STEVE MORNHINWEG WRE PROJECT
NOBLE COUNTY 2025

SPECIFICATION INDEX

CONSTRUCTION SPECIFICATIONS

2-CLEARING AND GRUBBING
6-SEEDING, SPRIGGING, AND MULCHING
7-CONSTRUCTION SURVEYS
8-MOBILIZATION
21-EXCAVATION
23-EARTHFILL
26-TOPSOIL
32-STRUCTURE CONCRETE
52-STEEL PIPE
94-CONTRACTOR QUALITY CONTROL

MATERIAL SPECIFICATIONS

522-AGGREGATES FOR PORTLAND CEMENT CONCRETE
531-PORTLAND CEMENT
534-CONCRETE CURING COMPOUND
539-STEEL REINFORCEMENT (FOR CONCRETE)
554-STEEL PIPE
581-METAL

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Construction Specification 2—Clearing and Grubbing

1. Scope
The work consists of clearing and grubbing and disposal of trees, snags, logs, brush, stumps, shrubs, and rubbish from the designated areas.

2. Protection of existing vegetation
Trees and other vegetation designated to remain undisturbed shall be protected from damage throughout the duration of the construction period. Any damages resulting from the contractor's operations or neglect shall be repaired by the contractor.

Earthfill, stockpiling of materials, vehicular parking, and excessive foot or vehicular traffic shall not be allowed within the drip line of vegetation designated to remain in place. Vegetation damaged by any of these or similar actions shall be replaced with viable vegetation of the same species, similar condition, and like size unless otherwise approved by the contracting officer.

Any cuts, skins, scrapes, or bruises to the bark of the vegetation shall be carefully trimmed and local nursery accepted procedures used to seal damaged bark.

Any limbs or branches 0.5 inch or larger in diameter that are broken, severed, or otherwise seriously damaged during construction shall be cut off at the base of the damaged limb or branch flush with the adjacent limb or tree trunk. All roots 1-inch or larger in diameter that are cut, broken, or otherwise severed during construction operations shall have the end smoothly cut perpendicular to the root. Roots exposed during excavation or other operations shall be covered with moist earth or backfilled as soon as possible to prevent the roots from drying out.

3. Marking
The limits of the area(s) to be cleared and grubbed will be marked by stakes, flags, tree markings, or other suitable methods. Trees to be left standing and uninjured will be designated by special markings placed on the trunk about 6 feet above the ground surface.

4. Clearing and grubbing
All trees not marked for preservation and all snags, logs, brush, stumps, shrubs, rubbish, and similar materials shall be cleared from within the limits of the designated areas. Unless otherwise specified, all stumps, roots, and root clusters that have a diameter of 1 inch or larger shall be grubbed out to a depth of at least 2 feet below subgrade for concrete structures and 1 foot below the ground surface at embankment sites and other designated areas.

5. Disposal
All materials cleared and grubbed from the designated areas shall be disposed of at locations shown on the drawings or in a manner specified in section 7. The contractor is responsible for complying with all local rules and regulations and the payment of any and all fees that may result from disposal at locations away from the project site.

6. Measurement and payment
Method 1—For items of work for which specific units prices are established in the contract, the cleared and grubbed area is measured to the nearest 0.1 acre. Payment for clearing and grubbing is made for the total area within the designated limits at the contract unit price. Such payment will

constitute full compensation for all labor, equipment, tools, and all other items necessary and incidental to the completion of the work.

Method 2—For items of work for which specific unit prices are established in the contract, the length of the cleared and grubbed area is measured to the nearest full station (100 feet) along the line designated on the drawing or identified in the specifications. Payment for clearing and grubbing is made for the total length within the designated limits at the contract unit price. Such payment will constitute full compensation for all labor, equipment, tools, and all other items necessary and incidental to the completion of the work.

Method 3—For items of work for which specific unit prices are established in the contract, each tree, stump, and snag having a diameter of 4 inches or larger and each log having a diameter of 4 inches or larger and a length of 10 feet are measured before removal. The size of each tree and snag is determined by measuring its trunk at breast height above the natural ground surface. The size of each log is determined by measuring the butt and by measuring its length from butt to tip. The size of each stump is measured at the top. Diameter is determined by dividing the measured circumference by 3.14.

Payment for clearing and grubbing of each tree, stump, and snag having a diameter of 4 inches or larger and each log having a diameter of 4 inches or larger and a length of 10 feet or larger is made at the contract unit price for its size designation as determined by the following schedule:

Measured diameter (in)	Size designation (in)
4 to 8	6
8 to 12	10
12 to 24	18
24 to 36	30
36 to 60	48
Over 60	60

The sum of such payments shall constitute full compensation for clearing and grubbing (including the clearing and grubbing of smaller trees, stumps, snags, logs, brush, shrubs, and roots), applicable permits and associated fees, and rubbish removal. Such payment shall constitute full compensation for all labor, equipment, tools, and all other items necessary and incidental to the completion of the work.

Method 4—For items of work for which specific lump sum prices are established in the contract, payment for clearing and grubbing is made at the contract lump sum price. Such payment shall constitute full compensation for all labor, equipment, tools, and all other items necessary and incidental to the completion of the work.

All Methods—The following provisions apply to all methods of measurement and payment. Compensation for any item of work described in the contract, but not listed in the bid schedule will be included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in section 7.

7. Items of work and construction details

Items of work to be performed in conformance with this specification and the construction details are:

a. <u>Bid Item 2, Clearing & Grubbing</u>

(1) This item consists of furnishing all materials, labor, and equipment necessary for clearing the Wetland Units #2, #3, #4, #5 and the area of the Circle Pit, Deep Water Habitat, Earthfill and Excavation work areas by the removal and disposal of any trees, snags, stumps, shrubs, logs, rubbish, and vegetative materials as shown on the drawings or as directed by the Contracting Officer's Representative.

(2) Disposal of trees, snags, logs, stumps, shrubs, and rubbish material shall be by burning and/or burying onsite at locations to be designated in the field by the Contracting Officer's Representative.

(3) Payment shall be by Section 6, Method 4 of this specification.

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Construction Specification 6—Seeding, Sprigging, and Mulching

1. Scope

The work consists of preparing the area for treatment; furnishing and placing seed, sprigs, mulch, fertilizer, inoculant, lime, and other soil amendments; and anchoring mulch in designated areas as specified.

The following BioPreferred® product categories are applicable to this specification:

— Mulch and compost materials

— Erosion control materials

— Fertilizers

— Agricultural spray adjuvants

2. Material

Seed—All seed must conform to the current rules and regulations of the State where it is being used and must be from the latest crop available. It must meet or exceed the standard for purity and germination listed in section 7.

Seed must be labeled in accordance with State laws and U.S. Department of Agriculture rules and regulations under the Federal Seed Act in effect on the date of invitations for bids. Bag tag figures are evidence of purity and germination. No seed may be accepted with a test date of more than 9 months before the date of delivery to the site.

Seed that has become wet, moldy, or otherwise damaged in transit or storage will not be accepted. The percent of noxious weed seed allowable must be as defined in the current State laws relating to agricultural seeds. Each type of seed must be delivered in separate sealed containers and fully tagged unless an exception is granted in writing by the contracting officer.

Fertilizer—Unless otherwise specified, the fertilizer must be a commercial-grade fertilizer. It must meet the standard for grade and quality specified by State law. Where fertilizer is furnished from bulk storage, the contractor must furnish a supplier's certification of analysis and weight. When required by the contract, a representative sample of the fertilizer must be furnished to the contracting officer for chemical analysis.

Inoculants—The inoculant for treating legume seeds must be a pure culture of nitrogen-fixing bacteria prepared specifically for the species and must not be used later than the date indicated on the container or as otherwise specified. A mixing medium, as recommended by the manufacturer, must be used to bond the inoculant to the seed. Two times the amount of the inoculant recommended by the manufacturer must be used, except that four times the amount must be used when seed is applied using a hydraulic seeder. Seed must be sown within 24 hours of treatment and must not remain in the hydraulic seeder longer than 4 hours.

Lime and other soil amendments—Lime must consist of standard ground agriculture limestone, or approved equivalent. Standard ground agriculture limestone is defined as ground limestone meeting current requirements of the State department of agriculture. Other soil amendments must meet quality criteria and application requirements specified in section 7.

Mulch tackifiers—Asphalt emulsion tackifiers must conform to the requirements of ASTM D977, Specification for Emulsified Asphalt. The emulsified asphalt may be rapid setting, medium setting, or slow setting. Nonasphaltic tackifiers required because of environmental considerations must be as specified in section 7.

Straw mulch material—Straw mulch must consist of wheat, barley, oat or rye straw, hay, grass cut from native grasses, or other plants as specified in section 7. The mulch material must be air-dry, reasonably light in color, and must not be musty, moldy, caked, or otherwise of low quality. The use of mulch that contains noxious weeds is not permitted. The contractor must provide a method satisfactory to the contracting officer for determining weight of mulch furnished.

Other mulch materials—Mulching materials, such as wood cellulose fiber mulch, mulch tackifiers, synthetic fiber mulch, netting, and mesh may be required for specialized locations and conditions. These materials, when specified, must be accompanied by the manufacturer's recommendations for methods of application.

3. Seeding mixtures, sod, sprigs, and dates of planting

The application rate per acre for seed mixtures, sprigs, or sod and date of seeding or planting must be as shown on the plans or as specified in section 7.

4. Seedbed preparation and treatment

Areas to be treated must be dressed to a smooth, firm surface. On sites where equipment can operate on slopes safely, the seedbed must be adequately loosened (4 to 6 inches deep) and smoothed. Depending on soil and moisture conditions, disking or cultipacking, or both, may be necessary to properly prepare a seedbed. Where equipment cannot operate safely, the seedbed must be prepared by hand methods by scarifying to provide a roughened soil surface so that broadcast seed will remain in place.

If seeding is to be accomplished immediately following construction operations, seedbed preparation may not be required except on a compacted, polished, or freshly cut soil surface.

Rocks larger than 6 inches in diameter, trash, weeds, and other debris that will interfere with seeding or maintenance operations must be removed or disposed of as specified in section 7.

Seedbed preparation must be discontinued when soil moisture conditions are not suitable for the preparation of a satisfactory seedbed as determined by the responsible engineer.

5. Seeding, sprigging, fertilizing, mulching, and stabilizing

All seeding or sprigging operations must be performed in such a manner that the seed or sprigs are applied in the specified quantities uniformly in the designated areas. The method and rate of seed application must be as specified in section 7. Unless otherwise specified, seeding or sprigging must be accomplished within 2 days after final grading is completed and approved.

Fertilizer, lime, and other soil amendments must be applied as specified in section 7. When specified, the fertilizer and soil amendments must be thoroughly incorporated into the soil immediately following surface application.

The rate, amount, and kind of mulching or mesh must be as specified in section 7. Mulches must be applied uniformly to the designated areas. They must be applied to areas seeded not later than 2 working days after seeding has been performed. Straw mulch material must be stabilized within 24 hours of application using a mulch crimper or equivalent anchoring tool or by a suitable tackifier. When the mulch crimper or equivalent anchoring tool is used, it must have straight blades and be the type manufactured expressly for and capable of firmly punching the mulch into the soil. Where the equipment can be safely operated, it must be operated on the contour. Hand methods must be used where equipment cannot safely operate to perform the work required.

The tackifier must be applied uniformly over the mulch material at the specified rate, or it must be injected into the mulch material as it is being applied. Mesh or netting stabilizing materials must be applied smoothly but loosely on the designated areas. The edges of these materials must be buried or securely anchored using spikes or staples as specified in section 7.

The contractor must maintain the mesh or netting areas until all work under the contract has been completed and accepted. Maintenance must consist of the repair of areas damaged by water erosion, wind, fire, or other causes. Such areas must be repaired to reestablish the intended condition and to the design lines and grades required by the contract. The areas must be refertilized, reseeded, and remulched before the new application of the mesh or netting.

6. Measurement and payment

Method 1—For items of work for which specific unit prices are established in the contract, each area treated is measured as specified in section 7 and the area is calculated to the nearest 0.1 acre. Payment for treatment is made at the contract unit price for the designated treatment, which will constitute full compensation for completion of the work.

When specified as an item of work, mesh or netting is measured to the nearest square yard of surface area covered and accepted. Payment is made at the contract unit price and will constitute full compensation for completion of the work.

Method 2—For items of work for which specific lump-sum prices are established in the contract, the quantity of work will not be measured for payment. Payment for this item is made at the contract lump-sum price for the item and constitutes full compensation for the completion of the work.

Method 3—For items of work for which lump-sum prices are established in the contract, payment is made as the work proceeds. Progress payments are determined as specified in section 7. Payment of the lump sum contract price constitutes full compensation for completion of the work.

All Methods—The following provisions apply to all methods of measurement and payment. Compensation for any item of work described in the contract but not listed in the bid schedule is included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in section 7.

7. **ITEMS OF WORK AND CONSTRUCTION DETAILS**

Items of work to be performed in conformance with this specification and the construction details are:

a. **Bid Item 12, Sprigging, Bermudagrass**

(1) This item consists of furnishing, fertilizing, and planting bermudagrass (Cynodon dactylon) sprigs and applying hay mulch on the constructed embankments, excavated auxiliary spillways, and other disturbed areas as directed by the Contracting Officer's Representative.

(2) Sprigs shall consist of healthy uninjured live stems, runners (stolons), and root divisions (rhizomes) of locally adapted bermudagrass varieties. The contractor shall notify the engineer of the sources of bermudagrass sprigs and secure approval of the sources before any roots are harvested and delivered to the job site. The contractor shall provide the engineer free access to the source for the purpose of inspection.

