



ADDENDUM NO. 1

To: All prospective Bidders
DCR Contract #P24-3541-C1A
Lowe's Pond Dam Rehabilitation

Location: Huguenot Road, Oxford, MA / 42°06'30.3"N 71°51'52.3"W

From: Dan Mortell, DCR Dam Maintenance

RE: Addendum No. 1

Date: September 26, 2024

Pages: Addendum 2 pages

Attachment: Plan Set of 30 pages

Attachment: Technical Specification Section Part 5 of 584 pages

Please find the following ADDENDM NO 1 for DCR Contract P24-3541-C1A which is to be included as part of the Contract Documents thereof. The items set forth herein, whether of omission, addition, substitution or other change, are all to be included in and form a part of the proposed Contract Documents for the work.

Bidders shall acknowledge receipt of this Addendum No. 1 by checking the appropriate box on the project page within the Bid Express website (www.bidexpress.com)

The date, time and location for receipt of bids remain unchanged. General Bid proposals are to be received until 12:00 PM on Thursday, October 24, 2024 through DCR's E-Bid room at www.bidexpress.com/business/36765/home.

Item #1: Revision to Contract Documents

1. Replace complete plan set with attached documents dated August 2024.

COMMONWEALTH OF MASSACHUSETTS · EXECUTIVE OFFICE OF ENERGY & ENVIRONMENTAL AFFAIRS

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Executive Office of Energy & Environmental Affairs

Brian Arrigo, Commissioner

Department of Conservation & Recreation

2. Replace Technical Specifications – Part V of Blue Book Contract with attached technical specification documents in its entirety.

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END OF SECTION

SECTION 01010

SUMMARY OF WORK

PART 1 - GENERAL

1.01 LOCATION OF WORK:

- A. The work of this Contract is located in the Town of Oxford, Worcester County, Massachusetts, at the Lowes Pond Dam.
- B. Lowes Pond is a recreational pond which extends over an area of approximately 32 acres. The entire Lowes Pond is within the FEMA regulated Special Flood Hazard Area Zone AE.
- C. The Contractor shall maintain the Pond water level within the limits specified in Section 01063 and maintain a flow-by pass as specified in Section 01063.
- D. Access to the Work Area is gained via Huguenot Road. The Contractor shall note that Huguenot Road is a public road and falls under the jurisdiction of the Town of Oxford Department of Public Works. The Road must be passable at all times except for short duration disruptions as managed by a traffic flagger.

1.02 SCOPE OF WORK:

- A. Furnish all labor, materials, equipment and incidentals necessary and rehabilitate the Lowes Pond Dam and the associated adjacent areas complete and ready for operation as shown on the Drawings and specified herein.
- B. The Work includes, but is not necessarily limited to, the following major items:
 - 1. Install and maintain a by-pass flow pumping system, and monitor and regulate surface elevation of Lowes Pond
 - 2. Demolish and remove existing concrete and masonry sluiceway, retaining walls, and embankment, existing building foundation, channel, concrete slab and rock ledge
 - 3. Demolish existing concrete deteriorated vertical wall down to grade
 - 4. Excavate rock required to construct spillway keyway
 - 5. Remove and retain existing boulders for re-use
 - 6. Remove and retain existing guardrail and sign for reuse
 - 7. Repair existing spillway and extend spillway section

8. Construct new training walls, footings, stilling basin, slope riprap
9. Construct a new pedestrian bridge, walkways, and parking lots.
10. Regrade the site, install loam topsoil, plant, and seed within the limits of work
11. Install a new fence along the Northeast limit of work
12. Install erosion and sedimentation control measures.
13. Comply with the conditions of Environmental Permits.

1.03 CONTRACTOR'S USE OF PREMISES:

- A. Contractor shall limit the use of the premises for the performance of the Work and storage of materials and equipment to those areas identified in the Drawings.
- B. Contractor shall assume full responsibility for security of all his and his subcontractors' materials and equipment stored on the site.
- C. If directed by the Owner, Contractor shall move any stored items which interfere with operations of Owner.
- D. Obtain and pay for use of additional storage or work areas if needed to perform the Work.

END OF SECTION

SECTION 01045

CUTTING, CORING AND PATCHING

PART 1 - GENERAL

1.01 DESCRIPTION:

- A. This Section covers the cutting, coring, rough and finish patching of holes and openings in existing and new construction.
- B. All cutting, coring, and rough patching shall be performed by the Contractor. Finish patching shall be the responsibility of the Contractor and shall be performed by the trade associated with the application of the particular finish.

1.02 ALTERATIONS, CUTTING, AND PROTECTION:

- A. Survey and record condition of existing facilities to remain in-place that may be affected by alteration operations. After alteration work is complete, survey conditions again and restore existing facilities to pre-alteration condition.
- B. Perform Work of moving, removal, cutting, and patching with trades qualified to perform Work in manner causing least damage to each type of Work.
- C. Cut finish surfaces such as masonry, tile, plaster or metals, by methods to terminate surfaces in a straight line at a natural point of division.
- D. Protect existing finishes, equipment, and adjacent Work which is to remain, from damage.
- E. Provide shoring, needling, and bracing to keep structures structurally secure and free of damaging deflection during cutting or coring operations.

1.03 QUALITY ASSURANCE:

- A. Comply with the requirements specified in Section 01400.
- B. Adhere strictly to the manufacturer's current printed recommendations regarding temperature at time of application for all work involving epoxy, cement base coating and protective coating.
- C. Use only products of the specified Repair Mortar System Manufacturer(s) or equal.
- D. Any changes in the specified repair mortar work methods shall be allowed only with the written acceptance of the Engineer.

PART 2 - PRODUCTS

2.01 MATERIALS:

- A. Concrete repair mortar shall be a non-shrink, commercial formulation requiring only the addition of water with minimum 28-day compressive strength of 5,000 psi.
- B. Provide a non-shrink cementitious repair mortar material as manufactured by:
 - 1. Sika Repair 224 manufactured by Sika Corporation,
 - 2. MasterEmaco S 488CI manufactured by BASF Corporation,
 - 3. Restokrete Underlayment No. F-120 by Sauereisen, Inc.,
 - 4. Or acceptable equivalent product.
- C. Materials for finish patching shall be equal to those of adjacent construction.

PART 3 - EXECUTION

3.01 GENERAL:

- A. All cutting and coring shall be performed in such a manner as to limit the extent of patching.
- B. All holes cut through concrete and masonry walls, slabs or arches shall be core drilled unless otherwise accepted. No structural members shall be cut without acceptance of the Structural Engineer of Record and all such cutting shall be done in a manner directed by the SER. No holes may be drilled in beams or other structural members. All work shall be performed by mechanics skilled in this type of work.
- C. Rough patching shall be such as to bring the cut or cored area flush with existing construction unless otherwise shown. Finish patching shall match existing surfaces.
- D. Reinforcing steel cut by cutting and coring operations shall be coated with a three-component, solvent free, moisture tolerant, epoxy-modified cementitious product specifically formulated as an anti-corrosion coating; installed in accordance with the manufacturer's printed instructions.

3.02 CUTTING:

- A. Inspect existing conditions of Work, including components subject to damage or movement during cutting or patching.
- B. Do not cut or notch structural members without specific written acceptance of the Engineer.

- C. Cutting shall be performed with a concrete saw and diamond saw blades of proper size.
- D. Corners of square or rectangular openings shall be cored. Do not overcut corners of openings. Corners shall be chipped out square, if required, so as not to cause cracking at the corners.
- E. Provide for control of slurry generated by sawing operation on both sides of element.
- F. When cutting reinforced concrete, the cutting shall be done so as not damage bond between the concrete and reinforcing steel left in structure. Cut shall be made so that steel neither protrudes nor is recessed from face of the cut.
- G. Adequate bracing and/or shoring of area to be cut shall be installed prior to start of cutting. Check area during sawing operations for cracking and provide additional bracing as required to prevent a partial release of cut area during sawing operations.
- H. Provide equipment of adequate size to remove cut panel.

3.03 CORING:

- A. Coring shall be performed with an accepted non-impact rotary tool with diamond core drills. Size of holes shall be suitable for pipe, conduit, sleeve, equipment or mechanical seals to be installed.
- B. Provide protection for existing equipment, utilities and critical areas against water or other damage caused by drilling operation.
- C. Slurry or tailings resulting from coring operations shall be removed from the area following drilling.

3.04 PATCHING:

- A. Prepare surfaces to receive cementitious repair mortar in accordance with manufacturer's instructions.
- B. Mix the cementitious repair mortar material components in accordance with the manufacturer's instructions. Concrete surfaces should be surface saturated dry (SSD) with no standing water prior to mortar application.
- C. Work a wet scrub coat of the mortar per the manufacturer's recommendations into the pores and voids in the substrate and over the substrate prior to mortar application by trowel.
- D. Apply the cementitious repair mortar using a steel trowel to work the material into the surface. Fill voids from deepest to shallowest areas as the application work proceeds. Strictly follow the manufacturer's application requirements.

- E. Once the repair areas are filled with repair mortar, strike off the mortar level with the surrounding concrete substrate. Do not leave a broom finish. Finish with a steel trowel until closed up at the surface and flat.
- F. Cure the repair mortar in strict accordance with the manufacturer's instructions.

3.05 CLEANING:

- A. Perform periodic and final cleaning as specified in Section 01740, and:
 - 1. Clean Owner-occupied areas daily.
 - 2. Clean spillage, overspray, and heavy collection of dust in Owner-occupied areas immediately.
- B. At completion of alterations work in each area, provide final cleaning and return space to condition suitable for use by Owner.
- C. Remove debris from site each day. Removed material, except that listed or marked by Engineer for retention, becomes property of Contractor.

3.06 CLOSEOUT ACTIVITIES:

- A. Provide in accordance with Section 01700.

END OF SECTION

SECTION 01046
CONTROL OF WORK

PART 1 - GENERAL

1.01 PLANT AND HOURS OF CONSTRUCTION:

- A. Furnish plant and equipment which will be efficient, appropriate, and large enough to secure a satisfactory quality of work and a rate of progress which will insure the completion of the work within the Contract Time. If at any time such plant appears to the Engineer to be inefficient, inappropriate, or insufficient for securing the quality of work required or for producing the rate of progress aforesaid, he may order the Contractor to increase the efficiency, change the character, or increase the plant equipment, and the Contractor shall conform to such order. Failure of the Engineer to give such order shall in no way relieve the Contractor of his obligations to secure the quality of the work and rate of progress required.
- B. Normal construction activity shall take place only between the hours of 7 a.m. to 6 p.m., excluding Saturdays, Sundays, and legal holidays. Work outside the above time periods will be permitted only on an emergency basis and only with the approval of the Owner.

1.02 OCCUPYING PRIVATE LAND:

- A. The Contractor shall not (except after written consent from the proper parties) enter or occupy with men, tools, materials, or equipment any land outside the rights of way or property of the Owner. A copy of the written consent shall be given to the Engineer.

1.03 DIMENSION OF EXISTING STRUCTURES

- A. Where the dimensions and locations of existing structures are of importance in the installation or connection of any part of the Work, the Contractor shall verify such dimensions and locations in the field before the fabrication of any material or equipment which is dependent on the correctness of such information.

1.04 DATUM VERIFICATION

- A. The Contractor shall confirm the horizontal and vertical datums and submit to the Engineer prior to demolition.

1.05 OPEN EXCAVATIONS:

- A. All open excavations shall be adequately safeguarded by providing temporary barricades, fencing, caution signs, lights, and other means to prevent accidents to persons and damage to property. The Contractor shall, at his own expense, provide suitable and safe bridges and other crossings for accommodating travel by pedestrians and workmen. Bridges provided for access during construction shall be removed when no longer required. The length or size of excavation will be controlled by the particular surrounding conditions, but

shall always be confined to the limits prescribed by the Engineer. If the excavation becomes a hazard, or if it excessively restricts traffic at any point, the Engineer may require special construction procedures such as limiting the length of the open trench, prohibiting stacking excavated material in the street, and requiring that the trench shall not remain open overnight.

- B. The Contractor shall take precautions to prevent injury to the public due to open trenches. All trenches, excavated material, equipment, or other obstacles which could be dangerous to the public shall be well lighted at night.

1.06 TEST PITS:

- A. Test pits for the purpose of locating underground pipeline or structures in advance of the construction shall be excavated and backfilled by the Contractor at the direction of the Engineer. Test pits shall be backfilled immediately after their purpose has been satisfied and the surface restored and maintained in a manner satisfactory to the Engineer.

1.07 INTERFERENCE WITH AND PROTECTION OF STREETS:

- A. The Contractor shall not close or obstruct any portion of a street, road, or private way without obtaining permits therefor from the proper authorities. If any street, road or private way shall be rendered unsafe by the Contractor's operations, he shall make such repairs or provide such temporary ways or guards as shall be acceptable to the proper authorities.
- B. Streets, roads, private ways, and walks not closed shall be maintained passable and safe by the Contractor, who shall assume and have full responsibility for the adequacy and safety of provisions made therefor.
- C. The Contractor shall, at least 24 hours in advance, notify the Police and Fire Departments in writing, with a copy to the Engineer, if the closure of a street or road is necessary. He shall cooperate with the Police Department in the establishment of alternate routes and shall provide adequate detour signs, plainly marked and well lighted, in order to minimize confusion.

1.08 CARE AND PROTECTION OF PROPERTY:

- A. The Contractor shall be responsible for the preservation of all public and private property, and shall use every precaution necessary to prevent damage thereto. If any direct or indirect damage is done to public or private property by or on account of any act, omission, neglect, or misconduct in the execution of the work on the part of the Contractor, such property shall be restored by the Contractor, at his expense, to a condition similar or equal to that existing before the damage was done, or he shall make good the damage in other manner acceptable to the Engineer.

1.09 PROTECTION AND RELOCATION OF EXISTING STRUCTURES AND UTILITIES:

- A. The Contractor shall assume full responsibility for the protection of all buildings, structures, and utilities, public or private, including poles, signs, services to buildings, utilities in the street, gas pipes, water pipes, hydrants, sewers, drains, and electric and telephone cables, whether or not they are shown on the Drawings. The Contractor shall carefully support and protect all such structures and utilities from injury of any kind. Any damage resulting from the Contractor's operations shall be repaired by him at his expense.
- B. Assistance will be given the Contractor in determining the location of existing services. The Contractor, however, shall bear full responsibility for obtaining all locations of underground structures and utilities (including existing water services, drain lines, and sewers). Services to buildings shall be maintained, and all costs or charges resulting from damage thereto shall be paid by the Contractor.
- C. Protection and temporary removal and replacement of existing utilities and structures shall be a part of the work under the Contract..

1.10 INSPECTION OF WORK AWAY FROM THE SITE:

- A. If work to be done away from the construction site is to be inspected on behalf of the Owner during its fabrication, manufacture, or testing, or before shipment, the Contractor shall give notice to the Engineer of the place and time where such fabrication, manufacture, testing, or shipping is to be done. Such notice shall be in writing and delivered to the Engineer in ample time so that the necessary arrangements for the inspection can be made.

1.11 COOPERATION WITHIN THIS CONTRACT:

- A. All firms or persons authorized to perform any work under this Contract shall cooperate with General Contractor and his Subcontractors or trades, and shall assist in incorporating the work of other trades where necessary or required.
- B. Cutting and patching, drilling and fitting shall be carried out where required by the trade or subcontractor having jurisdiction, unless otherwise indicated herein or directed by the Engineer.

1.12 CLEANUP AND DISPOSAL OF EXCESS MATERIAL:

- A. During the course of the work, the Contractor shall keep the site of his operations in as clean and as neat a condition as is possible. He shall dispose of all residue resulting from the construction work and, at the conclusion of the work, he shall remove and haul away any surplus excavation, broken pavement, lumber, equipment, temporary structures, and any other refuse remaining from the construction operations, and shall leave the entire site of the work in a neat and orderly condition.
- B. In order to prevent environmental pollution arising from the construction activities related to the performance of this Contract, the Contractor and his subcontractors shall comply

with all applicable Federal, State, and local laws, and regulations concerning waste material disposal, as well as the specific requirements stated in this Section and elsewhere in the Specifications.

- C. Dredged sediments shall be reused on-site to the maximum extent practicable. If offsite disposal is required and the sediment is determined to comply with applicable requirements, sediment may be disposed of and/or reused at a lined landfill in Massachusetts. Provided the sediments are determined to comply with applicable requirements, these materials may be reused as cover material at a non-hazardous landfill.
- D. The Contractor is advised that the disposal of excess excavated material in wetlands, stream corridors, and plains is strictly prohibited even if the permission of the property owner is obtained. Any violation of this restriction by the Contractor or any person employed by him, will be brought to the immediate attention of the responsible regulatory agencies, with a request that appropriate action be taken against the offending parties. Therefore, the Contractor will be required to remove the fill at his own expense and restore the area impacted.

END OF SECTION

SECTION 01063
MISCELLANEOUS REQUIREMENTS

PART 1 - GENERAL

1.01 SCOPE OF WORK:

- A. The Contractor shall conform to all miscellaneous requirements as herein specified.

1.02 TRAFFIC CONTROL:

- A. Whenever and wherever, in the opinion of the Owner, traffic is sufficiently congested or public safety is endangered, the Contractor, as required, shall furnish uniformed special officers to direct traffic and to keep traffic off the roadway area affected by his construction operations. Such officers shall be in addition to the watchmen required under other provisions of the contract.
- B. The cost of such special officers will be paid for under the appropriate item in the BID.
- C. The employment or presence of special officers, or police shall in no way relieve the Contractor of any responsibility or liability which is his under the terms of the contract.

1.03 WORK IN AND AROUND PONDS AND STREAMS:

- A. Contractor shall take all necessary precautions to minimize debris and contaminants during construction. The Contractor shall notify the Engineer or Owner immediately if any contaminant enters the water supply during construction activities so proper action can immediately be taken.
- B. Contractor shall not park construction vehicles in or immediately upstream of reservoir or stream. Construction vehicles and personal vehicles shall only be parked overnight in Contractor Staging Areas.
- C. The contractor shall take all necessary precautions to prevent the leakage of petroleum products and hydraulic fluid from these vehicles. Any release of contaminants from these vehicles shall be immediately cleaned up and disposed of in accordance with Federal, State, and local regulations.
- D. Tarps shall be deployed to prevent any debris from entering the stream or pond. **Do not allow any contamination of the pond and take all necessary precautions to prevent hazardous materials from entering the pond.**
- E. Contractor shall comply with applicable local, state, and federal guidelines and regulations for work involving the containment, handling, and disposal of hazardous materials, including the demolition and removal of lead paint and asbestos containing materials.

- F. Temporary sanitary facilities shall not be placed in or immediately upstream from the reservoir or stream.
- G. Contractor must secure their equipment and materials during non-working periods to prevent vandalism to the contractor's equipment and to prevent the equipment from being used to vandalize the dam.
- H. Contractor shall install temporary fencing around the Construction Staging Areas.

1.04 WATER CONTROL OF LOWES POND:

- A. Lowes Pond has a full pool water surface elevation of 474.8 feet. The Lowes Pond Dam impounds approximately 188 acre-feet (61.4 million gallons) of water.
- B. The full pool water surface elevation is established by the spillway to be rehabilitated and extended. The water that passes over the spillway flows into Lowes Brook on the downstream side of the dam and under Huguenot Road. The existing inlet and sluiceway to be demolished are currently inoperable, and all releases from Lowes Pond flow over the spillway.
- C. All construction work for demolition, excavation, surface preparation, concrete repair and placement shall be performed in the dry. Contractor shall isolate the work area within the pond and the downstream Lowes Brook by means of cofferdam(s).
- D. Installed cofferdam(s) shall have a crest at, or below elevation 474.8 to prevent raising the flood level in the FEMA regulated Special Flood Hazard Area, Zone AE contained in Lowes Pond.
- E. Lowes Pond level shall be maintained at elevation 471.0 most of the time, except that it is anticipated that the Lowes Pond level may rise above elevation 471.0 for short period following large precipitation events. It is estimated that if the Pond level is at elevation 471.0 the 2-year storm (3.27 inches in 24 hours) will be contained in the Pond below elevation 474.8. Based on permit application conditions, Lowes Pond water level shall not be lowered below elevation 471.
- F. Cofferdam shall be designed to be overtopped by a greater than 2-year storm event without failure of the cofferdam system.
- G. Contractor shall provide and operate a water by-pass facility for the work area to direct flow from Lowes Pond around the cofferdam/construction area to a discharge point downstream of the work area and just upstream of the Huguenot Road bridge.
- H. Contractor shall submit to the Engineer a plan on how they intend to maintain the Pond level and by-pass facility. The plan shall be submitted at least 2 weeks prior to start of on-site activities. The submitted plan shall include specific details with calculations supporting the plan. The plan shall also include a contingency plan in the event the cofferdam is overtopped during a large storm event.

- I. The Contractor shall be responsible for any demobilization and mobilization costs and any cleanup as a result of their cofferdam and bypass pumping system being exceeded by a greater than 2-year storm event. As such, the Contractor shall size their system accordingly.
- J. In order to control the pond level, when it is not raining the Contractor shall pump at a rate approximately equal to the amount of inflow to Lowes Pond. Following rainfall events, the Contractor shall provide sufficient pumping capacity to draw down Lowes Pond level to elevation 471.0 within one week.
 - 1. The following table shows the estimated daily inflow exceedances by month to the Lowes Pond based on the 71-year record period from October 1939 to September 2019 at the USGS gaging station # 01124500 on Little River near Oxford, MA adjusted for drainage area.

Table 1: Estimated Daily Inflow Exceedance to Lowes Pond (CFS)

	<i>90%</i>	<i>50%</i>	<i>10%</i>
October	0.3	4.0	21.1
November	2.0	9.7	31.3
December	4.0	10.8	30.2
January	3.4	12.2	35.3
February	6.0	15.9	36.7
March	12.2	28.2	65.5
April	9.1	18.5	44.1
May	4.8	12.0	28.5
June	0.9	4.8	19.4
July	0.3	2.3	10.8
August	0.3	1.4	10.8
September	0.3	2.6	13.9

1.05 SPILLS PREVENTION PLAN:

- A. Contractor shall prepare a spills contingency plan that addresses the potential releases of oil and/or hazardous materials, including refueling of machinery and storage of fuels, and the release of hazardous materials generated by demolition activities. The contingency plan

must address measures that will be taken to prevent a spill and the equipment and materials that will be stored at the site to contain and clean up a spill if it should occur.

- B. Contingency plan shall be submitted to the Engineer for review and approval at least 2 week prior to the start of construction.

1.06 SIGNAGE:

- A. Provide project signage according to DCR standards – sign detailing provided at the end of this section.
- B. Provide signage upstream on both sides of the Dam embankment, as shown on the drawings, notifying boaters of dam ahead according to Dam Safety Warning Signs Best Practices Promoting Public Awareness and Preventing Loss of Life provided by FEMA. Signage shall read “Danger” and a pictogram of “Dam Ahead (others)” according to FEMA sign standards in Section 4.
 - 1. The sign paneling, based on *Figure 1: Sign Paneling*, shall be a 1 Panel.
 - 2. The viewing distance, based on *Table 4: Sign Text and Sign Height*, shall be 83ft.
 - 3. The mounting height, based on *Table 8: Mounting Height for Water Viewed Signs*, shall be based on the letter height determined from Table 4.
 - 4. The coloring shall be red.

Submit sign design for approval by the Engineer.

END OF SECTION

96"



LOWES POND DAM

Oxford, MA

Massachusetts Department of Conservation and Recreation in partnership with the Town of Oxford

CONTRACTOR NAME GOES HERE

Contractor

Governor, Maura Healey

Lieutenant Governor, Kim Driscoll

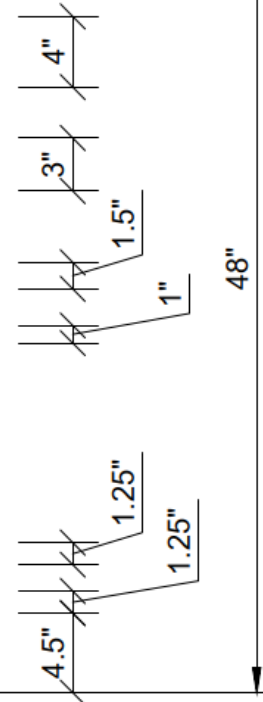
Executive Office of Energy and Environmental Affairs Secretary, Rebecca Tepper

Department of Conservation and Recreation Commissioner, Brian Arrigo

on behalf of

The Citizens of the Commonwealth of

Massachusetts



NOTES:

- * Sign size is 4'x8'. Substrate 3/4" MDO plywood or .080 aluminium mounted on 4'x6' wood posts of 2"x12" metal U channels. U-channels must be galvanized or painted black. A two part post system with 8ft U-Channel bolted to a 4'U-channel in the ground may be used. Use stainless hex head bolts to attach sign to posts. Install posts minimum 4' below grade. Bottom of sign 4' above grade.
- * Data contained: Project name, Location, DCR logo, Designer, Contractor & Credits.
- * DCR Logo: Contact project manager or sign shop for large logo in digital format.
- * For Project names requiring three lines, the text may be reduced to 3.75" tall.
- * Location of Sign: Site to be determined by DCR Project Manager and Site Manager.
- * Sign background color is Sage PMS 5655 or Benjamin Moore HC318
- * All text is Black. Logo is dark Maroon PMS 504U.
- * All Type is Frutiger, 65 Bold and Frutiger 55 Roman. Logo is Garamond.

