. Soil excavated for removal of poles shall be used as backfill. Place and compact backfill as specified in Section 31 23 17.

3.08 REMOVAL OF STRUCTURES

A. Remove designated existing structures where indicated on the Drawings.

B. During removal of structures, use all procedures necessary to assure that no portion of the structures become a hazard to persons by instability or other conditions.

C. Structures may be moved intact, without disassembly. If intact removal is not feasible, disassembly may be allowed as determined by the contractor. Proper equipment and methods shall be used to prevent damage to the structures.

3.09 DISPOSAL OF REMOVED MATERIALS

A. Demolition materials and debris classified as non-hazardous construction and debris (C&D) wastes shall be transported off-site and disposed at a permitted landfill in conformance with all applicable local, state and federal regulations.

3.10 SITE RESTORATION

A. Backfill and grade excavated areas as indicated on the Drawings and specified in applicable specification sections.

3.11 HAZARDOUS MATERIALS SURVEY

A. Reports of Hazardous Materials surveys are included for information on CD accompanying these construction documents and following this section.

END OF SECTION
02 40 00

SECTION 03 10 00

CONCRETE FORMWORK

PART 1 - GENERAL

1.01 DESCRIPTION

A. Related Work Specified Elsewhere:

1. Concrete Reinforcement: Section 03 20 00.

2. Cast-in-Place Concrete: Section 03 30 00.

1.02 QUALITY ASSURANCE

A. Design Criteria: Design, construct, erect, maintain, and remove formwork complying with ACI 347 and building code requirements. Contractor is solely responsible for formwork design.

B. Tolerances for Formed Surfaces:

1. Variation from plumb:

a. In lines and surfaces of walls:

1) In any 10 ft. of length: 1/4 in.

2. Variation in cross-sectional dimensions in thickness of slabs and walls:

a. Minus: 1/4 in.

b. Plus: ½ in.

3. Footings:

a. Tolerances apply to concrete dimensions only, not to positioning of vertical reinforcing steel, dowels, or embedded items.

b. Variations in dimensions in plan:

1) Minus: ½ in.

2) Plus: 2 in.

4. Maximum deflection of facing materials reflected in concrete surfaces exposed to view: 1/240 of span between structural members.

PART 2 - PRODUCTS

2.01 MATERIALS

A. FORMS:

1. Conform to ACI 347.

2. Use forms to confine concrete and shape to required dimensions.

B. Precast Concrete Soil Retainers: Continuous precast units.

C. Form Release Materials: Non-staining, field applied form release or sealer, or factory applied liner.

D. Form Accessories: Commercially manufactured ties, hangers, or other required type for partial or wholly embedding in concrete.

PART 3 - EXECUTION

3.01 PREPARATION

A. Preparation of Form Surfaces:

1. Clean surfaces of forms and embedded materials of accumulated mortar, grout, and of other foreign material before concrete is placed.

2. Apply form release agent or sealer, or use factory applied non-absorptive liner in accordance with manufacturer's recommendations.

B. Construct formwork so that concrete surface will conform to tolerance limits specified.

3.02 INSTALLATION OF FORMWORK

A. Fabricate formwork for loads, lateral pressure, and allowable stresses outlined in ACI 347 and for wind loads.

B. Assemble form ties so that ends or end fasteners can be removed without causing appreciable spalling at face of concrete.

3.03 REMOVAL OF FORMS

A. When repair of surface defects or finishing is required at early age, remove forms as soon as concrete has hardened sufficiently to resist damage from removal operation.

B. Maintain shoring used to support weight of concrete in beams, slabs, and other structural members in place until concrete has reached strength sufficient to carry its weight and

construction loads.

C. Concrete strength when shores are removed shall not be less than 75% of 28-day strength.

END OF SECTION
03 10 00

SECTION 03 20 00

CONCRETE REINFORCEMENT

PART 1 - GENERAL

1.01 DESCRIPTION

A. Related Work Specified Elsewhere:

1. Concrete Formwork: Section 03 10 00.

2. Cast-in-Place Concrete: Section 03 30 00.

1.02 QUALITY ASSURANCE

A. Reference Standards:

1. American Society for Testing and Materials (ASTM):

a. A 185, Standard Specification for Welded Steel Wire Fabric for Concrete Reinforcement.

b. A 615, Standard Specification for Deformed and Plain Billet Steel Bar for Concrete Reinforcement.

2. American Concrete Institute (ACI):

a. 315, Manual of Standard Practice for Detailing Reinforced Concrete Structures.

b. 318, Building Code Requirements for Reinforced Concrete.

c. 347, Recommended Practice for Concrete Formwork.

3. American Welding Society (AWS):

a. D12.1, Reinforcing Steel Welding Code.

4. Concrete Reinforcing Steel Institute (CRSI):

a.. Placing Reinforcing Bars.

B. Tolerances:

1. Fabricating tolerances:

a. Sheared length: + or - 1 in.

b. Depth of truss bars: + 0, - ½ in.

c. Overall dimensions of stirrups and ties: + or - ½ in.

d. Other bends: + or - 1 in.

2. Placing tolerances:

a. Clear distance to formed surfaces: + or - 1/4 in.

b. Minimum spacing between bars: + or - 1/4 in.

c. Top bars in slabs and beams:

1) Members 8 in. deep or less: + or - 1/4 in.

2) Members more than 8 in. but not over 2 ft. deep: + or - 1 in.

d. Crosswise of members: spaced evenly within 2 in.

e. Lengthwise of member: + or - 2 in.

1.03 SUBMITTALS

A. Shop Drawings:

1. Show number, size, and spacing of reinforcing and location in work.

2. Detail Splices.

3. Detail walls in elevation.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Reinforcing Bars:

1. ASTM A 615, Grade 60.

B. Welded Wire Fabric:

1. ASTM A 185.

2. Welded intersections shall be spaced not farther apart than 12 in. in direction of

principal reinforcement.

2.02 FABRICATIONS

A. Fabricate details of concrete reinforcement and accessories complying with ACI 315.

PART 3 - EXECUTION

3.01 PLACING:

A. Place reinforcement in accordance with CRSI Placing Reinforcing Bars.

B. Move bars as necessary to avoid interference with other reinforcing steel, conduits or embedded items.

C. If bars are moved more than one bar diameter or enough to exceed tolerances, submit resulting arrangement of bars to Engineer for review.

D. Minimum concrete protective covering for reinforcement. See Drawings.

E. Place reinforcement at time of concrete placing, free of mud, oil, or other materials that adversely affect or reduce bond.

F. Reinforcement with rust or mill scale will be accepted without cleaning or brushing provided dimensions and weights shall not be less than required by applicable ASTM Standard.

G. Support reinforcement and fasten together to prevent displacement by construction loads of placing concrete.

H. On ground, concrete blocks may be used to support reinforcement.

I. Over formwork, use metal or plastic bar chairs and spacers to support reinforcement.

J. Where concrete surface will be exposed to weather in finished structure, use noncorrosive or corrosion protected accessories within ½ in. of concrete surface.

K. Where successive mats or rolls are continuous, overlap welded wire fabric so that overlap measured between outermost cross wires of each fabric sheet is not less than spacing of cross wires plus 2 in.

L. Extend fabric across supporting beams to within 3 in. of concrete edges.

A. Bars having splices not shown on shop drawings or lapped in accordance with the Lap Splice Schedule on the drawings will be rejected.

N. Do not bend reinforcement after being embedded in hardened concrete.

END OF SECTION
03 20 00

SECTION 03 30 00

CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 DESCRIPTION

A. Related Work Specified Elsewhere:

1. Concrete Formwork: Section 03 10 00.

2. Concrete Reinforcement: Section 03 20 00.

1.02 QUALITY ASSURANCE

A. Testing Agency Services:

1. Inspect subgrade, excavations, and fill for required compaction and/or required bearing capacity.

2. Conduct strength and other tests of concrete during construction in accordance with following procedures:

a. Mold and cure four specimens from each sample in accordance with ASTM C 31.

b. Test specimens in accordance with ASTM C 39.

c. Test two specimens at 28 days for acceptance and one at 7 days for information. Break the fourth specimen at 56 days only in the event of low breaks at 28 days.

d. Acceptance test results shall be average of strengths of two specimens tested at 28 days.

e. If one specimen in test manifests evidence of improper sampling, molding, or testing, discard.

f. Strength of remaining cylinder shall be considered test result.

g. Should both specimens in test show defects, discard entire test.

h. Make at least one strength test for each 100 cu. yard or fraction thereof,

of each mix design of concrete placed in one day.

i. When total quantity of concrete with mix design is less than 50 cu. yd., strength tests may be waived by Engineer if, in his judgement, adequate evidence of satisfactory strength is provided.

3. Determine slump in accordance with ASTM C 143 of concrete sample for each strength test and when consistency of concrete appears to vary.

4. Determine air content of normal weight concrete for each strength test in accordance with ASTM C 138, C 173, or C 231.

5. Determine temperature of concrete sample for each strength test.

6. Sample concrete at point of placement where possible.

7. Indicate in report location specimens were taken, method of storing, and curing procedures.

1.03 SUBMITTALS

A. Samples: Secure in accordance with ASTM C 172.

B. Shop Drawings: Indicate location of proposed control, construction, and expansion joints not shown on the drawings.

C. Concrete mix designs shall be submitted to the design engineer for review and approval.

1.04 JOB CONDITIONS

A. Environmental Requirements:

1. Unless protection is provided, do not place concrete during rain, sleet, or snow.

2. Do not allow rainwater to increase mixing water nor to damage surface finish.

3. Cold Weather: ACI 306.

4. Hot Weather: ACI 305.

B. Protection:

1. During curing period, protect concrete from damaging mechanical disturbances, load stresses, shock, and vibration.

2. Protect finished concrete surfaces from damage by construction equipment or materials.

3. Protect from rain or running water.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Cement: ASTM C 150, Type as listed in Section 2.2. One brand of cement shall be used for all exposed work.

B. Water: Fresh, clean, and potable containing not more than 0.30 percent of chloride ion content, by weight of cement.
.

C. Aggregates for Normal Weight Concrete: ASTM C 33.

D. Curing Compound:

1. Comply with ASTM C 309.

E. Expansion Joint Fillers: Preformed type joint filler complying with ASTM D 994, D 1751, or D 1752.

2.02 CONCRETE MIX

A.

Cement	Type I or III
Strength	4,000 psi in 28 days
Maximum size of coarse aggregate	1 inch (#57)
Air content	3% to 6% by volume
Slump	3 to 5 inches

B. Slump:

1. Proportion concrete to produce slump listed above.

2. Tolerance of up to 1 in. above maximum shall be allowed for individual batches provided average for batches or most recent 10 batches tested, whichever is fewer, does not exceed maximum limit.

3. Concrete of lower than usual slump may be used provided properly placed and consolidated.

4. Determine slump by ASTM C 143.

2.03 SELECTION OF PROPORTIONS

A. GENERAL:

1. Proportion ingredients to produce mixture which will work readily into corners, angles of forms, and around reinforcement by methods of placing and consolidation to be employed on work.

2. Proportions shall not permit materials to segregate or excessive free water to collect on surface.

3. Select proportions of ingredients to produce proper ease of placing, durability, strength, and other required properties.

2.04 PRODUCTION OF CONCRETE

A. Ready Mixed Concrete: Batch mix and transport in accordance with ASTM C 94.

PART 3 - EXECUTION

3.01 INSPECTION

A. Notify soils engineer or owner 24 hours in advance so that final excavation subgrade may be inspected before concrete is poured.

B. Do not proceed with work until soils engineer's approval is obtained.

3.02 JOINTS AND EMBEDDED ITEMS

A. Control Joints:

1. As shown on drawings.

B. Construction Joints:

1. Locate joints in beams, slabs, and walls a shown on the drawings or as approved by the Engineer.

2. Make joints perpendicular to main reinforcement.

3. Place reinforcing steel continuously across joints unless shown otherwise.

4. Provide keys or roughened surface and dowels.

5. Clean surface of concrete and remove laitance at joint before placing adjoining concrete.

C. Expansion Joints: Do not extend reinforcing or embedded metal items through expansion joints except dowels to be bonded on one side.

D. Placing Miscellaneous Embedded Items.

1. Place sleeves, inserts, anchors, and other embedded items prior to concreting.

2. Coordinate placing of embedded items required by other trades prior to placing concrete.

3. Position embedded items accurately and support against displacement.

4. Temporarily fill voids in sleeves, inserts, and anchor slots with removable material to prevent entry of concrete into voids.

3.03 PREPARATION FOR PLACING CONCRETE

A. Remove hardened concrete and foreign materials from inner surfaces of conveying equipment.

B. Remove snow, ice, and water from completed formwork.

C. Verify that reinforcement is secured in place.

D. Verify that expansion joint material, anchors, and other embedded items are in place.

E. Slabs on Grade:

1. Subgrade shall be frost-free before concrete is placed.

2. If temperature is below freezing, raise and maintain subgrade temperature above 50 deg. F to eliminate frost.

3. Subgrade may be moist, but there shall be no free water standing on subgrade nor any muddy or soft spots when concrete is placed.

4. When formwork is cambered, set screeds to same camber to maintain thickness.

3.04 PLACING CONCRETE

A. Conveying:

1. Comply with ASTM C 94.

2. Handle concrete as rapidly as practicable by methods which will prevent segregation, loss of ingredients, or damage to quality of concrete.

3. Do not use conveying equipment that will restrict continuous placement of concrete.

4. When used, use horizontal or sloped belt conveyors that will not cause segregation or loss of ingredients.

5. Protect concrete against undue drying or rise in temperature.

6. Do not allow mortar to adhere to return length of belt.

7. Conveyor runs longer than 20 ft. shall discharge into a hopper.

8. Use metal or metal lined chutes with slope not exceeding 1 vertical to 2

horizontal and not less than 1 vertical to 3 horizontal.

B. Depositing:

1. Comply with ACI 304.

2. Deposit concrete continuously without formation of seams, cold joints, or planes of weakness.

3. If section cannot be placed continuously, provide construction joints. Obtain approval of Engineer.

4. Do not start placing of concrete on supported elements until concrete previously placed in columns or walls is no longer plastic and has been in place 6 hours minimum.

5. Slabs on grade:

a. Conform to ACI 302.

b. Coordinate placing with finishing.

c. Do not place concrete on subgrade or forms more rapidly than spreading and floating can be accomplished.

C. Segregation:

1. Deposit concrete as nearly as practicable in final position to prevent segregation due to rehandling or flowing.

2. Do not subject concrete to procedures which will cause segregation.

D. Consolidation:

1. Comply with ACI 309.

2. Consolidate concrete by vibration.

3. Thoroughly work around reinforcements, embedded items, and into corners of forms.

4. Eliminate air or stone pockets which may cause honeycombing, pitting, or planes of weakness.

5. Use internal vibrators with minimum frequency of 8,000 vibrations per minute and sufficient amplitude to consolidate concrete effectively.