(a) Prior to harvest, top growth greater than two inches shall be removed from the area where the sprigs are obtained.

(b) sprigs shall be kept moist and protected from wind and sunlight following harvest and during periods of transportation and/or storage.

(c) Sprigs shall be planted within 30 hours of harvest.

(3) Planting times shall be between February 1 and June 15.

(4) Fertilizer shall be a 1-1-1 ratio in a pelleted form and uniformly mixed. Labeling or analysis records shall be in accordance with the Oklahoma Fertilizer Law. Where fertilizer is furnished from bulk storage, the contractor shall furnish a supplier's certification of analysis and weight.

(a) Fertilizer shall be uniformly applied at a rate of 40 pounds nitrogen, 40 pounds phosphate (P_2O_5), and 40 pounds potash (K_2O) per acre.

(b) The fertilizer shall be incorporated into the soil prior to planting or by the planting equipment, provided the fertilizer is not applied in such a manner as to be in direct contact with the sprigs.

(5) Site Preparation - Prior to sprigging, the area shall be prepared by any method which will result in a clean, friable, firm seedbed.
(a) Tillage will be at a minimum depth of 4 inches.
(b) Rills and gullies will be filled or tilled if needed prior to seeding.

(6) Sprigs shall be planted in the following manner:

(a) Within 24 hours of site preparation. The soil at the time of planting shall be moist and not frozen. If planting cannot be accomplished when adequate moisture is

available (moisture cannot be detected to a depth of 4”), areas to be planted shall be moistened to a depth of 2 inches prior to sprigging and immediately following.

(b) Planted at a depth between one and three inches.

(c) Sprigs will be uniformly distributed at a minimum rate of 60-80 bushels of sprigs per acre and planted on the approximate contour, with a distance between rows not to exceed 24 inches.

(d) Sprigs may need to be manually planted in areas inaccessible to equipment by placing a minimum of 3 healthy sprigs on a maximum of 15-inch centers with soil firmly packed over the sprigs.

(e) After planting, the area shall be compacted with a flexible rolling-type soil packer or cultipacker, and left in a smooth condition.

(7) Hay Mulch shall be free of noxious weed seeds and other invasive pests and shall consist of native prairie, weeping lovegrass, introduced bluestem, or fescue. Hay mulch should have been harvested at a time when stems are available.

(a) Mulch shall be applied after planting operations.

(b) Mulch shall be applied in a reasonably continuous unbroken cover of uniform thickness at a rate of not less than 2 1/2 tons of air-dry hay per acre (1 lb/sq.yd). A minimum 80% ground cover for all designated treatment areas shall be achieved.

(c) Mulch shall be anchored into the soil to a minimum depth of 2 inches by pinning, crimping, or other methods approved by the COR. Anchoring shall be done on the approximate contour at a spacing of no more than 8 inches and set to run straight. The operation shall be such that approximately 50% of the mulch material remains on the soil surface after anchoring. The mulch shall be anchored within the same day as spreading.

(8) Measurement and Payment for Sprigging, Bermudagrass shall be by Method 1 as described in Section 6 of this specification.

b. Bid Item 13, Native Grass Seeding

(1) This item consists of site preparation, furnishing materials, fertilizing, planting a native grass seed mixture, and applying hay mulch on finished spoils areas from excavations, and other disturbed areas as directed by the Contracting Officer's Representative (COR).

(2) Seed from local native harvest will be used unless named varieties are proven superior. Seed source shall be less than 300 miles south and west and less than 150 miles north and east of the job site. The germination test used to determine PLS is valid for 9 months after the end of the month the test was made so long as the seed remains in Oklahoma.

(3) Seeding dates: December 1 to June 1.

(4) Native grass seed mixture:

SPECIES	ADAPTED VARIETIES	PLS (Lbs./Ac)
Grasses		
Indiangrass	Cheyenne, Lometa	4.0
Switchgrass	Blackwell	1.4
Big Bluestem	Kaw	1.2
Little Bluestem	Aldous	0.25
Sideoats Grama	El Reno	0.24
Florida Paspalum	Harrison	0.6
Buffalograss	Texoka (unhulled), Bison	2.5
Eastern Gamagrass	Verl, Pete, Luk, PMK-24	4.6
Legumes		
Illinois Bundleflower		0.4
Partridge Pea		0.08
Maximilian Sunflower	Aztec	0.16

(5) Site Preparation - Prior to seeding, the area shall be prepared by any method which will result in a clean, friable, firm seedbed.

(a) Tillage will be at a minimum depth of 4 inches

(b) Rills and gullies will be filled or tilled if needed prior to seeding.

(6) Fertilizers shall be a 1-1-1 ratio in a pelleted form and uniformly mixed. Labeling or analysis records shall be in accordance with the Oklahoma Fertilizer Law. Where

fertilizer is furnished from bulk storage, the contractor shall furnish a supplier's certification of analysis and weight.

(a) Fertilizer shall be uniformly applied at a rate of 40 pounds nitrogen, 40 pounds phosphate (P2O5), and 40 pounds potash (K2O) per acre.

(b) The fertilizer shall be incorporated into the soil prior to planting or by the planting equipment, provided it is not applied in such a manner as to be in direct contact with the seeds.

(7) Seeding of the mix will be in the following manner:

(a) Drilled with a grass drill equipped with double coulter furrow openers with depth bands, followed by a cultipacker, press wheels, or drag chains. Seed shall be uniformly mixed and planted ¼ to ½ inch deep. Row spacing shall not exceed 12 inches.

(b) In areas inaccessible to equipment or due to slope steepness, broadcasting may be used so long as seed can be firmly anchored into the soils at a depth of ¼ to ½ inch.

(8) Hay Mulch shall be free of noxious weed seeds and other invasive pests and shall consist of native prairie, or fescue. Hay mulch should have been harvested at a time when stems are available.

(a) Mulch shall be applied after planting operations.

(b) Mulch shall be applied in a reasonably continuous unbroken cover of uniform thickness at a rate of not less than 2 ½ tons of air-dry hay per acre (1 lb/sq.yd). A minimum 80% ground cover for all designated treatment areas shall be achieved.

(c) Mulch shall be anchored into the soil to a minimum depth of 2 inches by pinning, crimping, or other methods approved by the GR. Anchoring shall be done on the approximate contour at a spacing of no more than 8 inches and set to run straight. The operation shall be such that approximately 50% of the mulch material remains on the soil surface after anchoring. The mulch shall be anchored within the same day as spreading.

(9) Measurement and Payment for Native Grass Seeding shall be by Method 1 as described in Section 6 of this specification.

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Construction Specification 7 — Construction Surveys

Title 210 – Engineering
Part 642 –Specifications for Construction Contracts
Subpart B – National Construction Specifications
June 2024

A. Scope

1. The work consists of performing all surveys, measurements, and computations required by this specification.

B. Equipment and Material

1. Equipment for construction surveys must be of a quality and condition to provide the required accuracy. The equipment must be maintained in good working order and in proper adjustment at all times. Records of repairs, calibration tests, accuracy checks, and adjustments must be maintained and be available for inspection by the engineer. Equipment must be checked, tested, and adjusted as necessary in conformance with manufacturer's recommendations.
2. Necessary materials include field notebooks, stakes, templates, platforms, equipment, spikes, steel pins, tools, and all other items necessary to perform the work specified.

C. Quality of Work

1. All work must follow recognized professional practice and the standards of the industry unless otherwise specified in Section I of this specification. Perform the work to the accuracy and detail appropriate for the type of job. Notes, sketches, and other data must be complete, neatly recorded, legible, reproducible, and organized to facilitate ease in review for job documentation. Survey equipment that requires little or no manual recording of field data must have survey information documented as outlined in Section I of this specification.
2. All computations must be mathematically correct and include information to identify the bid item, date, and the person who performed, checked, and approved the computations. Computations must be legible, complete, and clearly document the source of all information used, including assumptions and measurements collected.
3. If a computer program is used to perform the computations, the contractor must provide the engineer with the software identification, vendor's name, version number, and other pertinent data before beginning survey activities. Computer-generated computations must show all input data, including values assigned and assumptions made.

4. Determine and record the elevations of permanent and temporary benchmarks to the nearest 0.01 foot. Differential leveling and transit traverses must be of such precision that the error of vertical closure in feet must not exceed plus or minus 0.1 times the square root of the traverse distance in miles. Linear measurements must be accurate to within 1 foot in 5,000 feet unless otherwise specified in Section I of this specification. The angular error of closure for transit traverses must not exceed 1 minute times the square root of the number of angles turned.
5. The minimum requirements for placing slope stakes must be at 100-foot stations for tangents and as little as 25 feet for sharp curves, breaks in the original ground surface, and at any other intermediate stations necessary to ensure accurate location for construction layout and measurement. Slope stakes and cross-sections must be perpendicular to the centerline. Significant breaks in grade must be determined for cross-sections. Distances must be measured horizontally and recorded to the nearest 0.1 foot. Side shots for interim construction stakes may be taken with a hand level.
6. Unless otherwise specified in Section I of this specification, measurements for stationing and establishing the location of structures must be made to the nearest 0.1 foot.
7. Elevations for concrete work, pipes, and mechanical equipment must be determined and recorded to the nearest 0.01 foot. Elevations for earthwork must be determined and recorded to the nearest 0.1 foot.

D. Primary Control

1. The baselines and benchmarks for primary control necessary to establish lines and grades needed for construction are shown on the drawings and have been located on the jobsite.
2. These baselines and benchmarks must be used as the origin of all surveys, layouts, and measurements to establish construction lines and grades. The contractor must take all necessary precautions to prevent the loss or damage of primary control points. Any stakes or control points lost or damaged by construction activity will be reestablished by the contractor or at contractor expense.

E. Construction Surveys

1. All Methods. Before starting work that requires contractor-performed surveys, the contractor must submit in writing for the engineer's review the names, qualifications, and experiences of the individuals to be assigned to the survey tasks.
2. Method 1. Contractor-performed surveys must include:
   a. Checking and any supplemental or interim staking
   b. Performing quantity surveys, measurements, and computations for progress payment
   c. Other surveys as described in Section I of this specification

3. Method 2. Contractor-performed surveys must consist of all work necessary for:
    a. Establishing line and grade for all work
    b. Setting slope stakes for all work
    c. Checking and any supplemental or interim staking
    d. Establishing final grade stakes
    e. Performing quantity surveys, measurements, and computations for progress payment
    f. Other surveys as described in Section I of this specification
4. Method 3. Contractor-performed surveys must consist of all work necessary for:
    a. Establishing line and grade for all work
    b. Setting slope stakes for all work
    c. Checking and any supplemental or interim staking
    d. Establishing final grade stakes
    e. Performing quantity surveys, measurements, and computations for progress payments
    f. Performing initial and final surveys for determinations of final quantities
    g. Other surveys as described in Section I of this specification.

F. Staking

1. Complete the construction staking required for the item before work on any item starts. Complete construction staking as follows or as otherwise specified in Section I of this specification:
    a. Clearing and Grubbing. The boundary of the areas to be cleared and grubbed must be staked or flagged at a maximum interval of 200 feet, closer if needed, to clearly mark the limits of work. When contractor staking is the basis for determining the area for final payment, all boundary stakes will be reviewed by the engineer before start of this work item.
    b. Excavation and Fill. Place slope stakes at the intersection of the specified slopes and ground line. Slope stakes and the reference stakes for slopes must be marked with the stationing, required cut or fill, slope ratio, and horizontal distance from the centerline or other control line. The minimum requirements for placing slope stakes are outlined in Section C, Quality of Work.
    c. Structures. Place centerline and offset reference line stakes for location, alignment, and elevation for all structures.

G. Records

1. Record all survey data in properly labeled, standard, hardbound engineering survey field notebooks with consecutively numbered pages. All field notes and printed data must include the purpose or description of the work, the date the work was performed, weather data, sketches, and the personnel who performed and checked the work. Electronically generated survey data and computations must be bound with numbered pages and cross-referenced in a bound field notebook containing the index for all survey activities. All work must follow recognized professional practices.

2. The construction survey records must be available at all times during the progress of the work for examination and use by the engineer. When requested, copies must be made available. The original field notebooks and other records must be provided to and become the property of the owner before final payment and acceptance of all work.
3. Complete documentation of computations and supporting data for progress payments must be submitted to the engineer with each invoice for payment as specified in Section I of the specification. When the contractor is required to conduct initial and final surveys as outlined in Section E, Construction Surveys, notes must be provided as soon as possible after completion to the engineer for the purpose of determining final payment quantities.

H. Payment

1. Method 1. For items of work for which lump-sum prices are established in the contract, payment is made as the work proceeds after presentation of correct and accurate invoices by the contractor showing related costs and evidence of the charges of suppliers, subcontractors, and others for supplies furnished and work performed. Invoices for the total amount of the contract price will not be accepted until all surveys are complete and required documentation has been determined complete. If the total of such payments is less than the lump-sum contract price for this item, the unpaid balance will be included in the final contract payment. Payment of the lump-sum contract price will constitute full compensation for completion of all work under the bid item.
2. Method 2. For items of work for which lump-sum prices are established in the contract, payment is made as the work proceeds with progress payment amounts determined as a percentage of the total work planned as projected from the contractor's approved construction schedule. Payment of the lump-sum contract price will constitute full compensation for completion of all work under this bid item.
3. All Methods. Payment will not be provided under this item for the purchase price of materials or equipment having a residual value. Compensation for any item of work described in the contract but not listed in the bid schedule will be included in the payment for the item of work to which it is made subsidiary. Such items and the item to which they are made subsidiary are identified in Section I of this specification.