DCR Project Manager

Approval Date

SECTION 01065

STRUCTURAL TESTS AND INSPECTIONS

PART 1 - GENERAL

1.01 GENERAL:

- A. The Structural Engineer of Record (SER) is required to prepare a program describing the structural tests and inspections that will be performed for this project. The SER is the structural engineer (an individual) who is in responsible charge of the preparation of the structural drawings and structural specifications for this project and whose professional engineering seal appears on said structural drawings. The parties responsible for the performance of the structural tests and inspections are noted on the Program of Structural Tests and Inspections prepared by the SER.
- B. The SER has prepared a Program of Structural Tests and Inspections (the "Program"), which has been or will be submitted to the building official who has jurisdiction over this project. A copy of this program is included in this specification as Attachment No 1 for reference.
- C. The Program shall not relieve the Contractor or its subcontractors of their responsibilities and obligations for quality control of the Work, their other obligations for supervising the work, for any design work, which is included in their scope of services, and for full compliance with the requirements of the Contract Documents. The detection of, or failure to detect, deficiencies or defects in the Work during the testing and inspection conducted pursuant to the Program shall not relieve the Contractor or its subcontractors of their responsibility to correct all deficiencies or defects, whether detected or undetected, in all parts of the Work, and to otherwise comply with all requirements of the Contract Documents. Further, while the SER, and the Resident Engineer shall perform certain tasks in the Program requiring the review of certain construction activities, the SER and Resident Engineer shall only perform such tasks to ensure compliance with the SER approved submittals and the specifications. Neither the SER nor the Resident Engineer shall assume any responsibility or liability for the means, methods, procedures or techniques used by any construction contractor.
- D. The program of structural tests and inspection does not apply to the Contractor's equipment, temporary structures used by the Contractor to construct the project, the Contractor's means, methods, and procedures, and job site safety.

1.02 CONTRACTOR'S RESPONSIBILITIES:

- A. Where the Program of Structural Tests and Inspections indicates that a structural component or system is subject to structural tests and inspections and that the SER for the project has not been retained to design said component or system or to prepare a performance specification for said component of system, the Contractor shall retain, or

require others under his aegis to retain, a professional engineer registered in the jurisdiction where the project is located to design said component or system and to provide the required program of structural tests and inspections for said component or system.

- B. The Contractor shall provide free and safe access to the Work for the SER and all other individuals who are observing the Work or performing structural tests or inspections. The Contractor shall provide all ladders, scaffolding, staging, and up-to-date safety equipment, all in good and safe working order, and qualified personnel to handle and erect them, as may be required for safe access.

1.03 CONTRACTOR FURNISHED TESTING LABORATORY SERVICES:

- A. An independent commercial testing laboratory acceptable to the Engineer shall perform all tests that require the services of a laboratory to determine compliance with the Contract Documents. The laboratory shall be staffed with experienced technicians, properly equipped, and fully qualified to perform the tests in accordance with the specified standards.
- B. Preliminary Testing Services: The Contractor shall be responsible for all testing laboratory services in connection with concrete materials and mix designs, the design of asphalt mixtures, gradation tests for structural and embankment fills, backfill materials, and all other tests and engineering data required for the Engineer's review of materials and equipment proposed to be used in the Work. The Contractor shall obtain the Engineer's acceptance of the testing laboratory before having services performed, and shall pay all costs for services.
- C. The Contractor shall not retain any testing laboratory against which the Owner or the Engineer have reasonable objection, and if at any time during the construction process the services become unacceptable to the Owner, or the Engineer, either the Owner or the Engineer may direct in writing that such services be terminated. The request must be supported with evidence of improper testing or unreasonable delay. If the Engineer determines that sufficient cause exists, the Contractor shall terminate the services and engage a different testing laboratory.
- D. Transmittal of Test Reports: Written reports of testing and engineering data furnished by the Contractor for the Engineer's review of materials and equipment proposed to be used in the Work shall be submitted as specified for Shop Drawings.
- E. The Contractor's testing laboratory shall furnish four copies of a written report of each test performed by laboratory personnel within three days after each test is completed. Distribution shall be two copies of each test report to the Engineer's Representative, one copy to the Owner, and one copy for the Contractor.

1.04 OWNER FURNISHED TESTING AND INSPECTION SERVICES:

- A. The Owner will employ the services of an independent testing agency to conduct the Program of Structural Tests and Inspections as described in Section 01065 and perform

all quality control tests of materials of construction in the field or in the laboratory during and after their incorporation in the Work. Field sampling and testing shall be performed in the general manner indicated in the specifications, with minimum interference with construction operations.

- B. The Contractor shall furnish a construction schedule and a minimum of 48 hour notice of readiness for testing and inspection of the work. The Engineer shall determine the exact time and location of field sampling and testing, and may require such additional sampling and testing as necessary to determine that materials and equipment conform with data previously furnished by Contractor and to the Contract Documents.
- C. The Contractor shall schedule the work to permit adequate time for testing and re-testing should test results not conform to the contract documents. Lack of testing or inspection which is attributable to insufficient notice by the Contractor or failure of the Contractor to cooperate, will be cause for rejection of the work.
- D. The Contractor shall deliver materials in sufficient quantities to the Owner's testing agency as may be required. Laboratory testing shall be performed within a reasonable time, consistent with the specified standards.
- E. The Contractor shall furnish material samples and cooperate in the field sampling and testing activities, interrupting the work when necessary. The Contractor shall furnish personnel, facilities and access to assist in the sampling and testing activities.

PART 2 - PRODUCTS

(Not Used)

PART 3 - EXECUTION

(Not Used)

**ATTACHMENT NO. 1
PROGRAM OF STRUCTURAL TESTS AND INSPECTIONS**

Project: Mass DCR Abandoned Dams Lowes Pond Dam Contract No. P19-3264-D4A

Location: Oxford, MA

Owner: Massachusetts Department of Conservation and Recreation

Owner's Address: 251 Causeway Street, Suite 600 Boston, MA 02114-2119

Structural Engineer of Record (SER): Anthony Catalano Jr., PE

This program of structural tests and inspections is submitted as a condition for issuance of the building permit in accordance with the International Building Code.

The following firms, agencies, or individuals (hereinafter referred to collectively as agents) will perform the tests and inspections under the direction of the SER:

<u>Abbreviation</u>	<u>Agent</u>
SER	Structural Engineer Of Record Listed Above
RES	The Resident Representative
ITA(C)	Independent Testing Agency Employed By Contractor
ITA	Independent Testing Agency Employed By Owner
RPE(C)	Registered Professional Engineer Employed By Contractor
GEO	The Project Geotechnical Engineer
IWI	Independent Welding Inspector

The above abbreviations will be used on the attached pages to identify which agent is performing the particular tests or inspections.

The following categories of structural tests and inspections, if checked, are included in the program for structural tests and inspections for this project. The specific tests and inspections required for each checked category are listed on the page noted opposite the category and further described in the various technical specification sections.

<u>Category</u>	<u>Page</u>	<u>Category</u>	<u>Page</u>
<input type="checkbox"/> Steel Construction		<input checked="" type="checkbox"/> Controlled Structural Fill	7
<input checked="" type="checkbox"/> Cast-in-Place Concrete	6	<input type="checkbox"/> Pile Foundations	
<input type="checkbox"/> Precast Concrete Construction		<input type="checkbox"/> Pier Foundations	
<input type="checkbox"/> Masonry Construction		<input checked="" type="checkbox"/> Aluminum Construction	7
<input checked="" type="checkbox"/> In-situ Bearing Strata	6	<input checked="" type="checkbox"/> Special Cases	8

The following items of construction, if checked, are specified in the structural plans or specifications on a performance basis. The structural design of these items will be performed by the RPEC and reviewed by the SER. The construction of these items is included in the program for tests and inspections on the attached sheets.

<u>Category</u>	<u>Category</u>
<input type="checkbox"/> Curtain Walls	<input type="checkbox"/> Metal Buildings
<input type="checkbox"/> Precast Concrete Components	<input checked="" type="checkbox"/> Metal Stairs
<input type="checkbox"/> Post-Tensioning Steel	<input checked="" type="checkbox"/> Metal Railings
<input type="checkbox"/> Structural Steel Connections	<input checked="" type="checkbox"/> Metal and Composite Gratings
<input checked="" type="checkbox"/> Structural Aluminum Connections	<input type="checkbox"/> Metal Plate Covers

The following items are excluded from this program of structural tests and inspections, since other structural engineers not under the aegis of the SER designed them and the SER has no duties or responsibilities with respect to such performance specifications or designs. The Owner shall assign other architects, or construction contractors, as applicable; to be special SER's for their respective designs and such architects and/or contractors shall be responsible for all such structural tests and inspections for their respective designs.

- Seismic design of mechanical or electrical components, systems and their anchorage to the structure.
- Excavation support systems.
- Temporary bracing, temporary platforms, scaffolding, temporary guards and railings.
- Anything related to jobsite safety or construction means and methods.

Structural Engineer of Record:

Name: Anthony Catalano Jr.

Signature: 

Firm: AECOM

Date: 8/20/24



Registration Seal

CAST-IN-PLACE CONCRETE CONSTRUCTION

Item	Agent	Scope	Frequency
1. Mix Design	ITA(C)	Design Concrete Mixes	Each mix
2. Materials Certification	SER	Review mix designs.	Each mix
	SER	Review for conformance to specifications.	Each product
3. Batching Plant	ITA/SER	Review to ensure that Plant quality control procedures have been adopted.	Start of project
4. Reinforcement Installation	RES	Inspect reinforcing for size, quantity, condition and placement.	Prior to each placement
5. Formwork Geometry	RES	Inspect form sizes for compliance with specifications.	Prior to each placement
6. Concrete Placement	RES	Review for conformance with specifications.	Each placement
	ITA	Perform slump, density and air content tests at point of discharge.	Each truck
7. Curing and Protection	ITA/RES	Observe procedures for conformance to the specifications.	Each placement
8. Evaluation of Concrete Strength	ITA	Test and evaluate in accordance with the specifications.	Every 50 cubic yards or part thereof
<p>Note: The Contractor may elect to have the Contractor’s independent testing agency (ITA(C)) perform additional tests <u>in addition</u> to the testing by the Owner’s Independent Testing Agency (ITA) at no cost to the Owner.</p>			

IN-SITU BEARING STRATA FOR FOUNDATIONS

Item	Agent	Scope	Frequency
1. Bearing strata for foundations	GEO/ RES	Review strata for conformance to the structural drawings, specifications, and/or geotechnical report.	Prior to foundation placement
2. Bearing surfaces of foundations	GEO/ RES	Review for conformance to the requirements of the structural drawings, specifications, and/or geotechnical report.	Prior to foundation placement

CONTROLLED STRUCTURAL FILL (PREPARED FILL)

Item	Agent	Scope	Frequency
1. Fill Material	ITA	Test material for conformance to specifications or geotechnical report. Perform laboratory compaction tests in accordance with the specifications to determine optimum water content and maximum dry density.	Each Material
2. Installation of Controlled Structural Fill	RES/ ITA	Provide review of the installation, in accordance with the specifications. Verify maximum lift placement thickness (ITA).	Each lift
3. Density of Fill	ITA	Perform field density tests of the in-place fill in accordance with the specifications.	Each lift
NOTE: Above testing is confirmatory testing by the Owner's independent testing agency (ITA). These tests are <u>in addition</u> to the testing required by the Contractor's independent testing agency (ITA(C)).			

ALUMINUM CONSTRUCTION

Item	Agent	Scope	Frequency
1. Fabricator Certification/ Quality Control Procedures.	SER	Review to ensure that quality control procedures have been adopted for each Fabricator.	Start of project
2. Fabricator Inspection	SER	Review to ensure that an Independent Inspection Agency has approved each Fabricator.	Start of project
3. Material Certification	SER	Review for conformance to the specifications.	Each product
4. Bolting	ITA	Test and inspect bolted connections in accordance with specifications. Verify bolt size and grade in accordance with AISC specifications A325/A490.	Periodic

Item	Agent	Scope	Frequency
5. Welding	IWI	Check welder qualifications. Verify filler material in accordance with AWS D1.1. Visually inspect fillet welds. Test complete and partial penetration groove welds full length by dye penetrant, ultrasonic, or radiographic testing in accordance with the contract documents.	Periodic
6. Structural Framing, Details and Assemblies	RES	Review for conformance with specifications and shop drawings.	Periodic

SPECIAL CASES

Item	Agent	Scope	Frequency
1. Concrete Anchor Installation	RES	Verify diameters, depth and cleaning of holes conforms to manufacturer's instructions.	Each anchor
2. Rock Anchors	RES	Witness testing in accordance with contract documents.	Each anchor

END OF SECTION

SECTION 01080
ABBREVIATIONS AND DEFINITIONS

PART 1 - GENERAL

1.01 RELATED SECTIONS:

- A. Section 01090: Reference Standards

1.02 ABBREVIATIONS:

- A. Where any of the following abbreviations are used in the Contract Documents, they shall have the meaning set forth opposite each. Abbreviations for trade associations and standards organizations are listed in Section 01090.

AASHTO	American Association of State Highway and Transportation Officials
ACI	American Concrete Institute
AFBMA	Anti-Friction Bearing Manufacturers Association
AGA	American Gas Association
AGMA	American Gear Manufacturers Association
AISC	American Institute of Steel Construction
AMCA	Air Moving and Conditioning Association
ANS	American National Standard
ANSI	American National Standards Institute
API	American Petroleum Institute
ASCE	American Society of Civil Engineers
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
AWG	American or Brown and Sharpe Wire Gage
AWPA	American Wood-Preservers' Association
AWWA	American Water Works Association

CS	Commercial Standard
IBR	Institute of Boiler and Radiator Manufacturers
IEEE	Institute of Electrical and Electronics Engineers, Inc.
Fed. Spec.	Federal Specifications issued by the Federal Supply Service of the General Services Administration, Washington, D.C.
IPS	Iron Pipe Size
JIC	Joint Industry Conference Standards
NBS	National Bureau of Standards
NEC	National Electrical Code; latest edition
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
NPT	National Pipe Thread
OS&Y	Outside screw and yoke
SMACNA	Sheet Metal and Air Conditioning Contractors National Association, Inc.
Stl. WG	U. S. Steel Wire, Washburn and Moen, American Steel and Wire or Roebbling Gage
UL	Underwriters' Laboratories
USS Gage	United States Standard Gage
WOG	Water, Oil, Gas
WSP	Working steam pressure
125-lb. ANS	American National Standard for Cast-Iron or Pipe Flanges and Flanged Fittings,
250-lb. ANS	Designation B16.1-1975, for the appropriate class

1.03 DEFINITIONS:

- A. Wherever the words defined in this section or pronouns used in their stead occur in the Contract Documents, they shall have the meanings herein given.

As Directed, as Required, Etc.

Wherever in the Contract Documents, or on the Drawings, the words "as directed," "as ordered," "as requested," "as required," "as permitted," or words of like import are used, it shall be understood that the direction, order, request, requirement, or permission of the Engineer is intended. Similarly, the words "approved," "acceptable," "suitable," "satisfactory," and words of like import shall mean approved by, acceptable to, suitable to, or satisfactory to the Engineer.

Provide

Wherever in the Contract Documents the word "provide" is used, it shall mean to furnish (or supply) and install.

Elevation

The figures given on the Drawings or in the other Contract Documents after the word "elevation" or abbreviation of it shall mean the distance in feet above the datum adopted by the Engineer.

Rock

The word "rock," wherever used as the name of an excavated material or material to be excavated, shall mean only boulders and pieces of concrete or masonry exceeding 1 cu. yd. in volume, or solid ledge rock which, in the opinion of the Engineer, requires, for its removal, drilling and blasting, wedging, sledging, barring, or breaking up with a power-operated tool. No soft or disintegrated rock which can be removed with a hand pick or power-operated excavator or shovel, no loose, shaken, or previously blasted rock or broken stone in rock fillings or elsewhere, and no rock exterior to the maximum limits of measurement allowed, which may fall into the excavation, will be measured or allowed as "rock."

Earth

The word "earth", wherever used as the name of an excavated material or material to be excavated, shall mean all kinds of material other than rock as above defined.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01090
REFERENCE STANDARDS

PART 1 - GENERAL

1.01 QUALITY ASSURANCE:

A. Should specified reference standards conflict with the Contract Documents, refer to Article II, Section 3 in Part III of the General Conditions of the Contract.

B.

1.02 SCHEDULE OF REFERENCES:

AA	Aluminum Association 818 Connecticut Avenue, N.W. Washington, DC 20006
AABC	Associated Air Balance Council 1000 Vermont Avenue, N.W. Washington, DC 20005
AASHTO	American Association of State Highway and Transportation Officials 444 North Capitol Street, N.W. Washington, DC 20001
ABMA	American Bearing Manufacturers Association 1101 Connecticut Avenue, N.W., Suite 700 Washington, DC 20036
ACI	American Concrete Institute Box 19150 Reford Station Detroit, MI 48219
ADC	Air Diffusion Council 230 North Michigan Avenue Chicago, IL 60601
AGA	American Gas Association
AGC	Associated General Contractors of America 1957 E Street, N.W. Washington, DC 20006
AI	Asphalt Institute Asphalt Institute Building

College Park, MD 20740

- AIA American Institute of Architects
1735 New York Avenue, N.W.
Washington, DC 20006
- AISC American Institute of Steel Construction
Eighth Floor
400 North Michigan Avenue
Chicago, IL 60611
- AISI American Iron and Steel Institute
1000 16th Street, N.W.
Washington, DC 20036
- AITC American Institute of Timber Construction
333 W. Hampden Avenue
Englewood, CO 80110
- AMCA Air Movement and Control Association
30 West University Drive
Arlington Heights, IL 60004
- ANSI American National Standards Institute
1430 Broadway
New York, NY 10018
- APA American Plywood Association
Box 11700
Tacoma, WA 98411
- API American Petroleum Institute
1220 L. Street, N.W.
Washington, DC 20005
- ARI Air-Conditioning and Refrigeration Institute
1501 Wilson Boulevard
Arlington, VA 22209
- ASCE American Society of Civil Engineers
1801 Alexander Bell Drive
Reston, VA 20191
- ASHRAE American Society of Heating, Refrigeration and Air Conditioning Engineers
1791 Tullie Circle, N.E.
Atlanta, GA 30329
- ASME American Society of Mechanical Engineers

345 East 47th Street
New York, NY 10017

- ASPA American Sod Producers Association
4415 West Harrison Street
Hillside, IL 60162
- ASTM American Society for Testing and Materials
1916 Race Street
Philadelphia, PA 19103
- AWI Architectural Woodwork Institute
2310 South Walter Reed Drive
Arlington, VA 22206
- AWPA American Wood-Preservers' Association
7735 Old Georgetown Road
Bethesda, MD 20014
- AWS American Welding Society
550 LeJeune Road, N.W.
Miami, FL 33135
- AWWA American Water Works Association
6666 West Quincy Avenue
Denver, CO 80235
- BIA Brick Institute of America
11490 Commerce Park Drive
Reston, VA 22091
- BOCA BOCA International
Headquarters Office
4051 West Flossmoor Road
Country, Club Hills, IL 60478-5795
- CDA Copper Development Association
57th Floor, Chrysler Building
405 Lexington Avenue
New York, NY 10174
- CLFMI Chain Link Fence Manufacturers Institute
1101 Connecticut Avenue, N.W.
Washington, DC 20036
- CRSI Concrete Reinforcing Steel Institute
933 Plum Grove Road
Schaumburg, IL 60195

DHI	Door and Hardware Institute 7711 Old Springhouse Road McLean, VA 22101
EJCDC	Engineers' Joint Contract Documents Committee American Consulting Engineers Council 1015 15th Street, N.W. Washington, DC 20005
EJMA	Expansion Joint Manufacturers Association 25 North Broadway Tarrytown, NY 10591
FGMA	Flat Glass Marketing Association 3310 Harrison White Lakes Professional Building Topeka, KS 66611
FM	Factory Mutual System 1151 Boston-Providence Turnpike P.O. Box 688 Norwood, MA 02062
FS	Federal Specification General Services Administration Specifications and Consumer Information Distribution Section (WRSIS) Washington Navy Yard, Building 197 Washington, DC 20407
GA	Gypsum Association 1603 Orrington Avenue Evanston, IL 60201
JIC	Joint Industrial Council c/o National Machine Tool Builders Association 79-1 Westpark Drive McLean, VA 22102
IBR	Institute of Boiler and Radiator Manufacturers a/k/a Hydronics Institute P.O. Box 218 35 Russo Place Berkeley Heights, NJ 07922
ICBO	International Conference of Building Officials 5360 S. Workman Mill Road Whittier, CA 90601

ICEA	Insulated Cable Engineers Association Box 1568 Carrollton, GA 30112
IEEE	Institute for Electrical and Electronics Engineers 3 Park Ave 17th Floor New York, NY 10016-5997
IMIAC	International Masonry Industry All-Weather Council International Masonry Institute 815 15th Street, N.W. Washington, DC 20005
MBMA	Metal Buildings Manufacturer's Association 1230 Keith Building Cleveland, OH 44115
MEC	Massachusetts Electric Code
MIL	Military Specifications Naval Publications and Forms Center 5801 Tabor Avenue Philadelphia, PA 19120
ML/SFA	Metal Lath/Steel Framing Association 221 North LaSalle Street Chicago, IL 60601
NAAMM	National Association of Architectural Metal Manufacturers 221 North LaSalle Street Chicago, IL 60601
NCMA	National Concrete Masonry Association P.O. Box 781 Hendron, VA 22070
NEBB	National Environmental Balancing Bureau 8224 Old Courthouse Road Vienna, VA 22180
NEC	National Electric Code
NECA	National Electrical Contractors Association 3 Belhesda Metro Center Suite 1100 Bethesda, MD 20814

NEMA	National Electrical Manufacturers' Association 1300 N 17th Street Suite 1847 Rosslyn VA 22209
NETA	InterNational Electrical Testing Association 106 Stone St. P.O. Box 687 Morrison, CO 80465
NFPA	National Fire Protection Association March Park Quincy, MA 02269
NFPA	National Forest Products Association 1619 Massachusetts Avenue, N.W. Washington, DC 20036
NSWMA	National Solid Wastes Management Association 1730 Rhode Island Avenue, N.W. Washington, DC 20036
NTMA	National Woodwork Manufacturers Association 205 W. Touhy Avenue Park Ridge, IL 60068
PCA	Portland Cement Association 5420 Old Orchard Road Skokie, IL 60077
PCI	Prestressed Concrete Institute 201 North Wells Street Chicago, IL 60606
PS	Product Standard U.S. Department of Commerce Washington, DC 20203
RIS	Redwood Inspection Service One Lombard Street San Francisco, CA 94111
RCSHSB	Red Cedar Shingle and Handsplit Shake Bureau 515 116th Avenue Bellevue, WA 98004

SDI Steel Deck Institute
P.O. Box 9506
Canton, OH 44711

SDI Steel Door Institute
712 Lakewood Center North
14600 Detroit Avenue
Cleveland, OH 44107

SIGMA Sealed Insulating Glass Manufacturers Association
111 East Wacker Drive
Chicago, Il 60601

END OF SECTION

SECTION 01110
ENVIRONMENTAL PROTECTION PROCEDURES

PART 1 - GENERAL

1.01 SCOPE OF WORK:

- A. The work covered by this Section consists of furnishing all labor materials and equipment and performing all work required for the prevention of environmental pollution in conformance with applicable laws and regulations, during and as the result of construction operations under this Contract. For the purpose of this Specification, environmental pollution is defined as the presence of chemical, physical, or biological elements or agents which adversely affect human health or welfare; unfavorably alter ecological balances of importance to human life; affect other species of importance to man; or degrade the utility of the environment for aesthetic and/or recreational purposes.
- B. The control of environmental pollution requires consideration of air, water, and land, and involves management of noise and solid waste, as well as other pollutants.
- C. Schedule and conduct all work in a manner that will minimize the erosion of soils in the area of the work. Provide erosion control measures such as diversion channels, sedimentation or filtration systems, berms, seeding, mulching, or other special surface treatments as are required to prevent silting and muddying of streams, rivers, impoundments, lakes, etc. All erosion control measures shall be in place in an area prior to any construction activity in that area. Specific requirements for erosion and sedimentation controls are specified in Section 01568.
- D. These Specifications are intended to ensure that construction is achieved with a minimum of disturbance to the existing ecological balance between a water resource and its surroundings. These are general guidelines. It is the Contractor's responsibility to determine the specific construction techniques to meet these guidelines.
- E. All phases of sedimentation and erosion control shall comply with and be subject to the approval of the Massachusetts Department of Environmental Protection and local Conservation Commission.
- F. Schedule and conduct all work in a manner that will minimize the level of noise escaping the site, especially at night and on weekends.
- G. Ensure that there will be no discharge of sediment to Lowes Pond or Lowes Brook. All discharge shall be properly treated prior to being introduced to the reservoir or brook.