6. Do not use vibrators to transport concrete within forms.

7. Insert and withdraw vibrators at points approximately 18 in. apart.

8. At each insertion, maintain duration from 5 to 15 sec. to consolidate concrete but not long enough to cause segregation.

9. Keep spare vibrators on job site during concrete placing operations.

10. Where concrete is to have as-cast finish, bring full surface of mortar against form by vibration process and supplement by spading to work coarse aggregate back from formed surface.

11. Use internal vibration in beams, girders, slabs, and along bulkheads of slabs on grade.

F. Bonding:

1. Before placing fresh concrete, dampen hardened concrete and coat with grout proportioned to mortar in concrete.

2. Place grout as thick as possible on vertical surfaces.

3. Place grout ½ in. thick on horizontal surfaces.

4. Place fresh concrete before grout has attained its initial set.

3.05 REPAIR OF SURFACE DEFECTS

A. Preparation:

1. Repair tie holes and surface defects immediately after form removal.

2. After approval by the engineer, remove honeycombed and otherwise defective concrete down to sound concrete.

3. If chipping is necessary, place edges perpendicular to surface or slightly undercut.

4. No feathered edges will be permitted.

5. Dampen patch and minimum of 6 in. of surrounding area.

B. Bonding Grout:

1. Use mix of approximately one part cement to one part fine sand passing No. 30 mesh sieve.

2. Mix to consistency of thick cream.

3. Brush into surface.

C. Patching Mixture:

1. Use same materials and approximately same proportion used for concrete.

2. Omit coarse aggregate.

3. Mix one part cement to 2 ½ parts sand by damp loose volume.

4. Use patching mortar to match color of surrounding concrete as determined by trial patch.

5. Add water only as necessary for handling and placing.

6. Mix patching mortar in advance and allow to stand with frequent manipulation with trowel, without addition of water, until it has reached stiffest consistency that will permit placing.

D. Patch Application

1. Apply patching mortar after bonding grout has lost its sheen.

2. Thoroughly consolidate mortar into place and strike off to leave patch slightly higher than surrounding surface.

3. Leave undisturbed for one hour minimum before being finally finished.

E. Tie Holes: After cleaning and dampening, fill solid with patching mortar.

3.06 FINISHING OF FORMED SURFACES

A. As-Cast Finishes:

1. Rough Form Finish: (Not exposed to view)

a. No selected form facing materials are specified.

b. Patch tie holes and defects.

c. Remove fins exceeding 1/8 in. in height.

d. Leave surfaces with texture imparted by forms.

2. Smooth Form Finish (Exposed to view):

a. Form facing material shall produce smooth, hard, and uniform texture on concrete.

b. Arrange facing material orderly and symmetrical with minimum seams.

c. Supported by forms capable of preventing excessive deflection.

d. Do not use materials with raised grain, torn surfaces, worn edges, patches, dents, or other defects which will impair texture of concrete.

e. Patch tie holes and defects.

f. Remove fins completely.

B. Related Unformed Surfaces:

1. Strike tops of walls or buttresses, horizontal offsets, and similar unformed surfaces occurring adjacent of formed surfaces. Smooth after concrete is placed and floated to texture consistent with that of formed surfaces.

2. Final treatment on formed surfaces shall continue uniformly across unformed surface.

C. Finishes Not Designated:

1. All exposed concrete faces: Smooth form finish.

2. Unexposed faces: Rough form finish.

3.07 FINISHING SLABS

A. Conform to ACI 302.

B. Finishing Tolerance:

1. True planes within 1/8 in. in 10 ft. as determined by 10 ft. straight edge placed anywhere on slab in any direction.

C. Floated Finish (Slabs not intended for foot traffic):

1. After concrete has been placed, consolidated, struck off, and leveled do not work concrete further until ready for floating.

2. Begin floating when water sheen has disappeared and when concrete has stiffened sufficiently to permit operation.

3. Check planeness of surface with 10 ft. straight edge applied at two different angles.

4. Cut down high spots and fix low spots to produce surface within finishing tolerance.

5. Refloat immediately to uniform sandy texture.

D. Troweled Finish (Slabs intended for foot traffic):

1. Float finish surface and trowel.

2. Finished surface shall be free of trowel marks, uniform in texture and appearance, and planed to Class A tolerance.

3. On surfaces intended to support floor coverings, remove defects which will show through floor covering by grinding.

E. Broom or Belt Finish: After concrete has received float finish, give coarse transverse scored texture by drawing broom or burlap belt across surface.

F. Finishes Not Designated:

1. Slabs to be exposed: Broom finish.

3.08 CURING

A. General:

1. Comply with ACI 308.

2. After placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.

3. Maintain concrete with minimal moisture loss at relative constant temperature for period necessary for hydration and hardening.

B. Preservation of Moisture for Concrete Surfaces not in Contact with Forms:

1. Ponding or continuous sprinkling.

2. Absorptive mats or fabric kept continuously wet.

3. Sand kept continuously wet.

4. Continuous application of steam not exceeding 150 deg. F or mist spray.

5. Curing compound:

a. Apply in accordance with manufacturer's recommendations.

b. Do not apply to surfaces to which additional concrete or resilient materials are to be bonded unless manufacturer certifies that compound will not prevent bond or positive means are taken to completely remove compound.

C. Curing Period:

1. Continue curing for seven days minimum or when average compressive strength or job-cured cylinders have reached 70% of the specified design strength.

D. Cold Weather:

1. Comply with ACI 306.

2. When mean daily outdoor temperature is less than 40 deg. F, maintain

temperature of concrete between 50 deg. F and 70 deg. F for curing period.

3. Make arrangements for heating, covering, insulating, or housing concrete work in advance of placement.

4. Maintain required temperature without injury due to concentration of heat.

5. Do not use combustion heaters during first 24 hrs. unless precautions are taken to prevent exposure of concrete to exhaust gases containing carbon dioxide.

E. Hot Weather:

1. Comply with ACI 305.

2. Make provision for windbreaks, shading, fog spraying, sprinkling, ponding, or wet covering in advance of placement.

3. Take protective measures as quickly as concrete finishing operations will allow.

4. Prevention of rapid surface drying.

a. Protect unformed surfaces of slab concrete against rapid surface drying.

b. Apply membrane curing compound immediately following finishers.

F. Rate of Temperature Change: Keep changes in temperature of air uniform and do not exceed 5 deg. F in one hour or 50 deg. F in 24 hr. period.

G. Protection from Mechanical Injury:

1. Protect concrete from damaging disturbances, load stresses, shock, and vibration.

2. Protect finished concrete surfaces from damage by construction equipment, material, rain, and running water.

END OF SECTION
03 30 00

SECTION 05 05 23

ANCHOR BOLTS

PART 1 GENERAL

1.1 SCOPE

Furnish all labor, materials and equipment required to install following anchors:

1. Cast-in-place anchor bolts as detailed on the Drawings or as required by equipment manufacturer's anchor bolt setting plan.

2. All expansion bolts indicated on the Drawings required to attach or anchor ladders, handrails, stairs, ship's ladders and structural steel shapes to hardened concrete or masonry.

1.2 APPLICABLE SPECIFICATIONS AND STANDARDS

The following publications of issues listed below, but referenced to thereafter by basic designation only, apply to this section to extent applicable in each reference thereto.

1. American Society for Testing and Materials (ASTM)

   F 593-80 Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.

   F 594-80 Specifications for Stainless Steel Nuts.

2. Federal Specification

   FF-S-325 Shield, Expansion; Nail Expansion; and Nail, Drive Screw (Devices, Anchoring, Masonry).

3. Manual of Steel Construction (AISC).

1.3 MATERIAL STORAGE

All material shall be stored in a manner which will protect it from deterioration and damage.

PART 2 -PRODUCTS

2.1 MATERIALS

A. All anchor and expansion bolts shall be of stainless steel meeting requirements of ASTM F 593, Alloy Group 1, Condition CW.

B. All nuts shall be of stainless steel meeting requirements of ASTM F 594, Alloy Group 1, Condition CW.

C. All washers shall meet dimensional requirements of ASTM F 436. Material for washers shall be stainless steel, Type 304, 305, 384 or MX7.

D. Expansion bolts shall meet requirements of Federal Specification FF-S324 and Interim Amendments. Expansion bolts complying with following are acceptable.

1. Group I
   Type 1, Class 2.
   Type 2, Class 2, Styles 1 and 2.

2. Group 11
   Type 3, Class 1 and 2.

3. Group III
   Type 1 and 2.

4. Group VIII
   Type 1 and 2.

5. All expansion bolts shall be stainless steel.

PART 3 - EXECUTION

3.1 ANCHOR BOLT SETTING

A. Accurately locate and hold all anchor bolts in place by templates until the concrete has hardened.

B. Furnish anchor bolts for equipment with baseplates with pipe sleeves to permit adjustment and grouting. Cast anchor bolts integrally with concrete. Pipe sleeve shall have an internal diameter not less than three times bolt diameter and shall be not less than 10 bolt diameters long.

3.2 EXPANSION BOLT INSTALLATION

A. Drill expansion bolt holes into concrete through item being supported or locate by a template. Drill all holes by a tool designed by or approved by manufacturer of expansion anchors.

B. Installation of expansion anchors shall be in compliance with manufacturer's recommendations for maximum holding power, but in no case shall depth of hole be less than 4 bolt diameters. Minimum distance between center of any expansion anchor and an edge or exterior corner of concrete shall be not less than 4 1/2 times diameter of hole in which it is installed.

END OF SECTION
05 05 23

SECTION 31 00 00

EARTHWORK

PART 1 - GENERAL

1.1 DESCRIPTION

A. Related Work Specified Elsewhere:
1. Site Preparation: Section 31 10 00.
2. Excavating, Filling and Backfilling for Structures: Section 31 23 17.

1.2 QUALITY ASSURANCE

A. Reference Standards:
1. American Society for Testing and Materials (ASTM)
2. D 424-59 (R 1971), Test for Plastic Lime and Plasticity Index for Soils.
   a. D 698-78, Methods of Test for Moisture-Density Relations of Soils, Using 5.5 lb. (2.5 kg) Rammer and 12 in. (304.8 mm) Drop.
   b. D 1556-64 (R 1974), Method of Test for Density of Soil in Place by the Sand-Cone Method.
   c. D 2922-71 (76), Methods of Test of Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
   d. D 2937 (94) Method of Test for Density of Soil in Place by the Drive Cylinder method.

1.3 PROTECTION

A. Maintain protection of trees.

B. Protect existing utilities, facilities, or permanent objects to remain.

C. Maintain adequate clearance, cut back banks on stable slope, or properly and substantially sheet, brace, and shore as required to prevent caving or sliding to protect workmen, work, and structures and to prevent undermining, disturbing, or removing support to structures to remain.

D. Design and build sheeting, bracing, and shoring to withstand loads caused by earth movement and construction operations.

E. Maintain shape and position of sheeting, bracing, and shoring for duration necessary.

F. Remove when not necessary.

PART 2 - PRODUCTS

2.1 MATERIAL

A. Fill:
1. Soil free from trash, vegetation, and organic matter, rock over 3" in size, hard lumps of earth and frozen, corrosive or perishable material. All fill materials shall be subject to the approval of the Engineer.

B. Top Soil:
1. Fertile, friable loam, suitable for growth of grass and plants.
2. Decomposed vegetable matter, finely divided and minimum 4% by weight.
3. Free from subsoil, clay, brush, weeds, stones larger than 1/2 in. diameter, stalks, roots, and other materials that would be toxic or harmful to growth.

PART 3 - EXECUTION

3.1 CLASSIFICATION OF EXCAVATED MATERIALS

A. All excavated materials will be unclassified except rock excavation which consists of the removal and disposal of natural material encountered that cannot be excavated without continuous and systemic drilling and blasting or continuous use of a ripper or other special equipment. Intermittent drilling or blasting performed to increase production and unnecessary for excavation of material encountered will not be classified as rock excavation.

3.2 EXCAVATION

A. Perform excavation of every description and of substances encountered within grading limits of project to lines and grades indicated.

B. Transport suitable excavated material to and place in fill areas within limits of work.

C. Where material encountered within limits of work is unsuitable, excavate material below required grade and replace with suitable material.

D. Maintain existing sections and ditches to ensure proper drainage at all times.

E. Construct and maintain ditches and channels to avoid damage to sections.

F. Utilize suitable excavated materials in construction.

3.3 BORROW AREA

A. In excavating materials which are suitable for use in the dam embankment, the Engineer

will designate the depths of cut and areas to be excavated which will result in the best gradation of materials, and the cuts shall be made to such designated depths and in such areas. The location and extent of all borrow pits within borrow areas shall be as directed, and the Engineer reserves the right to change the limits of the borrow areas in order to obtain the most suitable material, to minimize stripping, or for other reasons.

B. The borrow area shall be graded smooth upon completion of borrowing operations. The borrow site shall be graded to drain adequately and grades left without humps and ridges. Maximum finished cut slopes in borrow areas shall be 1.5(H) to 1.0(V).

C. During borrow operations, all cut areas shall be maintained so as to provide surface drainage and prevent ponding of surface water.

D. The Contractor will be required to excavate sufficient suitable material from borrow areas to complete the work under these Specifications, regardless of whether overly wet conditions encountered are due to groundwater, precipitation, difficulty in draining, or any other reason. To minimize operations with overly wet material, the Contractor will be permitted to utilize portions of the borrow areas which contain dry materials and which have been designated as suitable borrow pits to the greatest extent practicable consistent with obtaining suitable material.

E. The Contractor shall be entitled to no additional allowance above the base bid on account of the requirement for excavating drainage ditches; for allowing additional time for curing or drying; for stockpiling and rehandling excavated materials which have been deposited temporarily in stockpiles; delays or increased costs due to stockpiling; poor trafficability in the borrow area, the haul roads, or the embankment; reduced efficiency of the equipment the Contractor elects to use; or on account of any other operations or difficulties caused by overly wet or dry materials.

3.4 EMBANKMENTS AND FILLS

A. Preparation of Ground Surfaces:
1. Backfill stump holes or other small excavations with fill material and compact.
2. Plow, step (bench), or break upsloped ground surfaces that are steeper than one vertical to four horizontal on which fill is to be placed, so that fill material will bond with existing surface.
3. Scarify dam “footprint” area to 6 in. depth minimum.
4. Scarify or plow areas outside dam “footprint” area which are to receive embankment or fill to depth of 4 in. minimum.
5. Re-compact loosened material with new fill or embankment material.