I. ITEMS OF WORK AND CONSTRUCTION DETAILS

Items of work to be performed in conformance with this specification and the construction details are:

1. Subsidiary Item, Construction Surveys

a. This item consists of conducting surveys for construction controls.

b. In Section D Primary Control, baselines and benchmarks for primary control necessary to establish lines and grades will be provided by the government.

c. In Section E Construction Surveys, Method 2 shall apply.

   (1) Re-staking any original government layout or references that are removed or destroyed is the responsibility of the contractor.

d. In Section F Staking, construction staking required for the items before work on any item starts will be provided by the government.

e. No separate payment will be made for Construction Surveys. Compensation will be included in the payment for Bid Item 1, Mobilization.

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Construction Specification 8 — Mobilization and Demobilization

Title 210 – Engineering
Part 642 – Specifications for Construction Contracts
Subpart B – National Construction Specifications
June 2024

A. Scope

1. The work consists of the mobilization and demobilization of the contractor's forces and equipment necessary for performing the work required under the contract. It does not include mobilization and demobilization for specific items of work for which payment is provided elsewhere in the contract. Mobilization will not be considered as work in fulfilling the contract requirements for commencement of work.

B. Equipment and Material

1. Mobilization includes all activities and associated costs for transportation of contractor's personnel, equipment, and operating supplies to the site; establishment of offices, buildings, and other necessary general facilities for the contractor's operations at the site; premiums paid for performance and payment bonds including coinsurance and reinsurance agreements as applicable; and other items specified in Section D of this specification.
2. Demobilization includes all activities and costs for transportation of personnel, equipment, and supplies not required or included in the contract from the site, including the disassembly, removal, and site cleanup of offices, buildings, and other facilities assembled on the site specifically for this contract.
3. This work includes mobilization and demobilization required by the contract at the time of award. If additional mobilization and demobilization activities and costs are required during the performance of the contract as a result of changed, deleted, or added items of work for which the contractor is entitled to an adjustment in contract price, compensation for such costs will be included in the price adjustment for the item or items of work changed or added.

C. Payment

1. Payment will be made as the work proceeds after presentation of paid invoices or documentation of direct costs by the contractor showing specific mobilization and demobilization costs and supporting evidence of the charges of suppliers, subcontractors, and others. When the total of such payments is less than the lump-sum contract price, the balance remaining will be included in the final contract payment. Payment of the lump sum contract price for mobilization and demobilization will constitute full compensation for completion of the work.

2. Payment will not be made under this item for the purchase costs of materials having a residual value, the purchase costs of materials to be incorporated in the project, or the purchase costs of operating supplies.

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D. ITEMS OF WORK AND CONSTRUCTION DETAILS

Items of work to be performed in conformance with this specification and the construction details are:

1. <u>Bid Item 1, Mobilization</u>

a. This item consists of the mobilization and demobilization of the contractor's forces and equipment necessary for performing the work required under this contract.

b. This item also consists of establishing, stabilizing, maintaining, and restoring the ingress-egress road. The ingress-egress road shall be restored back to a condition "as-good-as" or better than it was prior to the start of construction.

c. In addition, this item further consists of the removal of existing fences as necessary to access the work site and the construction of a temporary ingress-egress gate(s) as needed. Any temporary ingress-egress gate(s) installed, or fence removed shall be restored to a condition "as-good-as" or better than it was prior to the start of construction, once construction is complete. See Construction Specification 92 – Field Fence.

d. The contractor shall be responsible for identifying the location of utilities prior to construction activities and shall notify the Oklahoma One-Call System at least 48 hours prior to starting work at the project site. If any unidentified utilities are encountered after work is initiated, the contractor shall discontinue work and notify the contracting officer immediately.

e. To minimize the establishment of the Imported Fire Ant, *Solenopsis invicta*, Federal Regulation 7 CFR 301.81 and Oklahoma Administrative Rule OAC 35:30-13-3 have established a quarantine to regulate the movement of soil, hay or straw, plants with soil attached (including grass sod), and soil-moving equipment. All soil-moving equipment shall be properly washed and/or otherwise cleaned of all soil material before mobilizing to and demobilizing from the job site(s). Equipment cleaning is not required for site-to-site mobilization within a County on contracts which contain more than one job site. The movement of other regulated articles listed above may require an authenticated certificate or permit.

f. This item shall also include the securing of any bonds or payment protection, and payment for such, as required by the Contracting Officer under the terms of this contract.

g. Payment will be made as the work proceeds, after presentation of paid invoices and/or documentation of direct costs by the Contractor showing specific mobilization and demobilization costs and supporting evidence of the charges of suppliers, subcontractors, and others. When the total of such payments is less than the lump sum contract, the balance remaining will be included in the final contract payment. Payment of the lump sum contract

price for mobilization and demobilization will constitute full compensation for the completion of the work.

h. Items of work subsidiary to Mobilization are:

(1) Construction Surveys - Construction Specification 7

(2) Contractor Quality Control - Construction Specification 94

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Construction Specification 21—Excavation

1. Scope

The work shall consist of the excavation required by the drawings and specifications and disposal of the excavated materials.

2. Classification

Excavation is classified as common excavation, rock excavation, or unclassified excavation in accordance with the following definitions.

Common excavation is defined as the excavation of all materials that can be excavated, transported, and unloaded using heavy ripping equipment and wheel tractor-scrapers with pusher tractors or that can be excavated and dumped into place or loaded onto hauling equipment by excavators having a rated capacity of one cubic yard or larger and equipped with attachments (shovel, bucket, backhoe, dragline, or clam shell) appropriate to the material type, character, and nature of the materials.

Rock excavation is defined as the excavation of all hard, compacted, or cemented materials that require blasting or the use of ripping and excavating equipment larger than defined for common excavation. The excavation and removal of isolated boulders or rock fragments larger than 1 cubic yard encountered in materials otherwise conforming to the definition of common excavation shall be classified as rock excavation. The presence of isolated boulders or rock fragments larger than 1 cubic yard is not in itself sufficient cause to change the classification of the surrounding material.

For the purpose of these classifications, the following definitions shall apply:

> *Heavy ripping equipment* is a rear-mounted, heavy duty, single-tooth, ripping attachment mounted on a track type tractor having a power rating of at least 250 flywheel horsepower unless otherwise specified in section 10.
>
> *Wheel tractor-scraper* is a self-loading (not elevating) and unloading scraper having a struck bowl capacity of at least 12 cubic yards.
>
> *Pusher tractor* is a track type tractor having a power rating of at least 250 flywheel horsepower equipped with appropriate attachments.

Unclassified excavation is defined as the excavation of all materials encountered, including rock materials, regardless of their nature or the manner in which they are removed.

3. Blasting

The transportation, handling, storage, and use of dynamite and other explosives shall be directed and supervised by a person(s) of proven experience and ability who is authorized and qualified to conduct blasting operations.

Blasting shall be done in a manner as to prevent damage to the work or unnecessary fracturing of the underlying rock materials and shall conform to any special requirements in section 10 of this

specification. When specified in section 10, the contractor shall furnish the engineer, in writing, a blasting plan before blasting operations begin.

4. Use of excavated material

Method 1—To the extent they are needed, all suitable material from the specified excavations shall be used in the construction of required permanent earthfill or rockfill. The suitability of material for specific purposes is determined by the engineer. The contractor shall not waste or otherwise dispose of suitable excavated material.

Method 2—Suitable material from the specified excavations may be used in the construction of required earthfill or rockfill. The suitability of material for specific purposes is determined by the engineer.

5. Disposal of waste materials

Method 1—All surplus or unsuitable excavated materials are designated as waste and shall be disposed of at the locations shown on the drawings.

Method 2—All surplus or unsuitable excavated materials are designated as waste and shall be disposed of by the contractor at sites of his own choosing away from the site of the work. The disposal shall be in an environmentally acceptable manner that does not violate local rules and regulations.

6. Excavation limits

Excavations shall comply with OSHA Construction Industry Standards (29CFR Part 1926) Subpart P, Excavations, Trenching, and Shoring. All excavations shall be completed and maintained in a safe and stable condition throughout the total construction phase. Structure and trench excavations shall be completed to the specified elevations and to the length and width required to safely install, adjust, and remove any forms, bracing, or supports necessary for the installation of the work. Excavations outside the lines and limits shown on the drawings or specified herein required to meet safety requirements shall be the responsibility of the contractor in constructing and maintaining a safe and stable excavation.

7. Borrow excavation

When the quantities of suitable material obtained from specified excavations are insufficient to construct the specified earthfills and earth backfills, additional material shall be obtained from the designated borrow areas. The extent and depth of borrow pits within the limits of the designated borrow areas shall be as specified in section 10 or as approved by the engineer.

Borrow pits shall be excavated and finally dressed to blend with the existing topography and sloped to prevent ponding and to provide drainage.

8. Overexcavation

Excavation in rock beyond the specified lines and grades shall be corrected by filling the resulting voids with portland cement concrete made of materials and mix proportions approved by the engineer. Concrete that will be exposed to the atmosphere when construction is completed shall meet the requirements of concrete selected for use under Construction Specification 31, Concrete for Major Structures, or 32, Structure Concrete, as appropriate.

Concrete that will be permanently covered shall contain not less than five bags of cement per

cubic yard. The concrete shall be placed and cured as specified by the engineer.

Excavation in earth beyond the specified lines and grades shall be corrected by filling the resulting voids with approved, compacted earthfill. The exception to this is that if the earth is to become the subgrade for riprap, rockfill, sand or gravel bedding, or drainfill, the voids may be filled with material conforming to the specifications for the riprap, rockfill, bedding, or drainfill. Before correcting an overexcavation condition, the contractor shall review the planned corrective action with the engineer and obtain approval of the corrective measures.

9. Measurement and payment

For items of work for which specific unit prices are established in the contract, the volume of each type and class of excavation within the specified pay limits is measured and computed to the nearest cubic yard by the method of average cross-sectional end areas or by methods outlined in section 10 of this specification. Regardless of quantities excavated, the measurement for payment is made to the specified pay limits except that excavation outside the specified lines and grades directed by the engineer to remove unsuitable material is included. Excavation required because unsuitable conditions result from the contractor's improper construction operations, as determined by the engineer, is not included for measurement and payment.

Method 1—The pay limits shall be as designated on the drawings.

Method 2—The pay limits shall be defined as follows:

a. The upper limit shall be the original ground surface as it existed before the start of construction operations except that where excavation is performed within areas designated for previous excavation or earthfill, the upper limit shall be the modified ground surface resulting from the specified previous excavation or earthfill.
b. The lower and lateral limits shall be the neat lines and grades shown on the drawings.

Method 3—The pay limits shall be defined as follows:

a. The upper limit shall be the original ground surface as it existed before the start of construction operations except that where excavation is performed within areas designated for previous excavation or earthfill, the upper limit shall be the modified ground surface resulting from the specified previous excavation or earthfill.
b. The lower and lateral limits shall be the true surface of the completed excavation as directed by the engineer.

Method 4—The pay limits shall be defined as follows:

a. The upper limit shall be the original ground surface as it existed before the start of construction operations except that where excavation is performed within areas designated for previous excavation or earthfill, the upper limit shall be the modified ground surface resulting from the specified previous excavation or earthfill.
b. The lower limit shall be at the bottom surface of the proposed structure.
c. The lateral limits shall be 18 inches outside of the outside surface of the proposed structure or shall be vertical planes 18 inches outside of and parallel to the footings, whichever gives the larger pay quantity, except as provided in d below.
d. For trapezoidal channel linings or similar structures that are to be supported upon the sides of the excavation without intervening forms, the lateral limits shall be at the underside of

the proposed lining or structure.

e. For the purposes of the definitions in b, c, and d, above, any specified bedding or drainfill directly beneath or beside the structure will be considered to be a part of the structure.

All methods—The following provisions apply to all methods of measurement and payment.

Payment for each type and class of excavation is made at the contract unit price for that type and class of excavation. Such payment will constitute full compensation for all labor, materials, equipment, and all other items necessary and incidental to the performance of the work except that extra payment for backfilling overexcavation will be made in accordance with the following provisions.

Payment for backfilling overexcavation, as specified in section 8 of this specification, is made only if the excavation outside specified lines and grades is directed by the engineer to remove unsuitable material and if the unsuitable condition is not a result of the contractor's improper construction operations as determined by the engineer.

Compensation for any item of work described in the contract, but not listed in the bid schedule is included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in section 10 of this specification.

10. Items of work and construction details

Items of work to be performed in conformance with this specification and the construction details are:

a. <u>Bid Item 7, Excavation, Circle Pit, Deep Water Habitat</u>

(1) This item consists of furnishing all equipment, labor, and materials necessary to excavate the Circle Pit, Deep Water Habitat to the lines and grades as shown on the drawings or as staked in the field.

(2) Measurement and payment for Excavation, Circle Pit, Deep Water Habitat will be by each unit completed.

(3) Items of work subsidiary to this item are:
   a. Earthfill, Spoils Deposition Areas - Construction Specification 23
   b. Topsoil - Construction Specification 26

b. <u>Bid Item 10, Excavation, Unit #1</u>

(4) This item consists of furnishing all equipment, labor, and materials necessary to excavate Unit #1 to the extent and elevation shown on the drawings or as staked in the field.

(5) Measurement and payment for Excavation, Unit #1 will be computed to the nearest cubic yard by comparing surface models of before and after construction ground surfaces.