1.02 APPLICABLE REGULATIONS:

- A. Comply with all applicable Federal, State, and local laws and regulations concerning environmental pollution control and abatement.
- B. The Contractor shall comply with the conditions of the permits listed below which are included in **Appendix B** of the Specifications.
 - 1. Massachusetts Department of Conservation and Recreation M.G.L. Chapter 253 Dam Safety Permit.
 - 2. Massachusetts Department of Environmental Protection 401 Water Quality certification.
 - 3. Massachusetts Department of Environmental Protection Chapter 91 License.
 - 4. Oxford Conservation Commission Determination of Applicability.
 - 5. US Army Corps of Engineers Approval under General Permits for Massachusetts.
- C. Contractor shall obtain and pay for any permits required for Construction and not listed herein.

1.03 NOTIFICATIONS:

- A. The Engineer will notify the Contractor in writing of any non-compliance with the foregoing provisions or of any environmentally objectional acts and corrective action to be taken. State or local agencies responsible for verification of certain aspects of the environmental protection requirements shall notify the Contractor in writing, through the Engineer, of any non-compliance with State or local requirements. The Contractor shall, after receipt of such notice from the Engineer or from the regulatory agency through the Engineer, immediately take corrective action. Such notice, when delivered to the Contractor or his authorized representative at the site of the work, shall be deemed sufficient for the purpose. If the Contractor fails or refuses to comply promptly, the Owner may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No part of the time lost due to any such stop orders shall be made the subject of a claim for extension of time or for excess costs or damages by the Contractor unless it is later determined that the Contractor was in compliance.

1.04 IMPLEMENTATION:

- A. Prior to commencement of the work, meet with the Engineer to develop mutual understandings relative to compliance with this provision and administration of the environmental pollution control program.
- B. Remove temporary environmental control features, when approved by the Engineer, and incorporate permanent control features into the project at the earliest practicable time.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 EROSION CONTROL:

- A. Provide positive means of erosion control such as shallow ditches around construction to carry off surface water. Erosion control measures such as siltation basins, filtering devices, check dams, mulching, jute netting, and other equivalent techniques shall be used as appropriate. Lowes Pond surface water shall be diverted around the cofferdam to discharge to the channel downstream of the dam and upstream of Huguenot Road; by-pass flow as well as pond lowering flow shall be discharged to a siltation bag as shown on the Drawings. Flow of surface water into excavated areas shall be prevented. Ditches around construction area shall also be used to carry away water resulting from dewatering of excavated areas. At the completion of the work, ditches shall be backfilled and the ground surface restored as shown on Drawings. No disturbance shall occur outside limit of work shown on Drawings.

3.02 PROTECTION OF STREAMS, WETLANDS, AND SURFACE WATER:

- A. Care shall be taken to prevent or reduce to a minimum any damage to any stream, drainage ditch, storm drain, or sewer from pollution by debris, sediment, or other material, or from the manipulation of equipment and/or materials in or near such streams. Water that has been used for washing or processing, or that contains oils or sediments that will reduce the quality of the water in the stream, shall not be directly returned to the stream. Such water will be diverted through a settling basin or filter before being directed into the streams.
- B. The Contractor shall not discharge water from dewatering operations directly into any live or intermittent stream, channel, wetlands, surface water, or any storm sewer. Water from dewatering operations shall be discharged to a dewatering bag, per Drawings, to reduce the amount of sediment contained in the discharge water to allowable levels.
- C. All preventative measures shall be taken to avoid spillage of petroleum products and other pollutants. In the event of any spillage, prompt remedial action shall be taken in accordance with a contingency action drawing or plan approved by the Massachusetts Department of Environmental Protection. Contractor shall submit copies of approved contingency drawings or plans to the Engineer.
- D. Water being flushed from structures or pipelines after disinfection, with a chlorine residual of 2 mg/l or greater, shall be treated with a dechlorination solution, in a method approved by the Engineer, prior to discharge.

3.03 PROTECTION OF LAND RESOURCES:

- A. Land resources within the project boundaries and the limits of permanent work shall be restored to a condition, after completion of construction, that will appear to be natural and not detract from the appearance of the project. Confine all construction activities to areas within the limit of work shown on the Drawings.

- B. Outside of areas requiring earthwork for the construction of the new facilities, the Contractor shall not deface, injure, or destroy trees or shrubs, nor remove or cut them without prior approval. No ropes, cables, or guys shall be fastened to or attached to any existing nearby trees for anchorage unless specifically authorized by the Engineer. Where such special emergency use is permitted, first wrap the trunk with a sufficient thickness of burlap or rags over which softwood cleats shall be tied before any rope, cable, or wire is placed. The Contractor shall in any event be responsible for any damage resulting from such use.
- C. Where trees may possibly be defaced, bruised, injured, or otherwise damaged by the Contractor's equipment, dumping or other operations, protect such trees by placing boards, planks, or poles around them. Monuments and markers shall be protected similarly before beginning operations near them.
- D. Any trees or other landscape feature scarred or damaged by the Contractor's equipment or operations shall be restored as nearly as possible to its original condition. The Engineer will decide what method of restoration shall be used and whether damaged trees shall be treated and healed or removed and disposed of.

All scars made on trees by equipment, construction operations, or by the removal of limbs larger than 1-in. in diameter shall be coated as soon as possible with an approved tree wound dressing. All trimming or pruning shall be performed in an approved manner by experienced workmen with saws or pruning shears. Tree trimming with axes will not be permitted.

Climbing ropes shall be used where necessary for safety. Trees that are to remain, either within or outside established clearing limits, that are subsequently damaged by the Contractor and are beyond saving in the opinion of the Engineer, shall be immediately removed and replaced.

- E. The locations of the Contractor's storage, and other construction building, required temporarily in the performance of the work, shall be cleared portions of the job site or areas to be cleared as shown on the Drawings and shall require written approval of the Engineer and shall not be within wetlands or floodplains. The preservation of the landscape shall be an imperative consideration in the selection of all sites and in the construction of buildings. Drawings showing storage facilities shall be submitted for approval of the Engineer.
- F. Remove all signs of temporary construction facilities such as haul roads, work areas, structures, foundations of temporary structures, stockpiles of excess of waste materials, or any other vestiges of construction as directed by the Engineer. The disturbed areas shall be prepared and seeded as described in Section 01568, or as approved by the Engineer. Once areas are stabilized, temporary erosion and sediment control measures shall be removed from site or decommissioned in accordance with manufacturer's instructions. All measures to remain onsite permanently shall be approved by the Engineer.

- G. All debris and excess material will be disposed of outside wetland or floodplain areas in an environmentally sound manner.

3.04 PROTECTION OF AIR QUALITY:

- A. Burning. The use of burning at the project site for the disposal of refuse and debris will not be permitted.
- B. Dust Control. The Contractor will be required to maintain all excavations, embankments, stockpiles, access roads, plant sites, waste areas, borrow areas, and all other work areas within or without the project boundaries free from dust which could cause the standards for air pollution to be exceeded, and which would cause a hazard or nuisance to others.
- C. An approved method of stabilization consisting of sprinkling or other similar methods will be permitted to control dust. The use of chlorides may be permitted with approval from the Engineer.
- D. Sprinkling, to be approved, must be repeated at such intervals as to keep all parts of the disturbed area at least damp at all times, and the Contractor must have sufficient competent equipment on the job to accomplish this if sprinkling is used. Dust control shall be performed as the work proceeds and whenever a dust nuisance or hazard occurs, as determined by the Engineer.

3.05 MAINTENANCE OF POLLUTION CONTROL FACILITIES DURING CONSTRUCTION:

- A. During the life of this Contract, maintain all facilities constructed for pollution control as long as the operations creating the particular pollutant are being carried out or until the material concerned has become stabilized to the extent that pollution is no longer being created.

3.06 NOISE CONTROL:

- A. The Contractor shall make every effort to minimize noises caused by their operations. Equipment shall be equipped with silencers or mufflers designed to operate with the least possible noise in compliance with State and Federal (OSHA) regulations.

END OF SECTION

SECTION 01200
PROJECT MEETINGS

PART 1 - GENERAL

1.01 PRECONSTRUCTION CONFERENCE:

- A. A preconstruction conference will be held between the Contractor, the Engineer, and the Owner to review the Contractor's proposed methods of complying with the requirements of the Contract Documents.
- B. Contractor will be notified of the time, date and place where the preconstruction conference will be held.

1.02 PROGRESS MEETINGS WITH ENGINEER:

- A. In addition to other regular project meetings for other purposes (as indicated elsewhere in the Contract Documents), hold general progress meetings once each week with times coordinated with preparation of payment requests. Meeting dates shall be established by the Engineer. Require every entity then involved in the planning, coordination or performance of work to be properly represented at each meeting. Include (when applicable) consultants, separate contractors (if any), principal subcontractors, suppliers/manufacturers/fabricators, governing authorities, insurers, special supervisory personnel and others with an interest or expertise in the progress of the work. Review each entity's present and future needs including interface requirements, time, sequence, deliveries, access, site utilization, temporary facilities and services, hours of work, hazards and risks, housekeeping, submittals, change orders, and documentation of information for payment requests. Discuss whether each element of current work is ahead of schedule. Determine how behind-time work will be expedited, and secure commitments from the entities involved in doing so. Discuss whether schedule revisions are required to ensure that current work and subsequent work will be completed within the Contract Time. Review everything of significance which could affect the progress of the work.
- B. Within four days after each progress meeting date, the Engineer will forward copies of the minutes-of-the-meeting, to the Contractor.
- C. Immediately following each progress meeting where revisions to the Progress Schedule have been made or recognized (regardless of whether agreed to by each entity represented), revise the Schedule. Reissue revised Schedule within 7 days after meeting. At intervals matching the preparation of payment requests, revise and reissue the Schedule to show actual progress of the work in relation to the latest revision of the Schedule.

END OF SECTION

SECTION 01300

SUBMITTALS

PART 1 - GENERAL

1.01 DESCRIPTION:

- A. This Section specifies the general methods and requirements of submissions applicable to the following work-related submittals.
 - 1. Shop Drawings, Product Data and Samples.
 - 2. Mock Ups.
 - 3. Construction Photographs.
 - 4. Contractor's Responsibilities.
 - 5. Submission Requirements.
 - 6. Review of Shop Drawings, Product Data, Working Drawings and Samples.
 - 7. Distribution.
 - 8. General Procedures for Submittals.
 - 9. Certificate of Design.
 - 10. Certificates of Compliance.
 - 11. Schedules.
- B. Additional general submission requirements are contained in Article V, Section 2 in Part III of the General Conditions of the Contract.
- C. Detailed submittal requirements will be specified in the technical specifications section.

1.02 SHOP DRAWINGS, PRODUCT DATA, SAMPLES:

- A. Shop Drawings:
 - 1. Shop drawings, as defined in the General Conditions, and as specified in individual work Sections include, but are not necessarily limited to: custom-prepared data such as fabrication and erection/installation (working) drawings of concrete reinforcement, structural details and piping layout, scheduled information, setting diagrams, actual shopwork manufacturing instructions, custom templates, special wiring diagrams, coordination drawings, individual system or equipment inspection

and test reports including performance curves and certifications as applicable to the work.

2. All shop drawings shall be submitted using the transmittal form furnished by the Engineer.
3. All shop drawings submitted by subcontractors for approval shall be sent directly to the Contractor for checking. The Contractor shall be responsible for their submission at the proper time so as to prevent delays in delivery of materials.
4. The Contractor shall check all subcontractor's shop drawings regarding measurements, size of members, materials, and details to satisfy themselves that they conform to the intent of the Drawings and Specifications. Shop drawings found to be inaccurate or otherwise in error shall be returned to the subcontractors for correction before submission thereof.
5. All details on shop drawings submitted for approval shall show clearly the relation of the various parts of the main members and lines of the structure, and where correct fabrication of the work depends upon field measurements, such measurements shall be made and noted on the drawings before being submitted for approval.
6. All details on shop drawings submitted for approval shall show clearly the relation of the various parts of the main members and lines of the structure, and where correct fabrication of the work depends upon field measurements; such measurements shall be made and noted on the drawings before being submitted for approval.

B. Product Data:

1. Product data as specified in individual Sections, include but are not necessarily limited to, standard prepared data for manufactured products (sometimes referred to as catalog data), such as the manufacturer's product specification and printed installation instructions, availability of colors and patterns, manufacturer's printed statements of compliances including certificates of compliance and applicability, roughing-in diagrams and templates, catalog cuts, product photographs, standard wiring diagrams, printed performance curves and operational-range diagrams, production or quality control inspection and test reports and certifications and recommended spare-parts listing, and printed product warranties, as applicable to the Work.

C. Samples:

1. Samples specified in individual Sections, include, but are not necessarily limited to, physical examples of the work such as sections of manufactured or fabricated work, small cuts or containers of materials, complete units of repetitively-used products, color/texture/pattern swatches and range sets, specimens for coordination of visual

effect, graphic symbols, and units of work to be used by the Engineer or Owner for independent inspection and testing, as applicable to the Work.

1.03 MOCK UPS:

- A. Mock Up units as specified in individual Sections, include but are not necessarily limited to, complete units of the standard of acceptance for that type of work to be used on the project. Remove at the completion of the work or when directed by the Engineer.

1.04 CONSTRUCTION PHOTOGRAPHS:

- A. The Contractor shall provide construction photographs in accordance with requirements specified in Section 01380.

1.05 CONTRACTOR'S RESPONSIBILITIES:

- A. The Contractor shall review shop drawings, product data and samples, including those by subcontractors, prior to submission to determine and verify the following:
 - 1. Field measurements
 - 2. Field construction criteria
 - 3. Catalog numbers and similar data
 - 4. Conformance with the Specifications
- B. Each shop drawing, sample, and product data submitted by the Contractor shall have affixed to it the following Certification Statement including the Contractor's Company name and signed by the Contractor: "Certification Statement: by this submittal, I hereby represent that I have determined and verified all field measurements, field construction criteria, materials, dimensions, catalog numbers and similar data, and I have checked and coordinated each item with other applicable approved shop drawings and all Contract requirements." Shop drawings and product data sheets 11-in. X 17-in. and smaller shall be bound together in an orderly fashion and bear the above Certification Statement on the cover sheet. The cover sheet shall fully describe the packaged data and include a listing of all items within the package. Provide to the Engineer a copy of each submittal transmittal form for shop drawings, product data and samples at the time of submittal of said drawings, product data and samples to the Engineer.
- C. If a shop drawing shows any deviation from the requirements of the Contract Documents, the Contractor shall make specific mention of the deviations in the Transmittal Form furnished by the Engineer and provide a description of the deviations in a letter attached to the submittal.
- D. The review and approval of shop drawings, samples or product data by the Engineer shall not relieve the Contractor from their responsibility with regard to the fulfillment of the

terms of the Contract. All risks of error and omission are assumed by the Contractor and the Engineer will not have responsibility therefor.

- E. No portion of the work requiring a shop drawing, sample, or product data shall be started nor shall any materials be fabricated or installed prior to the approval or qualified approval of such item. Fabrication performed, materials purchased or on-site construction accomplished which does not conform to approved shop drawings and data shall be at the Contractor's risk. The Owner will not be liable for any expense or delay due to corrections or remedies required to accomplish conformity.
- F. Project work, materials, fabrication, and installation shall conform with approved shop drawings, applicable samples, and product data.
 - 1. Manufacturer's printed installation instructions, a part of product data submitted to the Engineer will not be reviewed and are for informational purposes only.

1.06 SUBMISSION REQUIREMENTS:

- A. Make submittals promptly in accordance with approved schedule, and in such sequence as to cause no delay in the Work or in the work of any other contractor.
- B. All submittals shall be submitted sufficiently in advance of construction requirements to provide adequate time for review from the time received at the Engineer's reviewing office.
- C. Number of submittals required:
 - 1. Shop Drawings: Unless otherwise stated in the respective Specifications Sections, submit four (4) copies.
 - 2. Product Data: Unless otherwise stated in the respective Specifications submit four (4) copies.
 - 3. Samples: Submit the number stated in the respective Specification Sections.
 - 4. Electronic Submittals: Electronic Submission of shop drawing is acceptable in lieu of hard copies, except on submittals regarding detailed drawings such as rebar placement.
- D. Submittals shall contain:
 - 1. The date of submission and the dates of any previous submissions.
 - 2. The Project title and number.
 - 3. Contractor identification.
 - 4. The names of:

- a. Contractor
 - b. Supplier
 - c. Manufacturer
5. Identification of the product, with the specification section number, page and paragraph(s).
 6. Field dimensions, clearly identified as such.
 7. Relation to adjacent or critical features of the Work or materials.
 8. Applicable standards, such as ASTM or Federal Specification numbers.
 9. Identification of deviations from Contract Documents.
 10. Identification of revisions on resubmittals.
 11. An 8-in. X 3-in. blank space for Contractor and Engineer stamps.
- E. Each shipment of drawings shall be accompanied by a transmittal form furnished by the Engineer providing a list of the drawing numbers and the names mentioned above.
- F. Submittals shall be separated by specification section. Do not combine submittals for different specification sections under the same transmittal.
- G. Expected Submittals include, but are not limited to, those listed in Table 1.

Table 1. Expected Submittals

Submittal	Specification Section
Digital Construction Photographs	01380 – Construction Photographs
Erosion Control Plan	01568 – Erosion Control
Schedule of Selective Demolition Activities	01732 – Selective Demolition
Warranties	01740 – Warranties and Bonds
Certification of Unit Responsibility	01900 – Seismic and Wind Requirements
Codes and Specifications	01900 – Seismic and Wind Requirements
Dewatering Plan	02140 – Dewatering
Excavation Support System Qualifications	02160 – Temporary Excavation Support Systems

Temporary Excavation Support Plan	02160 – Temporary Excavation Support Systems
Construction Contingency Plan	02160 – Temporary Excavation Support Systems
Monitoring Data	02160 – Temporary Excavation Support Systems
Cofferdam System Qualifications	02165 – Temporary Cofferdam
Product Data	02165 – Temporary Cofferdam
Temporary Cofferdam Plan	02615 – Temporary Cofferdam
Independent Testing Laboratory Qualifications	02210 – Earth Excavation, Backfill, Fill and Grading
Excavation, Backfilling, and Filling Plan	02210 – Earth Excavation, Backfill, Fill and Grading
Gradation and Compaction Test Results	02222 – Impervious Fill
Sample	02222 – Impervious Fill
Product Data	02226 – Foundation Preparation
Equipment List	02226 – Foundation Preparation
Quarry Stone Source Information	02271 – Riprap
LA Abrasion Test Test Data	02271 – Riprap
Sample	02271 – Riprap
Product Data	02273 – Geotextile Fabric
Gradation Test Result	02435 – Crushed Stone
Sample	02435 – Crushed Stone
Product Data	02615 – Ductile Iron Pipe and Fittings
Certified Shop and Erection Drawings	02615 – Ductile Iron Pipe and Fittings
Certificates	02615 – Ductile Iron Pipe and Fittings

Product Data	02615 – Ductile Iron Pipe and Fittings
Aggregate Certificates	02701 – Exfiltrating Bioretention Areas
Aggregate Samples	02701 – Exfiltrating Bioretention Areas
Stone Aggregates	02701 – Exfiltrating Bioretention Areas
Pea Gravel	02701 – Exfiltrating Bioretention Areas
Soil Samples	02701 – Exfiltrating Bioretention Areas
Materials Source	02701 – Exfiltrating Bioretention Areas
Topsoil	02701 – Exfiltrating Bioretention Areas
Compost	02701 – Exfiltrating Bioretention Areas
Engineered Bioretention Soil	02701 – Exfiltrating Bioretention Areas
Drainage and Erosion Control Geotextiles	02701 – Exfiltrating Bioretention Areas
Plants and Seeds	02701 – Exfiltrating Bioretention Areas
Fencing Material Samples	02820 – Chain Link Fences and Gates
Fence Finish Certified Test Reports	02820 – Chain Link Fences and Gates
Welding Procedure	02850 – Pre-Fabricated Bridge
Certificate of Design	02850 – Pre-Fabricated Bridge
Soil Additives and Amendments	02900 – Planting and Seeding
Chemicals and Pesticides	02900 – Planting and Seeding
Plant Materials	02900 – Planting and Seeding
Tagging and Planting Schedule	02900 – Planting and Seeding
Seed Mix	02900 – Planting and Seeding
Organic Material	02900 – Planting and Seeding
Samples	02900 – Planting and Seeding

Certified Test Reports	02910 – Planting Soils
Samples	02910 – Planting Soils
Crushed Stone Paving Material	02920 – Site Improvements
Materials List	02930 – Landscape Maintenance
Pest and Disease Treatment	02930 – Landscape Maintenance
Maintenance Manual	02930 – Landscape Maintenance
Product Data	03100 – Concrete Formwork
Layout of Panel Joints and Tie Hole Pattern	03100 – Concrete Formwork
Form Ties	03100 – Concrete Formwork
Shop Drawings	03200 – Concrete Reinforcement
Certificates	03200 – Concrete Reinforcement
Mill Test Reports	03200 – Concrete Reinforcement
Chemical Composition of Reinforcement Steel	03200 – Concrete Reinforcement
Product Data	03250 – Concrete Joints and Accessories
Water Stop Samples	03250 – Concrete Joints and Accessories
Layouts for Joints	03250 – Concrete Joints and Accessories
Product Data	03255 – Non-Expanding Waterstops
Product Data	03256 – Expanding Waterstops
Product Data	03300 – Cast-in-Place Concrete
Shop Drawings	03300 – Cast-in-Place Concrete
Test and Evaluation Reports	03300 – Cast-in-Place Concrete
Manufacturer’s Instructions	03300 – Cast-in-Place Concrete
Field Quality Control Submittals	03300 – Cast-in-Place Concrete

Product Data	03600 – Grout
Laboratory Test Reports	03600 – Grout
Mill Test Reports	03600 – Grout
Procedures	03730 – Concrete Repair
Material Safety Data Sheets	03730 – Concrete Repair
Design Mixes	03730 – Concrete Repair
Shop Drawings	05500 – Miscellaneous Metals
Shop Drawings	05510 – Aluminum Stairs and Platforms
Setting Diagrams and Erection Plans	05510 – Aluminum Stairs and Platforms
Certified Test Reports	05519 – Post-Installed Concrete Anchors
Installation Instructions	05519 – Post-Installed Concrete Anchors
Shop Drawings	05520 – Metal Railings
Product Data	05520 – Metal Railings
Certificates	05520 – Metal Railings
Operation and Maintenance Data	05520 – Metal Railings
Product Data	09940 – Shop Painting
Shop and Erection Drawings	15103 – Stainless Steel Slide Gates and Appurtenances
Operating and Maintenance Instructions	15103 – Stainless Steel Slide Gates and Appurtenances
Certified Test Results	15103 – Stainless Steel Slide Gates and Appurtenances
Shop Drawings	15112 – Stop Logs and Appurtenances
Operating and Maintenance Instructions	15112 – Stop Logs and Appurtenances
Certified Shop and Erection Drawings	15150 – Flap Gates and Appurtenances

- 1.07 REVIEW OF SHOP DRAWINGS, PRODUCT DATA, WORKING DRAWINGS AND SAMPLES:
- A. The Engineer's review is for general conformance with the design concept and contract drawings. Markings or comments shall not be construed as relieving the Contractor from compliance with the contract plans and specifications or from departures therefrom. The Contractor remains responsible for details and accuracy, for coordinating the work with all other associated work and trades, for selecting fabrication processes, for techniques of assembly, and for performing work in a safe manner.
 - B. The review of shop drawings, data, and samples will be general. They shall not be construed:
 - 1. as permitting any departure from the Contract requirements;
 - 2. as relieving the Contractor of responsibility for any errors, including details, dimensions, and materials;
 - 3. as approving departures from details furnished by the Engineer, except as otherwise provided herein.
 - C. If the shop drawings, data or samples as submitted describe variations and show a departure from the Contract requirements which the Engineer finds to be in the interest of the Owner and to be so minor as not to involve a change in Contract Price or time for performance, the Engineer may return the reviewed drawings without noting an exception.
 - D. Two (maximum) copies of shop drawings or product data will be returned to the Contractor via First Class United States Postal Service. Samples will not be returned.
 - E. Submittals will be returned to the Contractor under one of the action codes indicated and defined on the transmittal form furnished by the Engineer.
 - F. Resubmittals will be handled in the same manner as first submittals. On resubmittals the Contractor shall direct specific attention, in writing, on the letter of transmittal and on resubmitted shop drawings by use of revision triangles or other similar methods, to revisions other than the corrections requested by the Engineer, on previous submissions. Any such revisions which are not clearly identified shall be made at the risk of the Contractor. The Contractor shall make corrections to any work done because of this type revision that is not in accordance to the Contract Documents as may be required by the Engineer.
 - G. Partial submittals may not be reviewed. The Engineer will be the only judge as to the completeness of a submittal. Submittals not complete will be returned to the Contractor,

and will be considered "Rejected" until resubmitted. The Engineer may at his option provide a list or mark the submittal directing the Contractor to the areas that are incomplete.