B. Formation of Embankments and Fills:
1. Construct embankments at locations and to lines and grades indicated within limits of work.
2. Form embankments from earth free from roots or other organic material, trash,

frozen material, and rock or stones having maximum dimension greater than 3 in.

3. Construct embankments in layers and compact.
4. Do not place trees, stumps, roots, vegetation, or other unsuitable materials in embankment.
5. Construct embankment in layers approximately parallel to finished grade surface.
6. Construct embankments to grade; completed embankments shall correspond to general shape of typical sections.
7. Each section of embankment shall correspond to detailed section or required slopes.
8. Continuously maintain finished section and grade until project is accepted.

C. Earth Embankments:

1. Shall be defined as those composed principally of material other than rock, and shall be constructed of accepted material from reviewed sources as defined for fill material.
2. Constructed in successive layers for full width of individual cross section and in lengths as best suited to sprinkling and compaction methods utilized.
3. Form layers of embankment by utilizing equipment which will spread material as it is dumped or from by spreading by blading or other acceptable methods from piles or windrows dumped form excavating or hauling equipment in amounts that material is evenly distributed.
4. Each layer of embankment shall be uniform as to material, density and moisture content before beginning compaction.
5. No material placed in embankment by dumping in a pile or windrows shall be incorporated in a layer in that position, but such piles or windrows shall be moved by blading or similar methods.
6. Break clods or lumps of material and mix embankment material by blading, harrowing, disking or similar methods to obtain material of uniform density in each layer.
7. When water is required for sprinkling to bring material to moisture content necessary for required compaction, apply evenly and secure uniform moisture content throughout layer by necessary methods.
8. In order to facilitate uniform wetting of embankment material, water may be applied at material source if sequence and methods used will not cause undue waste of water.
9. Scarify earth cuts, full width or part width cuts in hill side to uniform depth 6 in. below grade, and mix material and reshape by blading and then sprinkle and compact to same density as that required for adjustment embankment.
10. Compact each layer to required density by methods, type, and size of equipment which will give required compaction.
11. Depth of layers, prior to compaction, shall depend upon type of sprinkling and compacting equipment used.
12. Prior to and in conjunction with rolling operation, bring each layer to moisture content necessary to obtain required density and keep level with suitable equipment to insure uniform compaction over entire layer.

13. For each layer of earth embankment and select material, provide required density.
14. Sprinkle or dry embankment materials as required and compact to extent necessary to provide not less than 95% of maximum density at optimum moisture content as determined by ASTM D 698-79 (Standard Proctor).
15. Control moisture so that required density is achieved at or above optimum moisture content.
16. Make field density determinations in accordance with ASTM D 2937 or other approved method.
17. After each layer of earth embankment or select material is complete, make tests.
18. If material fails to meet density specified or moisture content is out of acceptable range, rework course to obtain specified results, and compaction method shall be altered on subsequent work.
19. Scarify layers as necessary to eliminate any smooth horizontal planes.
20. Procedure shall be subject to review of Engineer.

D. Embankments at Outlet Pipe:
1. Embankments adjacent to drain pipe which cannot be compacted by use of blading and rolling equipment used in compacting adjoining sections of embankment shall be compacted using reviewed hand tamped equipment and methods.
2. Mix, wet, and compact materials as specified.
3. Embankment material placed adjacent to any portion of structure and in first two layers above top of any culvert or similar structure shall be earth free of any appreciable amount of gravel or stone particles more than 3 in. in greatest dimensions and of such gradation as to permit thorough compaction.

3.5 CHANNEL EXCAVATION:

A. Description:
1. Channel excavation shall consist of required excavation for channels, removal and proper utilization or disposal of excavated materials, and constructing, shaping, and finishing of earthwork involved in conformity with required lines, grades, and typical cross sections and in accordance with specifications requirements herein outlined.

B. Construction Methods:
1. Materials removed from excavation shall be satisfactorily disposed of as indicated on drawings or as reviewed, and completed work shall conform to established alignment, grades and cross sections.
2. During construction, channel shall be kept drained, insofar as practicable, and work shall be prosecuted in a neat workmanlike manner.

3.6 COMPACTING

A. General:
1. Place fill in uniform layers, dried or moistened as required to obtain approximate optimum moisture content, and roll where practicable, to density of at least 95% of maximum density at or above optimum moisture determined by ASTM D 698-78 (Standard Proctor).
2. Maximum thickness of uniform layers (loose measurement) shall be as follows:
   a. Layers of thickness required to achieve the specified density compatible with the equipment being utilized.
   b. Compaction equipment selected should leave a non-smooth surface; otherwise, scarify each layer prior to placing additional fill materials.
   c. Compacting equipment and methods of compaction shall be such that uniform density will be obtained over entire area and depth of material being compacted.
   d. Break up fill material deposited in place by means of scrappers, dump trucks, drag lines, or other similar equipment before being spread into uniform layers.
   e. Start rolling longitudinally at sides and proceed toward center of crowned sections, or start longitudinally at low side and proceed toward high side of sloped areas, overlapping on successive trips by at least ½ width of roller unit.
   f. Alternate trips of roller shall be slightly different in length.
   g. Maintain equipment in good repair and in operating condition; operate and load according to recommendations of equipment manufacturer.
   h. Mechanical hand tampers:
      1) Use reviewed mechanical hand tampers in areas inaccessible to roller equipment.
      2) Use methods of compaction so that uniform density is obtained throughout entire area and depth of each layer.

3.7 FIELD QUALITY CONTROL

A. Frequency and Types of Tests:
1. Laboratory shall make one density test of earth fill and embankment for each 5,000 sq. ft of filled areas for each two (2) vertical feet of fill placed in compliance with ASTM D 2937 and D 1556.

3.8 FINISH GRADING

A. Finish surface not more than 0.15 ft. above or below established grade or reviewed cross-sections.

B. Finish ditches and gutters to drain readily.

C. Where existing grade is disturbed in areas not marked to be graded, regrade disturbed area to original grade.

3.9 EXTRA EXCAVATION

A. Some areas may have poor or weak soil conditions.

B. Owner may direct Contractor to undercut proposed subgrade as required and replace unsuitable material with stable material.

C. These areas of weak soil will be determined by geotechnical engineer in field.

3.10 EXCESS MATERIAL

A. Excavated and stripped materials meeting requirements for fill or topsoil material in excess of that used to construct required fills, embankments, stockpiles and topsoiled areas shall remain property of Owner and shall be spread on site as directed by the Engineer.

B. Excess Material that cannot be spread on site shall be hauled offsite by the Contractor. The material may be taken to the Fayette County Staging Area located on 1st Manassas Mile Road in Fayetteville. See Supplementary Conditions for additional information.

3.11 DISPOSAL OF WASTE MATERIALS

A. Objectionable materials such as trash, debris, cleared and grubbed materials, and unsuitable, unusable, and undesirable materials necessary to be removed for construction operations shall be termed “waste materials.

B. Burning of combustible and cleared and grubbed materials will be permitted only after appropriate permits are obtained.

C. Disposal of waste material shall be the responsibility of the Contractor and all costs associated with hauling and disposal shall be included in the lump sum fee for the project.

3.12 TOPSOIL

A. Distribute topsoil on areas indicated to minimum depth of 4 in.

B. Topsoil from stripping operations which meets requirements of paragraph entitled “Materials” may be used.

C. Provide additional topsoil as needed.

D. Maintain finished surfaces to grade shown, and spread additional topsoil to correct settlement or erosion.

E. Existing Fencing: Mend damage to existing fencing or provide temporary fencing to maintain function of fencing that is disturbed.

* END OF SECTION *
31 10 00

SECTION 31 09 13

INSTRUMENTATION

PART 1 - GENERAL

1.1 SCOPE

The Contractor shall install monitoring instruments, as described in these Specifications and on the Drawings. These instruments shall include observation wells. These instruments shall be capable of permitting monitoring of the development of the phreatic surface during and after the initial filling of the reservoir. The number and locations of these instruments are shown on the drawings.

1.2 STANDARDS

This specification describes the general requirements for installing the monitoring devices. Detailed installation methods and types of materials used shall be in accordance with recognized standards such as American Society for Testing and Materials (ASTM) and U.S. Army Corps of Engineers (COE). The following standards, as referred to herein, shall have the equal authority as though included in full in this specification, except as explicitly modified by this specification:

1. Annual Book of ASTM Standards - Volume 04.08
2. Annual Book of ASTM Standards - Volume 08.04
3. Instrumentation of Earth and Rock-fill Dams (Groundwater and Pore Pressure Observations), Engineer Manual, EM1 1 10-2-1908, Department of the Army Corps of Engineers.

1.3 SUBMITTALS

A. Upon completion of installation of each observation well, the Contractor shall submit to the Engineer the following items:

   1. Drill log for the well, including the location of special features such as abnormal gain or loss of drill water, drill action, penetration rate, drilling RPM, hydraulic pressure, and other pertinent items.
   2. All required data collected during the installation performance tests.

PART 2 - PRODUCTS

2.1 OBSERVATION WELLS

Products for the installation, performance testing, and reading of observation wells are described in this section.

A. The well pipe shall have a 2-inch nominal inside diameter and shall be blank slotted pipe with the slotted PVC section 5-foot long. The blank PVC section shall be in convenient length for coupling.

B. The slotted section shall have circumferential slots cut in two rows on 180 degree centers. The slots shall be 0.010 inch in width and of sufficient number to provide a minimum of 0.75 square inch of opening per linear foot of pipe.

C. All pipe shall conform to ASTM D 1785 polyvinyl chloride (PVC) pipe, Schedule 80. Fittings shall be Schedule 80 socket or screwed end.

D. All socketed joints shall be solvent welded conforming to ASTM D 2672, except when noted on the design drawings as flanged and/or screwed joints.

E. Solvent cement shall conform to ASTM D 2564. Before applying the cement to the socket joint, the pipe end and fitting socket shall be cleaned with a cleaner or primer recommended for PVC pipe and in accordance with manufacturers recommended procedure which shall be considered as being part of this Specification.

F. Procedure for cementing pipe and fittings shall be in accordance with ASTM D 2855.

G. Sand for the filter pack shall be #20 Morrie Industrial Sand and shall not extend more than 4 feet above the screened interval.

H. Sand for the backfill seals shall have 100 percent passing the No. 10 sieve, not more than 50 percent passing the No. 40 screen, and not more than 5 percent passing the No. 200 sieve.

I. Bentonite for seals shall be in pellet or other approved form.

J. A concrete base as shown on the Drawings shall be constructed in the ground surface at the top of each hole.

K. A steel sleeve with leak-resistant cover shall be permanently set in the concrete base to protect the well pipe. The well pipe shall be equipped with a locking cover.

PART 3 - EXECUTION

3.1 INSTALLATION OF OBSERVATION WELLS

A. The monitoring wells shall serve to monitor the phreatic surface within the embankment. The depths and locations of the wells shall be as specified on the drawings.

B. Borings shall be drilled in accordance with reference specifications. A drill log shall be prepared for each drill hole. The log shall include the location of special features, such as abnormal gain or loss of drill water, drill action, penetration rate, drilling RPM, hydraulic pressure, and other pertinent items.

C. The borehole shall be stabilized with casing, clean drilling water or clean water with a degradable drilling fluid additive as specified in the reference specification. When the hole has reached the prescribed depth and cuttings have been removed from the hole, the slotted screen pipe shall be lowered into the hole, centered using centering spiders, and backfilled with filter material as shown on the drawings. If the hole has been stabilized using casing, the backfill shall be placed using 1-foot increments as the casing is removed. Sand backfill in wet drill holes shall be placed through a tremie.

D. Once the well is in place and the hole is backfilled as specified, an installation performance test consisting of a failing-head permeability test shall be performed on each well. If a drilling fluid is used in the installation procedure, the installation performance test shall be performed only after the fluid has broken down (degraded). During this test, the well shall be filled to the top of the riser pipe with clean clear water and the water level in the well recorded at 1 minute intervals for the first 5 minutes and then at 5 minute intervals for an additional 15 minute period. Any well which does not fall 50 percent of the distance to its original level within 5 minutes shall be re-evaluated.

E. An installation record shall be provided to the Engineer containing a copy of the field boring log and documenting all pertinent dimensions, conditions, observations made during installation and installation performance test results.

F. Installation and performance test data shall be reviewed by the Engineer. If he/she determines that the well is not functioning property, the well will be pulled, the hole will be backfilled, and a working well shall be installed at a new location specified by the Engineer.

END OF SECTION
31 09 13

SECTION 31 10 00

SITE PREPARATION

PART 1 - GENERAL

1.1 DESCRIPTION

A. Related Work Specified Elsewhere:
   1. Earthwork: Section 31 00 00.
   2. Excavating, Filling and Backfilling for Structures: Section 31 23 17.

1.2 JOB CONDITIONS

A. Protection of Existing Improvements:
   1. Provide barricades, coverings, or other types of protection necessary to prevent damage to existing improvements indicated to remain in place.
   2. Protect improvements on adjoining properties as well as those on Owner's property.
   3. Restore improvements damaged by work to their original condition, as acceptable to owners or other parties or authorities having jurisdiction.

B. Protection of Existing Trees and Vegetation:
   1. All trees and vegetation outside of clearing limits shall be protected.
   2 Protect against unnecessary cutting, breaking or skinning of roots, or skinning and bruising of bark.
   3. Do not smother trees by stockpiling construction materials or excavated materials within drip line, excess foot or vehicular traffic, or parking of vehicles within drip line.
   4. Provide temporary fences, barricades or guards as required to protect trees and vegetation to be left standing.
   5. Water trees and other vegetation which are to remain within limits of contract work to maintain their health.
   6. Carefully and cleanly cut roots and branches of trees where roots and branches obstruct construction.
   7. Coat roots over 1 ½ in. diameter that are cut during construction operations with asphalt paint.
   8. Temporarily cover exposed roots with wet burlap to prevent roots from drying out.
   9. Provide early cover as soon as possible.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Asphalt Paint: Emulsified asphalt or other coating especially formulated for horticultural use on cut or injured plant tissue.

B. Liquid Fertilizer: 20% nitrogen, 10% phosphorus, and 5% potash.

PART 3 - EXECUTION

3.1 PRESERVATION OF STAKING

A. Site preparation operations shall preserve survey staking.

B. At completion of site preparation, check staking and reset missing, damaged, or disturbed staking.

C. Use staking to check that obstructions have been removed within designated construction areas, right-of-way, or easements.

3.2 SITE CLEARING

A. Topsoil Removal:
1. Topsoil is defined as friable clay loam surface soil found to a depth of not less than 4 in.
2. Satisfactory topsoil is reasonably free of subsoil, clay lumps, stones, and other objects over 1/2 inch in diameter.
3. Strip topsoil to depths encountered.
4. Perform stripping in a manner to prevent intermingling with underlying subsoil or other objectionable material.
5. Remove heavy growths of grass from areas before stripping.
6. Where trees are indicated to be left standing, stop topsoil stripping at sufficient distance from such trees to prevent damage to main root system.
7. Stockpile topsoil in storage piles in designated areas.
8. Construction storage piles shall freely drain surface water.
9. Cover storage piles if required to prevent wind-blown dust.