(6) Items of work subsidiary to this item are:
   a. Earthfill, Spoils Deposition Areas - Construction Specification 23
   b. Topsoil - Construction Specification 26

c. <u>Bid Item 11, Excavation, Wetland Pond</u>

(7) This item consists of furnishing all equipment, labor, and materials necessary to excavate the Wetland Pond to the extent and elevation shown on the drawings or as staked in the field.

(8) Measurement and payment for Excavation, Wetland Pond will be computed to the nearest cubic yard by comparing surface models of before and after construction ground surfaces.

(9) Items of work subsidiary to this item are:
   a. Earthfill, Spoils Deposition Areas - Construction Specification 23
   b. Topsoil - Construction Specification 26

d. <u>Subsidiary Items, Excavation of Borrow Areas</u>

(1) This item consists of the excavation of the borrow areas necessary for the placing of earthfill as shown on the drawings and as staked in the field.

(2) The finished side slopes of all borrow areas shall be 3: 1 or flatter, and the excavated depth before natural ground shall be as needed not to exceed 2 feet.

(3) Any unnatural debris that is encountered during the excavation of the barrow areas shall be separated from the earthfill material. Refuse material shall become the property of the Contractor, removed from the site prior to demobilization, and properly disposed of at off-site locations of the Contractor's choosing. This disposal shall be in accordance with all applicable, Federal, State, and local laws, rules, and regulations.

(4) No separate payment will be made for Excavation of Borrow Areas. Compensation shall be included in Bid Item 3, Earthfill, Wetland Embankment, Unit #2; Bid Item 4, Earthfill, Wetland Embankment, Unit #3; Bid Item 5, Earthfill, Wetland Embankment, Unit #4; or Bid Item 6, Earthfill, Wetland Embankment, Unit #5, as the case may be.

e. <u>Subsidiary Items, Excavation of Pipe Trench</u>

(1) This item consists of the excavation necessary and incidental for preparing the subgrade and placing of the Steel Pipe with Riser, Water Control Structures 1 & 2.

(2) The side slopes and bottom width of the excavation pipe trenches, to remove or install and conduits, shall be sloped out on a 2.5:1 side slope or flatter, and the excavated trench shall be a minimum of 8' wide, unless otherwise specified. The area disturbed by the removal or installation process shall be restored to previous elevations or grades or constructed to the planned elevations and grades according to the criteria in the Construction Specification 23, Earthfill.

(3) No separate payment will be made for Excavation of Pipe Trench. Compensation shall be included in the payment for Bid Items 8 & 9, Water Control Structure 1 - Steel Pipe with Plug & Nipple Control and Water Control Structure 2 - Steel Pipe with Plug & Nipple Control, as the case may be.

Construction Specification 23—Earthfill

1. Scope

The work consists of the construction of earth embankments, other earthfills, and earth backfills required by the drawings and specifications.

Earthfill is composed of natural earth materials that can be placed and compacted by construction equipment operated in a conventional manner.

Earth backfill is composed of natural earth material placed and compacted in confined spaces or adjacent to structures (including pipes) by hand tamping, manually directed power tampers or vibrating plates, or their equivalent.

2. Material

All fill material shall be obtained from required excavations and designated borrow areas. The selection, blending, routing, and disposition of material in the various fills shall be subject to approval by the engineer.

Fill materials shall contain no frozen soil, sod, brush, roots, or other perishable material. Rock particles larger than the maximum size specified for each type of fill shall be removed prior to compaction of the fill.

The types of material used in the various fills shall be as listed and described in the specifications and drawings.

3. Foundation preparation

Foundations for earthfill shall be stripped to remove vegetation and other unsuitable material or shall be excavated as specified.

Except as otherwise specified, earth foundation surfaces shall be graded to remove surface irregularities and shall be scarified parallel to the axis of the fill or otherwise acceptably scored and loosened to a minimum depth of 2 inches. The moisture content of the loosened material shall be controlled as specified for the earthfill, and the surface material of the foundation shall be compacted and bonded with the first layer of earthfill as specified for subsequent layers of earthfill.

Earth abutment surfaces shall be free of loose, uncompacted earth in excess of 2 inches in depth normal to the slope and shall be at such a moisture content that the earthfill can be compacted against them to produce a good bond between the fill and the abutments.

Rock foundation and abutment surfaces shall be cleared of all loose material by hand or other effective means and shall be free of standing water when fill is placed upon them. Occasional rock outcrops in earth foundations for earthfill, except in dams and other structures designed to restrain the movement of water, shall not require special treatment if they do not interfere with compaction of the foundation and initial layers of the fill or the bond between the foundation and the fill.

Foundation and abutment surfaces shall be no steeper than one horizontal to one vertical unless otherwise specified. Test pits or other cavities shall be filled with compacted earthfill conforming to the specifications for the earthfill to be placed upon the foundation.

4. Placement

Earthfill shall not be placed until the required excavation and foundation preparation have been completed and the foundation has been inspected and approved by the engineer. Earthfill shall not be placed upon a frozen surface nor shall snow, ice, or frozen material be incorporated in the earthfill matrix.

Earthfill shall be placed in approximately horizontal layers. The thickness of each layer before compaction shall not exceed the maximum thickness specified in section 10 or shown on the drawings. Materials placed by dumping in piles or windrows shall be spread uniformly to not more than the specified thickness before being compacted.

Hand compacted earth backfill shall be placed in layers whose thickness before compaction does not exceed the maximum thickness specified for layers of earth backfill compacted by manually directed power tampers.

Earth backfill shall be placed in a manner that prevents damage to the structures and allows the structures to assume the loads from the earth backfill gradually and uniformly. The height of the earth backfill adjacent to a structure shall be increased at approximately the same rate on all sides of the structure.

Earthfill and earth backfill in dams, levees, and other structures designed to restrain the movement of water shall be placed to meet the following additional requirements:

(a) The distribution of materials throughout each zone shall be essentially uniform, and the earthfill shall be free from lenses, pockets, streaks, or layers of material differing substantially in texture, moisture content, or gradation from the surrounding material. Zone earthfills shall be constructed concurrently unless otherwise specified.

(b) The surface of each layer shall be scarified parallel to the axis of the fill to a depth of not less than 2 inches before the next layer is placed.

(c) The top surface of embankments shall be maintained approximately level during construction with two exceptions: A crown or cross-slope of about 2 percent shall be maintained to ensure effective drainage, or as otherwise specified for drainfill or sectional zones.

(d) Dam embankments shall be constructed in continuous layers from abutment to abutment except where openings to facilitate construction or to allow the passage of streamflow during construction are specifically authorized in the contract.

(e) Embankments built at different levels as described under (c) or (d) above shall be constructed so that the slope of the bonding surfaces between embankment in place and embankment to be placed is not steeper than 3 feet horizontal to 1 foot vertical. The bonding surface of the embankment in place shall be stripped of all material not meeting the requirements of this specification and shall be scarified, moistened, and recompacted when the new earthfill is placed against it. This ensures a good bond with the new earthfill and obtains the specified moisture content and density at the contact of the inplace and new earthfills.

5. Control of moisture content

During placement and compaction of earthfill and earth backfill, the moisture content of the material being placed shall be maintained within the specified range.

The application of water to the earthfill material shall be accomplished at the borrow areas insofar as practicable. Water may be applied by sprinkling the material after placement on the earthfill, if necessary. Uniform moisture distribution shall be obtained by disking.

Material that is too wet when deposited on the earthfill shall either be removed or be dried to the specified moisture content prior to compaction.

If the top surface of the preceding layer of compacted earthfill or a foundation or abutment surface in the zone of contact with the earthfill becomes too dry to permit suitable bond, it shall either be removed or scarified and moistened by sprinkling to an acceptable moisture content before placement of the next layer of earthfill.

6. Compaction

Earthfill—Earthfill shall be compacted according to the following requirements for the class of compaction specified:

Class A compaction—Each layer of earthfill shall be compacted as necessary to provide the density of the earthfill matrix not less than the minimum density specified in Section 10 or identified on the drawings. The earthfill matrix is defined as the portion of the earthfill material finer than the maximum particle size allowed in the reference compaction test method specified (ASTM D698 or ASTM D1557).

Class B compaction—Each layer of earthfill shall be compacted to a mass density not less than the minimum density specified.

Class C compaction—Each layer of earthfill shall be compacted by the specified number of passes of the type and weight of roller or other equipment specified or by an approved equivalent method. Each pass shall consist of at least one passage of the roller wheel or drum over the entire surface of the layer.

Earth backfill—Earth backfill adjacent to structures shall be compacted to a density equivalent to that of the surrounding inplace earth material or adjacent required earthfill or earth backfill. Compaction shall be accomplished by hand tamping or manually directed power tampers, plate vibrators, walk-behind, miniature, or self-propelled rollers. Unless otherwise specified heavy equipment including backhoe mounted power tampers or vibrating compactors and manually directed vibrating rollers shall not be operated within 3 feet of any structure. Towed or self-propelled vibrating rollers shall not be operated within 5 feet of any structure. Compaction by means of drop weights operating from a crane or hoist is not permitted.

The passage of heavy equipment will not be allowed:

- Over cast-in-place conduits within 14-days after placement of the concrete
- Over cradled or bedded precast conduits within 7 days after placement of the concrete cradle or bedding
- Over any type of conduit until the backfill has been placed above the top surface of the structure to a height equal to one-half the clear span width of the structure or pipe or 3 feet, whichever is greater, except as may be specified in section 10.

Compacting of earth backfill adjacent to structures shall not be started until the concrete has attained the strength specified in section 10 for this purpose. The strength is determined by compression testing of test cylinders cast by the contractor's quality control personnel for this purpose and cured at the work site in the manner specified in ASTM C 31 for determining when a structure may be put into service.

When the required strength of the concrete is not specified as described above, compaction of earth backfill adjacent to structures shall not be started until the following time intervals have elapsed after placement of the concrete.

Structure	**Time interval** (days)
Vertical or near-vertical walls with earth loading on one side only	14
Walls backfilled on both sides simultaneously	7
Conduits and spillway risers, cast-in-place (with inside forms in place)	7
Conduits and spillway risers, cast-in-place (inside forms removed)	14
Conduits, pre-cast, cradled	2
Conduits, pre-cast, bedded	1
Cantilever outlet bents (backfilled both sides simultaneously)	3

7. Reworking or removal and replacement of defective earthfill

Earthfill placed at densities lower than the specified minimum density or at moisture contents outside the specified acceptable range of moisture content or otherwise not conforming to the requirements of the specifications shall be reworked to meet the requirements or removed and replaced by acceptable earthfill. The replacement earthfill and the foundation, abutment, and earthfill surfaces upon which it is placed shall conform to all requirements of this specification for foundation preparation, approval, placement, moisture control, and compaction.

8. Testing

During the course of the work, the contractor shall perform quality control tests, as applicable, to identify earthfill and earth backfill materials; determine the reference maximum density and optimum moisture content; and document that the moisture content of material at the time of compaction and the density of earthfill and earth backfill in place conform to the requirements of this specification.

Determining Reference Maximum Density and Optimum Moisture Content—For Class A compaction, the reference maximum density and optimum moisture content shall be determined in accordance with the compaction test and method specified on the drawings or in section 10.

Documenting Specification Conformance—In-place densities of earthfill and earth backfill requiring Class A compaction shall be measured in accordance with ASTM D1556, D2167, D2937, D6938 or D8167. Moisture contents of earthfill and earth backfill at the time of compaction shall be measured in accordance with ASTM D2216, D4643, or D6938. Values of moisture content determined by ASTM D2216 are considered the true value of the soil moisture. Values of moisture content determined by ASTM D4643 or D6938 shall be verified by comparison to values obtained by ASTM D2216. Values of in-place density and moisture content determined by these tests shall be compared to the minimum density and moisture content range specified on the drawings or in section 10.

Correction for Oversize Particles—If the materials to be used for earthfill or earth backfill contain more than 5 percent by dry weight of oversize rock particles (particles larger than those allowed in the specified compaction test and method), corrections for oversize particles shall be made using the appropriate procedures explained in ASTM D4718.

9. Measurement and payment

For items of work for which specific unit prices are established in the contract, the volume of each type and compaction class of earthfill and earth backfill within the specified zone boundaries and pay limits is measured and computed to the nearest cubic yard by the method of average cross-sectional end areas. Unless otherwise specified in section 10, no deduction in volume is made for embedded items, such as, but not limited to, conduits, inlet structures, outlet structures, embankment drains, sand diaphragm and outlet, and their appurtenances.

The pay limits shall be as defined below, with the further provision that earthfill required to fill voids resulting from overexcavation of the foundation, outside the specified lines and grades, will be included in the measurement for payment only under the following conditions:

- Where such overexcavation is directed by the engineer to remove unsuitable material, and
- Where the unsuitable condition is not a result of the contractor's improper construction operations as determined by the engineer.

Earthfill beyond the specified lines and grades to backfill excavation required for compliance with OSHA requirements will be considered subsidiary to the earthfill bid item(s).

Method 1—The pay limits shall be as designated on the drawings.

Method 2—The pay limits shall be the measured surface of the foundation when approved for placement of the earthfill and the specified neat lines of the earthfill surface.

Method 3—The pay limits shall be the measured surface of the foundation when approved for placement of the earthfill and the measured surface of the completed earthfill.

Method 4—The pay limits shall be the specified pay limits for excavation and the specified neat lines of the earthfill surface.

Method 5—The pay limits shall be the specified pay limits for excavation and the measured surface of the completed earthfill.