- H. If the Contractor considers any correction indicated on the shop drawings to constitute a change to the Contract Documents, the Contractor shall give written notice thereof to the Engineer at least seven working days prior to release for manufacture.
- I. When the shop drawings have been completed to the satisfaction of the Engineer, the Contractor shall carry out the construction in accordance therewith and shall make no further changes therein except upon written instructions from the Engineer.

1.08 DISTRIBUTION:

- A. Distribute reproductions of approved shop drawings and copies of approved product data and samples, where required, to the job site file and elsewhere as directed by the Engineer. Number of copies shall be as directed by the Engineer but shall not exceed 4.

1.09 GENERAL PROCEDURES FOR SUBMITTALS:

- A. Coordination of Submittal Times: Prepare and transmit each submittal sufficiently in advance of performing the related work or other applicable activities, or within the time specified in the individual work sections, of the Specifications, so that the installation will not be delayed by processing times including disapproval resubmittal (if required), coordination with other submittals, inspection, testing (off-site and on-site), purchasing, fabrication, delivery and similar sequenced activities. No extension of time will be authorized because of the Contractor's failure to transmit submittals sufficiently in advance of the Work.

1.10 CERTIFICATE OF DESIGN:

- A. If specifically specified in other Sections of these Specifications, the Contractor shall submit the applicable Certificate of Design for each item required, and in the form attached to this Section, completely filled in and signed and sealed by a registered professional engineer.

1.11 CERTIFICATES OF COMPLIANCE:

- A. Certificates of Compliance as specified in the specifications shall include and mean certificates, manufacturer's certificates, certifications, certified copies, letters of certification and certificate of materials.
- B. The Contractor shall be responsible for providing Certificates of Compliance as specified in the technical specifications. Certificates are required for demonstrating proof of compliance with specification requirements and shall be executed in 6 copies unless otherwise specified. Each certificate shall be signed by an official authorized to certify on behalf of the manufacturing company and shall contain the name and address of the

Supplier, the project name and location, and the quantity and date or dates of shipment or delivery to which the certificates apply. Copies of laboratory test reports submitted with certificates shall contain the name and address of the testing laboratory and the date or dates of the tests to which the report applies. Certification shall not be construed as relieving the Supplier from furnishing satisfactory material, if after tests are performed on selected samples, the material is found not to meet the specific requirements.

1.12 SCHEDULES:

- A. Provide all schedules specified in Articles 2.05 B, 2.07, 14.01 and elsewhere in the General Conditions.

END OF SECTION

CERTIFICATE OF DESIGN

The undersigned hereby certifies that he/she is a Professional Engineer registered in the state of _____ and that he/she has been employed by (Name of Contractor) _____ to design _____ in accordance with Specifications Section _____ for the Lowe's Pond Dam Repair Project. The undersigned further certifies that he/she has performed similar designs previously and has performed the design of the _____; that said design is in conformance with all applicable local, state, and federal codes, rules, and regulations and professional practice standards; that his/her signature and Professional Engineer (P.E.) Stamp have been affixed to all calculations and drawings used in, and resulting from, the design; and that the use of that stamp signifies the responsibility of the undersigned for that design.

The undersigned hereby certifies that he/she has Professional Liability Insurance with limits of \$1,000,000.00 and a Certificate of Insurance is attached.

The undersigned hereby agrees to make all original design drawings and calculations available to MassDCR or Owner's representative within seven (7) days following written request therefore by the Owner.

P.E. Name

Contractor's Name

Signature

Signature

Title

Title

Address

Address

CERTIFICATE OF DESIGN

The undersigned hereby certifies that he/she is a Professional Engineer registered in the state of _____ and that he/she has been employed by (Name of Contractor) _____ to design _____ in accordance with Specifications Section _____ for the Lowe's Pond Dam Repair Project. The undersigned further certifies that he/she has performed similar designs previously and has performed the design of the _____; that said design is in conformance with all applicable local, state, and federal codes, rules, and regulations and professional practice standards; that his/her signature and Professional Engineer (P.E.) Stamp have been affixed to all calculations and drawings used in, and resulting from, the design; and that the use of that stamp signifies the responsibility of the undersigned for that design.

The undersigned hereby certifies that he/she has Professional Liability Insurance with limits of \$1,000,000.00 and a Certificate of Insurance is attached.

The undersigned hereby agrees to make all original design drawings and calculations available to MassDCR or Owner's representative within seven (7) days following written request therefore by the Owner.

P.E. Name

Contractor's Name

Signature

Signature

Title

Title

Address

Address

SECTION 01310
CONSTRUCTION PROGRESS SCHEDULES

PART 1 - GENERAL

1.01 DESCRIPTION:

- A. CONTRACTOR shall prepare and submit to ENGINEER for review within 15 days after Notice to Proceed, a construction progress schedule.
- B. No work shall be done between 6 p.m. and 7 a.m. nor on Sundays or legal holidays without written permission of OWNER. However, emergency work may be done without prior permission.
- C. Night work may be established by CONTRACTOR as regular procedure with written permission of OWNER. Such permission, however, may be revoked at any time by OWNER if CONTRACTOR fails to maintain adequate equipment and supervision for proper prosecution and control of work at night.

1.02 FORM OF SCHEDULES:

- A. Prepare schedules in form of a horizontal bar chart.
 - 1. Provide separate horizontal bar for each trade or operation.
 - 2. Horizontal Time Scale: Identify first work day of each week.
 - 3. Scale and spacing to allow space for notations and future revisions.
- B. Format of Listings: Chronological order of start of each item of work.
- C. Identification of Listings: By major specification section numbers.

1.03 CONTENT OF SCHEDULES:

- A. Construction Progress Schedule:
 - 1. Show complete sequence of construction by activity.
 - 2. Show dates for beginning and completion of each major element of construction and installation dates for major items of equipment. Elements shall include, but not be limited to, the following:
 - a. Shop drawing receipt from supplier/manufacturer submitted to ENGINEER, review and return to supplier/manufacturer.
 - b. Material and equipment order, manufacturer, delivery, installation, and checkout.

- c. Performance tests and supervisory services activity.
- d. Piping installation
- e. Construction of various facilities.
- f. Concrete pour sequence.
- g. Precast concrete erection.
- h. Backfilling, grading, seeding, sodding, landscaping, fence construction, and paving.
- i. Subcontractor's items of work.
- j. Final cleanup.
- k. Allowance for inclement weather.
- l. Demolition.
- m. Miscellaneous concrete placement.

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

1.04 SCHEDULE REVISIONS:

- A. Every 14 days CONTRACTOR shall revise construction schedule to reflect changes in progress of work. Contractor shall present revised schedule at each progress meeting.
- B. Indicate progress of each activity at date of submittal.
- C. Show changes occurring since previous submittal of schedule.
 - 1. Major changes in scope.
 - 2. Activities modified since previous submittal.
 - 3. Revised projections of progress and completion.
 - 4. Other identifiable changes.
- D. Provide a narrative report as needed to define:
 - 1. Problem areas, anticipated delays, and impact on schedule.
 - 2. Corrective action recommended and its effect.
 - 3. Effect of changes on schedules of other CONTRACTORS.

1.05 SUBMITTAL REQUIREMENTS:

- A. For initial submittal of construction schedule and subsequent revisions thereof, furnish four copies of schedule to ENGINEER.

END OF SECTION

SECTION 01380
CONSTRUCTION PHOTOGRAPHS

PART 1 - GENERAL

1.01 DESCRIPTION:

- A. Provide construction photographs pertinent to the Contract work during the Contract period as specified and as directed by the Engineer.
 - 1. Section includes administrative and procedural requirements for the following:
 - a. Preconstruction photographs.
 - b. Periodic construction photographs.
 - c. Final completion construction photographs.

1.02 SUBMITTALS:

- A. Submit in accordance with Section 01300.
- B. Digital Photographs: Submit electronic image files within seven (7) **calendar** days of taking photographs.
 - 1. Digital Camera: Minimum sensor resolution of 8 megapixels.
 - 2. Format: Minimum 3200 by 2400 pixels, in unaltered original files, with same aspect ratio as the sensor, uncropped, date and time stamped, in folder named by date of photograph, accompanied by key plan file.
 - 3. Digital Photographs of all areas requiring excavation, erosion and sediment control, wetland restoration, pavement cuts, and pavement repair.
 - 4. Identification: Provide the following information with each image description in file metadata tag:
 - a. Name of Project and Owner's project number.
 - b. Name and contact information for photographer.
 - c. Name of Contractor.
 - d. Date photograph was taken.

- e. Description of vantage point, indicating location, direction (by compass point), plan and profile sheet number, pipe length identification number from plan and profile sheet.
- f. Unique sequential identifier keyed to accompanying key plan.

C. CONSTRUCTION PHOTOGRAPHS

1. Submit digital format photos in a digital format acceptable to Engineer.
2. Identification: Label each photograph with an identifier as specified herein or directed by the Engineer.
3. Identification: Provide the following information with each submitted flash drive:
 - a. Name of Project and Engineer's and Owner's project number.
 - b. Name and contact information for photographer.
 - c. Name of Engineer.
 - d. Name of Contractor.
 - e. Date photographs were taken and/or date range
 - f. Description of vantage point, indicating location, direction (by compass point), plan and profile sheet number, pipe length identification number from plan and profile sheet.
 - g. Unique sequential identifier keyed to accompanying key plan.

1.03 QUALITY ASSURANCE:

- A. Photographer proposed to be approved by Engineer.
- B. Photographer to use techniques, material and equipment capable of producing photographs of high quality and resolution.
- C. Dates for photography at site to be coordinated with Engineer and Engineer to be present during photographic periods at site unless approved otherwise by Engineer.
- D. Photographer to make and retain detailed records of all photographs by photographer under this Contract:

1. The records to be in sufficient detail to support any attestation that may be required of photographer.
2. Photographer to retain such records for a period not less than two years from the final acceptance of entire work under this Contract.

1.04 USAGE RIGHTS:

- A. Obtain and transfer copyright usage rights from photographer to Owner for unlimited reproduction of photographic documentation.

1.05 DELIVERY STORAGE AND HANDLING:

- A. Comply with the requirements specified in Section 01610.

PART 2 – PRODUCTS

2.01 PHOTOGRAPHIC MEDIA:

- A. Digital Images: Provide images in JPG format, produced by a digital camera with minimum sensor size of 8 megapixels, and at an image resolution of not less than 3200 by 2400 pixels.

PART 3 - EXECUTION

3.01 GENERAL REQUIREMENTS:

- A. The Contractor shall notify the Engineer 5 days in advance of any photographic sessions.
- B. All views to contain a relative dimension reference that is easily recognizable. In views where dimensions are critical use a recognizable measuring devices such as folding ruler, measuring tape in a manner the markings are clear and sharp in the photograph and the device located in close relationship with subject of photograph.

3.02 CONSTRUCTION PHOTOGRAPHS:

- A. Photographer: Engage a qualified photographer to take construction photographs.
- B. General: Take photographs using the maximum range of depth of field, and that are in focus, to clearly show the Work. Photographs with blurry or out-of-focus areas will not be accepted.
 1. Maintain key plan with each set of construction photographs that identifies each photographic location.

- C. Digital Images: Submit digital images exactly as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.
 - 1. Date and Time: Include date and time in file name for each image.
 - 2. Field Office Images: Maintain one set of images accessible in the field office at Project site, available at all times for reference. Identify images in the same manner as those submitted to Engineer.

- D. Preconstruction Photographs: Before the start of any construction work, take photographs of Project site and surrounding properties, including existing items to remain during construction, from different vantage points, as directed by Engineer.
 - 1. Flag construction limits for approval by the Engineer before taking construction photographs.
 - 2. Take as many photographs as required to accurately record physical conditions at start of construction on either side of the pipeline and roadway.
 - 3. Take additional photographs as required to record settlement or cracking of pavement and final conditions of all areas of excavation and wetlands.
 - 4. Set up timelapse photography prior to start of construction.

- E. Periodic Construction Photographs: Take photographs regularly as specified herein. Select vantage points to show status of construction and progress since last photographs were taken. Regularly submit bi-weekly for the duration of the project. (NTS: Retain "(Engineer) (Construction Manager)-Directed Construction Photographs" Paragraph below only if the cost of photographer's work is covered by an allowance or by a unit-price commitment and Engineer or Construction Manager is responsible for determining photographic vantage points.)

- F. In addition to the professional photographs provided as specified in this Section, the General Contractor shall also take daily photographs documenting the progress of the work. Digital copies of the General Contractor's image files shall be provided as part of project closeout in a format acceptable to the Engineer and Owner.

3.03 SITE PHOTOGRAPHY REQUIRED:

- A. Provide photographs at following stages of construction:
 - 1. Site before commencement of any construction.
 - 2. Site upon completion of site clearing.
 - 3. At completion of each structural excavation.

4. At completion of each structural foundation.
5. At completion of framing or forming for structures.
6. At completion of enclosures of structures.
7. At 1-month intervals, progress photography during construction of facilities. Photos of any month need show only new work performed during month.
8. Such special photographs required by Engineer.
9. Upon completion of all Contract work over-all site photography.

B. Views:

1. Coordinate with Engineer on views to be taken. In general views from locations to adequately illustrate state of project and condition of construction.
2. At least 3 different views of photographic subject except over-all site photography to have at least 4 different views unless otherwise approved by Engineer.
3. Succeeding photography of same photographic subject to be taken, insofar as practical, from the same view points as preceding photographic sessions. Variations in this procedure to be approved by Engineer.

3.04 COUNTRACT CLOSEOUT:

- A. Complete in accordance with Section 01700.

END OF SECTION

SECTION 01400
QUALITY ASSURANCE

PART 1 - GENERAL

1.01 DESCRIPTION:

- A. This section covers Quality Assurance and Control requirements for this contract.
- B. The Contractor is responsible for controlling the quality of work, including work of its subcontractors, and suppliers and for assuring the quality specified in the Technical Specifications is achieved.
- C. Refer to the Article IV – General Performance Obligations of the Contractor.

1.02 CONTRACTOR FURNISHED TESTING LABORATORY SERVICES:

- A. An independent commercial testing laboratory acceptable to the Engineer shall perform all tests that require the services of a laboratory to determine compliance with the Contract Documents. The laboratory shall be staffed with experienced technicians, properly equipped, and fully qualified to perform the tests in accordance with the specified standards.
- B. Preliminary Testing Services: The Contractor shall be responsible for all testing laboratory services in connection with concrete materials and mix designs, the design of asphalt mixtures, gradation tests for structural and embankment fills, backfill materials, and all other tests and engineering data required for the Engineer's review of materials and equipment proposed to be used in the Work. The Contractor shall obtain the Engineer's acceptance of the testing laboratory before having services performed, and shall pay all costs for services.
- C. The Contractor shall not retain any testing laboratory against which the Owner or the Engineer have reasonable objection, and if at any time during the construction process the services become unacceptable to the Owner, or the Engineer, either the Owner or the Engineer may direct in writing that such services be terminated. The request must be supported with evidence of improper testing or unreasonable delay. If the Engineer determines that sufficient cause exists, the Contractor shall terminate the services and engage a different testing laboratory.
- D. Transmittal of Test Reports: Written reports of testing and engineering data furnished by the Contractor for the Engineer's review of materials and equipment proposed to be used in the Work shall be submitted as specified for Shop Drawings.
- E. The Contractor's testing laboratory shall furnish four copies of a written report of each test performed by laboratory personnel within three days after each test is completed. Distribution shall be two copies of each test report to the Engineer's Representative, one copy to the Owner, and one copy for the Contractor.

1.03 QUALITY ASSURANCE:

- A. Codes and Standards: Refer to Article II – Execution of the Contract, Scope of Work, Interpretation of Contract Documents in Part III of the General Conditions of the Contract.
- B. Copies of applicable referenced standards are not included in the Contract Documents. Where copies of standards are needed by the Contractor for superintendence and quality control of the work, the Contractor shall obtain a copy or copies directly from the publication source and maintain at the jobsite, available to the Contractor's personnel, subcontractors, and Engineer
- C. Quality of Materials: Unless otherwise specified, all materials and equipment furnished for permanent installation in the Work shall conform to applicable standards and specifications and shall be new, unused, and free from defects and imperfections, when installed or otherwise incorporated in the Work. The Contractor shall not use material and equipment for any purpose other than that intended or specified unless the Engineer authorizes such use.
- D. Where so specified, products or workmanship shall also conform to the additional performance requirements included within the Contract Documents to establish a higher or more stringent standard or quality than that required by the referenced standard.

1.04 OFFSITE INSPECTION:

- A. When the specifications require inspection of materials or equipment during the production, manufacturing, or fabricating process, or before shipment, such services shall be performed by the Owner's independent testing laboratory, or inspection organization acceptable to Engineer in conjunction with or by the Engineer.
- B. The Contractor shall give appropriate written notice to the Engineer not less than 30 days before offsite inspection services are required, and shall provide for the producer, manufacturer, or fabricator to furnish safe access and proper facilities and to cooperate with inspecting personnel in the performance of their duties.

1.05 MATERIALS AND EQUIPMENT:

- A. The Contractor shall maintain control over procurement sources to ensure that materials and equipment conform to specified requirements in the Contract Documents.
- B. The Contractor shall comply with manufacturer's printed instructions regarding all facets of materials and/or equipment movement, storage, installation, testing, startup, and operation. Should circumstances occur where the contract documents are more stringent than the manufacturer's printed instructions, the Contractor shall comply with the specifications. In cases where the manufacturer's printed instructions are more stringent than the contract documents, the Contractor shall advise the Engineer of the disparity and conform to the manufacturer's printed instructions. In either case, the Contractor is to apply the more stringent specification or recommendation, unless approved otherwise by the Engineer.

1.06 SHOP AND FIELD TESTING:

- A. The Contractor is responsible for providing advance notice of and access for the shop and field testing specified in the technical specification sections.
- B. The Contractor and its Subcontractor shall permit inspections, tests, and other services as required by the Contract Documents.
- C. Contractor shall provide twenty one days written notice to the Engineer so that the Engineer may schedule and witness off site and on site tests. The Engineer's witnessing of tests does not relieve the Contractor and/or Subcontractors of their obligation to comply with the requirements of the Contract Documents.

1.07 MANUFACTURER'S FIELD SERVICES:

- A. When specified in the technical specifications sections, the Contractor shall arrange for and provide technical representation from manufacturer's of respective equipment, items or components. The manufacturer's representative shall be a factory trained service engineer/technician with the type and length of experience specified in the technical specifications.
- B. Services Furnished Under This Contract: An experienced, competent, and authorized factory trained service engineer/technician representative of the manufacturer of each item of equipment for which field services are indicated in the specifications shall visit the site of the Work and inspect, operate, test, check, adjust if necessary, and approve the equipment installation. In each case, the manufacturer's service representative shall be present when the equipment is placed in operation. The manufacturer's service representative shall revisit the jobsite as often as necessary until all problems are corrected and the equipment installation and operation are satisfactory to the Engineer.

1.08 CERTIFICATION FORMS AND CERTIFICATES:

- A. The Contractor shall be responsible for submitting the certification forms and certificates in conformance with the requirements specified in Section 01300 - Submittals.

PART 2 - PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 QUALITY CONTROL:

- A. Quality control is the responsibility of the Contractor, and the Contractor shall maintain control over construction and installation processes to assure compliance with specified requirements.
- B. Certifications for personnel, procedures, and equipment associated with special processes (e.g., welding, cable splicing, instrument calibration, surveying) shall be maintained in the

Contractor's field office, available for inspection by the Engineer. Copies shall be made available to the Engineer upon request.

- C. Means and methods of construction and installation processes are the responsibility of the Contractor, and at no time is it the intent of the Engineer to supersede or void that responsibility.

END OF SECTION

SECTION 01500
TEMPORARY FACILITIES

PART 1 - GENERAL

1.01 SCOPE OF WORK:

- A. The Contractor shall provide all temporary facilities for the proper completion of the work, as required and as specified.

1.02 SANITARY REGULATIONS:

- A. The Contractor shall provide adequate sanitary facilities for the use of those employed on the Work. Such facilities shall be made available when the first employees arrive on the site of the Work, shall be properly secluded from public observation, and shall be constructed and maintained during the progress of the Work in suitable numbers and at such points and in such manner as may be required.
- B. The Contractor shall maintain the sanitary facilities in a satisfactory and sanitary condition at all times and shall enforce their use. He shall rigorously prohibit the committing of nuisances on the site of the Work, on the lands of the Owner, or on adjacent property.

1.03 WATER SUPPLY:

- A. The Contractor shall make arrangements and pay for all water necessary for completion of construction operations under this contract.
- B. Contractor shall note that there are no available potable water supplies near the Lowes Pond Dam area.

1.04 TEMPORARY HEAT:

- A. If temporary heat is required for the protection of the Work, the Contractor shall provide and install suitable heating apparatus, shall provide adequate and proper fuel, and shall maintain heat as required.
- B. Temporary heating apparatus shall be installed and operated in such manner that finished work will not be damaged thereby. After the permanent heating system has been installed, tested, and made ready for operation, the Contractor may, at his own risk and expense, use it for providing heat for protection of the Work. The contractor shall provide and pay for all fuel and care necessary, and, when the Work is ready for acceptance, he shall, at his own expense, put the system into first-class condition, even to the extent of replacing worn or damaged parts as directed.

1.05 ELECTRICAL ENERGY:

- A. The Contractor shall make all necessary applications and arrangements and pay all fees and charges for electrical energy for power and light necessary for the proper completion of the Work and during its entire progress. The Contractor shall provide and pay for all temporary wiring, switches, connections, and meters.
- B. The Contractor shall provide sufficient electric lighting so that all work may be done in a workmanlike manner when there is not sufficient daylight.
- C. Contractor shall note that there is no available electrical service near the Lowes Pond Dam area.
- D. Contractor shall provide a portable generator for providing power to the Engineer's Office (Item 1.08) to power lights, fan, and unit heater.

1.06 PRECAUTIONS DURING ADVERSE WEATHER:

- A. During adverse weather and against the possibility thereof, the Contractor shall take all necessary precautions so that the Work may be properly done and satisfactory in all respects. When required, protection shall be provided by use of tarpaulins, wood and building-paper shelters, or other suitable means.
- B. During cold weather, materials shall be preheated, if required, and the materials and adjacent structure into which they are to be incorporated shall be made and kept sufficiently warm so that a proper bond will take place and a proper curing, aging, or drying will result. Protected spaces shall be artificially heated by suitable means which will result in a moist or a dry atmosphere according to the particular requirements of the work being protected. Ingredients for concrete and mortar shall be sufficiently heated so that the mixture will be warm throughout when used.

1.07 CONTRACTOR'S FIELD OFFICE:

- A. The Contractor shall maintain a temporary field office near the work for his own use during the period of construction at which readily accessible copies of all contract documents shall be kept. The office shall be located where it will not interfere with the progress of the work. In charge of this office there shall be a competent superintendent of the Contractor as specified under "Supervision of Work" in the AGREEMENT.

1.08 OFFICE FOR ENGINEER:

- A. The Contractor shall provide a suitable office for exclusive use of the Engineer and equip it with, at minimum, amenities that are equal to the Contractor's amenities for the temporary field office.
- B. The Contractor shall furnish insurance coverage of adequate amount to replace not only the Contractor's equipment, but all property belonging to the Engineer and the Engineer's staff, at replacement cost.

- C. The Office shall be of suitable height and of ample size to accommodate the furniture and equipment listed below, without crowding (at least 200 sq. ft. of floor area). It shall be weathertight and acceptably insulated and suitably ventilated; the floor shall be tight and of sufficient construction to withstand the loads imposed upon it. The office shall have two exterior doors, with cylinder locks and keys and a minimum of two screened windows which can be both opened and locked shut. The exterior doors shall also be provided with a hasp, for which the Engineer will furnish his own locks. The office shall include:
1. Temporary Electricity: The Contractor shall be required to supply temporary electricity to the Resident Engineer's field office. Electric supply may be provided by temporary service wiring from the overhead supply lines. The Contractor shall be responsible for the making all appropriate coordination with the electric utility, installation of a meter, and payment of all bills for electricity used in the trailer during the Work of the Contract. Ground circuit interrupters shall be required on all electrical equipment.
 2. Telephone and Internet Service: The Contractor shall provide the Owner with one (1) laptop computers which include wireless Internet capability and service. The Contractor shall provide and maintain a separate and private internet service provider account for the duration of the Project.
 3. Temporary Water Service: The Contractor shall be required to supply water service to the Resident Engineer's field office. Water shall be provided for both drinking water and for sanitary (washing) purposes. Temporary water service may be via a connection to existing municipal lines, if available, or may be through temporary delivery service. All charges, tariffs, and fees, as applicable, for the use of temporary water service shall be borne by the Contractor at no additional cost to the Owner. The Contractor is responsible for coordinating with the Town of Andover to arrange for the provision of water from the City or Town system. The Contractor shall furnish drinking water with suitable containers and cups for use of the Resident Engineer.
 4. Temporary Sanitary Facilities: Resident Engineer's temporary field office shall be provided with both a bathroom within the trailer itself as well as a portable sanitary facility located outside of the trailer. The Contractor shall maintain sanitary facilities within the Resident Engineer's field office. The Contractor shall maintain these facilities in a clean and sanitary condition and in such a manner as required or approved by the Owner and in accordance with all applicable regulations. These conveniences shall be maintained at all times without nuisance. Upon completion of the Work, the sanitary facilities shall be removed by the Contractor from the premises, leaving the premises clean.
- D. The Contractor shall furnish a parking area large enough to accommodate a minimum of two cars adjacent to the office, for the exclusive use of the Engineer.
- E. The Contractor shall furnish the following furniture, equipment, supplies, and services:

1. One plan table or sloping plan shelf, about 3 ft. by 6 ft., with a reasonably smooth top, and one suitable swivel stool.
2. Eight additional folding chairs.
3. Electric lights, desk lamps and outlets as directed. The Contractor shall pay for installation and all charges for the energy used.
4. Broom and dustpan.
5. One desk for general office use about 3 ft. by 5 ft., all with a desk chair of the armchair swivel type.
6. Two four-drawer, legal size, metal filing cabinets each with locks.
7. Class ABC type fire extinguisher of at least 4-lb capacity.
8. Insulated waterproof chest for storage and moist curing of concrete cylinders; size and construction as directed with capability of maintaining required curing temp.
9. A waste basket for appropriately sized plastic trash bags.
10. Outdoor minimum-maximum thermometer with range of -40 deg. F to +120 deg. F and reset provisions.
11. Power, lighting, heat, and air conditioning at least equal to that provided for the Contractors temporary field office.
12. High speed internet access. The Contractor shall be responsible for connection and paying all fees associated with providing this service for the duration of the contract.
13. Copy machine with color scanning capabilities.