B. Clearing and Grubbing:
1. Clear project site of trees, shrubs, and other vegetation, except for those indicated to be left standing.
2. Completely remove stumps, roots, and other debris protruding through ground surface.
3. Use only hand methods for grubbing inside drip line of trees indicated to be left standing.

4. Fill depressions caused by clearing and grubbing operations with satisfactory soil material, unless further excavation for earthwork is indicated.
5. Place fill materials in horizontal layers not exceeding 6 in. loose depth, and thoroughly compact to density equal to adjacent original ground.
6. On areas required for embankment construction, completely remove all stumps, roots and other organic material.
7. Blade entire area to prevent ponding of water and to provide drainage, except in areas to be immediately excavated.

C. Removal of Obstructions or Improvements:
1. Remove culverts, storm sewers, manholes, weir structures and inlets in proper sequence for maintenance of traffic and drainage.
2. Backfill and tamp holes remaining after removal of obstructions.
3. Complete operation by blading, grading, or bulldozing, so that prepared area is free of holes, ditches, abrupt changes in elevations, irregularities of contour, and drainage of area is preserved.
4. Completely fill abandoned storm sewers, culverts, sanitary sewers, conduits, and water or gas pipes over 3 in. in diameter, with concrete or grout to form tight closure when backfilling is required.
5. Removal of Above-Grade Improvements:
   a. Remove surfacing and pavements, including bases for pavements.
   b. Remove concrete slabs, curbs, gutters, walks, concrete or wood headers, valve boxes, concrete and masonry walls, posts, poles, fences, manhole frames and covers, catch basin grates, and other work as specifically indicated.
6. Removal of Below-Grade Improvements:
   a. Remove foundations, footing, walls, catch basins, manholes, cisterns, septic tanks, underground pipe, and other work as specifically indicated.
   b. Remove foundation and underground obstructions to following depths:
      1) In areas to receive embankment: 2 ft. below natural ground.
      2) In areas to be excavated: 2 ft. below lower elevation of excavation.
      3) Other areas: 1 ft. below natural ground.

3.3 DISPOSAL OF WASTE MATERIALS

A. Burning on Owner's Property:
1. Burning of combustible cleared and grubbed materials is permitted on Owner's property only after all appropriate permits are obtained.

B. Removal of Waste Materials:
   1. Remove waste materials and unsuitable and excess topsoil from Owner's property and legally dispose of it.

3.4 ADJUSTMENTS

A. Repair or replace trees and vegetation damaged by construction operations, in a manner acceptable to Engineer.

B. Repair tree damage by qualified tree surgeon.

C. Replace trees which cannot be repaired and restored to full growth status, as determined by tree surgeon.

END OF SECTION
31 10 00

SECTION 31 23 17

EXCAVATING, FILLING AND BACKFILLING FOR STRUCTURES

PART 1 – GENERAL

1.1 DESCRIPTION

A. Related Work Specified Elsewhere:
   1. General Requirements: Section 01 11 00.
   2. Site Preparation: Section 31 10 00.
   3. Cast-in-Place Concrete: Section 03 30 00.

B. Definitions:
   1. Cohesionless and cohesive materials:
      a. Cohesionless materials: Gravels, gravel-sand mixtures, sand, and gravelly sands.
      b. Cohesive material: Clayey and silty gravels, gravel-silt mixtures, clayey and silt mixtures, clayey and silty sands, sand-clay mixtures, clays, silts, and very fine sands.
   2. Degree of compaction required: Percentage of maximum obtained by test procedure presented in ASTM D 698.

1.2 QUALITY ASSURANCE

A. Design Criteria: Conform to dimensions and elevations of structure.

1.3 PROTECTION

A. Repair damage caused by project construction operations to new and existing utility lines that are to be retained at locations shown on drawings, or made known prior to excavation.

B. Report immediately to Owner damages to existing utility lines that are not shown or locations of which were not known.

C. When utility lines are to be removed or relocated, notify Owner in time to prevent interruption of services.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Fill:

1. Fill material shall be on site material approved by the Engineer.
2. Material shall be free of debris, roots, organic or frozen materials.

B. Crushed Stone Drainage Fill: Number 57 crushed stone unless shown otherwise on the drawings.

PART 3 - EXECUTION

3.1 EXCAVATION

A. General :
1. Except where concrete for walls and footings is authorized to be deposited directly against excavated surfaces, extend excavation sufficient distance from walls and footings to allow for placing and removal of forms, for installation of services, and for inspection.
2. Excavations carried below indicated depths will not be permitted except to remove unsatisfactory material.
3. Excavate unsatisfactory material, as directed, below grades shown and replace with satisfactory materials.
4. Replace materials removed below indicated depths, without specific directions, with satisfactory materials and compact.
5. Column footings shall bear on compacted earth.

B. Drainage:
1. Perform excavation of site area and immediate surroundings to continually and effectively drain by gravity.
2. Do not allow water to accumulate in excavation.
3. Drain excavation to prevent softening of foundation bottom, undercutting of footings, or other actions detrimental to proper construction procedures.

C. Shoring:
1. Place shoring and sheet piling to protect banks, adjacent paving, structures and utilities.
2. Remove shoring, bracing, and sheeting to prevent caving as excavations are backfilled.

D. Excavated Materials:
1. Place satisfactory excavated material required for fill or backfill in permanent work or stockpile separately if materials cannot be readily placed.
2 Dispose of satisfactory material in excess of project requirements and unsatisfactory materials as directed by the engineer.
3. Place, grade, and shape stockpiles for proper drainage.

E. Final Grade:
1. Take care not to disturb bottom of excavation.
2. Do not make excavation to final grade until immediately prior to placing of concrete.

3. Excavations for column footings shall be inspected by the soils engineer before placing concrete. Owner shall be notified 24 hours in advance of required inspection.

3.2 FILLING AND SUBGRADE PREPARATION

A. Fill:
1. Provide fill where required to raise concrete slabs, appurtenances, and adjacent areas to required elevations.
2. Replace unsuitable material and removed topsoil material to required elevations, as required by the soils engineer.
3. Replace unstable material and remove topsoil within areas of structures.
4. Do not place fill on subgrade that is muddy, frozen, or contains frost.
5. Spread layers uniformly.
6. Moisten layers uniformly.
7. Compact each layer with self-propelled or towed sheepsfoot rollers except vibrating plate compactors shall be used within 5 ft of structures.
8. Bring surface to reasonably true and even plane for review.

B. Filling under Concrete Slabs on Grade:
1. Where concrete slabs are placed on earth or fill, remove organic matter and excavate subgrade within limits of slab construction for minimum of 6 in. Below natural grade.
2. Soils, other than undisturbed earth providing a uniform bearing under the entire slab, shall be prepared as described in 3 thru 7 below.
3. Loosen additional 6 in. below excavated material.
4. Moisten as required to obtain optimum moisture content.
5. Manipulate and recompact to density of 95% of Standard Proctor density complying with ASTM D 698 at not less than optimum moisture content.
6. Place fill in loose layers, not exceeding 8 in. In thickness and compact to at least 95% of maximum density.
7. Determine maximum density and moisture content in accordance with ASTM D 698.
8. Use 6 inches of compacted #57 crushed stone as top fill under slab on grade.

3.3 BACKFILLING

A. Place backfill material equivalent to specified fill material in layers around structures.

B. Backfill material shall not contain wood, grass, roots, broken concrete, stones, trash, or other debris.

C. Compact to density of 95% of Standard Proctor density complying with ASTM D 698 at not less than optimum moisture content.

D. Do not use water settlement procedures.

E. Do not deposit backfill intended to be mechanically tamped in water.

3.4 SOIL COMPACTION TESTING

A. After compaction, the laboratory shall perform one soil compaction test per 5,000 sq. Ft. or a minimum of one test per every two (2) feet of fill placed in compliance with ASTM D 1556 and ASTM D 2992.

B. If test results are not satisfactory, modify compaction procedure to obtain acceptable maximum density.

END OF SECTION
31 23 17

SECTION 31 23 19

CARE, DIVERSION AND REMOVAL OF WATER

PART 1 - GENERAL

1.1 PROTECTION

A. The Contractor shall provide all diversion and care of stream during construction.

B. The Contractor shall construct and maintain all necessary channels, flumes, drains, sumps, and/or other temporary diversion and protective work; shall furnish all materials required thereof; and shall furnish, install, maintain, and operate all necessary pumping and other equipment for removal of water from the various parts of the work and for maintaining the foundations and other parts of the work free from water. The Contractor shall be responsible for and shall repair at his expense any damage to the foundations, structures, or any other part of the work caused by floods, water or failure of any part of the diversion of protective work.

1.2 SUBMITTALS

A. Prior to beginning any work on diversion and care of stream and removal of water from foundations, the Contractor shall submit for approval a water control plan showing his proposed method for the diversion and care of the water during construction and removal of water from foundations. The plan may be placed in operation upon approval, but nothing in this section shall relieve the Contractor for full responsibility for the adequacy of the diversion and protection works.

PART 2 – PRODUCTS – NOT APPLICABLE

PART 3 - EXECUTION

3.1 EXAMINATION

A. The contractor shall verify the existing conditions.

3.2 DIVERSION AND CARE OF SURFACE WATER

A. The Contractor shall provide measures to route surface runoff and stream flows to prevent damage to the foundation subgrade, embankment fill, internal drains, permanent ditches, drawdown structures, outlet conduits and all other project features.

3.3 REMOVAL OF WATER FROM FOUNDATIONS

A. The Contractor should be aware that considerable removal and control of groundwater will be required during undercutting and replacement of unsuitable materials in the floodplain, installation of the seepage drains and construction of the spillway structure, conduits, and plunge pool.

B. The design of the dewatering system is the responsibility of the contractor.

C. Dewatering shall be accomplished in a manner that will prevent the loss of fines from the foundation.

D. The Contractor will maintain the stability of the excavated slopes and bottom of the trenches.

E. The contractor shall perform dewatering such that groundwater is lowered in all work areas to a depth of at least three feet below the lowest excavation level.

F. The dewatering system should function continuously, 24 hours a day, 7 days a week until structures, drains and fill (if appropriate) is placed to a level of at least three feet above stabilized groundwater levels.

G. Construction operations shall be performed in the dry.

H. The Contractor must use wellpoints, deep sumps, cased wells and/or similar means of effectively dewatering the floodplain area. Shallow sumps and trenches will not provide adequate dewatering.

I. The Contractor will be required to control seepage along the bottom of the excavation.

J. The Contractor shall install temporary groundwater monitoring wells at locations directed by the Geotechnical Engineer to confirm that the groundwater has been lowered to the level directed by the contract documents.

3.4 REMOVAL OF DIVERSION AND DEWATERING WORKS

A. All cofferdams or other temporary diversion and dewatering works downstream from the dam shall be removed from the stream channel in a manner approved by the Engineer.

B. All cofferdams or other temporary diversion and dewatering works constructed upstream from the dam and not a part of the permanent dam embankment shall be removed or leveled and graded to the extent required to prevent obstruction in

any degree whatever of the flow of water to the spillway or outlet works.

C. The portions of the dewatering works that are to remain in place such as wellpoints or cased wells shall be filled with cement grout as directed by the Engineer.

END OF SECTION
31 23 19

SECTION 31 23 34

TRENCHING AND BACKFILLING FOR PIPE

PART 1 GENERAL

1.01 SUMMARY

A. Section includes trenching, foundation preparation, backfilling and compaction (as applicable) for the installation of underground pipelines.

B. Related Sections:

1. Section 31 23 19 – Dewatering

1.02 REFERENCES

A. ASTM International:

1. ASTM C 1479, Standard Practice for Installation of Precast Concrete Sewer, Storm Drain, and Culvert Pipe Using Standard Installations

2. ASTM D 448, Standard Classification for Sizes of Aggregate for Road and Bridge Construction

3. ASTM D 698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort

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

5. ASTM D 2216, Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass

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

7. ASTM D 2487, Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)

8. ASTM D 2937, Standard Test Method for Density of Soil in Place by the Drive-Cylinder Method

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

1.03 SUBMITTALS

A. Submit the following for review prior to commencement of the work of this Section:

1. Certifications by material suppliers for proposed borrow materials showing conformance with the Specifications as applicable.

1.04 QUALITY ASSURANCE / QUALITY CONTROL

A. Owner will retain the services of independent Quality Control firm(s) to determine conformance of the materials and constructed work with the Specifications.

1.05 PROJECT CONDITIONS

A. The Contractor is solely responsible for excavation slope stability. Excavation work shall be in compliance with applicable local, state and federal regulations (including OSHA).

PART 2 PRODUCTS

2.01 SOURCE QUALITY CONTROL

A. Proposed materials and source of supply shall be approved by the Owner and Engineer as specified prior to delivery and use in the construction. The QC Firm shall also determine:

1. The suitability of excavated trench bottoms for pipe bedding.

2.02 STABILIZER AGGREGATE (if required)

A. Stabilizer Aggregate shall consist of coarse aggregate with gradation conforming to Size Number 2 aggregate (2 1/2 inch to 1 1/2 inch nominal size) as defined in ASTM D 448, or as required by the QC Firm.

2.03 PIPE BEDDING MATERIAL

A. Unless otherwise indicated, Bedding Material shall consist of either excavated material or imported material conforming to the specifications in the following paragraphs, depending on type of pipe.

B. Precast Reinforced Concrete Pipe (RCP) Bedding: Conform to the requirements for Category I, II or III materials as defined in ASTM C 1479 and as specified in the following paragraphs. Maximum particle size shall be one inch.

1. Category I materials consist of clean coarse-grained soils and having characteristics consistent with SW, SP, GW or GP classifications as defined by the Unified Soil Classification System (USCS).

2. Category II materials consist of coarse-grained soils with fines and having characteristics consistent with SM, SC, GM or GC classifications as defined by the USCS.

3. Category III materials consist of fine-grained soils having characteristics consistent with CL, ML, or CL-ML classifications as defined by the USCS.

C. PVC Pipe Bedding: Conform to the requirements for Class II or Class III materials as defined in ASTM D 2321 and as specified in the following paragraphs. Maximum particle size shall be: 3/4 inch (for pipe diameters greater than 6 inches); 1/2 inch for pipes 4-inch to 6-inch diameter; and 3/8 inch for pipes less than 4-inch diameter.

1. Class II materials consist of clean coarse-grained soils and having characteristics consistent with SW, SP, GW or GP classifications as defined by the Unified Soil Classification System (USCS).