Method 6—Payment for each type and compaction class of earthfill and earth backfill is made at the contract unit price for that type and compaction class of earthfill. Such payment will constitute full compensation for all labor, material, equipment, and all other items necessary and incidental to the performance of the work.

Method 7—Payment for each type and compaction class of earthfill and earth backfill is made at the contract unit price for that type and compaction class of earthfill. Such payment will constitute full compensation for all labor, material, equipment, and all other items necessary and incidental to the performance of the work except furnishing, transporting, and applying water to the foundation and earthfill material. Water applied to the foundation and earthfill material is measured and payment made as specified in Construction Specification 10.

All methods—The following provisions apply to all methods of measurement and payment. Compensation for any item of work described in the contract, but not listed in the bid schedule is included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in section 10 of this specification.

10. Items of work and construction details

Items of work to be performed in conformance with this specification and the construction details are:

a. <u>Bid Items 3, 4, 5, & 6 Earthfill, Wetland Embankments, Units #2, #3, #4, & #5</u>

(1) This item consists of furnishing all equipment, labor, and materials necessary to construct the embankments for Wetland Units #2, #3, #4, and #5 to the lines and grades as shown on the drawings or as staked in the field.

(2) Strip the foundation below the embankments 6-inches prior to constructing the embankment and stockpile. Stockpiled soils will be used as topsoil in the construction of the embankments.

(3) Construct a centerline core according to the stations and dimensions as shown on the drawings or as staked in the field.

(4) Each lift shall be compacted by routing the fill equipment so that the entire surface of each layer shall be traversed by the track tread, or by an approved equivalent method.

(5) No testing as per Section 8 will be required.

(6) Borrow areas are identified on the drawings.

(7) Tolerances for the construction of the Wetland Embankments will be as follows:
a) the top of the embankment elevations over the conduit shall not exceed -0 .1 ' or +0. 5' from the design elevations, and
b) the remaining top of embankment and the auxiliary spillway elevations shall not exceed -0.1' or +0.1' from the design elevations.

(8) The design height of the embankments shall be increased by the amount needed to ensure that after settlement the height of the embankment equals or exceeds the design height. Allowance for settlement will be based on the type of equipment placing the majority of the fill.

TYPE OF EQUIMPENT	PERCENT FILL HEIGHT
Scraper-Carry All	5
Dozer	10
Terracing Machine & Motor Grader	15
Dragline-Trackhoe	20

Equipment, labor, and materials required to construct the additional height for settlement shall be subsidiary to this item.

(9) Disposal of trees, snags, logs, stumps, shrubs, and rubbish will be burned and buried onsite at locations to be designated in the field by the Government Representative.

(10) Measurement and payment shall be the quantities as staked in the field as specified in Method 4 of Section 9 of this specification. The finished embankment surface with the topsoil in place will be the surface the earthfill volume for the embankments will be calculated on.

(11) Items of work subsidiary to this item are:
a) Excavation, Borrow Areas - Construction Specification 21
b) Topsoil - Construction Specification 26

b. <u>Subsidiary Item, Earthfill, Spoils Deposition Areas</u>

(1) Excavated materials used as spoil near the excavations shall be spread, shaped, and compacted to a sufficient density to prevent it from sloughing back into the excavation. The maximum height of the spoil above the original ground level shall not exceed 2 feet.

(2) Areas of earthfill marked on the plan map to be placed up to elevation 906.2 will be compacted as Class C. Side slopes will be kept as flat as possible.

(3) No separate payment will be made for Spoils Deposition Areas. Compensation shall be included in the payment for Bid Item 7, Excavation, Circle Pit, Deep Water Habitat; Bid Item 10, Excavation, Unit #1; or Bid Item 11, Excavation, Wetland Pond; as the case may be.

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Construction Specification 26—Topsoiling

1. Scope
The work consists of furnishing and spreading topsoil to specified depths at locations shown on the drawings.

2. Quality of topsoil
Topsoil shall consist of friable surface soil reasonably free of grass, roots, weeds, sticks, rocks, or other unsuitable material. Additional quality requirements, if any, are in section 7 of this specification.

3. Furnishing
Method 1—Topsoil shall be salvaged from designated earth surfaces that will be disturbed by construction activities. After designated sites have been cleared and grubbed, the topsoil shall be removed from the designated areas and stockpiled at locations shown on the drawings or acceptable to the engineer. Unsuitable material encountered during removal of topsoil shall be disposed of at locations shown on the drawings or approved by the engineer, or it will be otherwise hauled and disposed of at locations removed from the construction site. The contractor is responsible for complying with all local rules and regulations and the payment of any and all fees that may result from the disposal at locations outside the construction work limits.

Method 2—Topsoil shall be furnished from an offsite source designated by the contractor. The engineer shall be granted access to the source for inspection and acceptance before delivery to the site. Test results and samples shall be provided when specified in section 7 of this specification.

4. Stockpiling
Stockpiles of topsoil shall not conflict with the requirements of Construction Specification 5, Pollution Control, when made a part of this contract.

5. Spreading
Method 1—Spreading shall not be conducted when the ground or topsoil is frozen, excessively wet, or otherwise in a condition detrimental to uniform spreading operations. Surfaces designated to receive a topsoil application shall be lightly scarified just before the spreading operation.

Following the spreading operation, the topsoil surface shall be left reasonably smooth and without ruts or surface irregularities that could contribute to concentrated waterflow downslope.

Method 2—Spreading shall not be performed when the ground or topsoil is frozen, excessively wet, or otherwise in a condition detrimental to uniform spreading operations. Surfaces designated to receive a topsoil application shall be lightly scarified just before the spreading operation. Where compacted earthfills are designated to be topsoiled, the topsoil shall be placed concurrently with the earthfill and shall be bonded to the compacted fill with the compacting equipment.

Following the spreading operation, the topsoil surface shall be left reasonably smooth and without ruts or surface irregularities that could contribute to concentrated waterflow downslope.

6. Measurement and payment

***Method 1*—**The total surface covered by topsoil is measured and the area(s) computed to the nearest square yard. Payment for furnishing and placing topsoil is made at the contract unit price.

***Method 2*—**The total surface covered by topsoil, except the surface area of embankments, levees, dikes, and other earthfills not included for payment, is measured and the area(s) computed to the nearest square yard.

Payment for topsoil spread on the surface of embankments, levees, dikes, and other earthfills is included in the measurement and payment for that item of earthfill where topsoil application occurred.

***Method 3*—**For items of work for which specific unit prices are established in the contract, the volume of topsoil furnished and spread is computed to the nearest cubic yard by the method of average cross-sectional end areas from surveys of the excavated topsoil stockpile or, if not stockpiled, cross-sectional surveys of the borrow area(s). Payment for furnishing and spreading topsoil is made at the contract unit price.

***All methods*—**The following provisions apply to all methods of measurement and payment. Compensation for any item of work described in the contract, but not listed in the bid schedule is included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in section 7 of this specification.

***All payment methods*—**Payment will constitute full compensation for all labor, equipment, material, and all other items necessary and incidental to the completion of the work. This includes excavating, stockpiling, hauling, spreading, and the wasting of unsuitable excavated material.

7. Items of work and construction details

Items of work to be performed in conformance with this specification and the construction details are:

a. <u>Subsidiary Item, Topsoil</u>

(1) This item consists of furnishing equipment, labor, and materials necessary for stripping the topsoil to a depth of six inches from areas to be excavated or covered with earthfill; salvaging it and spreading it over the completed earthfill areas.

(2) The earthfill volumes to fill in the six-inch-deep excavated topsoil stripping volumes are included in the Wetland Embankment volume computations. Stripped volumes deeper than six inches shall not be considered in the volume computations. The finished embankment surface with the topsoil in place will be the surface the earthfill volume for the embankments will be calculated on.

(3) Spreading will be by Method 2.

(4) No separate payment will be made for Topsoil. Compensation will be included in the payment for Bid Items 3, 4, 5, and 6, Earthfill, Wetland Embankment, Units #2, #3, #4 and #5; Bid Item 7, Excavation, Circle Pit, Deep Water Habitat; Bid Item 10, Excavation, Unit #1; and Bid Item 11, Excavation, Wetland Pond, as the case may be.

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Construction Specification 32—Structure Concrete

1. Scope

The work shall consist of furnishing, forming, placing, finishing, and curing portland cement concrete as required to build the structures described in section 24 of this specification.

The following BioPreferred® product category is applicable to this specification:

— Concrete release fluids (aka form-release agents)

2. Material

Aggregates shall conform to the requirements of Material Specification 522, Aggregates for Portland Cement Concrete, unless otherwise specified. The grading of coarse aggregates shall be as specified in section 24.

Portland cement shall conform to the requirements of Material Specification 531, Portland Cement, for the specified type.

Fly ash shall conform to the requirements of Material Specification 532, Supplementary Cementitious Materials.

Air-entraining admixtures shall conform to the requirements of Material Specification 533, Chemical Admixtures for Concrete. If air-entraining cement is used, any additional air-entraining admixture shall be of the same type as that in the cement.

Water reducing and/or retarding admixtures shall conform to the requirements of Material Specification 533, Chemical Admixtures for Concrete.

Curing compound shall conform to the requirements of Material Specification 534, Concrete Curing Compound.

Preformed expansion joint filler shall conform to the requirements of Material Specification 535, Preformed Expansion Joint Filler.

Waterstops shall conform to the requirements of Material Specifications 537, Nonmetallic Waterstops, and 538, Metal Waterstops, for the specified kinds.

Water used in mixing and curing concrete shall be clean and free from injurious amounts of oil, salt, acid, alkali, organic matter, or other deleterious substances.

3. Class of concrete

Concrete for structure concrete shall be classified as follows:

Class of concrete	Maximum net water content (gal/bag)	Minimum cement content (bags/yd^3)
3000M	6	5.5
4000M	6	6

4. Air content and consistency

Unless otherwise specified, the slump shall be 3 to 5 inches. If air entrainment is specified, the air content, by volume, shall be 4 to 7 percent of the volume of the concrete. When specified, directed, or approved by the engineer, a water-reducing, set-retarding, or other admixture shall be used. High range, water reducing agents (superplasticizers) may be used to increase workability, reduce water content, and control concrete temperature in hot weather. The maximum slump after adding high range water reducing agents shall be 7.5 inches.

5. Design of the concrete mix

The proportions of the aggregates shall be such as to produce a concrete mixture that works readily into the corners and angles of the forms and around reinforcement when consolidated, but does not segregate or exude free water during consolidation.

Fly ash may be used as a partial substitution for portland cement in an amount of no more than 25 percent (by weight) of the cement in the concrete mix, unless otherwise specified.

The maximum water to cement ratio shall be 0.5 unless otherwise specified. When more than one cementitious material is used, the maximum water to cementitious materials ratio shall be 0.5 unless otherwise specified.

Before the concrete is placed, the contractor shall furnish the contracting officer, for approval, a statement of the materials and mix proportions (including admixtures, if any) intended for use. The statement shall include evidence satisfactory to the contracting officer that the materials and proportions will produce concrete conforming to this specification. The materials and proportions so stated shall constitute the "job mix." After a job mix has been approved, neither the source, character, or grading of the aggregates nor the type or brand of cement or admixture shall be changed without prior notice to the contracting officer. If such changes are necessary, no concrete containing such new or altered material shall be placed until the contracting officer has approved a revised job mix.

6. Inspection and testing

The engineer shall have free entry to the plant and equipment furnishing concrete under the contract. Proper facilities shall be provided for the engineer to inspect materials, equipment, and processes and to obtain samples of the concrete. All tests and inspections will be conducted so as not to interfere unnecessarily with manufacture and delivery of the concrete.

7. Handling and measurement of material

Materials shall be stockpiled and batched by methods that prevent segregation or contamination of aggregates and ensure accurate proportioning of the ingredients of the mix. Except as otherwise provided in section 8, cement and aggregates shall be measured as follows:

- Cement shall be measured by weight or in bags of 94 pounds each. When cement is measured in bags, no fraction of a bag shall be used unless weighed.
- Aggregates shall be measured by weight. Mix proportions shall be based on saturated, surface-dry weight. The batch weight of each aggregate shall be the required saturated, surface-dry weight plus the weight of surface moisture it contains.
- Water shall be measured, by volume or by weight, to an accuracy within 1 percent of the total quantity of water required for the batch.
- Admixtures shall be measured within a limit of accuracy of 3 percent.

8. Mixers and mixing

Concrete shall be uniform and thoroughly mixed when delivered to the work site. Variations in slump of more than 1 inch within a batch are considered evidence of inadequate mixing and shall be corrected by increasing mixing time or other acceptable alternative.

For stationary mixers, the mixing time after all cement and aggregates are in the mixer drum shall be not less than 1.5 minutes. When concrete is mixed in a truck mixer, the number of revolutions of the drum or blades at mixing speed shall be not less than 70 nor more than 100.

Unless otherwise specified, volumetric batching and continuous mixing at the construction site are permitted. To produce concrete meeting the specified proportioning and uniformity requirements, the batching and mixing equipment shall conform to the requirements of ASTM C685 and shall be demonstrated by tests with the job mix before the concrete is placed. Concrete made by this method shall be produced, inspected, and certified in conformance with sections 6, 7, 8, 13, and 14 of ASTM C685.

No mixing water in excess of the amount called for by the job mix shall be added to the concrete during mixing or hauling or after arrival at the delivery point.

9. Forms

Forms shall be of wood, plywood, steel, or other approved material and shall be mortar tight. The forms and associated falsework shall be substantial and unyielding and shall be constructed so that the finished concrete will conform to the specified dimensions and contours. Form surfaces shall be smooth and free from holes, dents, sags, or other irregularities. Forms shall be coated with a nonstaining form release agent before being set into place.