F. The Contractor shall provide office space and facilities until the office, furnishings, and equipment described above are ready for use, but by so doing he shall not be relieved of his obligation to provide and equip the specified Engineer's office as promptly as possible.

G. Unless otherwise directed by the Engineer, after the date of completion of the Work as stated in the final estimate, the Contractor shall remove the office and all such temporary facilities from the site, the same to become his property, and leave the premises in a condition acceptable to the Engineer.

1.09 TEMPORARY FENCING:

- A. Provide commercial grade chain link fence to prevent trespass by workmen and suppliers onto private property and the public from construction site.
- B. Provide 6 foot high fence around staging area and as necessary to prevent unapproved access to the work area. Equip fence with vehicular and pedestrian gates with locks.

C. Coordinate location of temporary fencing with Owner (Engineer).

1.10 HOISTING, SCAFFOLDING, STAGING AND PLANKING:

- A. Except as otherwise specified in the various sections of the specifications, the Contractor shall provide, set up, and maintain all derricks, hoisting machinery, and shall do all hoisting required for the project.
- B. Except as otherwise specified in the various sections of the specifications, the Contractor shall furnish, install, and maintain in safe condition, scaffolding, staging, and planking and all supports therefore, for the use of all trades requiring same, and shall bear all costs there from. The Contractor shall confer with the various trades to ascertain where and when such scaffolding, staging, and planking will be required.
- C. Scaffolds shall have solid backs and floors to prevent dropping materials there from to the floors or ground.

END OF SECTION

SECTION 01568

EROSION CONTROL, SEDIMENTATION AND CONTAINMENT OF CONSTRUCTION MATERIALS

PART 1 – GENERAL

1.01 DESCRIPTION:

- A. Provide all work and take all measures necessary to control soil erosion resulting from construction operations, prevent flow of sediment from construction site, and contain construction materials (including excavation and backfill) within protected working area as to prevent damage to any stream or wetlands.

1.02 SUBMITTALS:

- A. Two weeks prior to the start of the work, submit to Engineer, for review, a plan with detailed sketches showing the proposed methods to be used for controlling erosion during construction.

1.03 QUALITY ASSURANCE:

- A. Use acceptable procedures, including use of water diversion structures, diversion ditches, settling basins, and sediment traps.
- B. Operations restricted to areas of work indicated on drawings and area which must be entered for construction of temporary or permanent facilities.
- C. If construction materials are washed away during construction, remove materials from fouled areas.
- D. Engineer has authority to limit surface area of erodible earth material exposed by clearing and grubbing, excavation, borrow and fill operations and to direct immediate permanent or temporary pollution control measures to prevent contamination of any stream or wetlands, including construction of temporary berms, dikes, dams, sediment basins, sediment traps, slope drains, and use of temporary mulches, mats, or other control devices or methods as necessary to control erosion.
- E. The erosion control barrier shall be doubly staked with the ends butted on against another to prevent siltation from passing through in the location shown on the plans. Hay is not to be used as a barrier as it contains numerous invasive seeds and may result in additional long term impact to resource areas through the introduction of invasive plants. Alternatives include mulch, filter fences, straw, in bundle, bags, or sleeves.
- F. All stockpiled materials shall be located in designated upland portions of the site and shall not impact waterbodies and wetlands in the vicinity of the project.

G. Stabilize diversion outlets by means acceptable to Engineer.

PART 2 – PRODUCTS

2.01 FILTERING DEVICES

A. Filtrexx® Siltsoxx, or equivalent as approved by the Engineer, shall meet the following minimum specifications:

<u>Physical Property</u>	<u>Requirements</u>
Total Suspended Solids Removal	78%
Tensile Strength	26 lbs/square inch
Flow Rate	11.3 gallons per minute per foot
Density	32 lbs/ft
Motor Oil Removal	99%
Diesel Fuel Removal*	99%
Gasoline Removal*	54%

*Removal Rate achieved by addition of Hydrocarbon agent.

B. Compost media inside Filtrexx® Siltsoxx or equivalent shall not contain noxious non-native weed seeds.

C. Media inside Siltsoxx or equivalent shall include a hydrocarbon removal additive, PetroLoxx or equivalent, designed to remove oil, diesel and gasoline from runoff.

2.02 WOOD STAKES:

A. 2 in. by 2 in. by 3 ft.

2.03 SYNTHETIC FILTER FABRIC:

A. Synthetic filter fabric to be a pervious sheet of propylene, nylon, polyester or ethylene filaments and shall be certified by the manufacturer or supplier as conforming to the following requirements:

<u>Physical Property</u>	<u>Requirements</u>
Filtering Efficiency	75% (min.)

Tensile Strength at	Extra Strength –
20% (max.) Elongation	50 lbs./lin. in. (min.)
	Standard Strength –
	30 lbs./lin. in. (min.)
Flow Rate	0.3 gal./sq. ft./min. (min.)

- B. Burlap to be 10 ounce per square yard fabric.
- C. Posts or stakes for filter fences either 2 x 3 or 2 x 4 inch studs or 0.5 pounds (minimum) per linear foot

2.04 EROSION CONTROL BLANKETS

- A. Erosion control blankets shall be used to cover exposed soil surfaces and slopes with potential to erode.
- B. Erosion Control Blankets shall consist of a biodegradable blanket recommended for use on slopes of at least 1:1 and longevity of up to 24 months such as North American Green’s BioNet C125BN.

PART 3 – EXECUTION

3.01 GENERAL:

- A. Do not discharge chemicals, fuels, lubricants, bitumen, raw sewage, or other harmful waste into or alongside any body of water or into natural or man-made channels.
- B. Activities where there is any potential for runoff of any pollutant into wetlands and waterbodies should be subject to this section. If there is any uncertainty whether an activity is subject to this section, then precaution should be exercised.
- C. Soil and sedimentation control measures consisting of Filtrexx® Siltsoxx or equivalent approved by the Engineer shall be placed in areas as depicted on Drawings and where potential for dust or petroleum entering a waterbody exists. Modifications to the location of perimeter filtering devices shall be approved by the Engineer. Filtering devices shall be installed prior to the start of work. Sediment controls are to be placed surrounding at the base of all stored and demolished materials that contain liquids or sediment.

3.02 INSTALLATION:

- A. Filtrexx® Siltsoxx compost filter sock or equivalent
 - 1. Filtrexx® Siltsoxx or equivalent shall be installed as per manufacturer’s recommendations.

2. Any gaps between bottom of Filtrexx® Siltsoxx and top of ground surface shall be filled with compost filter media or additional Siltsoxx material such that there is good contact between the bottom of the Filtrexx® Siltsoxx and the ground surface.
3. In impervious areas, concrete blocks, sand bags or other means of weighted barrier shall be used in lieu of stakes to secure filter device in place.

B. Additional Requirements:

1. Do not place debris adjacent to watercourse in manner that will cause it to wash away by high water, runoff, or by wind.
2. Do not dump spoiled material into any streams, wetlands, surface waters, or unspecified locations.
3. Prevent indiscriminate, arbitrary, or capricious operation of equipment in wetlands or surface waters.
4. Do not pump silt-laden water from construction into surface waters, wetlands, or natural or man-made channels leading thereto.
5. Prevent damage to vegetation adjacent to or outside of construction area limits.
6. Do not dispose of debris, paints, chemicals, asphalt products, concrete curing compounds, fuels, lubricants, insecticides, washwater from concrete, or any other pollutant in wetlands, surface waters, or natural or man-made channels leading thereto, or unspecified locations.
7. No herbicides or pesticides shall be used.

3.03 MAINTENANCE:

- A. Inspect erosion and sedimentation control system immediately after each rainfall and at least daily during prolonged rainfall. Perform any required repairs immediately.
- B. Should the fabric decompose or become ineffective prior to the end of the expected usable life and the barrier still be necessary, replace fabric promptly.
- C. Remove sediment deposits when they reach approximately one-half the height of the barrier.
- D. Any sediment deposits remaining in place after the silt fence or filter barrier is no longer required shall be dressed to conform to the existing grade, prepared, and seeded.

3.04 ADDITIONAL REQUIREMENTS:

- A. Use Filtrexx® Siltsoxx compost filter sock or equivalent and silt fence or construct earth berms or diversions to intercept and divert runoff water from critical areas.
- B. Discharge silt-laden water from excavation and wet excavated materials onto filter fabric mat and/or filtering sediment traps to ensure that only sediment-free water is returned to watercourses.
- C. Do not place excavated soil material adjacent to watercourse in manner that will cause it to wash away by high water or runoff.
- D. Prevent damage to vegetation by excessive watering or silt accumulation in the discharge areas.
- E. Do not dump spoiled material into any streams, wetlands, surface waters, or unspecified locations.
- F. Prevent indiscriminate, arbitrary, or capricious operation of equipment in streams, wetlands, or surface waters.
- G. Do not pump silt-laden water from trenches or excavations into surface waters, streams, wetlands, or natural or man-made channels leading thereto.
- H. Prevent damage to vegetation adjacent to or outside of construction area limits.
- I. Do not dispose of trees, brush, debris, paints, chemicals, asphalt products, concrete curing compounds, fuels, lubricants, insecticides, washwater from concrete trucks or hydroseeders, or any other pollutant in streams, wetlands, surface waters, or natural or man-made channels leading thereto, or unspecified locations.
- J. Do not alter flow line or any stream (perennial or intermittent) unless indicated or specified.
- K. No herbicides or pesticides shall be used.
- L. Erosion control blankets shall be used to prevent erosion of exposed slopes prior to permanent stabilization measures.

END OF SECTION

SECTION 01600
CONTROL OF MATERIALS

PART 1 - GENERAL

1.01 APPROVAL OF MATERIALS:

- A. Unless otherwise specified, only new materials and equipment shall be incorporated in the work. All materials and equipment furnished by the Contractor shall be subject to the inspection and approval of the Engineer. No material shall be delivered to the work without prior approval of the Engineer.
- B. As specified in Section 01300, the Contractor shall submit to the Engineer, data relating to materials and equipment he proposes to furnish for the work. Such data shall be in sufficient detail to enable the Engineer to identify the particular product and to form an opinion as to its conformity to the specifications.
- C. Facilities and labor for handling and inspection of all materials and equipment shall be furnished by the Contractor. If the Engineer requires, either prior to beginning or during the progress of the work, the Contractor shall submit additional samples or materials for such special tests as may be necessary to demonstrate that they conform to the specifications. Such samples shall be furnished, stored, packed, and shipped as directed at the Contractor's expense. Except as otherwise noted, the Owner will make arrangements for and pay for the tests.
- D. Any delay of approval resulting from the Contractor's failure to submit samples or data promptly shall not be used as a basis of a claim against the Owner or the Engineer.
- E. In order to demonstrate the proficiency of workmen or to facilitate the choice among several textures, types, finishes, and surfaces, the Contractor shall provide such samples of workmanship or finish as may be required.
- F. The materials and equipment used on the work shall correspond to the approved samples or other data.

END OF SECTION

SECTION 01610
DELIVERY, STORAGE AND HANDLING

PART 1 - GENERAL

1.01 GENERAL:

- A. This Section specifies the general requirements for the delivery handling, storage and protection for all items required in the construction of the work. Specific requirements, if any, are specified with the related item.

1.02 TRANSPORTATION AND DELIVERY:

- A. Transport and handle items in accordance with manufacturer's printed instructions.
- B. Schedule delivery to reduce long term on-site storage prior to installation and/or operation. Under no circumstances shall equipment be delivered to the site more than one month prior to installation without written authorization from the Engineer.
- C. Coordinate delivery with installation to ensure minimum holding time for items that are hazardous, flammable, easily damaged or sensitive to deterioration.
- D. Deliver products to the site in manufacturer's original sealed containers or other packing systems, complete with instructions for handling, storing, unpacking, protecting and installing.
- E. All items delivered to the site shall be unloaded and placed in a manner which will not hamper the Contractor's normal construction operation or those of subcontractors and other contractors and will not interfere with the flow of necessary traffic.
- F. Provide equipment and personnel to unload all items delivered to the site.
- G. Promptly inspect shipment to assure that products comply with requirements, quantities are correct, and items are undamaged. For items furnished by others (i.e. Owner, other Contractors), perform inspection in the presence of the Engineer. Notify Engineer verbally, and in writing, of any problems.

1.03 STORAGE AND PROTECTION:

- A. Store and protect products and equipment in accordance with the manufacturer's instructions, with seals and labels intact and legible. Storage instruction shall be studied by the Contractor and reviewed with the Engineer. Instructions shall be carefully followed and a written record of this kept by the Contractor for each product and pieces of equipment.

- B. Arrange storage of products and equipment to permit access for inspection. Periodically inspect to make sure products and equipment are undamaged and are maintained under specified conditions.
- C. Provide protective maintenance during storage consisting of manually exercising equipment, inspecting mechanical surfaces for signs or corrosion or other damage, lubricating, applying any coatings as recommended by the equipment manufacturer necessary for its protection and all other precautions to assure proper protection of all equipment stored and for compliance with manufacturers' requirements related to warranties.
- D. Store loose granular materials on solid flat surface in a well-drained area. Prevent mixing with foreign matter.
- E. Cement and lime shall be stored under a roof and off the ground and shall be kept completely dry at all times. All structural, miscellaneous and reinforcing steel shall be stored off the ground or otherwise to prevent accumulation of dirt or grease, and in a position to prevent accumulations of standing water and to minimize rusting. Beams shall be stored with the webs vertical. Precast concrete shall be handled and stored in a manner to prevent accumulations of dirt, standing water, staining, chipping or cracking. Brick, block and similar masonry products shall be handled and stored in manner to reduce breakage, cracking and spalling to a minimum.

END OF SECTION

SECTION 01700
CONTRACT CLOSEOUT

PART 1 - GENERAL

1.01 SCOPE OF WORK:

- A. This Section specifies administrative and procedural requirements for project closeout, including but not limited to:
 - 1. Closeout procedures.
 - 2. Final cleaning.
 - 3. Adjusting.

1.02 RELATED WORK:

- A. Warranties and Bonds are included in Section 01740.

1.03 CLOSEOUT PROCEDURES:

- A. Submit written certification that Contract Documents have been reviewed, Work has been inspected, and that Work is complete in accordance with Contract Documents and ready for Engineer's inspection.
- B. Provide submittals to Engineer that are required by governing or other authorities.
- C. Submit final Application for Payment identifying total adjusted Contract Sum, previous payment, and sum remaining due.

1.04 FINAL CLEANING:

- A. Complete the following cleaning operations before requesting inspection for Certification of Substantial Completion.
 - 1. Remove labels that are not permanent labels.
 - 2. Clean exposed exterior and interior hard-surfaced finishes to a dust-free condition, free of stains, films and similar foreign substances. Restore reflective surfaces to their original reflective condition. Leave concrete floors broom clean.
 - 3. The installing Subcontractor shall wipe surface of mechanical and electrical equipment. Remove excess lubrication and other substances. Clean plumbing fixtures to a sanitary condition. Clean light fixtures and lamps.
 - 4. Clean the site, including landscape development areas, of rubbish, litter and other foreign substances. Sweep paved areas broom clean; remove stains, spills and other

foreign deposits. Rake grounds that are neither paved nor planted, to a smooth even-textured surface.

1.05 ADJUSTING:

- A. Adjust operating products and equipment to ensure smooth and unhindered operation.

END OF SECTION

SECTION 01710

CLEANING UP

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK:

- A. During its progress, the work and the adjacent areas affected thereby shall be cleaned up and all rubbish, surplus materials, and unneeded construction equipment shall be removed and all damage repaired so that the public and property owners will be inconvenienced as little as possible.
- B. Where material or debris has washed or flowed into or been placed in existing watercourses, ditches, gutters, drains, pipes structures, work done under this contract, or elsewhere during the course of the Contractor's operations, such material or debris shall be entirely removed and satisfactorily disposed of during the progress of the work, and the ditches, channels, drains, pipes, structures, and work, etc., shall, upon completion of the work, be left in a clean and neat condition.
- C. On or before the completion of the work, the Contractor shall, unless otherwise especially directed or permitted in writing, tear down and remove all temporary buildings and structures built by him; shall remove all temporary works, tools, and machinery or other construction equipment furnished by him; shall remove, acceptably disinfect, and cover all organic matter and material containing organic matter in, under, and around privies, houses, and other buildings used by him; shall remove all rubbish from any grounds which he has occupied; and shall leave the roads and all parts of the premises and adjacent property affected by his operations in a neat and satisfactory condition.
- D. Upon completion of the work, the Contractor shall remove from the sites of the subsurface explorations all of his plant, machinery, tools, equipment, temporary work, and surplus materials; shall, unless otherwise directed or permitted in writing, remove all rubbish from any grounds which he has occupied; and shall leave the roads and all parts of the premises and adjacent property affected by his operations in a neat and satisfactory condition.
- E. The Contractor shall thoroughly clean all materials and equipment installed by him and his sub-contractors, and on completion of the work shall deliver it undamaged and in fresh and new-appearing condition. All mechanical equipment shall be left fully charged with lubricant and ready for operation.

- F. The Contractor shall restore or replace, when and as directed, any public or private property damaged by his work, equipment, or employees, to a condition at least equal to that existing immediately prior to the beginning of operations. To this end the Contractor shall do as required all necessary highway or driveway, walk, and landscaping work. Suitable materials, equipment, and methods shall be used for such restoration. The restoration of existing property or structures shall be done as promptly as practicable as work progresses and shall not be left until the end of the contract period.

END OF SECTION

SECTION 01732

SELECTIVE DEMOLITION

PART 1 – GENERAL

1.01 DESCRIPTION:

- A. The work of this Section includes the removal, disposal and the replacement of selected portions of piping and valves.

1.02 RELATED DOCUMENTS:

- A. Section 01080: Abbreviations and Definitions
- B. Section 01090: Reference Standards
- C. Section 01300: Submittals
- D. Section 01400: Quality Assurance
- E. Section 01600: Control of Materials
- F. Section 01700: Contract Closeout
- G. Section 02615: Ductile Iron Pipe and Fittings

1.03 DEFINITIONS:

- A. Remove: Detach items from existing construction and legally dispose of them off-site, unless indicated to be removed and salvaged or removed and reinstalled.
- B. Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated.
- C. Existing; Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.04 SUBMITTALS:

- A. Schedule of Selective Demolition Activities: Indicate the following:
 - 1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Authority's on-site operations are uninterrupted.

2. Interruption of utility services. Indicate how long utility services will be interrupted.
3. Coordination for shutoff, capping, and continuation of utility services.
4. Coordination of Authority's continuing occupancy of portions of existing buildings.
5. Means of protection for items to remain and items in path of waste removal from buildings.

1.05 QUALITY ASSURANCE:

- A. Provide in accordance with Section 01400.
- B. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- C. Standards: Comply with ANSI A10.6 and NFPA 241.
- D. Predemolition Conference: Conduct conference at Project site to comply with requirements in Section 01200 – Project Meetings. Review methods and procedures related to selective demolition including, but not limited to, the following:
 1. Inspect and discuss condition of construction to be selectively demolished.
 2. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
 3. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
 4. Review areas where existing construction is to remain and requires protection.

1.06 PROJECT CONDITIONS:

- A. Authority will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Authority's operations will not be disrupted.
 1. Comply with requirements specified in Section 01010 – Summary of Work.
- B. Notify Authority of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

- C. Storage or sale of removed items or materials on-site is not permitted.
- D. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
 - 1. Maintain fire-protection facilities in service during selective demolition operations.

1.07 CORRECTION OF DEFECTIVE WORK:

- A. Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials so as not to void existing warranties.

PART 2 - PRODUCTS (Not Used)

PART 3 – EXECUTION

3.01 EXAMINATION:

- A. Verify that process pipe systems and utilities have been disconnected and capped.
- B. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.

3.02 UTILITY SERVICES:

- A. Existing Services/Systems: Maintain services/systems indicated to remain and protect them against damage during selective demolition operations.
 - 1. Comply with requirements for existing services/systems interruptions specified in Section 01010 – Summary of Work.
- B. Service/System Requirements: Locate, identify, disconnect, and seal or cap off indicated utility services systems serving areas to be selectively demolished.
 - 1. If services/systems are required to be removed, relocated, or abandoned, before proceeding with selective demolition provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services.

3.03 PREPARATION:

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

1. Comply with requirements for access and protection specified in Section 01500 – Temporary Facilities and as follows:
 - a. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
 - b. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.

3.04 SELECTIVE DEMOLITION, GENERAL:

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

1. Proceed with selective demolition systematically.
2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
4. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
5. Dispose of demolished items and materials promptly.

B. Removed and Reinstalled Items:

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

C. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by the Authority, items may be

removed to a suitable, protected storage location during selective demolition and reinstalled in their original locations after selective demolition operations are complete.

3.05 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS:

- A. Piping and Valves: Remove and dispose the piping and valves to the limits indicated.

3.06 DISPOSAL OF DEMOLISHED MATERIALS:

- A. General: Except for items or materials indicated to be reinstalled, remove demolished materials from Project site and legally dispose of them in an EPA-approved landfill.

1. Do not allow demolished materials to accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
3. Comply with the applicable requirements specified in Division 1.

- B. Burning: Do not burn demolished materials.

- C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

3.07 CLEANING:

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

END OF SECTION

SECTION 01740

WARRANTIES AND BONDS

PART 1 - GENERAL

1.01 SCOPE OF WORK:

- A. This Section specifies general administrative and procedural requirements for warranties and bonds required by the Contract Documents, including manufacturers standard warranties on products and special warranties.

1.02 RELATED WORK:

- A. Refer to Conditions of Contract for the general requirements relating to warranties and bonds.
- B. General closeout requirements are included in Section 01700 Project Closeout.
- C. Specific requirements for warranties for the Work and products and installations that are specified to be warranted are included in the individual Sections of Division 2 through 16.
- D. Certifications and other commitments and agreements for continuing services to Owner are specified elsewhere in the Contract Documents.

1.03 SUBMITTALS:

- A. Submit written warranties to the Owner prior to the date fixed by the Engineer for Substantial Completion. If the Certificate of Substantial Completion designates a commencement date for warranties other than the date of Substantial Completion for the Work, or a designated portion of the Work, submit written warranties upon request of the Owner.
- B. When a designated portion of the Work is completed and occupied or used by the Owner, by separate agreement with the Contractor during the construction period, submit properly executed warranties to the Owner within fifteen days of completion of that designated portion of the Work.
- C. When a special warranty is required to be executed by the Contractor, or the Contractor and a subcontractor, supplier or manufacturer, prepare a written document that contains appropriate terms and identification, ready for execution by the required parties. Submit a draft to the Engineer for approval prior to final execution.
- D. Refer to individual Sections of Divisions 2 through 16 for specific content requirements, and particular requirements for submittal of special warranties.
- E. At Final Completion, compile two copies of each required warranty and bond properly executed by the Contractor, or by the Contractor, subcontractor, supplier, or manufacturer.

Organize the warranty documents into an orderly sequence based on the table of contents of the Project Manual.