2. Class III materials consist of coarse-grained soils with fines and having characteristics consistent with SM, SC, GM or GC classifications as defined by the USCS.

D. Testing of Bedding Material:

1. Soil Classification (ASTM D 2487): Minimum of one test for each visible change in material.

2.04 INITIAL TRENCH BACKFILL

A. Initial Trench Backfill shall have characteristics consistent with Class II, Class III, or Class IV-A materials as defined in ASTM D 2321 with maximum particle sizes as specified in subsection 2.03 and as specified in the following paragraphs. On-site excavated materials will be considered suitable for Initial Trench Backfill, provided that the material conforms to the above specified maximum particle sizes and is substantially free of roots, trash and other material which may be compressible or which cannot be compacted properly.

1. Class II and Class III materials are as defined in subsection 2.03.C.

2. Class IV-A materials consist of fine-grained inorganic soils having characteristics consistent with ML or CL classifications as defined by the USCS.

B. Testing of Initial Trench Backfill Material:

1. Soil Classification (ASTM D 2487): Minimum of one test for each visible change in material.

2.04 FINAL TRENCH BACKFILL

A. Final Trench Backfill shall consist of soil obtained from trench excavation, provided that it is substantially free of material which may be compressible or which cannot be compacted properly.

B. Testing of Final Trench Backfill Material:

1. Moisture-Density Curve (ASTM D 698): Minimum of one test for each visible change in material.

PART 3 EXECUTION

3.01 FIELD QUALITY CONTROL

A. The following tests shall be performed during placement and compaction of Final Trench Backfill in areas subject to vehicular traffic:

1. In-Place Density (using ASTM D 1556, ASTM D 2937, or ASTM D 6938): Minimum of one test for every lift of Final Trench Backfill placed for every 100 linear feet of trench (or fraction thereof) and at each road crossing.

2. Moisture Content (using ASTM D 2216 or ASTM D 6938): Minimum of one test for every lift of Final Trench Backfill placed for every 100 linear feet of trench (or fraction thereof) and at each road crossing.

3.02 PREPARATION

A. Establish required alignment and elevations for trench excavation.

B. Implement, operate and maintain dewatering system as required to control groundwater in conformance with the requirements of Section 031 23 19. This work shall be included as part of the Base Bid.

3.03 EXCAVATION

A. Excavate trenches for pipe installation where indicated on the Drawings and as specified in the following paragraphs.

B. The depth of trench excavation shall be as necessary to provide the required invert elevations and stable foundation for the pipe. Excavate trenches to the width necessary for proper installation of the piping as indicated on the Drawings.

C. Sloping, shoring or bracing shall be used as necessary to prevent failure of the trench banks. All trench protection shall conform to applicable laws and regulations, including OSHA regulations regarding trench excavation.

D. Pipe Foundation Stabilization:

1. If existing material below the pipe invert elevation is unsuitable (such as excessively soft soils) for properly laying pipe, stabilize the subgrade using methods approved by the Owner and Engineer. Stabilization shall include: undercutting and replacement with suitable material (as defined below); or in-situ stabilization of subgrade.

2. For undercutting, excavate and remove the unsuitable material to the required depth below the pipe invert as determined by the QC firm and approved by the Owner and Engineer. Replace the removed unsuitable material with Stabilizer Aggregate, or as required by Owner's QC Firm, which shall be placed in horizontal loose lifts no greater than six inches and "lightly" compacted. "Light" compaction for purposes of trench stabilization is defined as spreading and tamping with a backhoe bucket to ensure reasonable uniformity of stabilized trench bottom.

E. Removal of materials beyond the indicated subgrade elevations, without authorization by the Owner and Engineer, shall be classified as unauthorized excavation and shall be backfilled and compacted at no additional cost to the Project.

F. Unless otherwise approved by the Owner and Engineer, a minimum of 6-inch thickness of Bedding Material shall be placed under all pipe. Thoroughly compact Bedding Material using manually-guided compaction equipment and accurately grade to the required elevations and slopes.

G. If rock is encountered in trench excavations, remove rock to a depth of six inches below the pipe invert elevation using methods approved by the Owner and Engineer. Place and compact Stabilizer Aggregate or Bedding Material to required elevation for installation of pipe as approved by the Owner and Engineer.

H. Removal of rock and stabilization of trench subgrade shall be included as part of the Base Bid.

I. Where suitable subgrade conditions are encountered, as determined by the QC Firm and approved by the Owner and Engineer, shape the existing exposed materials as required to provide a firm and uniform bearing for piping. Thoroughly compact using manually-guided compaction equipment.

3.04 PIPE INSTALLATION

A. Install piping as shown on the Drawings and as specified in the applicable sections of the Specifications.

3.05 BACKFILLING AND COMPACTING

A. Backfilling and compacting shall conform to the details shown on the Drawings and as specified in the following paragraphs.

B. Place and compact Initial Trench Backfill around pipes in the "haunch zone" up to the pipe "springline" (centerline). Contractor shall take necessary measures to prevent the pipe from

being displaced upwards during compaction of fill in this area. If applicable, continue placement and compaction of the material around and over pipes as follows:

1. Reinforced Concrete Pipe (Gravity-Flow): No Initial Trench Backfill is required above pipe centerline.

2. PVC Pipe: Place and compact Initial Trench Backfill in six-inch lifts up to approximately 12 inches above the top of the pipe.

C. Initial Trench Backfill shall be placed on both sides of pipes at the same time and to approximately the same elevation. Each lift shall be thoroughly compacted using manually-guided compaction equipment.

D. Do not place Final Trench Backfill until the piping, as installed, conforms to the specifications.

E. Place and compact Final Trench Backfill for pipe installations as follows:

1. Place backfill in lifts not greater than six-inch loose thickness and compact as specified in the following paragraphs.

2. Other than areas described in the following paragraph 3, compact trench backfill to at least 95 percent of the material's maximum dry density as determined by ASTM D 698.

3. For piping under pavement and building pads, backfill placed within the top 12 inches of the finished subgrade shall be compacted to a minimum of 98 percent of the material's maximum dry density as determined by ASTM D 698.

F. Place Final Trench Backfill up to the required subgrade elevation for roadway construction or finish grade (as applicable) and as indicated on the Drawings.

G. Placement and compaction of trench backfill around and over pipes shall be performed in a manner that does not damage the pipes. Pipes that are damaged shall be replaced.

H. Construction traffic shall not be allowed to cross installed pipes prior to placement and compaction of the full depth of cover.

I. Materials not meeting density specification requirement shall be scarified, recompacted and retested.

3.07 DISPOSAL OF MATERIAL

A. Excess and unsuitable materials shall be placed on-site where approved by the Owner and Engineer or hauled off site and legally disposed of.

END OF SECTION
31 23 34

SECTION 31 25 14

SOIL EROSION AND SEDIMENT CONTROL

PART 1 - GENERAL

1.1 SCOPE

A. These specifications cover control of Soil Erosion from the project area during the construction period and until such time as permanent erosion control is effective.

1.2 REFERENCE STANDARDS (LATEST EDITIONS)

A. Environmental Protection Agency, Guidelines for Erosion and Sediment Control Planning and Implementation.

B. Environmental Protection Agency, Control of Erosion and Sediment Deposition from Construction of Highways and Land Development.

C. Environmental Protect Agency, Guidelines for Erosion and Sediment Control Planning and Implementation , Environmental Protection Agency.

D. Soil Conservation Service, Georgia, Manual of Standards and Specifications for Control of Soil Erosion and Sediment in Areas Undergoing Urban Development.

E. State Soil and Water Conservation Committee of Georgia, Manual for Erosion and Sediment Control in Georgia.

PART 2 - PRODUCTS

2.1 MATERIALS

A. All sediment and erosion control measures to meet local ordinance and Georgia Department of Natural Resources rule and regulations.

PART 3 - EXECUTION

3.1 STORM DRAINAGE SYSTEM

A. As much of the storm drainage system as is practicable shall be initially installed and surface water diverted into the system. The remainder of the storm drainage system shall be installed as soon as conditions will allow.

B. Temporary sediment barriers shall be maintained around street drainage structures until final subgrade preparation is begun. It is recommended that the Contractor utilize shoulder berms, silt screen, or hay bales staked to the ground for this purpose.

3.2 GRADING OPERATIONS

A. Grading operations shall be scheduled such that the ground surface will be disturbed for the shortest possible time. Excavated materials shall be immediately placed into compacted embankments. Large areas shall be maintained as flat as possible to minimize soil transport through surface flow.

B. Wherever steeper slopes or abrupt changes in grade are required, a diversion or berm shall be constructed at the top of the slope to cause the surface water to flow along the diversion to a control point. In no case shall surface water be allowed to flow uncontrolled down slopes.

3.3 GRASSING AND MULCHING

A. Slopes and graded areas as indicated on drawing that are not to be immediately planted with permanent grass shall be seeded with a temporary seed that will produce a fast growing cover resistant to erosion. For shorter duration exposures, mulch may be applied alone to control erosion. Temporary seeding and mulch shall be applied to the steeper slopes.

3.4 EROSION CONTROL CHECK DAMS

A. Check dams shall be constructed across all drainage outfalls leaving the project area. All drainage leaving the site shall be diverted to a check dam. Check dams may be constructed of rubble, logs, brush, fencing, or other non-corrosive material. Sufficient wire mesh shall be employed to hold the lighter materials in place. Brush dams shall be tightly compacted by passes of tracked equipment.

B. The maximum height of the check dams shall be four feet and they shall be arranged to cause ponding behind them. Provision shall be made to remove the accumulated sediment periodically. The Contractor shall be responsible for anchoring check dams so that they will not be dislodged during high flows. Check dams shall be placed in the series in drainage outfalls to control sediment transport and shall be removed when permanent erosion control is effective.

3.5 PERIMETER SILT BARRIERS

A. Prior to commencement of any clearing or earthwork install the perimeter silt fencing at all points where flows onto adjacent properties.

3.6 SLOPE DRAINS

A. Temporary drains shall be provided to convey surface water down slopes. Slope drains may be constructed of pipe, fiber mats, rubble, Portland cement, concrete, bituminous concrete, or plastic sheets stabilized with asphalt. Slope drains shall be provided with an

apron at their tops to anchor them and properly direct water into them. Stone or rubble shall be placed at slope drain outlets to prevent scour at these points.

3.7 DIVERSION DITCHES

A. Temporary diversion ditches shall be constructed and maintained during construction to protect structures and site improvements, to direct drainage into the storm drainage and/or siltation ponds, and to protect other property.

3.8 LEVEL SPREADERS

A. Level spreaders shall be constructed to convert a concentrated flow of storm runoff into sheet flow and to outlet it onto areas stabilized by existing vegetation without causing erosion. Entrance to spreader must be graded in a manner to insure that runoff enters directly onto a zero percent graded channel. Construct level lip on zero percent grade to insure uniform spreading of storm runoff. Periodic inspection and maintenance must be provided to insure the intended purpose is accomplished.

3.9 MAINTENANCE

A. Maintain all erosion control structures at all times during the construction period.
   1. The contractor shall make daily inspections of the erosion control structures and shall construct adjustments and temporary structures as may be required to meet changing conditions.
   2. After each rain the Contractor shall inspect all erosion control structures and shall make repairs, reinforcements, and/or adjustments as required to keep the structures in working order.

END OF SECTION
31 25 14

SECTION 31 32 20

GEOTEXTILES

PART 1 - GENERAL

1.1 SCOPE

This specification covers nonwoven geotextile fabrics for use in all applications. The geotextile shall serve as a permeable layer allowing water to flow through while retaining the soil underneath.

1.2 REFERENCES

The following are ASTM Standards applicable to this Specification:

D3786 Hydraulic Bursting Strength of Knitted Goods and Nonwoven Fabrics - Diaphragm Bursting Strength Tester Methods

D4354 Sampling of Geotextiles for Testing

D4355 Deterioration of Geotextiles from exposure to ultraviolet light & Water (Xenon-arc Type Apparatus)

D4491 Water Permeability of Geotextiles by Permittivity

D4533 Trapezoid Tearing Strength of Geotextiles

D4632 Breaking Load and Elongation of Geotextiles (Grab Method)

D4751 Determining Apparent Opening Size of a Geotextile

D4759 Determining the Specification Conformance of Geotextiles

D4833 Index Puncture Resistance of Geotextiles, Geomembranes and Related Products

1.3 SUBMITTALS

Technical specifications and samples of the proposed geotextile(s) shall be submitted for approval.

PART 2 - PRODUCTS

2.1 MATERIAL REQUIREMENTS

Fibers used in the manufacture of geotextiles, and the threads used in joining geotextiles by sewing, shall consist of long-chain synthetic polymers. Where the geotextile will be in contact with fresh concrete, polyester fabrics will not be permitted. They shall be formed into a nonwoven network such that the filaments or yarns retain dimensional stability relative to each other, including selvedges. The geotextile shall be mildew and rot resistant, resistant to ultraviolet light exposure, insect and rodent resistant and inert to commonly encountered chemicals and hydrocarbons.

Geotextiles shall be nonwoven, needle-punched type having a minimum average roll weight of 8.0 oz./sq. yard and shall conform to the physical requirements stipulated in Table 1. Heat bonded geotextiles will not be permitted.

TABLE 1
REQUIREMENTS FOR NONWOVEN GEOTEXTILES

PROPERTY	TEST METHOD	
Tensile Strength (lbs.) 1/	ASTM D4632 Grab Test	200 min.
Bursting Strength (psi) 1/	ASTM D3786 Diaphragm Tester	360 min.
Elongation At Failure (Percent) 1/	ASTM D4632 Grab Test	$50
Puncture (lbs.) 1/	ASTM D3787	90 min.
Ultraviolet Light (Percent residual tensile strength)	ASTM D4355 150 Hours Exposure	70 min.
Apparent Opening Size - AOS	ASTM D4751	$#60 2/
Coefficient of Normal Permeability (cm/sec)	ASTM D4491	

1/ Minimum average roll value (weakest principle direction)
2/ U.S. Standard sieve size

2.2 SAMPLING AND TESTING

The geotextile shall be subject to sampling and testing. Sampling shall be in accordance with ASTM D4354, and testing procedures in accordance with the methods given on Table 1. If the manufacturer's quality control procedures do not include the testing requirements in Table 1, a competent laboratory shall be retained by the manufacturer of the fabric for testing to determine the necessary values.