Metal ties or anchorages within the forms shall be equipped with cones, she-bolts or other devices that permit their removal to a depth of at least 1 inch without injury to the concrete. Ties designed to break off below the surface of the concrete shall not be used without cones.

All edges that will be exposed to view when the structure is completed shall be chamfered, unless finished with molding tools as specified in Section l8.

10. Preparation of forms and subgrade

Prior to placement of concrete, the forms and subgrade shall be free of chips, sawdust, debris, water, ice, snow, extraneous oil, mortar, or other harmful substances or coatings and the temperature of all surfaces to be in contact with the new concrete shall be not be less than 40 degrees Fahrenheit. Any oil on the reinforcing steel or other surfaces required to be bonded to the concrete shall be removed. Rock surfaces shall be cleaned by air-water cutting, wet sandblasting, or wire brush scrubbing, as necessary, and shall be wetted immediately before placement of concrete. The earth surface shall be firm and damp. Placement of concrete on mud, dried earth, or uncompacted fill or frozen subgrade is not permitted.

Items to be embedded in the concrete shall be positioned accurately and anchored firmly.

Weepholes in walls or slabs shall be formed with nonferrous material.

11. Conveying

Concrete shall be delivered to the site and discharged into the forms within l-1/2 hours after the introduction of the cement to the aggregates. In hot weather or under conditions contributing to quick stiffening of the concrete, the time between the introduction of the cement to the aggregates and discharge shall not exceed 45 minutes.

The engineer may allow a longer time, provided the setting time of the concrete is increased a corresponding amount by the addition of an approved set-retarding admixture. In any case, concrete shall be conveyed from the mixer to the forms as rapidly as practicable by methods that prevent segregation of the aggregates and assure no loss of mortar occurs.

12. Placing

Concrete shall not be placed until the subgrade, forms, steel reinforcement, and embedded items have been inspected and approved. No concrete shall be placed except in the presence of the engineer. The contractor shall give reasonable notice to the engineer each time concrete is to be placed. Such notice shall provide sufficient time for the engineer to inspect the subgrade, forms, steel reinforcement, and other preparations for compliance with the specifications. Other preparations include, but are not limited to, the concrete mixing plant; delivery equipment system; placing, finishing, and curing equipment and system; schedule of work; workforce; and heating or cooling facilities, if applicable. Deficiencies are to be corrected before concrete is delivered for placing.

The concrete shall be deposited as closely as possible to its final position in the forms. It shall be worked into the corners and angles of the forms and around all reinforcement and embedded items in a manner to prevent segregation of aggregates or excessive laitance. Formed concrete shall be placed in horizontal layers not more than 20 inches thick. Concrete shall not be dropped more than 5 feet vertically unless suitable equipment is used to prevent segregation. When high range water reducing agents are used, the concrete shall not be allowed to drop more than

10 feet. Hoppers and chutes, pipes, or "elephant trunks" shall be used as necessary to prevent segregation and the splashing of mortar on the forms and reinforcing steel above the layer being placed.

Immediately after the concrete is placed in the forms, it shall be consolidated by spading, hand tamping, or vibration as necessary to ensure a smooth surface and dense concrete. Each layer shall be consolidated to ensure monolithic bond with the preceding layer. If the surface of a layer of concrete in place sets to the degree that it will not flow and merge with the succeeding layer when spaded or vibrated, the contractor shall discontinue placing concrete and shall make a construction joint according to the procedure specified in section 13.

If placing is discontinued when an incomplete horizontal layer is in place, the unfinished end of the layer shall be formed by a vertical bulkhead.

13. Construction joints

Construction joints shall be made at the locations shown on the drawings. If construction joints are needed that are not shown on the drawings, they shall be placed in locations approved by the engineer.

Where a feather edge would be produced at a construction joint, as in the top surface of a sloping wall, an insert form shall be used so that the resulting edge thickness on either side of the joint is not less than 6 inches.

In walls and columns, as each lift is completed, the top surface shall be immediately and carefully protected from any condition that might adversely affect the hardening of the concrete.

Steel tying and form construction adjacent to concrete in place shall not be started until the concrete has cured at least 12 hours. Before new concrete is deposited on or against concrete that has hardened, the forms shall be retightened. New concrete shall not be placed until the hardened concrete has cured at least 12 hours.

The surface of construction joints shall be cleaned of all unsatisfactory concrete, laitance, coatings, or debris by washing and scrubbing with a wire brush or wire broom or by other means approved by the engineer. The surface shall be kept moist for at least 1 hour before the new concrete is placed.

14. Expansion and contraction joints

Expansion and contraction joints shall be made only at locations shown on the drawings.

Exposed concrete edges at expansion and contraction joints shall be carefully tooled or chamfered, and the joints shall be free of mortar and concrete. Joint filler shall be left exposed for its full length with clean and true edges.

Preformed expansion joint filler shall be held firmly in the correct position as the concrete is placed.

When open joints are specified, they shall be constructed by the insertion and subsequent removal of a wooden strip, metal plate, or other suitable template in such a manner that the corners of the concrete are not chipped or broken. The edges of open joints shall be finished with an edging tool before the joint strips are removed.

15. Waterstops

Waterstops shall be held firmly in the correct position as the concrete is placed. Joints in metal waterstops shall be soldered, brazed, or welded. Joints in rubber or plastic waterstops shall be cemented, welded, or vulcanized as recommended by the manufacturer.

16. Removal of forms

Forms shall not be removed without the approval of the engineer. Forms shall be removed in such a way as to prevent damage to the concrete. Supports shall be removed in a manner that permits the concrete to take the stresses of its own weight uniformly and gradually.

17. Finishing formed surfaces

Immediately after the forms are removed:

a. All fins and irregular projections shall be removed from exposed surfaces.

b. The holes produced on all surfaces by the removal of form ties, cone-bolts, and she-bolts shall be cleaned, wetted, and filled with a dry-pack mortar. The mortar will consist of one part portland cement, three parts sand that will pass a No. 16 sieve, and just sufficient water to produce a consistency such that the filling is at the point of becoming rubbery when the material is solidly packed.

18. Finishing unformed surfaces

All exposed surfaces of the concrete shall be accurately screeded to grade and then float finished, unless specified otherwise.

Excessive floating or troweling of surfaces while the concrete is soft is not permitted.

Adding dry cement or water to the surface of the screeded concrete to expedite finishing is not allowed.

Joints and edges on unformed surfaces that will be exposed to view shall be chamfered or finished with molding tools.

19. Curing

Concrete shall be prevented from drying for a curing period of at least 7 days after it is placed. Exposed surfaces shall be kept continuously moist for the entire period, or until curing compound is applied as specified below. Moisture shall be maintained by sprinkling, flooding, or fog spraying, or by covering with continuously moistened canvas, cloth mats, straw, sand, or other approved material. Wood forms left in place during the curing period shall be kept continuously wet. A formed surface shall be thoroughly wetted immediately after forms are removed and shall be kept wet until patching and repairs are completed. Water or covering shall be applied in such a way that the concrete surface is not eroded or otherwise damaged.

Concrete, except at construction joints, may be coated with the approved curing compound instead of continued application of moisture, except as otherwise specified in section 24. The compound shall be sprayed on the moist concrete surface as soon as free water has disappeared, but shall not be applied to any surface until patching, repairs, and finishing of that surface are completed. The compound shall be applied at a uniform rate of not less than 1 gallon per 175 square feet of surface and shall form a continuous adherent membrane over the entire surface. Curing compound shall be thoroughly mixed before applying and continuously agitated during application. Curing compound shall not be applied to a surface requiring bond to subsequently placed concrete, such as construction joints, shear plates, reinforcing steel, and other embedded items. If the membrane is damaged during the curing period, the damaged area shall be resprayed at the rate of application specified above. Any surface covered by the membrane shall not be trafficked unless protected from wear.

20. Removal and replacement or repair

When concrete is honeycombed, damaged, or otherwise defective, the contractor shall remove and replace the structure or structural member containing the defective concrete or, where feasible, correct or repair the defective parts. The contracting officer determines the required extent of removal, replacement, or repair. Before starting repair work, the contractor shall obtain the contracting officer's approval of the plan for repairs. The contractor shall perform all repair work in the presence of the engineer.

21. Concreting in cold weather

Concrete shall not be mixed nor placed when the daily minimum atmospheric temperature is less than 40 degrees Fahrenheit unless facilities are provided to prevent the concrete from freezing. The use of accelerators or anti-freeze compounds is not allowed.

22. Concreting in hot weather

The contractor shall apply effective means to maintain the temperature of the concrete below 90 degrees Fahrenheit during mixing, conveying, and placing.

23. Measurement and payment

For items of work for which specific unit prices are established in the contract, concrete is measured to the neat lines shown on the drawings and the volume of concrete is computed to the nearest 0.1 cubic yard. Measurement of concrete placed against the sides of an excavation without using intervening forms is made only to the neatness or pay limits shown on the drawings. No deduction in volume is made for chamfers, rounded or beveled edges, or for any void or embedded item that is less than 5 cubic feet in volume.

Payment for each item of structure concrete is made at the contract unit price or the contract lump sum; whichever is applicable for that item. Such payment constitutes full compensation for all labor, material, equipment, transportation, tools, forms, falsework, bracing, and all other items necessary and incidental to the completion of the work except items listed for payment elsewhere in the contract. Compensation for any item of work described in the contract, but not listed in the bid schedule, is included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in section 24 of this specification.

24. Items of work and construction details

Cement for all concrete work shall be Type I. Coarse aggregate shall be Size No. 57, Table 2, ASTM C-33, unless otherwise approved by the Engineer.

Items of work to be performed in conformance with this specification and the construction details are:

a. Subsidiary Item, Concrete

(1) This item consists of furnishing and installing the concrete required for the footings and pads described in the drawings for Steel Pipe with Plug & Nipple Control, Water Control Structure 1 and Steel Pipe with Plug & Nipple Control, Water Control Structure 2.

(2) The concrete shall be Class 3000M.

(3) No separate payment will be made for Concrete. Compensation for this item will be included in the payment for Bid Items 8 & 9, Water Control Structures 1 and 2 - Steel Pipe with Plug & Nipple Control.

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Construction Specification 52—Steel Pipe

1. Scope
The work shall consist of furnishing and installing steel pipe complete with lining, coating, fittings, and appurtenances.

2. Material
Steel pipe and fittings shall conform to the requirements of Material Specification 554, Steel Pipe.

Unless otherwise specified, special fittings and appurtenances shall be of the same material as the pipe.

Welding electrodes shall conform to the requirements of Material Specification 581, Metal.

Coating and lining materials shall conform to the requirements of the following:

- AWWA C203, Standard for Coal-Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape - Hot-Applied
- AWWA C209, Standard for Cold-Applied Tape Coatings for the Exterior of Special Sections, Connections, and Fittings for Steel Water Pipelines
- AWWA C214, Standard for Tape Coating Systems for the Exterior of Steel Water Pipelines

and as specified below:

- Shop coating material shall conform to the requirements of AWWA Standard C203 and AWWA Standard C214 and as specified in section 12 of this specification.
- Shop lining material shall conform to the requirements of AWWA Standard C203.
- Field coating and coating repair material shall conform to the requirements of AWWA Standard C203, AWWA Standard C209, AWWA Standard C214, and, as specified in Section 12 of this specification.
- Field lining material shall conform to the requirements of AWWA Standard C203 and as specified in section 12 of this specification.

3. Coating and lining
Shop coating of pipe, specials, and fittings shall be in accordance with AWWA Standard C203, AWWA Standard C209, or AWWA Standard C214 and as specified in Section 12 of this specification.

Shop lining of pipe, specials, and fittings shall conform to the requirements of AWWA Standard C203.

4. Excavation
Excavation shall be in accordance with Construction Specification 21 or as specified in section 12 of this specification.

5. Laying and bedding the pipe
Pipe shall be installed to the line and grade shown on the drawings. Unless otherwise specified, the pipe shall be installed so that there are no reversals of grade between joints, and shall be installed in accordance with the manufacturer's recommendations. The pipe shall be firmly and uniformly bedded to the depth and in the manner specified on the drawings. An ample bell hole working area may be left at pipe joints to perform welding, coating, and other related activities. The bell hole area shall then be bedded, as specified, before backfill operations.

The pipe shall be weighed down sufficiently to prevent its displacement from the bedding during placement of the backfill under the haunches.

6. Joints and connections

Pipe joints shall conform to the details shown on the drawings and shall be sound and watertight at the pressures specified in section 12 of this specification.

Welded joints—Welding and welded joints shall conform to the welding procedure details and requirements of AWWA Standard C206. Field welding shall be done in such a way as to avoid burning the protective coating on the pipe except in the immediate vicinity of the weld.

Where welded field joints are used, they shall be single welded butt joints or lap welded slip joints, as shown on the drawings. Special closure lap joints shall be used as described in AWWA Standard C206.

Bell and spigot joints—The dimensions of bells and spigots shall be in accordance with the manufacturer's standard design dimensions and tolerances.

The pipe shall be laid with the bell oriented upstream. The spigot end shall be seated in the bell to a depth as recommended by the manufacturer. The spigot, when seated, shall compress the gasket radially in its annular recess to provide a positive seal. Joints with fish-mouthed gaskets will be taken apart and reseated with a new gasket.

Rubber gaskets shall meet the requirements of AWWA Standard C200.