- F. Bind warranties and bonds in heavy-duty, commercial quality, durable 3-ring vinyl covered loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-in. by 11-in. paper.
- G. Table of Contents: Neatly typed, in the sequence of the Table of Contents of the Project Manual, with each item identified with the number and title of the specification Section in which specified, and the name of the product or work item.
- H. Provide heavy paper dividers with celluloid covered tabs for each separate warranty. Mark the tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product, and the name, address and telephone number of the installer, supplier, and manufacturer.
- I. Identify each binder on the front and the spine with the typed or printed title "WARRANTIES AND BONDS," the Project title or name, and the name, address, and telephone numbers of the Contractor and equipment supplier.
- J. When operating and maintenance manuals are required for warranted construction, provide additional copies of each required warranty, as necessary, for inclusion in each required manual.
- K. Schedule of Special Warranties

None

1.04 WARRANTY REQUIREMENT:

- A. Related Damages and Losses: When correcting warranted Work that has failed, remove and replace other Work that has been damaged as a result of such failure or that must be removed and replaced to provide access for correction of warranted Work.
- B. Reinstatement of Warranty: When Work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.
- C. Replacement Cost: Upon determination that Work covered by a warranty has failed, replace or rebuild the Work to an acceptable condition complying with requirements of Contract Documents. The Contractor is responsible for the cost of replacing or rebuilding defective Work regardless of whether the Owner has benefited from use of the Work through a portion of its anticipated useful service life.
- D. Owner's Recourse: Written warranties made to the Owner are in addition to implied warranties, and shall not limit the duties, obligations, rights and remedies otherwise

available under the law, nor shall warranty periods be interpreted as limitations on time in which the Owner can enforce such other duties, obligations, rights or remedies.

- E. Rejection of Warranties: The Owner reserves the right to reject warranties and to limit selections to products with warranties not in conflict with requirements of the Contract Documents.
- F. The Owner reserves the right to refuse to accept Work for the Project where a special warranty, certification, or similar commitment is required on such Work or part of the Work, until evidence is presented that entities required to countersign such commitments are willing to do so.
- G. Disclaimers and Limitations: Manufacturer's disclaimers and limitations on product warranties do not relieve the Contractor of the warranty on the Work that incorporates the products, nor does it relieve suppliers, manufacturers, and subcontractors required to countersign special warranties with the Contractor.

1.05 DEFINITION:

- A. Standard Product Warranties are pre-printed written warranties published by individual manufacturers for particular products and are specifically endorsed by the manufacturer to the Owner.
- B. Special Warranties are written warranties required by or incorporated in the Contract Documents, either to extend time limits provided by standard warranties or to provide greater rights for the Owner.

PART 2 - PRODUCTS - (NOT USED)

PART 3 - EXECUTION - (NOT USED)

END OF SECTION

SECTION 01900

SEISMIC AND WIND REQUIREMENTS

PART 1 - GENERAL

1.01 DESCRIPTION:

- A. This section establishes the minimum seismic and wind loading design requirements for architectural, mechanical, electrical and non-structural components.
- B. The Contractor shall be responsible for compliance with the seismic and wind requirements specified including conformance by all Subcontractors, manufacturers and Suppliers.

1.02 REFERENCES:

- A. American Society of Civil Engineers (ASCE):
 - 1. ASCE/SEI 7: Minimum Design Loads for Buildings and Other Structures
- B. American Society of Mechanical Engineers (ASME):
 - 1. [B31](#): Code for Pressure Piping
- C. International Code Council (ICC):
 - 1. International Building Code
- D. Manufacturers Standardization Society of the Valve and Fitting Industry:
 - 1. [SP-58](#): Pipe Hangers and Supports - Materials, Design and Manufacture
- E. National Fire Protection Association (NFPA):
 - 1. Standard for the Installation of Sprinkler Systems

1.03 DEFINITIONS:

- A. Components are defined as systems, equipment, parts, or other elements, including supporting structures and attachments.
- B. The reference Building Code is the building code cited on the structural drawings or specified herein for the design of the basic structure.
- C. The specified seismic criteria is defined as the seismic criteria cited on the structural drawings or specified herein for the design of the basic structure.

- D. The specified wind criteria is defined as the wind criteria cited on the structural drawings or specified herein for the design of the basic structure.

1.04 SEISMIC AND WIND DESIGN REQUIREMENTS:

- A. Refer to structural drawings for project specific seismic and wind requirements and also conform to the requirements specified herein.
- B. Seismic and wind design shall conform to the International Building Code and ASCE/SEI 7.
- C. Architectural, mechanical, electrical and non-structural components shall be designed and constructed to resist the seismic and wind forces and displacements based upon ASCE/SEI 7, the reference building code, and the specified seismic and wind criteria. In the case of conflict the more stringent requirements shall govern.
- D. The interrelationship of components and their effect on each other shall be such that the failure of one component shall not cause the failure of any other component.
- E. Components shall be anchored to the building structure to transfer seismic and wind forces. Connections shall be bolted, welded or otherwise positively anchored to the structure. Anchorage shall not rely on friction for force transfer.
- F. Post-installed anchors in concrete shall be prequalified for seismic applications in accordance with ACI 355.2, ICC-ES AC-193, or ICC-ES AC-308. Drop-in anchors are prohibited for concrete anchorage.
- G. Post-installed anchors in masonry shall be prequalified for seismic applications in accordance with ICC-ES AC-01, or ICC-ES AC-58. Drop-in anchors are prohibited for masonry anchorage.
- H. Exceptions: Exemption from the requirements for seismic and wind analysis and design are permitted only to the extent permitted by applicable codes and standards.

1.05 SUBMITTALS:

- A. Submit the following shop drawings in accordance with Section 01300.
- B. Where specified in the technical specifications, provide and complete the Certificate of Unit Responsibility form in Section 01300 and submit to Engineer prior to manufacture of components.
- C. In addition, submit the following support data along with Certificate of Unit Responsibility:
 - 1. Certification, signed and sealed by a Professional Structural Engineer registered in the jurisdiction in which the project is located stating that all systems, equipment,

and other elements, including supporting structures, attachments and connections are designed to withstand the required seismic and wind forces and displacements.

2. Codes and specifications to which structural design conforms.

1.06 SPECIFIC COMPONENTS:

- A. Compound Equipment: Connecting elements for equipment combinations such as pumps and motors, valves and operators, engines and generators, etc. which are not capable of transferring seismic and/or wind loads or accommodating seismic and wind displacements shall be protected by appropriate design.
- B. Storage Tanks: Tanks, supporting structures and anchorages shall be designed for the weight of the tank, appurtenances and the tank contents at the maximum capacity. Tank contents shall not be considered in resistance to seismic and wind loads.
- C. Ductwork: Equipment installed within ductwork shall be independently supported and braced. Support and bracing of heating and cooling coils shall account for the weight of the contents.
- D. Piping Systems: Support and bracing of piping systems shall account for the weight and hydrodynamic effects of the contents.
- E. Pressure Piping: Pressure piping support and bracing shall conform to ASME B 31 in addition to the force and displacement requirements of the reference code.
- F. Sprinkler Systems: Sprinkler system support and bracing shall conform to NFPA 13 in addition to the force and displacement requirements of the reference code.
- G. General Supports: Pipe, duct, raceways and cable tray supports and bracing shall conform to the AISC Manual of Steel Construction and MSS SP-58 in addition to the force and displacement requirements of the reference code.

PART 2 - PRODUCTS

(Not Used)

PART 3 - EXECUTION

(Not Used)

END OF SECTION

SECTION 02000

MEASUREMENT AND PAYMENT

PART 1 - GENERAL

1.01 PAYMENT ITEMS

<u>ITEM</u>	<u>DESCRIPTION</u>
1.	GENERAL SITE WORK
2.	WATER MANAGEMENT
3.	DEMOLITION
4.	CONCRETE WORK
5.	CHINK AND REPOINT STONE RETAINING WALLS
6.	SEDIMENT REMOVAL
7.	PEDESTRIAN BRIDGE
8.	ALUMINUM PLATFORM
9.	LOW LEVEL OUTLET
10.	SITE IMPROVEMENTS
11.	ROCK EXCAVATION
12.	UNSUITABLE MATERIAL
13.	EROSION CONTROL BARRIER
14.	ALLOWANCE FOR UNIFORM POLICE OFFICER
15.	MOBILIZATION

1.02 MEASUREMENT AND PAYMENT:

A. The following subsections describe the measurement of and payment for the work to be done under the items listed in the BID.

1. Estimates of lump sum items shall be based on a schedule of values dividing each such item into its appropriate component parts together with a quantity and a unit

price for each part so that the sum of the products of prices and quantities will equal the Contract price for the item. This schedule shall be submitted by the Contractor for and must have the approval of the Engineer before the first estimate becomes due. Submit the schedule of values in accordance with Articles VIII of the General Conditions.

- B. Each unit or lump-sum price stated in the BID shall constitute full compensation as herein specified for each item of work completed in accordance with the drawings and specifications, including cleaning up.
 - C. The prices for those items which involve excavation shall include compensation for disposal of surplus excavated material, handling water, and installation of all necessary sheeting and bracing.
 - D. Unit prices established in the BID shall be adhered to and shall apply to final quantities regardless of any deviations between the estimated quantities in the BID and the final quantities at the completion of the work.
- 1.03 THE MEASUREMENT AND PAYMENT FOR BID ITEMS 1 THROUGH 15 ARE AS FOLLOW:

1. GENERAL WORK:

1.1. DESCRIPTION

- A. General Work shall include all site work necessary for the completion of the project but not specifically listed under other bid items.

1.2. MEASUREMENT FOR PAYMENT:

- A. General Work Bid items 1A through 1C shall be paid for on a lump sum basis.

1.3. PAYMENT:

- A. The lump sum price for Bid Item 1A – Contract Bonds shall include all contractor costs associated with contract bonds. Item 1A shall be paid for in full on the first contract invoice.
- B. The lump sum price for Bid Item 1B – General Conditions shall include contractor costs associated with submittals, meetings, administrative work, engineering trailer and sanitary facilities, and project closeout.
- C. The lump sum price for Bid Item 1C - Site Work shall include but not be limited to site preparation; temporary construction entrances, site clearing, grubbing, and filling, removal and reuse of boulders; general site excavation and backfill; excavation and backfill of silt below sediment line at upstream face of dam; installation of riprap; site work including earthwork, chain link fence and gate; site signage; remove and reset granite curbing as necessary; returning site to preconstruction conditions, and all other

work that is not included for payment under bid items 2 through 14, inclusive.

2. WATER MANAGEMENT

2.1. DESCRIPTION

- A. The work required to provide temporary cofferdams, bypass pipes, and dewatering pumps necessary to perform the work. The work for this bid item is primarily specified in Sections 01063, 02140, and 02165.

2.2. PRODUCTS/MATERIALS

- A. Refer to Specification section 02140 para 2.01, and section 02165.

2.3. SUMMARY OF SUBMITTALS

- A. Partial list of submittals from Section 02140, 02165 and related sections. Submit the following shop drawings in accordance with Section 01300.
 - 1. Dewatering Plan.
 - 2. Dewatering equipment.
 - 3. Sedimentation filter bag(s).
 - 4. Discharge piping and appurtenances.
 - 5. Cofferd dam, including sheet piling timber lagging, and concrete/grout.
 - 6. Temporary excavation support plan.
 - 7. Construction contingency plan.

2.4. MEASUREMENT FOR PAYMENT:

- A. Bid item 2A - Water Management shall be paid for on a lump sum basis.
- B. The unit price Bid Item 2B – Temporary Remobilization shall be measured as each distinct storm event that results in overtopping of the temporary cofferdam set to El. 474.8 overtops, which results in a suspension of work due to the flooding of the work area.

2.5. PAYMENT:

- A. The lump sum price for Bid Item 2A shall constitute full compensation for all work to provide temporary cofferdams, bypass pipes, and dewatering pumps and sedimentation filter bag(s) as necessary to perform the work, as indicated on the drawings and as specified. An amount of fifty (50) percent of the amount bid under this item (exclusive of normal contract retainage) will be made when the Contractor

has completed installation of the coffer dam system. The remaining fifty (50) percent (exclusive of normal retainage) will be made following demobilization of the coffer dam system.

- B. The unit price for Bid Item 2B shall be full compensation for furnishing all labor, equipment and materials required to remobilize after a storm event in which the cofferdam is overtopped when the top of the dam is set at elevation 474.8, including to reset and repair the cofferdam, pumping, and any down time for the contractor while the dry work area is reestablished.

3. DEMOLITION

3.1. DESCRIPTION

- A. The work required to demolish and remove concrete, masonry and stone, foundations, retaining walls, sluiceways, as described on the contract drawings and as specified. The work for this bid item is primarily specified in Section 01732.

3.2. PRODUCTS/MATERIALS

- A. Refer to Specification section 01732 2.01.

3.3. SUMMARY OF SUBMITTALS

- A. Partial list of submittals from Section 01732 and related sections. Submit the following shop drawings in accordance with Section 01300.
 - 1. Schedule of demolition activities.

3.4. MEASUREMENT FOR PAYMENT:

- A. Sub-bid items 3A thru 3C of the Demolition bid item shall be measured by actual cubic yards removed within the limits defined on the contract documents.
- B. The quantity of delaminated concrete to be removed and disposed of from the spillway face under Bid Item 3D shall be measured by the cubic yards of concrete that is removed from.
- C. The quantity of granite curb to be removed and reset shall be measured by linear foot of granite curb removed and replaced.

3.5. PAYMENT:

- A. The unit price for sub-bid items 3A thru 3C of the Demolition bid item shall constitute full compensation for all work to demolish and remove all concrete masonry and stone foundations, retaining walls, sluiceways, including legal disposal of all removed material, development of demolition plan and schedule, protection of nearby work including utilities, and all work incidental thereto and not specifically included for

payment under other items.

- B. The unit price for Bid Item 3D shall constitute full compensation for the cost of removing and disposing of loose and hollow sounding concrete from the existing spillway face as directed by the Engineer, complete, as indicated on the drawings, and as specified, including all work incidental thereto and not included for payment under other items. Replacement concrete shall be paid for under bid item 4B.
- C. The unit price for bid item 3E shall constitute full compensation for the cost of removing and resetting granite curbs as necessary to access the site and perform the work, including removal, storage and transporting, reinstallation, pavement restoration, cleaning, and repairing if necessary to return granite to original condition and all work incidental thereto and not included for payment under other items.

4. CONCRETE

4.1. DESCRIPTION

- A. The work required to place reinforced concrete as described on the contract drawings and as specified. The work for this bid item is primarily specified in Section 03300.

4.2. PRODUCTS/MATERIALS

- A. Refer to sections 03100, 03200, 03250, 03255, 03256, 03600, and 03730.

4.3. SUMMARY OF SUBMITTALS

- A. Partial list of submittals from Section 03300 and related sections. Submit the following shop drawings in accordance with Section 01300.
 1. Form ties, spreaders, chamfer strips, form coatings, bond breakers.
 2. Bar lists and placing drawings for all reinforced concrete and masonry.
 3. Accessory materials including chairs, ties, couplers and splicers.
 4. Joint sealants.
 5. Water stops.
 6. Concrete mix designs.
 7. Qualifications of testing laboratory.
 8. Procedures for repair work.
 9. Repair materials and tools and mix designs.

4.4. MEASUREMENT FOR PAYMENT:

- A. The quantity of concrete to be placed under the subdivision of this bid item shall be measured by the cubic yards of new concrete placed to the limits defined on the drawings.
- B. The quantity for new spillway concrete to be paid for under bid item 4B shall include new concrete replacing loose and hollow concrete removed from the existing spillway. The removal of the loose and hollow concrete is to be paid for under bid item 3D.

4.5. PAYMENT:

- A. The unit prices for the subdivisions of this bid item shall constitute full compensation for the cost of furnishing and installing new concrete and reinforcing bars, formwork, water stops, grout, admixtures, joint systems, drilled holes, pvc pipe and rock anchors; surface preparation, as necessary to complete each subdivision of this bid item, as indicated on the drawings and as specified, including all work incidental thereto and not included for payment under other items.

5. CHINK AND REPOINT STONE RETAINING WALLS

5.1. DESCRIPTION

- A. The quantity of cement mortar joints around the stone retaining walls to be repointed, per square foot. The work for this bid item is primarily specified in Section 03300 and 03730.

5.2. PRODUCTS/MATERIALS

- A. Refer to Specification section 03300 and 03730.

5.3. SUMMARY OF SUBMITTALS

- A. Partial list of submittals from Section 03730, and related sections. Submit the following shop drawings in accordance with Section 01300.
 - 1. Cleaning materials and equipment.
 - 2. Cement mortar.

5.4. MEASUREMENT FOR PAYMENT

- A. The quantity of cement mortar joints at the stone retaining walls to be repointed under this bid item shall be measured by the square footage of wall, including face of wall and top of wall.

5.5. PAYMENT

- A. The unit price shall be full compensation for the cost of removing the existing cement mortar and vegetation and installing new cement mortar in the stone joints as directed by the Engineer and as indicated on the drawings and specified.

6. SEDIMENT REMOVAL

6.1. DESCRIPTION

- A. Sediment removal from dam impoundment below ordinary high water, per cubic yard. The work for this bid item is primarily specified in Section 01046, 02140 and in Appendix A – 401 Water Quality Cert.

6.2. PRODUCTS/MATERIALS

- A. Refer to Specification section 01046, 02140 and Appendix A – Water Quality Certification.

6.3. SUMMARY OF SUBMITTALS

- A. Partial list of submittals from Section 01046, 02140 Appendix A -Water Quality Cert and related sections. Submit the following shop drawings in accordance with Section 01300.
 1. Notification of work to DEP.
 2. Material Shipping Records.
 3. Material characterization testing results.
 4. Disposal facility to be used.
 5. Photographs of dredging activity.

6.4. MEASUREMENT FOR PAYMENT

- A. The quantity of sediment removed to be paid for under this item shall be the number of cubic yards of sediment, within the payment limits indicated on the drawings and as defined in this section, unless sediment removal beyond such limits has been authorized in writing by the Engineer, in which case measurements shall be made to the authorized limits.
- B. All excavation and backfill below the limits of the finished silt elevation as defined on the drawings shall be paid for under bid item 1C - general site work.

6.5. PAYMENT

- A. The unit price shall be full compensation for furnishing all labor, equipment,

materials, tools, and supervision necessary for material characterization which the disposal facility may require (sampling and analysis plan, sampling, and chemical analysis), sediment management plan, excavation, dewatering, loading, transportation by licensed hauler, tipping fees, disposal at an approved, state-licensed facility, and preparation of Material Shipping Records or manifests as applicable to the characteristics of the material and the requirements of the accepting facility, complying with all requirements of the 401 Water Quality Cert, and all work incidental thereto and not specifically included for payment under other items.

7. PEDESTRIAN BRIDGE

7.1. DESCRIPTION

- A. Design, furnish, and install the pre-fabricated clear span bridge. The work for this bid item is primarily specified in Section 02850.

7.2. PRODUCTS/MATERIALS

- A. The materials to be used are specified in Section 02850.

7.3. SUMMARY OF SUBMITTALS

- A. Partial list of submittals from Section 02850 and related sections. Submit the following shop drawings in accordance with Section 01300.
 - 1. Shop and erection drawings for all structural steel.
 - 2. Complete and checked shop and erection drawings for all aluminum components.
 - 3. Welding procedure for each type of weld.
 - 4. Qualification test reports for each welder, welding operator, and tacker.

7.4. MEASUREMENT FOR PAYMENT

- A. Measurement for payment shall be on a lump sum basis.

7.5. PAYMENT

- A. The lump sum price for this item shall constitute full compensation for furnishing all labor, equipment, materials, tools, for the pedestrian bridge including design, furnishing, and installation of the pre-engineered, prefinished, clear span bridge of welded construction, including aluminum guardrails, connection to concrete foundations as indicated and as specified, and all work incidental thereto and not specifically included for payment under other items.
- B. Concrete foundation work for bridge abutments to be paid for under bid item 4.

8. ALUMINUM PLATFORM

8.1. DESCRIPTION

- A. Furnish, and install aluminum platform and appurtenances. The work for this bid item is primarily specified in Section 05500, 05510 and 05519.

8.2. PRODUCTS/MATERIALS

- A. The materials to be used are specified in Section 05500, 05510 and 05519.

8.3. SUMMARY OF SUBMITTALS

- A. Partial list of submittals from Section 05500 and related sections. Submit the following shop drawings in accordance with Section 01300.
 1. Aluminum stairs and platforms.
 2. Railings and guardrails with gate.
 3. Aluminum grating.
 4. Setting diagrams, erection plans, templates and direction for installation of backing plates, anchors and other similar items.
 5. Welder certifications.
 6. Complete and checked shop and erection drawings for all aluminum components.
 7. Welding procedure for each type of weld.
 8. Qualification test reports for each welder, welding operator, and tacker.
 9. Fasteners and anchors, including Test Reports and ICC ES evaluation reports.

8.4. MEASUREMENT FOR PAYMENT

- A. Measurement for payment shall be on a lump sum basis.

8.5. PAYMENT

- A. The lump sum price for this item shall constitute full compensation for furnishing all labor, equipment, materials, tools, for the aluminum platform including design, furnishing, and installation of aluminum stairs, railings, guardrails with gate, plates, welding of metals, fasteners, and anchors, as indicated and as specified, and all work incidental thereto and not specifically included for payment under other items.

9. LOW LEVEL OUTLET

9.1. DESCRIPTION

- A. All work necessary to furnish and install the low-level outlet. The work for this bid item is primarily specified in Section 02615, 15103, and 15112.

9.2. PRODUCTS/MATERIALS

- A. The materials to be used are specified in Section 02615, 15103, and 15112.

9.3. SUMMARY OF SUBMITTALS

- A. Partial list of submittals from Section 02615 and related sections. Submit the following shop drawings in accordance with Section 01300.
 - 1. Ductile iron pipe and fittings.
 - 2. Slide gates and actuators.
 - 3. Flap gate
 - 4. Stop logs.
 - 5. Lifting Pike Poles for stop log removal.
 - 6. Setting diagrams, erection plans, templates, and direction for installation of backing plates, anchors and other similar items.
 - 7. Manufacturer's qualifications.
 - 8. Trash Rack.

9.4. MEASUREMENT FOR PAYMENT

- A. The quantity of ductile iron pipe installed under unit price bid item 9A shall be measured by the linear feet of pipe installed.
- B. The quantity of for bid item 9B shall be measured by each complete slide gate system installed.
- C. The quantity for bid item 9C shall be measured by each complete stop log system installed.
- D. The quantity for bid item 9D shall be measured by each complete trash rack

system installed.

- E. The quantity of for bid item 9E shall be measured by each flap gate installed.

9.5. PAYMENT

- A. The unit price for bid item 9A shall constitute full compensation for furnishing all labor, equipment, materials, tools, for installation of the 24” low level outlet pipe, including ductile iron pipe, wall castings, fittings, joint restrains, as indicated and as specified, and all work incidental thereto and not specifically included for payment under other items.
- B. The unit price for bid item 9B shall constitute full compensation for furnishing all labor, equipment, materials, tools, for installation of the 24” x 24” slide gate system including operator, stem, gate stem shield, testing, preparation of concrete surface, coordination with aluminum platform design and installation, testing and field inspection, as indicated and as specified, and all work incidental thereto and not specifically included for payment under other items.
- C. The unit price for bid item 9C shall constitute full compensation for furnishing all labor, equipment, materials, tools, for installation of stop log system including stop logs grooves, preparation of concrete surface, tie back, coordination with aluminum platform design and installation, testing and field inspection, and poles as indicated and as specified, and all work incidental thereto and not specifically included for payment under other items.
- D. The unit price for bid item 9D shall constitute full compensation for furnishing all labor, equipment, materials, tools, for installation of trash rack system including mounting plates, fasteners, welding, chemical passivation, coordination with slide gate and stem guide, and all work incidental thereto and not specifically included for payment under other items.
- E. The unit price for bid item 9E shall constitute full compensation for furnishing all labor, equipment, materials, tools, for installation of the 24” flap gate including, testing, testing and field inspection, as indicated and as specified, and all work incidental thereto and not specifically included for payment under other items.
- F. Concrete work related to low level outlet to be paid for under bid item 4.

10. SITE IMPROVEMENTS

10.1. DESCRIPTION

- A. All work necessary to furnish and install site improvements. The work for this bid item is primarily specified in Section 02210, 02271, 02273, 02435, 02604, and 02701.

10.2. PRODUCTS/MATERIALS

- A. The materials to be used are specified in Section 02210, 02273, 02435, 02604, and 02701.

10.3. SUMMARY OF SUBMITTALS

- A. Partial list of submittals from Section 02701 and related sections. Submit the following shop drawings in accordance with Section 01300.

1. Testing laboratory qualifications.
2. Excavation, backfilling and filling plan.
3. Material submittals for fills and crushed stone.
4. Compaction test results.
5. Rip rap.
6. Geotextile fabric.
7. Hydrodynamic separator.
8. Bioretention aggregate and soil layers.
9. Bio infiltration seed mixes.
10. Drainage pipe and fittings.
11. Overflow structure.
12. Bituminous concrete mix design.

10.4. MEASUREMENT FOR PAYMENT

- A. Measurement for payment for bid item 10A – Bioretention areas shall be on a lump sum basis.
- B. Measurement for payment for bid item 10B – Plantings shall be on a lump sum basis.
- C. The quantity for bid item 10C and 10D shall be measured by the square foot area of bituminous concrete pavement installed.
- D. The quantity of guardrail to be removed and replaced shall be measured by linear foot of guardrail removed and replaced.