2.3 MANUFACTURER'S CERTIFICATE

The manufacturer shall file with the purchaser a certificate stating the name of the manufacturer, the chemical composition of the filaments or yarns, and other pertinent information so as to fully describe the geotextile. The manufacturer shall include in the certificate a guarantee stating that the geotextile that is furnished meets the requirements of the specification. The certificate shall be attested to by a person having legal authority to bind the company. Either mismarking or misrepresentation by the manufacturer shall be reason to discontinue acceptance under these specifications. Notice sent to the manufacturer by the purchaser regarding the discontinuance of acceptance will be considered to be notice to all wholesalers, jobbers, distributors, agents and other intermediaries handling the manufacturer's product.

2.4 PACKAGING AND IDENTIFICATION

The geotextile shall be provided in rolls wrapped with protective covering to protect from mud, dust, dirt, debris, and light. The geotextile shall be free of defects or flaws which affect its physical or chemical properties. Each roll of fabric in the shipment shall be labeled with a number or symbol to identify that production run.

PART 3 - EXECUTION

3.1 SHIPMENT AND STORAGE

During periods of shipment and storage, the geotextile will be kept wrapped until ready for installation. Rolls shall be labeled so as not to allow damage due to lifting devices or other equipment. Geotextile shall not be stored directly on the ground. Rolls of geotextile will be stored under cover on outside on racks supporting the roll at least 6 inches off the ground. Partial rolls shall be labeled as such, any rolls partially used shall not remain uncovered or unwrapped for over 48 hours.

3.2 SUBGRADE PREPARATION

Prior to placement of the geotextile, the subgrade shall be prepared in accordance with the plans. The subgrade shall be free of significant amounts of organic soil, mud, all tree stumps and roots, all metal objects or other sharp protruding objects that could penetrate the fabric. Filter fabric should be installed in the dry and ruts and similar irregularities shall be filled to prevent

overstressing the fabric due to voids underneath the fabric. The subgrade shall be prepared such that when the geotextile and stone are installed there will be intimate contact between the subsoil and the geotextile.

3.3 FABRIC INSTALLATION

The geotextile fabric shall be installed as indicated on the plans. Unless otherwise indicated, geotextile shall be unrolled and placed in the upslope-downslope direction. Placement shall begin from the furthermost downstream section and proceed in the upstream direction. Unless otherwise indicated, overlaps shall be a minimum of 18 inches. Soft subgrade may require additional overlap. Geotextile shall be secured to the slope with pins, U-shaped bars, or other means as suggested by the manufacturer or as directed by the Engineer. Spacing of securing pins shall not exceed ten feet in any direction. Ample slack will be provided in the geotextile, since fill placement tends to stretch and tighten the fabric. If anchorage trenches are indicated on the plans, special care must be taken to ensure the fabric is properly secured, has adequate slack, and will not be pulled from the trench.

If, during installation of the geotextile, the fabric becomes contaminated or clogged by sift from surface runoff or other sources, the damaged fabric shall be removed and replaced at no additional cost to the owner.

3.4 PLACEMENT OF BEDDING STONE

Bedding stone shall be placed on the geotextile as indicated on the plans. Bedding stone shall be dumped on top of previously-placed stone and spread to a uniform thickness. Dumping of the stone directly on the geotextile should be avoided. No construction vehicles or equipment will be allowed directly on the fabric. Any ruts that develop during spreading or compacting shall be filled with additional aggregate rather than bladed from surrounding areas.

END OF SECTION
31 32 20

SECTION 31 37 00

STONE RIP RAP

PART 1 - GENERAL

1.1 WORK INCLUDED

A. The contractor shall furnish all labor, materials, tools, and equipment necessary for hauling and properly placing stone rip rap at the locations and to the limits indicated on the drawings or as directed by the Engineer.

B. The rip rap and bedding shall be keyed into surface such that the surface of the completed rip rap approximately coincides with that of the general ground surface.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Furnish stone consisting of trap rock, granite, gneiss, or other hard, durable, tough rock having a percentage of wear more than 4.5 as determined in accordance with AASHTO Designation T3.

B. Stone shall be of the size and/or weight shown on the Drawings and free from clay, caked stone dust, or other objectionable materials.

C. The individual rip rap rock fragments shall be dense, sound and resistant to abrasion and shall be free from cracks, seams and other defects that would tend to increase unduly their destruction by water and frost actions.

D. Samples of the proposed rip rap material will be furnished to the Engineer for approval.

E. Rip rap shall be reasonably well graded with a maximum particle size as indicated on the drawings.

F. Bedding for the rip rap shall consist of a layer of geotextile (filter fabric) overlain by approximately 6 inches of No. 57 stone to prevent punching of the fabric when the rip rap is placed. The geotextile shall be AMOCO 4553, LINQ 180EX, MIRA FI 180N or approved equivalent. The fabric will be place as recommended by the manufacturer. The Contractor’s operations shall be such as to prevent damage to the fabric.

PART 3 - EXECUTION

3.1 CONSTRUCTION

A. The rip rap need not be compacted but shall be placed to grade in a manner to insure that the smaller rock fragments serve to fill the spaces between the larger rock fragments in such a manner as will result in well-keyed, densely placed, uniform layers of rip rap of the specified thickness. Hand placing will be required only to the extent necessary to secure the results specified above.

B. The Contractor's placement techniques will be subject to the approval of the Engineer.

END OF SECTION
31 37 00

SECTION 31 52 00

TEMPORARY COFFERDAMS

PART 1 – GENERAL

1.1 SCOPE:

A. Summary or Work: The Contractor shall furnish all labor, material and equipment necessary for the removal of all surface and subsurface waters from spillway excavation areas. This section includes the construction of temporary cofferdams with earth embankment and/or steel sheet piling and bracing. The work includes the removal of temporary cofferdams at the completion of the work.

1.2 APPLICABLE PUBLICATIONS:

A. American Society for Testing and Materials (ASTM):
1. ASTM A 36 - Standard Specification for Carbon Structural Steel
2. ASTM A328 - Standard Specification for Steel Sheet Pile

1.3 DEFINITIONS: (Not Used)

1.4 SUBMITTALS:

The Contractor shall make submittals in accordance with Section 01 33 23 and the following:

A. The Contractor shall submit to the Engineer a dewatering plan, which includes the cofferdam design and dewatering equipment, safety procedures and sequence of construction prior to the start of any such operations.

B. Submit certification from a professional engineer registered in the State of Georgia that the temporary cofferdam has been designed to meet the criteria specified herein.

C. Two sets of prints of the cofferdam system bearing the seal of an engineer registered in the State of Georgia shall be submitted to the Engineer for reference.

D. Acquire all permits required to discharge water and protect waterways from turbidity during the dewatering operation.

1.5 QUALIFICATIONS: (Not Used)

1.6 RESPONSIBILITIES:

A. This is a performance specification. Except as otherwise specified or indicated, selection of equipment, materials, and methods shall be Contractor's responsibility. The dewatering

of any excavation areas and disposal of all water handled shall be in strict accordance with all local and state government rules and regulations.

B. The Contractor shall be responsible for the design of the dewatering system including, but not necessarily limited to, the temporary cofferdam, required pump equipment, temporary shoring, as well as any miscellaneous temporary structures required.

1.7 CERTIFICATIONS AND TESTING:

A registered professional engineer in the State of Georgia hired by the Contractor shall inspect, accept, and certify any used sheet piling proposed for dewatering purposes.

1.8 INSPECTION COORDINATION:

The Contractor shall provide access to the work for the Engineer as requested for inspection. The Contractor shall provide 48 hours notice of its intention to begin new work activities.

1.9 WARRANTY: (Not Used)

PART 2 – PRODUCTS

2.1 PRODUCT REQUIREMENTS:

All materials used in the construction of the dewatering facilities shall be selected, furnished and installed by the Contractor in accordance with the design as submitted to the Engineer.

A. Earth Embankment Cofferdam shall meet all of the requirements outlined in these specifications including Specification Section 02200, "Earthwork".

B. Sheet Pile Cofferdam:

1. The Contractor shall provide new or used sheet piling for use in the cofferdam conforming to the requirements of ASTM A328.

2. Structural Steel: The Contractor shall provide structural steel for use in the cofferdam conforming to the requirements of ASTM A36.

PART 3 – EXECUTION

3.1 PERFORMANCE:

The Contractor shall furnish and install cofferdams in accordance with the following.

A. The Contractor shall employ the services of a structural engineer registered in the State of Georgia for the design of the cofferdam system. The walls and bracing shall be designed to withstand, without damage, the maximum water elevations indicated on the drawings.

B. Approximate locations of cofferdam, structural characteristics and embedment depths shall be determined by the engineer designing the cofferdam.

C. The layout and design of the interior and exterior bracing system for the cofferdam shall fully accommodate with appropriate factors of safety, all applied loading indicated. Those loadings may be increased if considered appropriate by the engineer designing the cofferdam.

3.2 DEWATERING:

A. The Contractor shall provide adequate equipment for removal of storm, subsurface or cofferdam leakage waters, which may accumulate in the cofferdam interior.

B. The Contractor shall perform all work for the water control structure in the cofferdam interior free from water. The Contractor shall furnish, install, maintain, and operate all necessary pumping and other equipment necessary for dewatering the work area.

1. All dewatering equipment shall be in first-class condition and shall at all times be maintained and operated at the efficiency and capacity necessary for maintaining the cofferdam interior free from standing water or wet conditions that prevent proper construction.

C. The Contractor shall provide dewatering facilities with stand-by pumps with 100 percent standby capacity.

D. The Contractor shall comply with all local, state and federal regulations when disposing of water generated by dewatering operations.

3.3 REMOVAL OF DEWATERING SYSTEM AND COFFERDAMS:

A. The Contractor shall remove the dewatering system in its entirety when construction has been completed.

END OF SECTION
31 52 00

SECTION 32 34 35

PRE-FABRICATED CONCRETE BRIDGE

PART 1 - GENERAL

1.1 DESCRIPTION

A. These specifications are for a fully engineered clear span bridge of precast concrete construction and shall be regarded as minimum standards for design.

1.2 DIMENSIONS

A. Width: The inside clear width of bridge shall be as shown on the drawings.

B. Camber: The bridge shall be cambered to provide a residual camber as required to provide the concrete surface to be straight after the application of bridge rails and concrete fill, including creep.

1.3 DESIGN

A. The bridge shall be designed by a professional engineer licensed in the State of Georgia and experienced in concrete bridge design. The Engineer shall submit a signed and sealed letter stating that the bridge has been designed in accordance with the design criteria of this specification, including all applicable codes and standards and generally accepted engineering principles.

B. In addition to normal dead loads, the bridge shall be designed for the following:

1. Uniform Live Load: Pedestrian walkways shall be designed for an evenly distributed live load of 100 pounds per square foot of deck area.

2. Wind Load: All bridges shall be designed for wind load in accordance with ASCE 7-10.

3. Design Criteria: The design of the bridge shall be in accordance with HL-93 Truck loading and all AASHTO and GDOT Requirements.

4. Seismic: All bridges shall be designed for seismic loads in accordance with ASCE 7-10.

5. Temperature: Bridge shall be designed to accommodate a temperature differential of 120 degrees Fahrenheit. Slip pads of UHMW polyethylene shall be placed between the smooth surface of this setting plate and the smooth bearing plate of the bridge. At least 1" clearance shall be provided between the bridge end and concrete abutments.

6. Deflection: The vertical deflection of the bridge due to design live load shall not exceed 1/400 of the span length. The horizontal deflection due to lateral wind load shall not exceed 1/500 of the span length.

1.4 QUALIFICATIONS

A. Manufacturers of precast bridge components will be considered acceptable if they meet the following minimum requirements.

B. The bridge manufacturer shall have been in the business of design and fabrication of bridges for a minimum of five years and provide a list of ten successful bridge projects, of similar construction, each of which has been in service at least three years.

C. The bridge supplier shall be the designer and fabricator of the bridge and shall not assign, sublet, or subcontract any part of the bridge fabrication.

PART 2 - MATERIALS

2.1 BRIDGE MATERIALS

A. All structural members shall have a minimum thickness of material of at least 5/16".

B. Concrete for precast concrete bridge components shall be of regular weight (145 pcf minimum) concrete and shall have a minimum 28-day compressive strength of at least 5000 psi.

C. Concrete for bridge topping shall be of regular weight (145 pcf minimum) concrete and shall have a minimum 28-day compressive strength of at least 4000 psi with an entrained air content of 3-6 percent.

D. All bolts and other metal components shall be stainless steel.

E. Welding materials shall be in strict accordance with the American Welding Society (AWS). Structural Welding Code, D1.1. Filler metal as specified in 4.1 shall be used for the particular welding process required. Welders will be certified in accordance with AWS D1.1.

PART 3 - EXECUTION

3.1 FABRICATION

A. Bridge fabricator shall be certified by the Precast Concrete Institute.

B. To ensure quality control during bridge fabrication, the bridge supplier shall be the designer and fabricator of the bridge and shall not assign, sublet, or subcontract any part of the bridge fabrication.

C. Workmanship, fabrication, and shop connections shall be in accordance with American Association of State Highway and Transportation Officials Specifications (AASHTO) and GDOT requirements.

3.2 RAILINGS & ACCESSORIES

A. All railings shall have a smooth inside surface with no protrusions or depressions and shall have rounded edges. Railing heights shall be in accordance with AASHTO requirements but shall be a minimum height of 42 inches above the walking surface.

3.3 FINISHES

A. Exposed surfaces of precast bridge components shall have smooth formed surfaces with no form marks or fins. Concrete walkway and driving surfaces shall be in accordance with ASSHTO and GDOT requirements but at a minimum shall have a medium broom finish perpendicular to the walking/driving direction.

3.4 DELIVERY AND ERECTION

A. Bridges will be delivered by truck to a location nearest to the site accessible by roads. Hauling permits and freight charges are the responsibility of the manufacturer.

B. The manufacturer will notify the customer in advance of the expected arrival time. Information regarding delays after the trucks depart the plant such as inclement weather, delays in permits, re-routing by public agencies or other circumstances will be passed on to the customer as soon as possible but the expense of such unavoidable delays will not be accepted by the manufacturer.

C. The manufacturer will advise the customer of the actual lifting weights, attachment points and all necessary information to install the bridge. Unloading, erection, splicing, bolting, and proper lifting equipment is the responsibility of the contractor.

D. The owner shall procure all necessary information about the site and soil conditions. The project engineer will design the bridge abutments, piers and/or footings. The contractor shall install the anchor bolts in accordance with the bridge manufacturer's anchor bolt spacing dimensions. All grounding and lightning protection installation shall be the responsibility of the contractor.

3.5 WARRANTY

A. The bridge manufacturer shall provide a warranty against defects in material and workmanship for a period of ten years.

* END OF SECTION *
32 34 35

SECTION 35 20 10

CAST IRON SLUICE GATES

PART 1 - GENERAL

1.1 SCOPE

A. Provide all labor, materials, tools, equipment and related items required to furnish and install heavy-duty sluice gates required on the project.