Mechanical couplings—The ends of pipe to be connected with mechanical couplings shall be machined to allow coupling the pipe sections without damaging or displacing the gaskets and to ensure uniform end separation of the pipes. Machined ends of the pipe that receive the coupling sleeves shall be free from dents, gouges, rust, or scale. The pipe and couplings shall be assembled with continuous rubber ring gaskets conforming to the dimensions and tolerances recommended by the pipe manufacturer. Coupling followers shall be drawn up evenly to ensure uniform pressure on the gaskets.

Grooved and shouldered joints shall be furnished and installed in accordance with AWWA Standard C606.

Flanged joints—All steel ring flanges shall be fabricated in accordance with AWWA Standard C207. Gaskets shall be either a neoprene cloth insert 1/16 or 1/8 inch thick or red rubber 1/16 inch thick. The gasket shall be full face where used between flat face flange surfaces. All flanged joints shall be made up tightly and shall not leak.

Fitting and coupling coatings—Compression couplings, mechanical couplings, and flanged fittings shall be shop coated with the AWWA Standard C203 coal tar enamel coating, as recommended by the coating manufacturer, or a factory-applied vinyl coating at least 12 mils thick and as specified in section 12 of this specification. All bolts furnished for flanges, couplings, and other types of bolted connections shall be stainless steel or low alloy steel and shall be field coated with a coal tar enamel or vinyl coating after installation.

7. Field lining, coating, wrapping, and repair

Lining and coating or wrapping of field joints or connections and repair of damage to the wrap or coating on pipe, couplings, fittings, and appurtenances shall be made in accordance with section 12 of this specification and one of the following methods:

***Method 1*—**All field coating, lining, and repair shall be as specified in AWWA Standard C203.

***Method 2*—**All field wrapping and repair shall be as specified in AWWA Standard C209 with type I or II tape.

***Method 3*—**All field wrapping and repair shall be as specified in AWWA Standard C214 and as specified in section 12 of this specification.

Surface preparation—Bare steel surfaces shall be prepared for coating by removing all grease and oil or other soluble contaminants with solvent commercial cleaners (wiping, dipping, or steam) or vapor degreasing. After degreasing, surfaces shall be cleaned with hand tools to remove all loose scale rust and other loose detrimental foreign matter.

On previously coated surfaces, all dirt, paper, and other foreign matter and loose coating shall be removed. Kraft paper, whitewash, or other surface protective layers shall be removed at least 12 inches on either side of the bare steel to be coated.

Welds shall be cleaned of all welding slag, splatter, and scale. Sharp edges or burrs that could puncture or cut the coating shall be removed by grinding or filing. All welds shall be allowed to cool before applying primer or coatings.

Primer application—After surface preparation is complete, primer shall be thoroughly mixed and applied in strict adherence to manufacturer's instructions. The primer shall be permitted to dry to the consistency recommended by the manufacturer before applying the coating. No foreign matter shall come in contact with the primed surface before application of the coating. Application of primer to surfaces shall be limited to that amount of area that can be wrapped during the same workshift. Primed areas not wrapped during the same workshift shall be reprimed. Cold weather applications of primer shall be done in accordance with AWWA Standard C203.

Coating application—The specified coating shall be applied in accordance with the manufacturer's recommendations unless otherwise specified.

After assembly, all pipe joints shall be field wrapped in accordance with AWWA C209 or AWWA C214, as appropriate. Surface preparation and primer application to the ends of the pipe to be wrapped shall be as previously described in this specification. A tape or filler tape shall be cigarette wrapped over the annular ring of the joint. The pipe coating shall be primed 2 inches back from the coating cutback and two layers of tape shall be wrapped overlapping 2 inches of pipe coating on one side of the joint, extending across the joint and overlapping 2 inches of coating on the other side of the joint. Coal tar enamel coating cutback edges shall be tapered back until 1 inch of coal tar is exposed on the taper before priming and wrapping. Wraps shall be terminated on the underside of the pipe. Tape widths shall be 6 inches for pipe greater than 8 inches in diameter and 4 inches for pipe 2 to 8 inches in diameter.

Welded field joints of lined pipe shall be lined in accordance with AWWA Standard C203, section 4.3, or as specified in section 12 of this specification.

Repair and patching factory coatings—All loose or disbonded material shall be removed from the area of the "holiday." All points, burrs, or rough edges shall be smoothed to a feathered edge. The surface shall be cleaned and prepared as specified for joints, couplings, and fittings. The area to be cleaned and prepared shall be at least twice the size of the "holiday." The repair coating shall be worked onto the surface of the steel to leave no voids or wrinkles on the surface.

Coal tar enamel coatings shall be repaired in accordance with AWWA Standard C203, section 2.15. Tape coatings shall be repaired in accordance with AWWA Standard C214, Section 3.4, Coating Repair. The repair shall be made by wrapping tape around the circumference of the pipe.

All damaged vinyl coat areas shall be cleaned and recoated in accordance with the manufacturer's recommendation.

8. Handling the pipe

The contractor shall furnish such equipment as is necessary to place the pipe without damaging the pipe or coating. Coated pipe shall be handled in the manner specified in AWWA Standard C203 or C214, as appropriate.

9. Pressure testing

If pressure testing of the conduit is specified, it shall be performed as follows:

a. Placement of backfill before pressure testing shall be as specified in section 10 of this specification.

b. Before pressure testing, the pipeline shall be flushed and cleaned.

c. The pipeline shall not be pressure tested until concrete in the anchor and thrust blocks has attained the minimum specified compressive strength.

d. The total conduit or section of the conduit, to be tested shall be filled with clean water at the rate specified and tested at the pressure specified in section 12 of this specification.

e. The section of conduit being tested shall be allowed to stand full of water for at least 24 hours before the start of pressure and leakage test. Test pressure shall be held constant for 2 hours. If the amount of water loss exceeds the limit specified, the leaks shall be repaired and the conduit shall be retested. The procedure shall be repeated until the amount of water loss is within the limits specified in section 12 of this specification.

10. Backfill

***Method 1*—**Backfill, in accordance with Construction Specification 23 and section 12 of this specification, shall be made only in sufficient amount to hold the conduit in place during testing, with the following exceptions:

a. Compacted backfill shall be placed to its final depth as shown on the drawings at vertical and horizontal angle points, road crossings, and thrust blocks. Backfill shall be placed in such a way that the conduit and joints will not be subject to displacement or damage.

b. All joints and connections shall be completely exposed for visual inspection during testing, except at locations that may be exempt as outlined in the previous exemption.

***Method 2*—**Backfill, in accordance with Construction Specification 23 and section 12 of this specification, shall be to its final depth as shown on the drawings for the section of conduit being tested.

***Use with either method*—**The contractor shall be fully responsible for any and all work required to repair any leakage when water loss exceeds the amount specified in section 12 of this specification. After pressure testing is satisfactorily completed, the backfill shall be placed in accordance with Construction Specification 23 and section 12 of this specification.

11. Measurement and payment

***Method 1*—**For items of work for which specific unit prices are established in the contract, the quantity of each type and size of pipe is determined to the nearest 0.1 foot by measurement of the installed length of pipe along the centerline of the pipe. Payment for each type and size of pipe is made at the contract unit price for that type and size of pipe. Such payment constitutes full compensation for furnishing, transporting, and installing the pipe, including the necessary fittings and all other items necessary and incidental to the completion of the work.

***Method 2*—**For items of work for which specific unit prices are established in the contract, the quantity of each type and size of pipe is determined to the nearest 0.1 foot by measurement of the installed length of pipe along the centerline of the pipe. Payment for each type and size of pipe is made at the contract unit price for that type and size of pipe. Such payment constitutes full compensation for furnishing, transporting, and installing the pipe, complete in place, including the necessary fittings and all other items necessary and incidental to the completion of the work except the special fittings and appurtenances listed separately in the bid schedule. Payment for each special fitting and appurtenance is made at the contract unit price for that type and size of fitting or appurtenance.

***Method 3*—**For items of work for which specific unit prices are established in the contract, the quantity of each type and size of pipe is determined to the nearest 0.1 foot by measurement of the installed length of pipe along the centerline of the pipe. Payment for each type and size of pipe is made at the contract unit price for that type and size of pipe. Such payment constitutes full compensation for furnishing, transporting, and installing the pipe, including excavation, shoring, backfill, and all the necessary fittings and all other items necessary and incidental to the completion of the work.

***Method 4*—**For items of work for which specific unit prices are established in the contract, the quantity of each type and size of pipe is determined to the nearest 0.1 foot by measurement of the installed length of pipe along the centerline of the pipe. Payment for each type and size of pipe is made at the contract unit price for that type and size of pipe. Such payment constitutes full compensation for furnishing, transporting, and installing the pipe, complete in place, including excavation, shoring, backfill, and all the necessary fittings and all other items necessary and incidental to the completion of the work except the special fittings and appurtenances listed separately in the bid schedule. Payment for each special fitting and appurtenance is made at the contract unit price for that type and size of fitting or appurtenance.

***All methods*—**The following provisions apply to all methods of measurement and payment. Compensation for any item of work described in the contract, but not listed in the bid schedule, is included in the payment for the item of work to which it is made subsidiary. Such items, and the items to which they are made subsidiary, are identified in section 12 of this specification.

12. Items of work and construction details

Items of work to be performed in conformance with this specification and the construction details are:

a. <u>Bid Items 8 & 9, Water Control Structures 1 & 2 - Steel Pipe with Plug & Nipple Control</u>

(1) These items consist of all equipment, labor, and materials necessary for furnishing and installing steel pipes, water control structures, and the necessary fittings and appurtenances, as shown on the drawings.

(2) Pipe may be used if the minimum effective wall thickness is equal to or greater than the wall thickness shown on the drawings. Minimum effective wall thickness is equal to wall thickness minus maximum depth of rush or corrosion pits.

(3) No coating shall be required.

(4) All welding shall be performed by a State Certified Welder.

(5) Laying, Bedding, and backfill of the pipe shall be as follows:

REQUIREMENTS AROUND METAL CONDUITS

A. Foundation Preparation

Foundation preparation for metal conduits shall conform to one of the following:

(1) If the conduit has at least 2 feet of compacted fill beneath the conduit, a minimum of 6 inches with a maximum of 8 inches below the grade line of the conduit shall be pulverized for a width of 2 conduit diameters.

(2) If the conduit has less than 2 feet of compacted fill beneath the conduit or less than 2 feet of excavation as measured from natural ground to grade line of the conduit, the area beneath the conduit shall be excavated a minimum width of 2 conduit diameters to a depth of 2 feet below gradeline of the conduit and replaced with compacted fill. A minimum of 6 inches with a maximum of 8 inches below the gradeline of the conduit shall be pulverized for a width of 2 conduit diameters.

(3) If the conduit has at least 2 feet of excavation as measured from natural groundline to gradeline of the conduit, a minimum of 6 inches with a maximum of 8 inches below the gradeline of the conduit shall be pulverized for a width of 2 conduit diameters.

B. Moisture, Backfill, and Compaction

After the conduit is seated into the pulverized bed, the bed shall be watered until it is thoroughly wetted.

Fill within 2 feet of conduit risers and within 2 feet of conduit barrels (except the foundation) shall contain no particles larger than 1/4 inch and shall be hand compacted or compacted with manually directed power tampers.

Fill within 3 inches of the barrel, and the riser shall be placed at a moisture content which permits ease of compaction around the conduit and into the corrugations of corrugated conduit. Each layer of the portion of fill that is within 3 inches of the conduit, and below the springline shall be thoroughly rodded or tamped around the conduit and into each corrugation by hand using a tamping bar.

Fill outside the 3-inch limits but within the 2-foot limits described above shall be at the moisture content specified for the remainder of the fill and shall be compacted to a density equal to the remainder of the fill.

(6) All fabrication and appurtenances shall be as specified on the drawings.

(7) These items shall also consist of furnishing all materials, labor, and equipment necessary to install:
   a) The inlet trash guard, as shown on the drawings.
   b) The rat guard, as shown on the drawings.
   c) The riser as shown on the drawings.

(8) The bid items subsidiary to this bid item shall only be installed Monday through Friday, 8:00 AM to 4:30 PM, excluding Federal Holidays. Continuous inspection by the government is required for this bid item and items subsidiary to this bid item.

(9) Measurement and Payment Shall be Method 1 by computing the length x diameter of both the barrel and riser and adding the two together for a total amount of diameter-inch-feet.

(10) Items of work subsidiary to these items are:
   a) Concrete – Construction Specification 32
   b) Excavation Pipe Trench – Construction Specification 21

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Construction Specification 94 — Contractor Quality Control

Title 210 – Engineering
Part 642 – Specifications for Construction Contracts
Subpart B – National Construction Specifications
June 2024

A. Scope

1. The work consists of developing, implementing, and maintaining a quality control system to ensure that the specified quality is achieved for all materials and work performed.

B. Equipment and Materials

1. Equipment and material used for quality control must be of the quality and condition required to meet the test specifications cited in the contract. Testing equipment must be properly adjusted and calibrated at the start of operations with the calibration maintained at the frequency specified. Records of equipment calibration tests must be available to the engineer at all times. Equipment must be operated and maintained by qualified operators as prescribed in the manufacturer's operating instructions, the references specified, and as specified in Section J of this specification. All equipment and materials used in performing quality control testing must be as prescribed by the test standards referenced in the contract or in Section J.
2. Handle and operate all equipment and materials in a safe and proper manner and comply with all applicable regulations pertaining to their use, operation, handling, storage, and transportation.