10.5. PAYMENT:

- A. The lump sum price for bid item 10A – Bioretention basins shall constitute full compensation for furnishing all labor, equipment, materials, and tools for installation of two bioretention basins including excavation, installation of rip rap, aggregate layers, soil mix, seeding, overflow structures, drainage piping and catch basin, underdrain, sediment forebay, geotextile fabric, mulch, grass swales, cleanouts as indicated on the drawings, and as specified, including all work incidental thereto and not included for payment under other items.
- B. The lump sum price for bid item 10B – Plantings shall constitute full compensation for furnishing all labor, equipment, materials, and tools for installation of all shrubs, trees, grasses including excavation, mulch, plant bedding, protection and care of plantings prior to and after installation as indicated on the drawings, and as specified, including all work incidental thereto and not included for payment under other items.
- C. The unit price for bid items 10C and 10D shall constitute full compensation for furnishing all labor, equipment, materials, and tools for installation of bituminous concrete paving including excavation, subgrade preparation, gravel borrow, crushed stone, geotextile fabric as indicated on the drawings, and as specified, including all work incidental thereto and not included for payment under other items.
- D. The unit price for bid item 10E shall constitute full compensation for the cost of removing and replacing guardrails as necessary to access the site and perform the work, including removal, disposal of old guardrail, installation including excavation and setting steel posts, and all work incidental thereto and not included for payment under other items.

11. ROCK EXCAVATION

11.1. DESCRIPTION

- A. Rock Excavation, per cubic yard. The work for this bid item is primarily specified in Section 02210.

11.2. PRODUCTS/MATERIALS:

- A. The materials to be used are specified in Section 02210.

11.3. SUMMARY OF SUBMITTALS:

- A. Partial list of submittals from Section 02210 and related sections. Submit the following shop drawings in accordance with Section 01300.
 - 1. Excavation, backfilling, and filling plan.

11.4. MEASUREMENT FOR PAYMENT:

- A. The quantity of rock to be paid for under this item shall be the number of cubic yards of rock, measured in place before excavation, within the payment limits indicated on the drawings and as defined in this Section, unless rock excavation beyond such limits has been authorized in writing by the Engineer, in which case measurements shall be made to the authorized limits. Where rock is encountered, it shall be uncovered but not excavated until measurements have been made by the Engineer, unless in the opinion of the Engineer, satisfactory measurements can be made in some manner. Excavated rock which has not been disposed of shall not be included for payment.

11.5. PAYMENT:

- A. The bidder shall include in their bid for items involving excavation, the cost of doing the entire excavation as earth, the price for this item being intended to cover the difference between the cost of rock excavation and the cost of earth excavation.
- B. The unit price for this item shall constitute full compensation for rock excavation and disposal, for all necessary backfilling, and for furnishing all additional material needed for backfilling, complete, as indicated on the drawings, and as specified, including all work incidental thereto and not included for payment under other items

12. UNSUITABLE MATERIAL

12.1. DESCRIPTION

- A. Unsuitable Material, per cubic yard. The work for this bid item is primarily specified in Section 02210.

12.2. PRODUCTS/MATERIALS:

- A. The materials to be used are specified in Section 02210.

12.3. SUMMARY OF SUBMITTALS:

- A. Partial list of submittals from Section 02210 and related sections. Submit the following shop drawings in accordance with Section 01300.
 - 1. Qualifications of the Contractor's Independent Testing Laboratory
 - 2. Excavation, backfilling, and filling plan

12.4. MEASUREMENT FOR PAYMENT:

- A. The prices bid under each division of this item shall be considered as fair compensation for all labor, equipment, tools and materials necessary to complete the Work as specified which shall include excavation, sheeting or shoring not ordered left in place, dewatering, removal and legal disposal of unsuitable materials, filter cloth, furnishing and placing replacement materials, transportation, backfilling, compaction and any other incidental Work relative thereto.
- B. Measurement for replacement of unsuitable material below the limits of normal trench excavation shall be made based on the volume removed and replaced as approved by the Engineer and as follows:
 - 1. Unsuitable material below the limits of normal trench excavation shall be measured from a point two (2) feet below the invert of pipe to the bottom of the excavation and a total width of three (3) feet plus the inside diameter of pipe for pipe twenty four (24) inches or less in diameter (minimum four (4) feet) for trench depths twelve (12) feet or less and five (5) feet plus the inside diameter of the pipe for trench depths greater than twelve (12) feet.
 - 2. Unsuitable material below foundations shall be measured from a point one (1) foot below bottom of the foundation. Replacement material below foundations shall be Mud mats unreinforced concrete.

12.5. PAYMENT:

- A. Payment for replacement of unsuitable material below the limits of normal trench excavation shall be made at the unit price bid per cubic yard under the applicable division of this item.
 - 1. No payment will be made for replacement of unsuitable material above and below the limits of normal trench excavation when suitable excess excavated material is available from other excavations made under this Project.
 - 2. No payment will be made for unsuitable material replaced beyond the limits approved by the Engineer.

13. EROSION CONTROL BARRIER EROSION AND SEDIMENTATION CONTROL:

13.1. DESCRIPTION

- A. Erosion and sedimentation control, per linear foot. The work for this bid item is primarily specified in Section 01568.

13.2. PRODUCTS/MATERIALS:

- A. The materials to be used are specified in Section 01568 – 2.01 through 2.04.

13.3. SUMMARY OF SUBMITTALS:

- A. Partial list of submittals from Section 01568 and related sections. Submit the following shop drawings in accordance with Section 01300.
 - 1. Erosion control plan and sketches
 - 2. Silt Sock.

13.4. MEASUREMENT FOR PAYMENT:

- A. The length of erosion control barrier to be installed shall be measured by the linear foot of the initial installation of erosion control barrier from the beginning to the end of the silt sock.

13.5. PAYMENT:

- A. The unit price for this item shall constitute full compensation for installing, maintaining, and removing the silt socks, and implementing any other erosion and sedimentation control requirements as indicated and as specified, including all work indicated thereto and not specifically included for payment under other items.

14. ALLOWANCE FOR UNIFORM POLICE OFFICER:

14.1. DESCRIPTION

- A. Allowance for uniform police officer for traffic control, the Contractor shall be reimbursed for the costs incurred related to paying for uniform police officers at the work site.

14.2. PRODUCTS/MATERIALS:

- A. Not Applicable

14.3. SUMMARY OF SUBMITTALS:

- A. Not applicable

14.4. MEASUREMENT FOR PAYMENT:

- A. Under the allowance for uniform police officer, the Contractor shall be reimbursed for the costs incurred related to paying for uniform police officers at the work site.

14.5. PAYMENT:

- A. The lump sum price for this item established in the Bid is an estimated figure to facilitate comparison of bids. The actual amount to be paid shall be the amount for the actual charges for this work, as agreed to by the Owner.

- B. If the total cost for the work for this item is greater or less than the allowance amount stated under this item in the Bid, a debit or credit of the difference in cost shall be made to the Owner.

15. MOBILIZATION:

15.1. DESCRIPTION

- A. Mobilization (maximum 5% of items 1 thru 14), the lump sum of.

15.2. PRODUCTS/MATERIALS:

- A. Not applicable.

15.3. SUMMARY OF SUBMITTALS:

- A. Not applicable

15.4. MEASUREMENT FOR PAYMENT:

- A. Measurement for payment shall be on a lump sum basis.

15.5. PAYMENT:

- A. The lump sum price for mobilization shall constitute full compensation for initiating the contract (exclusive of the cost of materials), for mobilization of all materials, tools, and other equipment necessary to carry on and complete the work, demobilization, utility connection fees, permits, licenses, Health and Safety Plan, insurance and all other incidental work relative thereto.
- B. The lump sum price for this item shall not exceed five percent (5%) of the total amount of the base bid. An amount of seventy-five (75) percent of the amount bid under this item (exclusive of normal contract retainage) will be made when the Contractor has mobilized to the project site and is ready to start construction. The remaining twenty-five (25) percent (exclusive of normal retainage) will be made following demobilization from the project site.

END OF SECTION

SECTION 02100
SITE PREPARATION

PART 1 - GENERAL

1.01 DESCRIPTION:

- A. Provide labor, material, tools and equipment to prepare site as indicated and specified.

1.02 RELATED WORK:

- A. Section 02210: Earth Excavation, Backfill, Fill and Grading

PART 2 - PRODUCTS

2.01 WOOD CHIPS:

- A. Chip from cleared wood.
- B. Provide additional wood chips as directed by Engineer.
- C. DO NOT PERMIT use of elm wood and elm bark as wood chips.

PART 3 - EXECUTION

3.01 EXISTING TREES AND VEGETATION:

- A. Avoid cutting or injuring trees and vegetation outside easement line and outside areas to be cleared as indicated, without Engineer's permission.
- B. Accept responsibility for damages outside these lines.
- C. Remove and dispose of trees and stumps within 20 feet of the dam embankments and core wall. Remove and dispose of trees and stumps in the staging area, in the location of the new access road and that otherwise interfere with the performance of the work as indicated on the drawings or as directed by Engineer.

3.02 EXISTING STRUCTURES AND PROPERTY:

- A. Remove existing signs, posts, catchbasin frames and grates, manhole frames and covers, and granite curbing within construction path unless directed otherwise.
- B. Store at a site designated by Owner, items in reusable condition as determined by Engineer.
- C. For work in loamed areas, strip loam to one side to avoid mixing with excavation materials. Do not take loam from site.

3.03 CLEARING:

- A. Cut or remove trees, brush, and other vegetable matter such as snags, bark and refuse, from areas to be cleared. Clear ground to width of permanent easement unless otherwise directed.
- B. Cut trees, stumps, and stubs to be cleared, except where clearing done by machinery, as close to ground surface as practicable, but no more than 6 in. above ground surface for small trees and 12 in. for larger trees.
- C. Bury elm bark, at least 1 ft. deep, or burn in incinerators off site with antipollution controls and fire prevention controls, to prevent spread of Dutch Elm disease as required by applicable laws.

3.04 CLEARING IN WOODED AREAS:

- A. Remove and dispose of cleared trees offsite. In doing so, observe all applicable laws, ordinances, rules and regulations.

3.05 GRUBBING, STRIPPING, DISPOSAL:

- A. Remove stumps and roots larger than 3 in. in diameter to a depth of 12 in., and roots larger than 1/2 in. in diameter to a depth of 6 in. Measure depths to cut from existing ground surface or proposed finished grade, whichever is lower.
- B. Strip stumps, roots, foreign matter, topsoil, loam and unsuitable earth from ground surface. Utilize topsoil and loam insofar as possible for finished surfacing. Do not take loam from site.
- C. Promptly dispose off site material from clearing and grubbing not reused or stockpiled. In doing so, observe all applicable laws, ordinances, rules and regulations. Do not consider work completed until final cleaning, unless otherwise directed.

3.06 CONTRACT CLOSEOUT:

- A. Provide in accordance with Section 01700.

END OF SECTION

SECTION 02140

DEWATERING

PART 1 - GENERAL

1.01 DESCRIPTION:

- A. Design, furnish, operate, maintain, and remove temporary dewatering systems to control groundwater and surface water to permit work to be performed under dry and stable conditions. Work to be done as part of dewatering includes, but is not limited to:
 - 1. Lower the groundwater level.
 - 2. Lower hydrostatic pressure.
 - 3. Prevent surface water from entering the excavation during construction.
 - 4. Implement erosion control measures for disposing of discharge water.
- B. Common dewatering methods include, but are not limited to, sump pumping, deep wells, well points, vacuum well points or any combinations thereof.
- C. The Contractor shall obtain the required permits for discharge from the Contractor's dewatering systems in accordance with 40 CFR Part 122 and 61 FR 19284. The discharge location shall be in accordance with permit requirements.
- D. For work related to drawdown and maintenance of the Lowes Pond Dam water level refer to Section 01063 Miscellaneous Requirements.

1.02 RELATED WORK:

- A. Section 01063: Miscellaneous Requirements.
- B. Section 01568: Erosion Control Sedimentation and Containment of Construction Materials.
- C. Section 02210: Earth Excavation, Backfill, Fill, and Grading
- D. Section 02222: Fine Aggregate
- E. Section 02223: Impervious Fill
- F. Section 02271: Riprap
- G. Section 02273: Geotextile Fabric
- H. Section 02435: Crushed Stone

1.03 SUBMITTALS:

- A. Submit the following in accordance with Section 01300:
 - 1. Submit a dewatering plan at least two weeks prior to start of any dewatering operation. The review will be for the information of the Owner and third parties for an overall understanding of the project relating to access, maintenance of existing facilities and proper utilization of the site. The Contractor shall remain responsible for the adequacy and safety of the means, methods and sequencing of construction. The plan shall include the following items as a minimum:
 - a. A list of equipment including, but not limited to, pumps, prime movers, and standby equipment.
 - b. Detailed description of dewatering, maintenance, and system removal procedures.
 - c. Approach and layout of the cofferdam installation.
 - d. Erosion/sedimentation control measures, and methods of disposal of pumped water.
 - e. List of all applicable laws, regulations, rules, and codes to which dewatering design conforms.

1.04 QUALITY ASSURANCE:

- A. Provide in accordance with Section 01400 and as specified.
- B. If subgrade soils are disturbed or become unstable due to dewatering operation or an inadequate dewatering system, notify the Engineer, stabilize the subgrade, and modify system to perform as specified at no additional cost to the Owner.
- C. Notify the Engineer immediately if any settlement or movement is detected on structures. If the settlement or movement is deemed by the Engineer to be related to the dewatering, take actions to protect the adjacent structures and submit a modified dewatering plan to the Engineer within 24 hours. Implement the modified plan and repair any damage incurred to the adjacent structures at no additional cost to the Owner.
- D. If oil and/or other hazardous materials are encountered after dewatering begins, immediately notify the Engineer.

1.05 DELIVERY, STORAGE AND HANDLING:

- A. Provide in accordance with Section 01610 and as specified.

1.06 PROJECT/SITE CONDITIONS:

- A. Subsurface Conditions: Refer to Appendix A.

PART 2 - PRODUCTS

2.01 MATERIALS:

- A. Provide casings, well screens, piping, fittings, pumps, power and other items required for dewatering system.
- B. Provide and store auxiliary dewatering equipment, consisting of pumps and hoses on the site in the event of breakdown, at least one (1) pump for every five (5) used.
- C. Provide and maintain erosion/sedimentation control devices as indicated or specified and in accordance with the dewatering plan.
- D. Provide temporary pipes, hoses, flumes, or channels for the transport of discharge water to the discharge location.

PART 3 - EXECUTION

3.01 EXECUTION:

- A. Execution of any earth excavation, installing earth retention systems, and dewatering shall not commence until the related submittals have been reviewed by the Engineer with all Engineer's comments satisfactorily addressed.
- B. Furnish, install and maintain dewatering system in accordance with the dewatering plan.
- C. Carry out dewatering program in such a manner as to prevent undermining or disturbing foundations of existing structures or of work ongoing or previously completed.
- D. Do not excavate until the dewatering system is operational and has successfully dewatered the soil to the required elevation.
- E. Unless otherwise specified, continue dewatering uninterrupted until all structures, pipes, and appurtenances below the original groundwater level have been completed and backfilled such that they will not be floated or otherwise damaged by an increase in groundwater elevation.
- F. Discontinue open pumping from sumps and ditches, if such pumping is resulting in boils, loss of fines, softening of the ground, or instability of the slopes. Modify dewatering plan and submit to the Engineer at no additional cost to the Owner.
- G. Where subgrade materials are disturbed or become unstable due to dewatering operations, remove and replace the materials in accordance with Section 02210 at no additional cost to the Owner.
- H. Dewatering Discharge:
 - 1. Transport pumped or drained water to discharge location without interference to other work, damage to pavement, other surfaces, or property.

2. Provide separately controllable pumping lines.
 3. The Engineer reserves the right to sample discharge water at any time.
 4. Immediately notify the Engineer if suspected contaminated groundwater is encountered. Do not pump water found to be contaminated with oil or other hazardous material to the discharge locations.
- I. Install and maintain erosion/sedimentation control devices at the point of discharge as indicated or specified and in accordance with the dewatering plan.
- J. Removal:
1. Do not remove dewatering system without written approval from the Engineer.
 2. Backfill and compact sumps or ditches with crushed stone wrapped with geotextile fabric in accordance with Section 02210.
 3. All dewatering wells shall be abandoned upon completion of the work, and completely backfilled with cement grout.
- 3.02 CONTRACT CLOSEOUT:
- A. Provide in accordance with section 01700.

END OF SECTION

SECTION 02160

TEMPORARY EXCAVATION SUPPORT SYSTEMS

PART 1 - GENERAL

1.01 DESCRIPTION:

- A. Design, furnish and install temporary excavation support systems as required to maintain lateral support, prevent loss of ground, limit soil movements to acceptable limits and protect from damage existing and proposed improvements including, but not limited to, pipelines, utilities, structures, roadways, railroads, embankments, and other facilities.
- B. The requirement of sheeting left in place in areas indicated on the drawings does not relieve the Contractor from the responsibility of furnishing and installing proper temporary excavation support systems in other areas.
- C. Common types of excavation support system include, but are not limited to, singular or multiple stages comprised of cantilevered or internally braced soldier piles and lagging, steel sheetpile wall, timber sheetpile wall, drilled secant pile wall system, trench box, or combinations thereof. Trench box temporary excavation support system is only acceptable for pipe or utility trench excavations. Temporary unsupported open cut excavation with stable sloping sides is allowed where applicable.
- D. Wherever the word "sheeting" is used in this section or on the contract drawings, it shall be in reference to any type of excavation support system specified except trench box.
- E. Construction of the temporary excavation support systems shall not disturb the existing structures or the completed proposed structures. Damage to such structures shall be repaired by the Contractor at no additional cost to the Owner.
- F. Temporary excavation support shall not be allowed within the limits of the existing or proposed embankment dam.
- G. Adjacent structures are those that are bear upon soils above the proposed excavation depth and within a distance equal to twice the total depth of the excavation away from the closest edge of the excavation. Monitor and protect adjacent structures as specified and indicated.
- H. Vibration monitoring for excavation support systems will be performed by Contractor's vibration consultant and monitoring firm. Vibration due to Contractor's operations shall not exceed specified limits 1.05 E.
- I. Construction operations not to exceed specified noise limits in accordance with Section 01100.

- J. The Contractor shall bear the entire cost and responsibility of correcting any failure, damages, subsidence, upheaval or cave-ins as a result of improper installation, maintenance or design of the temporary excavation support systems. The Contractor shall pay for all claims, costs and damages that arise as a result of the work performed at no additional cost to the Owner.

1.02 RELATED WORK:

- A. Section 02140: Dewatering
- B. Section 02210: Earth Excavation, Backfill, Fill, and Grading
- C. Section 03300: Cast-in-Place Concrete
- D. Section 05120: Structural Steel

1.03 REFERENCES:

- A. American Society for Testing and Materials (ASTM):
 - 1. A36: Standard Specification for Structural Steel
 - 2. A328: Standard Specification for Steel Sheet Piling
 - 3. A416: Standard Specification for Strand Steel, Uncoated Seven-Wire for Prestressed Concrete
 - 4. A722: Specification for Uncoated High-Strength Steel Bar for Prestressing Concrete
 - 5. A615: Standard Specifications for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
- B. American Wood-Preserves Association (AWPA) Standards.
- C. American Welding Society (AWS) Code: D1.1.
- D. Federal Standard, FS TT-W-571: Wood Preservation and Treating Practices.
- E. Occupational Safety and Health Administration (OSHA) Standards and Regulations contained in Title 29: Subpart P - Excavations, Trenching and Shoring.
- F. American Concrete Institute (ACI)
- G. ACI 304: Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete.

1.04 SUBMITTALS:

A. Submit the following in accordance with Section 01300:

1. Submit the following qualifications four (4) weeks prior to the construction:
 - a. Qualifications of independent vibration consulting and monitoring firm as specified in Paragraph 1.05 D.
 - b. Qualifications of Contractor's temporary excavation support system designer as specified in Paragraph 1.05 G.
 - c. Qualifications of Contractor's temporary excavation support system installer as specified in Paragraph 1.05 H.
 - d. Qualifications of Contractor's independent tieback testing laboratory as specified in Paragraph 1.05 I, if a tieback system is utilized.
 - e. Qualifications of Contractor's temporary excavation support system installation supervisor as specified in Paragraph 1.05 J.
 - f. Qualifications of vacuum excavation subcontractor as specified in Paragraph 1.05 F, if DMPs for utilities are utilized.
2. Submit a temporary excavation support plan stamped and signed by a Registered Professional Engineer at least two weeks prior to start of the construction. Do not submit design calculations. The review will be only for the information of the Owner and third parties for an overall understanding of the project relating to access, maintenance of existing facilities and proper utilization of the site. The Contractor shall remain responsible for the adequacy and safety of the means, methods and sequencing of construction. The plan shall include the following items as a minimum:
 - a. Proposed temporary excavation support system(s), details, location, layout, depths, extent of different types of support relative to existing features and the permanent structures to be constructed, and methods and sequence of installation and removal.
 - b. Certificate of Design: Refer to Section 01300.
 - c. A list of all design assumptions, including safety factors used for the temporary excavation support system(s) and all lateral pressures used for each system.

- d. If utilizing a tieback system, include tieback installation procedures and criteria for acceptance of tiebacks for performance and proof tests. Submit the tieback testing results to the Engineer for information only.
 - e. Requirements of dewatering during the construction.
 - f. Minimum lateral distance from the edge of the excavation support system for use for vehicles, construction equipment, and stockpiled construction and excavated materials.
 - g. List of equipment used for installing the excavation support systems.
 - h. Monitoring schedule, installation procedures and location plans for vibration/noise monitoring, geotechnical instrumentation (deformation monitoring points, inclinometers, etc.) and observation wells/piezometers to monitor ground, excavation support system, adjacent structures and groundwater fluctuation during the entire construction period.
3. Submit a Construction Contingency Plan specifying the methods and procedures to maintain temporary excavation support system stability if the allowable movement of the adjacent ground and adjacent structures is exceeded.
 4. Monitoring data within one (1) day of data collection from vibration and noise recording equipment, observation wells, deformation monitoring points and offset lines. Data shall include:
 - a. Horizontal and vertical movements of geotechnical instruments and groundwater readings.
 - b. New movements since the initial readings of the geotechnical instruments.
 - c. Weekly summary in tabular and graphic form at the end of each week.
 - d. A schematic plan of excavation and/or relevant construction activities at the time of monitoring.
 5. For excavation support systems left in place, submit the following as-built information prior to backfilling and covering the excavation support systems:
 - a. Survey locations of the temporary excavation support systems, including coordinates of the ends and points of change in direction.
 - b. Type of the temporary excavation support system.
 - c. Elevations of top and bottom of the excavation support systems left in place.

1.05 QUALITY ASSURANCE:

- A. Provide in accordance with Section 01400 and as specified.
- B. Conform to the requirements of the OSHA Standards and Interpretations: "Part 1926 Subpart P - Excavation, Trenching, and Shoring", and all other applicable laws, regulations, rules, and codes.
- C. Construction operations to conform to noise regulations provided in the Noise Control Plan and this Section.
- D. Retain the services of an independent vibration consulting firm with the following in-house personnel to conduct the following vibration monitoring requirements:
 - 1. Preparing, reviewing and signing of monitoring plans and daily reports, and overseeing of the monitoring and interpretation of the vibration data shall be performed by personnel with the following qualifications:
 - a. Be a Massachusetts Registered Professional Engineer.
 - b. Have a minimum of five (5) years experience in the vibration consulting field.
 - c. Have successfully completed at least five (5) projects with vibration-inducing construction operations, pile driving, and noise levels equal to or more severe than those to be encountered.
 - 2. Assist Contractor in selecting pile driving equipment which will generate the lowest vibration and noise levels.
 - 3. Installation, monitoring and interpretation of monitoring equipment shall be performed by personnel with the following qualifications:
 - a. Have at least three (3) years of experience in the operation of monitoring equipment proposed for use and interpretation of records produced by such equipment.
 - b. Have installed, operated, monitored and interpreted equipment and records on at least three (3) projects with vibration-inducing construction operations, pile driving, and noise levels equal to or more severe than those to be encountered.
- E. The peak particle velocity for pile driving, or other vibration-inducing operations, shall not exceed the following:

Type of Concrete	Age of Concrete, hrs	Peak Particle Velocity in/sec
Mass Concrete (footings, mats, Slab-on-grade, fill concrete, etc.)	0-11	1.0
	11 and over	2.0
Concrete Structures (walls, columns, elevated slabs, etc.)	0-11	0.5
	11-24	1.0
	24 and over	2.0
Existing Structures, residences or utilities	-	0.5

- F. If utilizing deformation monitoring points (DMPs) for utilities, vacuum excavation shall be performed by subcontractor having five (5) years of experience in non-destructive vacuum excavation methods for utilities.
- G. Prepare design, including calculations and drawings, under the direction of a Professional Engineer registered in the state where the project is located and having the following qualifications:
1. Not less than ten (10) years experience in the design of specific temporary excavation support systems to be used.
 2. Completed not less than five (5) successful temporary excavation support system projects of equal type, size, and complexity within the last five (5) years.
- H. Temporary Excavation Support System Installer's Qualifications:
1. Not less than three (3) year experience in the installation of similar types and equal complexity as the proposed system.
 2. Completed not less than three (3) successful excavation support systems of similar type and equal complexity as the proposed system.
- I. If utilizing a tieback system, employ an independent testing laboratory to test the tieback system with the following qualifications:
1. Be accredited by the American Association of State Highway and Transportation Officials (AASHTO) Accreditation Program.