B. Each gate shall be furnished and installed complete with anchor bolts, operating stem, gate lift operator and other appurtenances as specified or needed to make a complete and operable installation.

1.2 QUALIFICATIONS

A. All sluice gates shall be furnished by a manufacturer fully experienced, (minimum 5 years), reputable and qualified in the manufacture of the materials to be furnished.

B. Sluice gates shall be designed, constructed and installed in accordance with the best practices and methods and shall comply with these Specifications as applicable.

1.3 SUBMITTALS

Submittals shall comply with requirements of the section entitled “Shop Drawings, Product Data and Samples” of these Specifications, and shall include product data to show compliance with this section.

PART 2 - PRODUCTS

2.1 GENERAL

A. Gates, stems, lifts and other appurtenances shall be the size, type, material and construction as shown on the drawings and specified herein. Gates shall meet the requirements of AWWA Specifications C-501 (latest revision) or as modified per these Specifications.

B. Sluice gates shall be as manufactured by Waterman or approved equal. Sluice gates shall be with manual operators, flat back mounted on existing riser and of the sizes and with seating and unseating heads as indicated on the drawings.

C. All component parts shall be of the type of material shown, and interchangeable where

size and material are the same without grinding, chipping or special fitting in the field. All mating and sliding parts shall be fully machined. All sluice gate parts, including lift, shall be designed for the heads shown with a minimum safety factor of 5.

D. All materials used in the construction of the gate and appurtenances shall be the best suited for the application and shall be as follows:

Gate Part or Item	Bronze Trim	ASTM Standard Number
Anchor Bolts & Nuts	18-8 Stainless (4)	A-582-Type 303 or 276-Type 304
Frame, Slide and Guide Rails	Cast Iron	A-126 Class B
Seating Faces	Naval Bronze	B-2-1-Alloy 482
Wedges Fasteners	Manganese Bronze 18-8 Stainless (4)	B-584-Alloy 865 (Bolts) A-193 Grade B8 (Nuts) A-194 Grade 8
Stem Block	Manganese Bronze	B-584-Alloy 865
Sill Plate	Cast Iron	A-126 Class B
Seal	Rubber	2000-Grade R-62
Retainer	Naval Bronze	B-2-1-Alloy 482
Yoke	Cast Iron	A-126 Class B
Stem	18-8 Stainless (1)	A-582-Type 303 or 276-Type 304

2.2 FRAME AND GUIDE RAILS

A. The frame and guide rails shall be of cast iron and cast integrally and shall be machined on all bearing and contact surfaces.

B. Frame and guides shall be designed for the maximum head indicated with a minimum safety factor of 5 with respect to tensile, compressive and shear strength.

C. Guides shall be of such length as to support at least one-half of the vertical height of the slide when in the open position.

2.3 SLIDE

A. The slide shall be made of cast iron, with strengthening ribs where required, and a reinforced section to receive the seating faces.

B. The slide shall be designed for the maximum head indicated with a minimum safety factor of 5 with respect to tensile, compressive and shear strength.

C. The slide shall have tongues on each side extending its full length, and these tongues shall be accurately machined on contact surfaces. Surfaces of the slide that come in contact with the seat facings and wedges shall be accurately machined. The maximum allowable clearance between the slide and slide guide shall be 1/16 inch.

D. A thrust-nut pocket shall be provided above the horizontal centerline of the slide reinforced by ribs. The thrust-nut pocket shall be drained.

2.4 SEATING FACES

A. Seating faces shall be made of strips of rolled or extruded bronze or stainless steel. They shall be firmly secured in finished grooves in the frame and slide faces in such a way as to insure that they will remain in place, free from distortion and loosening during the life of the sluice gate

B. These faces shall be of ample section and so finished that the maximum clearance between the seating surfaces, with the slide in the closed position shall be 0.004 inches.

2.5 SEALS

A. Resilient seals for flush-bottom gates shall be of natural or synthetic rubber.

B. Reclaimed rubber shall not be used.

C. Rubber compounds shall contain no more than 1.5 part of wax per 100 parts of rubber hydrocarbon.

D. Rubber compounds shall be free of vegetable oils, vegetable-oil derivatives, animal fats, and animal oils.

E. Rubber seals shall be resistant to microbiological attack, copper poisoning and ozone attack.

F. Design of the seal should be such as to provide tight shutoff.

G. Seals shall be mounted on the slide and shall be securely held in place with a retainer bar bolted to the slide leaving an unobstructed flush invert.

2.6 THRUST NUT

A. Gate shall be provided with a thrust nut for connecting the stem to the slide. It shall be of ample design to take the thrust developed during gate operation under the maximum operating head condition loads with a safety factor of 5 in opening and closing direction.

B. The thrust nut and slide shall be constructed to prevent turning off the thrust nut in the pocket in the slide.

C. On nonrising stem gates, the thrust nut shall be threaded but not keyed or pinned to the stem, so that the nut and slide can move up and down the stem, as the stem turns.

2.7 WEDGING DEVICES

A. Sluice gate shall be equipped with adjustable side-wedging devices to provide contact between the slide and frame facings when the gate is in closed position.

B. All faces shall be accurately machined to give maximum contact and wedging action.

C. Wedges shall be fully adjustable and so designed that they will remain in the fixed position after adjustment.

D. On all gates larger than 24 inches in size that will be subject to unseating heads, top and bottom wedging devices shall be provided. If the gates are flush-bottom closure gates, they will be provided with top wedges only.

2.8 ASSEMBLY BOLTS, STUDS, NUTS AND ANCHOR BOLTS

A. All assembly bolts, studs, nuts, and anchor bolts shall be of such size and spacing as required to provide for the design forces with a safety factor of 5.

B. Bolting on circular flanged-back gates shall mate with 25-pound or 125-pound drilling as specified in ANSI B16.1.

C. An adequate number of holes shall be provided in the flange on the back of the gate to prevent leakage under the design heads and to resist the shearing action caused by closing and opening forces.

2.9 WALL THIMBLES

A. Wall thimbles shall be type “F” made of cast iron and shall be furnished by the gate manufacturer.

B. The wall thimble shall provide a rigid mounting designed to prevent warping of the gate frame during installation.

2.10 STEMS AND STEM COUPLINGS

A. Operating stems shall be of a size to safely withstand, without buckling or permanent distortion, stresses induced by normal operating forces.

B. Stems shall be fabricated from round bar stock of stainless steel and shall be provided with 29 degrees modified or full acme threads.

C. Stems composed of 2 or more sections shall be joined by bronze couplings threaded and keyed to stems, or couplings of the same material as the stems, pinned, bolted or welded and pinned to the stems.

2.11 STEM GUIDES

A. Stem guides shall be cast, with bronze bushings, and mounted on cast brackets. Guides shall be adjustable in two directions and shall be so constructed that when properly spaced they will hold the stem in alignment and still allow enough play to permit easy operation.

B. Stem guide spacing shall be as recommended by the manufacturer, but in no case shall it exceed and l/r ratio of 200.

C. Brackets shall be attached to the wall by anchor bolts of sufficient strength to prevent twisting or sagging under load.

2.12 MANUAL OPERATOR FLOOR STANDS

A. Manual operation shall be by handwheel or crank-operated floor stands or bench stands as shown on the plans. Handwheel operated type shall be without gear reduction and crank-operated type shall have either a single- or double-gear reduction depending upon the lifting capacity required. Each type shall be provided with a threaded cast bronze lift nut to engage the operating stem.

B. Tapered roller bearings shall be provided above and below a flange on the operating nut to support both opening and closing thrusts.

C. Floor stands shall operate the gates with not greater than a 40-pound pull on the crank or handwheel. Gears, where required, shall be steel or cast iron with machine-cut teeth designed for smooth operation. The pinion shafts on crank-operated floor stands, either single or double, shall be supported on tapered roller bearings or needle bearings. All components shall be totally enclosed in a cast iron case and cover. Positive mechanical seals shall be provided on the operating nut and the pinion shafts where they extend from the cast iron case or gear box to retain lubricant and to exclude moisture and dirt. Lubricating fittings shall be provided for the lubrication of all gears and bearings.

D. The removable crank shall be cast iron with a revolving brass grip. Floor stands shall include a cast iron pedestal design to position the input shaft approximately 36 inches above the operating floor.

2.13 WORKMANSHIP

A. All part in the sluice gate and accessories shall be accurately machined on mating and bearing surfaces. All like parts, except the bronze seating surfaces shall be interchangeable so that replacement parts can be furnished at any time and attached in the field with a minimum of fitting, chipping or re-machining. All parts shall conform to design dimensions and shall be free of defects of material and workmanship. All attaching bolt holes shall be drilled accurately to layout indicated on the drawings.

B. All casting shall be clean and sound without defect capable of impairing their functions.

C. The seating facings shall be machined to a finish of 63 micro-inch. The applicable standard is ANSI B46.1. All mating surfaces, such as guides-to-frame and frame-to-wall thimble, shall be machined flat.

2.14 SHOP TESTING

A. Before the final assembly, all seating and wedging surfaces shall be thoroughly cleaned of all foreign materials and final adjustments made. With the gate full closed, clearance between the seating faces shall be checked with a 0.004 inch thickness gauge. If this thickness gauge can be inserted between seating facers, wedging devices must be readjusted or the gate slide or gate frame or both re-machined, until insertion is no longer possible. In the event of re-machining, clearances will again be checked as stated above.

B. After completion, all seating and wedging surfaces shall be thoroughly cleaned of all foreign materials and final adjustments made. The sluice gate shall then be shop operated from the fully-closed to the fully-opened position to verify that the assembly is workable.

PART 3 - EXECUTION

3.1 STORAGE AND INSTALLATION

A. Sluice gates and equipment shall be stored and installed in accordance with the installation manual furnished by the gate manufacturer. After installation, the completely assembled gate, stem, guides and lift shall be operated through one full cycle to demonstrate satisfactory operation. Such adjustments as necessary will be made until operation is approved by the Engineer.

B. The gate shall be subjected to leakage tests and pass the standard requirements for maximum leakage as specified in AWWA C501.

3.2 PAINTING

All cast iron parts of the sluice gate (not in bearing or sliding contact) and stem guides shall be painted in accordance with manufacturer's recommendations.

END OF SECTION

35 20 10

SECTION 35 70 11

FOUNDATION DRAIN

PART 1 - GENERAL

1.1 DESCRIPTION

A. The foundation drain shall be constructed at the locations shown on the Contract Drawings or as directed by the project Engineer.

B. Care shall be taken to avoid clogging the drains during the progress of the work, and should any drain become clogged or obstructed from any cause before final acceptance of the work, it shall be cleaned out in a manner approved by the project Engineer or replaced by and at the expense of the Contractor.

C. The foundation drain shall consist of fine filter material compacted in place as indicated on the construction drawings. The upper 18" of drain material shall be protected by filter fabric as indicated on the construction drawings

PART 2 - PRODUCTS

2.1 MATERIALS

A. The fine filter material shall conform to ASTM Specification C-33- Concrete Sand,

B. The geotextile (filter fabric) shall be Linq Industries 180EX, AMOCO 4553, Mirafi 180N or approved equal.

PART 3 - EXECUTION

3.1 CONSTRUCTION

A. A typical cross section for the foundation drain is shown on the plans.

B. A general description of the drainage system has been presented in Part 1 of this Specification.

C. Care shall be taken to maintain the integrity of the various layers of filter material to assure that contamination of any layer or violation of the minimum specified layer thickness does not occur throughout the entire construction process.

D. The drainage system shall be constructed in the dry.

E. The contractor will be responsible for any damage to the drainage system which occurs during construction of the embankment.

END OF SECTION
35 70 10

SECTION 35 70 12

TOE DRAIN

PART 1 - GENERAL

1.1 DESCRIPTION

A. The toe drain system shall be constructed at the locations shown on the Contract Drawings or as directed by the project Engineer.

B. Care shall be taken to avoid clogging the drains during the progress of the work, and should any drain become clogged or obstructed from any cause before final acceptance of the work, it shall be cleaned out in a manner approved by the project Engineer or replaced by at the expense of the Contractor.

C. No pipe which has been damaged shall be used in the work if, in the opinion of the project Engineer, the pipe is unfit for use.

D. Travel over drainpipe will not be permitted until the pipe has been covered to a depth sufficient to prevent damage to or breakage of the pipe.

E. The toe drain system shall consist of 6 inch I.D. perforated drain pipe surrounded by coarse filter material in turn wrapped in a layer of geotextile (filter fabric). The coarse filter shall provide at least 6 inches of thickness between all points of the pipe and the filter fabric. The filter fabric shall separate the coarse filter from the embankment fill and subgrade at all points.

F. The pipe shall be laid to lines and grades so as to approximately follow the downstream abutment contacts and toe of the existing embankment or as directed by the project Engineer. No portion of the drain system shall be placed with adverse slopes. Toe drain location shall be set in the field by the project Engineer.

PART 2 - PRODUCTS

2.1 MATERIALS

A. The drain pipe shall be 6 inch I.D. PVC drain pipe SDR-35, The pipe shall meet AASHTO M 278 and ASTM F 758 Specifications. All pipe in the dam embankment drain system shall be perforated, except as shown on the Drawings.

B. The fine filter material shall conform to ASTM Specification C-33 Standard Gradation Sand.

C. The coarse filter material shall consist of washed stone conforming to #89 and/or #57 gradation.

D. The geotextile (filter fabric) shall be Linq Industries 180EX, AMOCO 4553, Mirafi 180N or approved equivalent.

PART 3 - EXECUTION

3.1 CONSTRUCTION

A. A typical cross section for the toe drain system is shown on the plans.

B. A general description of the drain system has been presented in Part 1 of this Specification.

C. The methods of lowering the pipe into the trench and placing pipe in position shall be such as to prevent getting dirt inside of the pipe and coupling, and to prevent damage to the pipe.

D. Before and during assembly of a joint, all parts shall be cleaned and shall be free of mud, ice, oil and grease.

E. All joints shall be made in accordance with the manufacturer's recommendations.

F. End caps shall be fastened in place on the upper ends of the drains, and a small animal guard shall be fastened to the discharge end of the pipe.

G. The layers of coarse filter material shall be placed and tamped to provide uniform bedding for the pipe.

H. Care shall be taken to maintain the integrity of the various layers of filter material to assure that contamination of any layer or violation of the minimum specified layer of thickness does not occur.

I. The drain system shall be constructed in the dry.

J. The perforated pipe shall be laid carefully in the coarse filter material. The pipe shall then be covered with the additional minimum thickness of filter materials as shown on the Drawing. The filter materials shall be placed and tamped about the pipe so as not to disturb the pipe and to hold it securely in position while the overlying material is being placed.

K. The contractor will be responsible for any damage to the drain system which occurs during construction of the embankment.