C. Quality Control System

1. Method 1. The contractor must develop, implement, and maintain a system of quality control to provide the specified material testing and verification of material quality before use. The system activities must include procedures to verify adequacy of completed work, initiate corrective action to be taken, and document the final results. The identification of the quality control personnel and their duties and authorities must be submitted to the contracting officer in writing within 15 calendar days after notice of award.
2. Method 2. The contractor must develop, implement, and maintain a system adequate to achieve the specified quality of all work performed, material incorporated, and equipment furnished before use. The system established must be documented in a written plan developed by the contractor and approved by the contracting officer. Include in the system activities the material testing and inspection needed to verify the adequacy of completed work and procedures to be followed when corrective action is required. Daily records to substantiate the

conduct of the system must be maintained by the contractor. The quality control plan must cover all aspects of quality control and must address, at a minimum, all specified testing and inspection requirements. Provide the plan consistent with the planned performance in the contractor's approved construction schedule. Identify in the plan the contractor's onsite quality control manager and provide an organizational listing of all quality control personnel and their specific duties. The written plan must be submitted to the contracting officer within 15 calendar days after notice of award. The contractor must not proceed with any construction activity that requires inspection until the written plan is approved by the contracting officer.

3. All Methods. The quality control system must include, but not be limited to, a rigorous examination of construction material, processes, and operation, including testing of material and examination of manufacturer's certifications as required, to verify that work meets contract requirements and is performed competently.

D. Quality Control Personnel

1. Method 1. Quality control activities must be accomplished by competent personnel. A competent person is one who is experienced and capable of identifying, evaluating, and documenting that materials and processes being used will result in work that complies with the contract. This person also has authority to take prompt action to remove, replace, or correct such work or products not in compliance. Off-site testing laboratories must be certified or inspected by a nationally recognized entity. The contractor must submit to the contracting officer for approval laboratory certification or inspection information. The contractor must submit to the contracting officer for approval the names, qualifications, authorities, certifications, and availability of the competent personnel who will perform the quality control activities.
2. Method 2. Quality control activities must be accomplished by competent personnel who are separate and apart from line supervision and report directly to management. A competent person is experienced and capable of identifying, evaluating, and documenting that material and processes being used will result in work that complies with the contract. This person has authorization to take prompt action to remove, replace, or correct such work or products not in compliance. Off-site testing laboratories must be certified or inspected by a nationally recognized entity. The contractor must submit to the contracting officer for approval laboratory certification or inspection information. The contractor must submit to the contracting officer for approval the names, qualifications, authorities, certifications, and availability of the competent personnel who will perform the quality control activities.

E. Post-award Conference

1. The contractor must meet with the contracting officer before any work begins and discuss the contractor's quality control system. The contracting officer and the contractor must develop a mutual understanding regarding the quality control system including procedures for correcting quality control issues.

F. Records

1. The contractor's quality control records must document both acceptable and deficient features of the work and corrective actions taken. All records must be on forms approved by the contracting officer, be legible, and be dated and signed by the competent person creating the record.
2. Unless otherwise specified in Section J of this specification, records must include:
    a. Documentation of shop drawings including date submitted to and date approved by the contracting officer, results of examinations, need for changes or modifications (if any), manufacturer's recommendations and certifications (if any), and signature of the authorized examiner.
    b. Documentation of material delivered including quantity, storage location, and results of quality control examinations and tests.
    c. Type, number, date, time, and name of individual performing quality control activities.
    d. The material or item inspected and tested, the location and extent of such material or item, and a description of conditions observed and test results obtained during the quality control activity.
    e. The determination that the material or item met the contract provisions and documentation that the engineer was notified.
    f. For deficient work, the nature of the defects, specifications not met, corrective action taken, and results of quality control activities on the corrected material or item.

G. Reporting Results

1. The results of contractor's quality control inspections and tests must be communicated to the engineer immediately upon completion of the inspection or test. Unless otherwise specified in Section J, the original plus one copy of all records, inspections, tests performed, and material testing reports must be submitted to the engineer within 1 working day of completion. The original plus one copy of documentation of material delivered must be submitted to the engineer before the material is used.

H. Access

1. The contracting officer and the engineer must be given free access to all testing equipment, facilities, sites, and related records for the duration of the contract.

I. Payment

1. Method 1.
    a. For items of work for which lump sum prices are established in the contract, payment is made as the work proceeds after presentation by the contractor of invoices showing related costs and evidence of charges by suppliers, subcontractors, and others for furnishing supplies and work performed. If the total of such payments is less than the lump sum contract price for this item, the remaining balance is included in the final contract payment. Payment of

the lump sum contract price constitutes full compensation for completion of the work.

b. Payment is not made under this item for the purchase cost of material and equipment having a residual value.

2. Method 2.

   a. For items of work for which lump sum prices are established in the contract, payment is prorated and paid in equal amounts on each monthly estimate. The number of months used for prorating must be the number estimated to complete the work. The final month's prorate amount is made with the final payment. Payment as described above constitutes full compensation for completion of the work.

   b. Payment is not made under this item for the purchase cost of material and equipment having a residual value.

3. All Methods. Compensation for any item of work described in the contract but not listed in the bid schedule is included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in section J.

J. ITEMS OF WORK AND CONSTRUCTION DETAILS

Items of work to be performed in conformance with this specification and the construction details are:

1. Subsidiary Item, Contractor Quality Control

a. This item consists of performing inspection and testing services for documentation that the finished construction work meets contract requirements.

b. In Section C, Quality Control System, Method 1 shall apply.

c. In Section D, Quality Control Personnel, Method 1 shall apply.

d. No separate payment will be made for Contractor Quality Control. Compensation for this item will be included in the payment for Bid Item 1, Mobilization.

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Material Specification 522—Aggregates for Portland Cement Concrete

1. Scope

This specification covers the quality of fine aggregate and coarse aggregate for use in the manufacture of portland cement concrete.

2. Quality

Aggregate shall conform to the requirements of ASTM Specification C 33 for the specified sizes. Aggregates that fail to meet any requirement may be accepted only when either:

a. The specified alternate conditions of acceptance can be proven before the aggregates are used on the job and within a period such that no work under the contract will be delayed by the requirements of such proof,

or

b. The specification for concrete expressly contains a provision of special mix requirements to compensate for the effects of the deficiencies.

3. Reactivity with alkalies

The potential reactivity of aggregates with the alkalies in cement shall be evaluated by petrographic examination and, where applicable, the chemical method of test, ASTM Designation C 289, or by the results of previous tests or service records of concrete made from similar aggregates from the same source. The standards for evaluating potential reactivity shall be as described in ASTM Specification C 33, appendix A1.

Aggregates indicated by any of the above to be potentially reactive shall not be used except under one of the following conditions:

a. Applicable test results of mortar bar tests made according to ASTM Method C 227 are available which indicate an expansion of less than 0.10 percent at 6 months in mortar bars made with cement containing not less than 0.8 percent alkalies expressed as sodium oxide; or

b. Concrete made from similar aggregates from the same source has been demonstrated to be sound after 3 years or more of service under conditions of exposure to moisture and weather similar to those anticipated for the concrete under these specifications.

Aggregates indicated to be potentially reactive, but within acceptable limits as determined by mortar bar test results or service records, shall be used only with low alkali cement, containing less than 0.60 percent alkalies expressed as sodium oxide.

4. Storing and handling

Aggregates of each class and size shall be stored and handled by methods that prevent segregation of particles sizes or contamination by intermixing with other material.

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Material Specification 531—Portland Cement

1. Scope

This specification covers the quality of portland cement.

2. Quality

Portland cement shall conform to the requirements of ASTM Specification C 150 for the specific types of cement. When Type I portland cement is specified, Type IS portland blast-furnace slag cement or Type IP portland-pozzolan cement conforming to the requirements of ASTM Specification C 595 may be used unless prohibited by the specifications.

When air-entraining cement is required, the contractor shall furnish the manufacturer's written statement providing the source, amount, and brand name of the air-entraining component.

3. Storage at the construction site

Cement shall be stored and protected at all times from weather, dampness, or other destructive elements. Cement that is partly hydrated or otherwise damaged will not be accepted.

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Material Specification 534—Concrete Curing Compound

1. Scope

This specification covers the quality of liquid membrane-forming compounds suitable for spraying on concrete surfaces to retard the loss of water during the concrete curing process.

2. Quality

The curing compound shall meet the requirements of either ASTM Specification C 309 or C 1315. If Type 1 is specified, a fugitive dye shall be used.

3. Delivery and storage

All curing compounds shall be delivered to the site of the work in the original container bearing the name of the manufacturer and the brand name. The compound shall be stored in a manner that prevents damage to the container and protects water-emulsion types from freezing.

Material Specification 539—Steel Reinforcement (for concrete)

1. Scope

This specification covers the quality of steel reinforcement for reinforced concrete.

2. Quality

All reinforcement shall be free from loose or flaky rust, soil, oil, grease, paint, or other deleterious matter.

Steel bars for concrete reinforcement shall be grade 40, 50, or 60 deformed bars conforming to one of the following specifications:

- Deformed and plain billet-steel bars for concrete reinforcement—ASTM A 615
- Rail-steel deformed bars for concrete reinforcement—ASTM A 996
- Axle-steel deformed bars for concrete reinforcement—ASTM A 996

Dowels shall be plain round bars conforming to the same specifications listed above for steel bars.

Fabricated deformed steel bar mats for concrete reinforcement shall conform to the requirements of ASTM A 184.

Plain steel welded wire reinforcement for concrete reinforcement shall conform to the requirements of ASTM A 185.

Deformed steel welded wire reinforcement for concrete reinforcement shall conform to the requirements of ASTM A 497.

Epoxy-coated steel bars for concrete reinforcement shall conform to the requirements of ASTM A 775.

3. Dimensions of welded wire reinforcement

Gauges, diameters, spacing, and arrangement of wires for welded steel wire fabric shall be as defined for the specified style designations.

4. Storage

Steel reinforcement inventories at the site of the work shall be stored above the ground surface on platforms, skids, or other supports and shall be kept clean and protected from mechanical injury and corrosion.

Material Specification 554—Steel Pipe

1. Scope

This specification covers the quality of steel pipe and fittings.

2. Pipe

Steel pipe shall conform to the requirements of the applicable specification listed below for the kind of pipe and the type, weight, grade, and finish specified:

Pipe	ASTM specification
Steel, black and hot-dipped, zinc-coated welded and seamless	A 53
Steel, electric-fusion (ARC)-welded (sizes NPS 16 and over)	A 134
Electric-resistance-welded steel	A 135
Electric-fusion (ARC)-welded steel (NPS 4 and over)	A 139
	AWWA standard
Steel water pipe, 6 inches and larger	C 200

3. Fittings

Fittings shall conform to the requirements for the types and kinds specified.

Fittings	ASTM specification
Heat-treated carbon steel fittings for low-temperature and corrosive service	A 858
Threaded couplings, steel, black or zinc-coated (galvanized) welded or seamless, for use in steel pipe joints	A 865

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Material Specification 581—Metal

1. Scope

This specification covers the quality of steel and aluminum alloys.

2. Structural steel

- Structural steel shall conform to the requirements of ASTM A 36.
- High-strength low-alloy structural steel shall conform to ASTM A 242 or A 588.
- Carbon steel plates of structural quality to be bent, formed, or shaped cold shall conform the ASTM A 283, Grade C.
- Carbon steel sheets of structural quality shall conform to ASTM Standard A 1011, Grade 40, or A 1008, Grade 40.
- Carbon steel strip of structural quality shall conform to ASTM Standard A 1011, Grade 36.

3. Commercial or merchant quality steel

Commercial or merchant quality steel shall conform to the requirements of the applicable ASTM listed below:

Product	ASTM standards
Carbon steel bars	A 575, Grade M 1015 to Grade M 1031
Carbon steel sheets	A 1011
Carbon steel strips	A 1011
Zinc-coated carbon steel sheets	A 653 or A 924

4. Aluminum alloy

Aluminum alloy products shall conform to the requirements of the applicable ASTM standard listed below. Unless otherwise specified, alloy 6061-T6 shall be used.

Product	ASTM standard
Standard structural shape	B 308
Extruded structural pipe and tube	B 429
Extruded bars, rods, shapes, and tubes	B 221
Drawn seamless tubes	B 210
Rolled or cold-finished bars, rods, and wire	B 211
Sheet and plate	B 209

5. Bolts

Steel bolts shall conform to the requirements of ASTM Standard A 307. If high-strength bolts are specified, they shall conform to the requirements of ASTM A 325.

When galvanized or zinc-coated bolts are specified, the zinc coating shall conform to the requirements of ASTM Standard A 153 except that bolts 0.5 inch or less in diameter may be coated with electro-deposited zinc or cadmium coating conforming to the requirements of ASTM Standard B 633, Service Condition SC 3, or ASTM B 766, unless otherwise specified.

6. Rivets

Unless otherwise specified, steel rivets shall conform to the requirements of ASTM Specification A 31, Grade B. Unless otherwise specified, aluminum alloy rivets shall be Alloy 6061 conforming to the requirements of ASTM Standard B 316.

7. Welding electrodes

Steel welding electrodes shall conform to the requirements of American Welding Society Specification AWS A5.1, "Specification for Mild Steel Covered Arc-Welding Electrodes," except that they shall be uniformly and heavily coated (not washed) and shall be of such a nature that the coating does not chip or peel while being used with the maximum amperage specified by the manufacturer.

Aluminum welding electrodes shall conform to the requirements of American Welding Society Specification AWS A5.10, "Specification for Aluminum and Aluminum-Alloy Welding Rods and Bare Electrodes."