L. Install filter fabric with a minimum 24 inch lap at all fabric joints.

END OF SECTION

35 70 12

SECTION 35 70 14

COLLAR DRAIN

PART 1 - GENERAL

1.1 DESCRIPTION

A. The collar drain system shall be constructed at the locations shown on the Contract Drawings or as directed by the project Engineer.

B. Care shall be taken to avoid clogging the drains during the progress of the work, and should any drain become clogged or obstructed from any cause before final acceptance of the work, it shall be cleaned out in a manner approved by the project Engineer or replaced by at the expense of the Contractor.

C. No pipe which has been damaged shall be used in the work if, in the opinion of the project Engineer, the pipe is unfit for use.

D. Travel over drainpipe will not be permitted until the pipe has been covered to a depth sufficient to prevent damage to or breakage of the pipe. Follow manufacturers' requirements for minimum cover.

E. The collar drain system shall consist of 6 inch I.D. perforated drain pipe surrounded by course filter material in turn wrapped in a layer of geotextile (filter fabric) as shown on the drawings. The course filter shall provide at least 6 inches of thickness between all points of the pipe and the filter fabric. The filter fabric shall separate the coarse filter from the embankment fill and subgrade at all points.

F. The pipe shall be laid to lines and grades so as to approximately follow the downstream abutment contacts and collar of the existing embankment or as directed by the project Engineer. No portion of the drain system shall be placed with adverse slopes. Collar drain location shall be set in the field by the project Engineer.

PART 2 - PRODUCTS

2.1 MATERIALS

A. The drain pipe shall be 6 inch I.D. PVC drain pipe SDR-35,. The pipe shall meet AASHTO M 278 and ASTM F 758 Specifications. All pipe in the dam embankment drain system shall be perforated, except as shown on the Drawings.

B. The fine filter material shall conform to ASTM Specification C-33 Standard Gradation Sand.

C. The coarse filter material shall consist of washed stone conforming to #89 and/or #57

gradation.

D. The geotextile (filter fabric) shall be Linq Industries 180EX, AMOCO 4553, Mirafi 180N or approved equivalent.

PART 3 - EXECUTION

3.1 CONSTRUCTION

A. A typical cross section for the collar drain system is shown on the plans.

B. A general description of the drain system has been presented in Part 1 of this Specification.

C. The methods of lowering the pipe into the trench and placing pipe in position shall be such as to prevent getting dirt inside of the pipe and coupling, and to prevent damage to the pipe.

D. Before and during assembly of a joint, all parts shall be cleaned and shall be free of mud, ice, oil and grease.

E. All joints shall be made in accordance with the manufacturer's recommendations.

F. End caps shall be fastened in place on the upper ends of the drains, and an small animal guard shall be fastened to the discharge end of the pipe.

G. The layers of coarse filter material shall be placed and tamped to provide uniform bedding for the pipe.

H. Care shall be taken to maintain the integrity of the various layers of filter material to assure that contamination of any layer or violation of the minimum specified layer of thickness does not occur.

I. The drain system shall be constructed in the dry.

J. The perforated pipe shall be laid carefully in the coarse filter material. The pipe shall then be covered with the additional minimum thickness of filter materials as shown on the Drawing. The filter materials shall be placed and tamped about the pipe so as not to disturb the pipe and to hold it securely in position while the overlying material is being placed.

K. The contractor will be responsible for any damage to the drain system which occurs during construction of the embankment.

L. Install filter fabric with a minimum 18 inch lap at all fabric joints.

END OF SECTION

SECTION 35 70 14

BLANKET DRAIN

PART 1 - GENERAL

1.1 DESCRIPTION

A. The blanket drain system shall be constructed at the locations shown on the Contract Drawings or as directed by the project Engineer.

B. Care shall be taken to avoid clogging the drains during the progress of the work, and should any drain become clogged or obstructed for any cause before final acceptance of the work, it shall be cleaned out in a manner approved by the project Engineer or replaced by and at the expense of the Contractor.

C. Travel over pipe will not be permitted until the drain has been covered to a depth sufficient to prevent displacement of filter material.

D. The blanket drain system shall consist of a fine filter material compacted in place as indicated on the construction drawings.

PART 2 - PRODUCTS

2.1 MATERIALS

A. The fine filter material shall conform to ASTM Specification C-33 Standard Gradation Sand.

PART 3 - EXECUTION

3.1 CONSTRUCTION

A. A typical cross section for the blanket drain system is shown on the plans.

B. A general description of the drainage system has been presented in Part 1 of this specification.

C. The layers of fine filter material shall be placed and tamped to provide uniform thickness.

D. Care shall be taken to maintain the integrity of the various layers of filter material to assure that contamination of any layer or violation of the minimum specified layer thickness does not occur.

E. The drain system shall be constructed in the dry.

F. The Contractor will be responsible for any damage to the drain system which occurs during construction of the embankment.

END OF SECTION
35 70 14

SECTION 40 05 33

HIGH DENSITY POLYETHYLENE (HDPE) PIPE

PART 1 - GENERAL

1.1 SECTION DESCRIPTION

A. This specification includes high-density polyethylene (PE 3408) pressure pipe primarily intended for temporary pipes through coffer dams.

1.2 REFERENCES

Reference:	**Title:**
AWWA C906	Polyethylene (PE) pressure Pipe & Fittings, 4 inch through 63 inch for water dist.
ASTM D3035	Standard Spec for PE Pipe (DR-PR) Based on Controlled Outside Diameter
ASTM D3261	Butt Heat Fusion PE Fittings for PE Pipe & Tubing
ASTM D3350	Standard Specification for PE Pipe & Fittings Materials
ASTM D1238	Melt Flow Index
ASTM D1505	Density of Plastics
ASTM D2837	Hydrostatic Design Basis
NSF Std.#14	Plastic Piping Components & Related Materials

1.3 GENERAL

A. USE
1. High Density Polyethylene (HDPE) pipes/fittings shall be used for temporary pipes through coffer dams as shown on the drawings.

B. DOCUMENTATION
1. Documentation from the resin's manufacturer showing results of the following tests for resin identification:
(a) Melt Flow Index ASTM D1238
2. Density ASTM D1505

C. MANUFACTURER
1. All HDPE pipe and fittings shall be from a single manufacturer, who is fully experienced, reputable and qualified in the manufacture of the HDPE pipe to be furnished. The pipe shall be designed, constructed and installed in accordance with the best practices and methods and shall comply with these Specifications. Qualified manufacturers shall be: PLEXCO Division of Chevron Chemical Company, DRISCOPIPE as manufactured by Phillips Products Co., Inc., SCLAIRPIPE as manufactured by Dupont of Canada or equal as approved by the Engineer.

D. FINISHED PRODUCT EVALUATION
1. Production staff shall check each length of pipe produced for the items listed below. The results of all measurements shall be recorded on production sheets, which become part of the manufacturer's permanent records.
a. Pipe in process shall be checked visually, inside and out for cosmetic defects (grooves, pits, hollows, etc.)
b. Pipe outside diameter shall be measured using a suitable periphery tape to ensure conformance with ASTM F714 or ASTM D3035, whichever is applicable.
c. Pipe wall thickness shall be measured at 12 equally spaced locations around the circumference at both ends of the pipe to ensure conformance with ASTM F714 or ASTM D3035, whichever is applicable.
d. Pipe length shall be measured.
e. Pipe marking shall be examined and checked for accuracy.
f. Pipe ends shall be checked to ensure they are cut square and clean.
g. Subject inside surface to a "reverse bend test" to ensure the pipe is free of oxidation (brittleness).

E. STRESS REGRESSION TESTING
1. The polyethylene pipe manufacturer shall provide certification that stress regression testing has been performed on the specific polyethylene resin being utilized in the manufacture of this product. This stress regression testing shall have been done in accordance with ASTM D2837 and the manufacturer shall provide a product supplying a minimum Hydrostatic Design Basis (HDB) of 1,600 psi as determined in accordance with ASTM D2837.

F. COMPATIBILITY
1. Contractor is responsible for compatibility between pipe materials, fittings and appurtenances.

PART 2 - PRODUCTS

2.1 MATERIALS FOR PIPE SIZES 4-INCH DIAMETER AND LARGER

A. Materials used for the manufacture of polyethylene pipe and fittings shall be made from a PE 3408 high density polyethylene resin compound meeting cell classification 345434C per ASTM D3350; and meeting Type lll, Class C, Category 5, Grade P34 per ASTM D1238.
B. High Density Polyethylene (HDPE) pipe shall comply with AWWA Specifications C906.
C. If rework compounds are required, only those generated in the Manufacturer's own plant from resin compounds of the same class and type from the same raw material supplier shall be used.
D. Dimensions and workmanship shall be as specified by ASTM F714. HDPE fittings and transitions shall meet ASTM D3261. HDPE pipe shall have a minimum density of 0.955 grams per cubic centimeter. All HDPE pipe and fittings shall have a Hydrostatic Design Basis (HDB) of 1,600 psi.
E. HDPE pipe and accessories 4-inch diameter and larger, shall be 160 psi at 73.4E F

meeting the requirements of Standard Dimension Ration (SDR) 17 as MINIMUM STRENGTH.

F. The pipe manufacturer must certify compliance with the above requirements.

2.2 FITTINGS

A. All molded fittings and fabricated fittings shall be fully pressure rated to match the pipe SDR pressure rating to which they are made. All fittings shall be molded or fabricated by the manufacturer. No Contractor fabricated fittings shall be used unless approved by the Engineer.

B. The manufacturer of the HDPE pipe shall supply all HDPE fittings and accessories as well as any adapters and/or specials required to perform the work as shown on the Drawings and specified herein.

C. All fittings shall be installed using butt-fused fittings, thermo-fused fittings/couplings, or flanged adapters and must be approved by the Engineer. No size on size wet taps shall be permitted.

D. All transition from HDPE pipe to ductile iron or PVC must be approved by the Engineer and per the HDPE pipe manufacturer's recommendations and specifications.

2.3 PIPE IDENTIFICATION

A. The following shall be continuously indent printed on the pipe or spaced at intervals not exceeding 5-feet:
   1. Name and/or trademark of the pipe manufacturer.
   2. Nominal pipe size.
   3. Dimension ratio.
   4. The letters PE followed by the polyethylene grade in accordance with ASTM
   5. D1248 followed by the hydrostatic design basis in 160's of psi, e.g., PE 3408.
   6. Manufacturing standard reference, e.g., ASTM F714 or D-3035, as required.
   7. A production code from which the date and place of manufacture can be determined.

PART 3 - EXECUTION

3.1 JOINTING METHOD

A. The pipe shall be joined with butt, heat fusion joints as outlined in ASTM D2657. All joints shall be made in strict compliance with the manufacturer's recommendations. A factory qualified joining technician as designated by pipe manufacturer or experienced, trained technician shall perform all heat fusion joints in the presence of the Engineer.

B. Lengths of pipe shall be assembled into suitable installation lengths by the butt-fusion process. All pipe so joined shall be made from the same class and type of raw material made by the same raw material supplier. Pipe shall be furnished in standard laying lengths not to exceed 50 feet and no shorter than 20 feet.

C. On days butt fusions are to be made, the first fusion shall be a trial fusion in the presence of the Engineer. The following shall apply:
   1. Heating plates shall be inspected for cuts and scrapes. The plate temperature shall

be measured at various locations to ensure proper heating/melting per manufacturer's recommendations and approval by the Engineer.

2. The fusion or test section shall be cut out after cooling completely for inspection.
3. The test section shall be 12" or 30 times (minimum) the wall thickness in length and 1" or 1.5 times the wall thickness in width (minimum).
4. The joint shall be visually inspected as to continuity of "beads" from the melted material, and for assurance of "cold joint" prevention (i.e. – joint shall have visible molded material between walls of pipe). Joint spacing between the walls of the two ends shall be a minimum of 1/16" to a maximum 3/16".

D. The polyethylene flange adapters at pipe material transitions shall be backed up by stainless steel flanges conforming to ANSI B16.1 and shaped as necessary to suit the outside dimensions of the pipe. The flange adapter assemblies shall be connected with corrosion resisting bolts and nuts of Type 316 Stainless Steel as specified in ASTM A726 and ASTM A307. All bolts shall be tightened to the manufacturer's specified torques. Bolts shall be tightened alternatively and evenly. After installation apply a bitumastic coating to bolts and nuts.

3.2 INSTALLATION

A. High Density Polyethylene (HDPE) Pipe shall be installed in accordance with the instruction of the manufacturer, as shown on the Drawings and as specified herein. A factory qualified joining technician as designated by the pipe manufacturer shall perform all heat fusion joints.

B. Care shall be taken in loading, transporting and unloading to prevent injury to the pipe. Pipe or fitting shall not be dropped. All pipe or fitting shall be examined before installation, and no piece shall be installed which is found to be defective. Any damage to the pipe shall be repaired as directed by the Engineer.

C. Care shall be taken during transportation of the pipe such that it will not be cut, kinked or otherwise damaged.

D. Ropes, fabric or rubber protected slings and straps shall be used when handling pipes. Chains, cables or hooks inserted into the pipe ends shall not be used. Two slings spread apart shall be used for lifting each length of pipe.

E. Pipes shall be stored on level ground, preferably turf or sand, free of sharp objects, which could damage the pipe. Stacking of the polyethylene pipe shall be limited to a height that will not cause excessive deformation of the bottom layers of pipes under anticipated temperature conditions. Where necessary due to ground conditions, the pipe shall be stored on wooden sleepers, spaced suitably and of such width as not to allow deformation of the pipe at the point of contact with the sleeper or between supports.

F. Pipe shall be stored on clean level ground to prevent undue scratching or gouging. The handling of the pipe shall be in such a manner that the pipe is not damaged by dragging it over sharp and cutting objects. The maximum allowable depth of cuts, scratches or gouges on the exterior of the pipe is 5 percent of wall thickness. The interior pipe surface shall be free of cuts, gouges or scratches.

G. Pipe shall be laid to lines and grade shown on the Drawings with bedding and backfill as shown on the Drawings.

H. Sections of pipe with cuts, scratches or gouges exceeding 5 percent of the pipe wall thickness shall be removed completely and the ends of the pipeline rejoined.

I. The pipe shall be joined by the method of thermal butt fusion, as outlined in PART 3 –

Execution, Section 3.1 Joining Method. All joints shall be made in strict compliance with the manufacturer's recommendations.

J. Flange connections shall be provided with a full-face neoprene gasket.

K. If a defective pipe is discovered after it has been installed, it shall be removed and replaced with a sound pipe in a satisfactory manner at no additional cost to the Owner. All pipe and fittings shall be thoroughly cleaned before installation, shall be kept clean until they are used in the work and when laid, shall conform to the lines and grades required.

END OF SECTION

40 05 33