2. Employ personnel conducting testing who are trained in the methods and procedures to test and monitor tieback systems of similar type and equal complexity, as the proposed system.
 3. Have not less than five (5) years experience in testing of tieback systems of similar type and equal complexity as the proposed system.
 4. Have successfully tested at least three (3) tieback systems of similar type and equal complexity as the proposed system.
- J. Install all temporary excavation support systems under the supervision of a supervisor having the following qualifications:
1. Not less than five (5) years experience in installation of systems of similar type and equal complexity as the proposed system.
 2. Completed at least five (5) successful temporary excavation support systems of similar type and equal complexity as the proposed system.
- K. All welding shall be performed in accordance with AWS D1.1.

1.06 DESIGN CRITERIA:

- A. Design of temporary excavation support systems shall meet the following minimum requirements:
1. Support systems shall be designed for earth pressures, hydrostatic pressure, equipment, temporary stockpiles, construction loads, roadways, railroads, and other surcharge loads.
 2. Design a bracing system to provide sufficient reaction to maintain stability.
 3. Limit movement of ground adjacent to the excavation support system to be within the allowable ground deformation as specified.
 4. Design the embedment depth below bottom of excavation to minimize lateral and vertical earth movements and provide bottom stability. Toe of braced temporary excavation support systems shall not be less than 5 feet [1.5 m] below the bottom of the excavation.
 5. Design temporary excavation support systems to withstand an additional 2 feet [60 cm] of excavation below proposed bottom of excavation without redesign except for the addition of lagging and/or bracing.
 6. Maximum width of pipe trench excavation shall be as indicated on the drawings.

7. Do not cast permanent structure walls directly against excavation support walls.
8. The design location of the excavation support wall shall be determined such that the installed wall and bracing system components are all located outside the limits of the permanent structure. Construction tolerances (e.g. wall verticality) shall be considered in determining the plan location.

1.07 DELIVERY, STORAGE AND HANDLING:

- A. Provide in accordance with Sections 01610 and as specified.
- B. Store sheeting and bracing materials to prevent sagging which would produce permanent deformation. Keep concentrated loads which occur during stacking or lifting below the level which would produce permanent deformation of the material.

1.08 PROJECT/SITE CONDITIONS:

- A. Subsurface Conditions: Refer to Attachment A.

PART 2 - PRODUCTS

2.01 MATERIALS:

- A. Structural Steel: All soldier piles, wales, rakers, struts, wedges, plates, waterstop and accessory steel shapes shall conform to ASTM A36.
- B. Timber Lagging Left in Place: Pressured treated per appropriate AWWA standards.
- C. Tieback Tendons: Tieback tendons shall be high strength steel wire strand cables conforming to ASTM A416, or bars conforming to ASTM A722. Splicing of individual cables shall not be permitted.
- D. Raker Ties: ASTM A615 Grade 60.
- E. Cement Grout Materials And Admixtures For Tieback Anchorages: Grout cube strength shall be a minimum 3500 psi at 7 days and 5000 psi at 28 days.
- F. Cast-In-Place Concrete: Section 03300.
- G. Tamping tools adapted for backfilling voids after removal of the excavation support system.
- H. Provide specific trench box sizes for each pipe and utility excavation with structural capacity of retaining soil types as described in OSHA's 29 CFR Part 1926 Subpart P.

2.02 EQUIPMENT:

PART 3 - EXECUTION

3.01 INSTALLATION:

- A. Installation of the temporary excavation support systems shall not commence until the related earth excavation and dewatering submittals have been reviewed by the Engineer with all Engineer's comments satisfactorily addressed.
- B. Install excavation support systems in accordance with the temporary excavation support plan.
- C. If utilizing a tieback system, all performance and proof tests shall be conducted in the presence of the Engineer. Testing performed without the Engineer present will not be accepted. Repeat testing in the Engineer's presence at no additional cost to the Owner.
- D. Do not drive sheeting within 100 feet [30 m] of concrete less than seven (7) days old.
- E. Carry out program of temporary excavation support in such a manner as to prevent undermining or disturbing foundations of existing structures of work ongoing or previously completed.
- F. Bottom of the trench box excavation support system shall be above the pipe invert prior to installing the pipe.
- G. Install and read geotechnical instrumentation in accordance with the temporary excavation support plan. Notify the Engineer immediately if any geotechnical instrumentation is damaged. Repair or replace damaged geotechnical instrumentation at the sole option of the Engineer and at no additional cost to the Owner.
- H. Continuously monitor movements of the ground adjacent to excavation support systems and adjacent structures. In events of the measured movements approaching or exceeding the allowable movements, take immediate steps to arrest further movement by revising procedures such as providing supplementary bracing, filling voids behind the trench box, supporting utilities or other measures (Construction Contingency Plan) as required.
- I. Notify utility owners if existing utilities interfere with the temporary excavation support system. Modify the existing utility with the utility owners permission or have the utility owner make the modifications at no additional cost to Owner.

3.02 GROUND DEFORMATION ADJACENT TO EXCAVATION SUPPORT SYSTEMS:

- A. Allowable Vertical (heave/settlement) and Lateral Movements: 2 inches [5 cm] maximum for the trench box excavation support system, and 1 inch [2.5 cm] maximum for other types of excavation support systems at any location behind the excavation support system.
- B. Monitoring personnel shall use a procedure for reading and recording geotechnical instrumentation data which compares the current reading to the last reading during data collection to eliminate spurious readings.
- C. Plot the observed ground deformation readings versus time. Annotate the plots with construction loading and excavation events having an impact on the readings. Evaluate plots by means of secondary rate-of-change plots to provide early warning of accelerating ground movements.
- D. Notify the Engineer when the allowable ground deformation is exceeded.
- E. Implement Construction Contingency Plan under direction of the temporary excavation support system designer and the Engineer.

3.03 REMOVAL OF EARTH RETENTION SYSTEM:

- A. Sheet piling shall be left in place unless otherwise indicated or approved in writing by the Engineer.
- B. When indicated or approved by the Engineer, remove the temporary excavation support system without endangering the constructed or adjacent structures, utilities, or property. Immediately backfill all voids left or caused by withdrawal of temporary excavation support systems with bank-run gravel, screened gravel or select borrow by tamping with tools specifically adapted for that purpose.
- C. When tiebacks are used, release tension in tiebacks as the excavation is backfilled. Do not leave tensioned tieback in place at the completion of the work.
- D. The excavation support system left-in-place shall be cut-off a minimum of 2 feet [60 cm] below the bottom of the next higher foundation level or a minimum of 5 feet [152 cm] below finished grade.
- E. Conduct survey of the locations and final cut-off elevations of the excavation support systems left in place.

3.04 CONTRACT CLOSEOUT:

- A. Provide in accordance with Section 01700.

END OF SECTION

SECTION 02165

TEMPORARY COFFERDAM

PART 1 - GENERAL

1.01 DESCRIPTION:

- A. The work of this section consists of designing, furnishing, installing, maintaining and removing a temporary cofferdam within the Lowe's Pond to enable the dewatering of the construction areas within the reservoir for excavation, backfill, formwork erection and concrete placement in the dry.
- B. Design and provide the temporary cofferdam and temporary pumping systems to lower and maintain reservoir to desired level and to maintain dewatered area free of water. Contractor shall assume temporary pumps will be required on the interior of the cofferdams.
- C. The temporary cofferdam shall consist of one or combination of the following systems: portable dam, rubber dam system, and soldier pile with steel plate lagging or others approved by the Engineer.

1.02 RELATED REQUIREMENTS

- A. Sediment control devices are shown on drawings and are specified in Section 01568.

1.03 PROJECT CONDITIONS

- A. Refer to Appendix A for subsurface information. The Contractor may perform additional investigations for the temporary cofferdam design. The drilling cost shall be included in the submitted bid for the temporary Cofferdam.
- B. The cofferdam shall not extend outside the limits of temporary or permanent easements.

1.04 SUBMITTALS:

- A. Shop Drawing: Submit the following in accordance with Section 01300 - SUBMITTALS:
 - 1. Submit the following qualifications two (2) weeks prior to the construction:
 - a. Qualifications of Contractor's temporary cofferdam system designer.
 - b. Qualifications of Contractor's temporary cofferdam system installer.

2. Manufacturer's material and installation information.
3. Dewatering Plan to include drawings with written descriptions of the proposed procedures for dewatering and disposal of the fluidized materials. The Dewatering Plan shall provide detailed information of the proposed temporary cofferdam system's materials, dimension, layout and pumping plan.
4. Submit a temporary cofferdam plan stamped and signed by a Massachusetts Registered Professional Engineer at least two (2) weeks prior to start of the construction. Do not submit design calculations. The review will be only for the information of the Owner and third parties for an overall understanding of the project relating to access, maintenance of existing facilities and proper utilization of the site. The Contractor shall remain responsible for the adequacy and safety of the means, methods and sequencing of construction. The plan shall include the following items as a minimum:
 - a. Proposed temporary cofferdam system(s), details, location, layout, depths, extent of different types of support relative to existing features and methods and sequence of installation and removal.
 - b. Certificate of Design: Refer to Section 01300.
 - c. Requirements of dewatering during the construction.
 - d. List of equipment used for installing the temporary cofferdam systems.

1.05 QUALITY ASSURANCE:

- A. Provide in accordance with Section 01400 and as specified.
- B. Conform to the requirements of the OSHA Standards and Interpretations and all other applicable laws, regulations, rules, and codes.
- C. Prepare design, including calculations and drawings, under the direction of a Massachusetts Registered Professional Engineer and having the following qualifications:
 1. Not less than ten (10) years experience in the design of specific temporary cofferdam systems to be used.
 2. Completed not less than five (5) successful temporary excavation support system projects of equal type, size, and complexity within the last five (5) years.
- D. Temporary Cofferdam System or Installer's Qualifications:
 1. Not less than three (3) year experience in the installation of similar types and equal complexity as the proposed system.

2. Completed not less than three (3) successful cofferdam systems of similar type and equal complexity as the proposed system.
- E. Install temporary cofferdam systems under the supervision of a supervisor having the following qualifications:
1. Not less than five (5) years experience in installation of systems of similar type and equal complexity as the proposed system.
 2. Completed at least five (5) successful temporary cofferdam systems of similar type and equal complexity as the proposed system.

1.06 DESIGN CRITERIA:

- A. Design of temporary cofferdam systems shall meet the following minimum requirements:
1. Support systems shall be designed for hydrostatic pressure, water current, wave forces, ice forces, and other applicable surcharge loads.
 2. Cofferdam shall be designed to overtop under extreme conditions without failing.

PART 2 - PRODUCTS

2.01 TEMPORARY COFFERDAM

- A. The Contractor shall have full responsibility for the structural and protective adequacy of the temporary cofferdam system installed. The following type may be used:
1. Portadam System as manufactured by Portdam, Inc., Dover-Foxcroft, ME, 044265; 207-564-7878; Fax 207-564-7877; www.portadam.com.
 2. Rubber Dam System as manufactured by Dam-It Dams, Inc., Fenton, MI, 48430; 313-886-6761; Fax 313-886-6710; www.damitdams.com.
 3. Soldier pile with steel plate lagging cofferdams.
 4. Or approved equal.

PART 3 - EXECUTION

3.01 GENERAL

- A. The Dewatering Plan shall be approved by the Engineer. All sediment and erosion control measures shall be in place prior to the commencement of the construction for the

temporary cofferdam. The Contractor shall notify the Engineer 48 hours in advance of the delivery and onsite erection of the cofferdam system.

- B. The Contractor shall be responsible for maintaining a safe, clean and accessible construction site. The Contractor shall have full responsibility for the complete and proper diversion of water during all stages of the project and shall repair, at no additional expense to the Owner, any damage to any equipment, materials or work caused by floods, high water or failure of the diversion of protective works.
- C. The temporary cofferdam shall be constructed to provide adequate clearances in all directions are required for the execution of work to be performed in the dewatered area. This shall include room for the dewatering pumps and installation and removal operations.

3.02 SUBGRADE PREPARATION

- A. The portable dam shall be placed directly on the existing ground of the reservoir. If large obstructions are encountered, such as boulders, their removal is necessary. Softer ground areas may be traversed by using distribution pads under the steel framework or by driving steel poles down to suitable subsurface material. Either of these methods shall be performed in accordance with the manufacturer's recommendations.

3.03 FRAME INSTALLATION

- A. Assembly of the steel framework for the portable dam requires in-water labor to position frame toes properly and can be accomplished using floating, light-lift equipment or landside crane. Assemble the steel framework using bolted clamps and pinned connections. Place appropriate portable dam frames as per the manufacturer's recommendations.

3.04 MEMBRANE INSTALLATION

- A. Membrane for the portable dam shall be installed and sealed after the frames are installed in accordance with the manufacturer's recommendations. The fabric sections are connected on shore, rolled and floated into position on the assembled framework. After connection of the top of the fabric at the desired elevation, it is unrolled down the diagonal face of the framework and extended over the mudline to the required distance out from the toes. Sandbags may be used to anchor the ends of the membrane approximately one sandbag per linear foot.

3.06 DEWATERING

- A. After the cofferdam has been installed and adequately sealed, the Contractor shall pump out the water behind the membrane. Minor leaks shall be located and sealed. All water pumped after construction has started shall be pumped to a temporary dewatering

sediment basin which shall filter the water prior to discharging into the downstream flow channel.

- B. Temporary sump holes may be installed within the area to be dewatered to create a more suitable pumping area. Pumps shall be kept in a workable condition and a spare pump shall be available for breakdowns or emergency conditions.
- C. A temporary dewatering sediment basin shall be sized, constructed, and located by the Contractor. The sides of the dewatering basin shall be constructed of substantial materials designed for the prevention of siltation. The siltation prevention screening shall extend two feet above normal high water.

3.07 REMOVAL

- A. The Contractor shall notify the Engineer 48 hours in advance prior to removing any portion of the temporary cofferdam system. Upon completion, cleanup, inspection, and acceptance of the internal dry work, the enclosed area shall be flooded to equalize the water pressure on both side of the cofferdam. For the portable dam option, the fabric is first removed and then the frames. Sandbags shall be removed and disposed of. The Contractor shall check the ground surface for any stray objects, and dispose all surplus and unsuitable material from the site in accordance with all local, state, and federal rules.

END OF SECTION

SECTION 02210

EARTH EXCAVATION, BACKFILL, FILL, AND GRADING

PART 1 - GENERAL

1.01 DESCRIPTION:

1. Perform the following earth excavation, backfill, fill and grading as indicated or specified:
2. Make excavations to accommodate piping, conduits, foundations and other structures.
3. Provide materials for backfilling excavations and constructing embankments and fills as indicated and specified.
4. Construct embankments of compacted materials.
5. Grade surfaces to meet finished grades indicated.
6. Immediately notify the Engineer if suspected hazardous materials are encountered and cease operations in that part of work.

1.02 RELATED WORK:

- A. Section 01568: Erosion Control Sedimentation and Containment of Construction Materials.
 1. Section 02100: Site Preparation.
 2. Section 02140: Dewatering
 3. Section 02222: Impervious Fill
 4. Section 02271: Riprap
 5. Section 02273: Geotextile Fabric
 6. Section 02435: Crushed Stone
 7. Section 03300: Cast-in-Place Concrete

1.03 REFERENCES:

- A. American Society for Testing and Materials (ASTM) Publications:

1. C33: Specification for Concrete Aggregates.
2. C136: Sieve Analysis of Fine and Coarse Aggregates.
3. D421: Practice for Dry Preparation of Soil Samples for Particle Size Analysis and Determination of Soil Constants.
4. D6913: Standard Test Methods for Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis
5. D1140: Test Method for Amount of Material in Soils Finer than the No. 200 (75 μm) Sieve.
6. D1556: Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.
7. D1557: Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lb/ft³ (600 kN-m/m³)).
8. D2167: Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
9. D4318: Test Method for Liquid Limit, Plastic Limit and Plasticity Index of Soils.
10. D4718: Practice for Correction of Unit Weight and Water Content for Soils Containing Oversized Particles.
11. D4944: Test Method for Field Determination of Water (Moisture) Content of Soil by the Calcium Carbide Pressure Tester Method.
12. D4959: Test Method for Field Determination of Water (Moisture) Content of Soil by Direct Heating Method.
13. D5080: Test Method for Rapid Determination of Percent Compaction.
14. D6938: Standard Test method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)
15. Occupational Safety and Health Administration (OSHA) Standards and Regulations contained in Title 29: Subpart P - Excavations, Trenching and Shoring.

1.04 DEFINITIONS:

- A. Percentage of compaction is defined as the ratio of the field dry density, as determined by ASTM D1556 or ASTM D6938 to the maximum dry density determined by ASTM D1557 Procedure C, multiplied by 100.

- B. Proof Roll: Compaction with a minimum of 4 passes of a vibratory steel drum or rubber tire roller. Vibratory plate compactors shall be used in small areas where vibratory steel drum or rubber tire roller can not be used.
- C. Acceptable Material: Material which does not contain organic silt or organic clay, peat, vegetation, wood or roots, stones or rock fragments over 6-inch in diameter, porous biodegradable matter, loose or soft fill, excavated pavement, construction debris, or refuse. Stones or rock fragments shall not exceed 40 percent by weight of the backfill material.
- D. Unacceptable Materials:
 - 1. Material which contain organic silt or organic clay, peat, vegetation, wood or roots, stones or rock fragments over 6-inch in diameter, porous biodegradable matter, loose or soft fill, excavated pavement, construction debris, or refuse. Stones or rock fragments shall not exceed 40 percent by weight of the backfill material. Materials that do not comply with the requirements for the acceptable material or
 - 2. Materials that cannot be compacted to the specified or indicated density.

1.05 SUBMITTALS:

- A. Submit the following in accordance with Section 01300:
 - 1. Qualifications of the Contractor's Independent Testing Laboratory as specified in Paragraph 1.06 G, four (4) weeks prior to the execution of any earth excavation, backfilling, filling, or compaction process.
 - 2. Submit an excavation, backfilling, and filling plan at least two weeks prior to start of any earth moving activities. The review will be only for the information of the Owner and third parties for an overall understanding of the project relating to access, maintenance of existing facilities and proper utilization of the site. The Contractor shall remain responsible for the adequacy and safety of the means, methods and sequencing of construction. The plan shall include, but not be limited to the following items:
 - a. Detailed sequence of work.
 - b. General description of construction methods.
 - c. Numbers, types, and sizes of equipment proposed to perform excavation and compaction.
 - d. Details of dust control measures.
 - e. Proposed locations of stockpiled excavation and/or backfill materials.

- f. Proposed surplus excavated material off-site disposal areas and required permits.
 - g. Details of erosion and sedimentation control measures which will prevent erosion and sedimentation during the earth moving activities.
3. The following material submittals shall be submitted to the Engineer prior to backfilling and filling:
4. Impervious Fill: As specified in Section 02222.
- a. Crushed Stone: As specified in Section 02435.
 - b. Other Acceptable Materials: Laboratory testing results of gradation and moisture-density relationship. Submittal shall include specific location of the source and the date when sample was taken. Test results shall be less than 3 months old.
5. During Construction, keep records and submit written confirmation of fill lift thickness, in-place soil moisture content, and percentage of compaction to the Engineer.

1.06 QUALITY ASSURANCE AND CONTROL:

- A. Provide in accordance with Section 01400 and as specified.
- B. Dewatering and Groundwater Control: Provide and maintain as specified in Section 02140.
- C. Excavations shall be performed in the dry, and kept free from water, snow and ice during construction. Bedding and backfill material shall not be placed in water. Water shall not be allowed to rise upon or flow over the bedding and backfill material.
 - 1. The Contractor shall be solely responsible for making all excavations in a safe manner. All excavation, trenching, and related sheeting, bracing, etc. shall comply with the requirements of OSHA excavation safety standards (29 CFR Part 1926 Subpart P) and State requirements. Where conflict between OSHA and State regulations exists, the more stringent requirements shall apply.
- D. Do not excavate, construct embankments, or fill until all the required submittals have been reviewed by the Engineer.
- E. Formulate excavation, backfilling, and filling schedule and procedures to eliminate possibility of undermining or disturbing foundations of partially and completed structures, pipelines and embankments or existing structures and pipelines.
 - 1. Employ an independent testing laboratory to perform particle size and gradation analyses in accordance with ASTM D6913, and to determine compactibility in

accordance with ASTM D1557 for all the proposed backfill and fill materials, and monitoring field compaction operations.

2. The Contractor's independent testing laboratory shall have the following qualifications:
3. Be accredited by the American Associates of State Highway and Transportation Officials (AASHTO) Accreditation Program or U.S. Army Corps Engineers (USACE).
4. Have three (3) years experience in sampling, testing and analysis of soil and aggregates, and monitoring field compaction operations.
5. Able to provide three (3) references from previous work.
6. Field Testing and Inspections:
7. By Contractor's independent testing laboratory, acceptable to the Engineer, at Contractor's expense as specified in Paragraph 1.06 J.
8. Location of tests mutually acceptable to testing laboratory and the Engineer or as directed by the Engineer.
9. In the event compacted material does not meet specified in-place density, recompact material and retest this area until specified results are obtained at no additional to the Owner.
10. Contractor's testing laboratory to perform inspection at least once daily to confirm lift thickness and compaction effort for entire fill area.
11. Methods of Field Testing:
12. In-Place Density: ASTM D1556, ASTM D2167, or ASTM D6938.
13. In-Place Moisture Content: ASTM D6938, ASTM D4944, or ASTM D4959.
14. Material Testing Frequency: The following testing frequencies are minimum required for all structural and non-structural fill, grading and embankment.
15. Field In-Place Density and Moisture Content - crushed stone shall be compacted as specified and indicated. For other backfill and fill materials, minimum test frequency shall be as follows, and no less than one test per:
16. Trenches under structures, foundation preparation or roadways subbase: Every 1000 lin. ft. per lift.
17. Trenches in areas without structures or roadways: Every 1000 lin. ft. per alternate lift.

18. Under Structures: 1,000 sq. ft. per lift.
19. Around Structures: 1,500 sq. ft. per lift.
20. Embankment Fills: 10,000 sq. ft. per lift.
21. Moisture Density - One per source, except for crushed stone. Repeat the moisture density test for every 5,000 cubic yard of material use, and whenever visual inspection indicates a change in material gradation as determined by the Engineer.
22. Gradation Analysis - A minimum of one per source and for each moisture density test and whenever visual inspection indicates a change in material gradation.
23. Liquid Limit, Plastic Limit and Plasticity Index - Minimum of one test per 5,000 cubic yard of soil for use as fill material and whenever classification of material is in doubt as determined by the Engineer.
24. Construction Tolerances:
25. Construct finished surfaces to plus or minus 1 inch of the elevations indicated.
26. Grade cut and fill areas to plus or minus 0.20 foot of the grades indicated.
27. Complete embankment edges to plus or minus 6 inches of the slope lines indicated.
28. Provide the Engineer with adequate survey information to verify compliance with above tolerances.
29. Pipes, drains, and other utilities may exist in certain locations not indicated on drawings. No attempt has been made to show all services. Completeness or accuracy of information given is not guaranteed.
30. Dig test pits considered as incidental to the normal excavation as indicated and specified in this Section, at no additional compensation. When the Engineer orders test pits beyond limits of excavation, payment for such test pits shall be as specified in Section 01151.
31. Carefully support and protect from damage, existing pipes, poles, wires, fences, curbs, property line markers, and other structures, which the Engineer determines must be preserved in place without being temporarily or permanently relocated. Should such items be damaged, restore without compensation therefore, to at least as good condition as that in which they were found immediately before the work was begun.
32. Whenever certain existing structures, as described below, are encountered, and the Engineer so directs, change the location, remove and later restore, or replace such

structures, or assist the Owner in doing so. Such work to be paid for under applicable items of work, otherwise as Extra Work.

33. In removing existing pipes or other structures, include for payment only those new materials which are necessary to replace those unavoidably damaged as determined by the Engineer.
34. The preceding two paragraphs apply to pipes, wires, and other structures which meet the following: (a) are not indicated on the drawings or otherwise provided for, (b) encroach upon or are encountered near and substantially parallel to the edge of the excavation, and (c) in the opinion of the Engineer, will impede progress to such an extent that satisfactory construction cannot proceed until they have been changed in location, removed (to be later restored), or replaced.
35. Restore existing property or structures as promptly as practicable.
36. Do not remove excavation materials from the site of the work or dispose of except as directed or permitted by the Engineer.
37. Haul away and dispose of surplus excavated materials at locations approved by the Engineer at no additional cost to the Owner.
38. During progress of work, conduct earth moving operations and maintain work site so as to minimize the creation and dispersion of dust. Furnish and spread calcium chloride if the Engineer decides that it is necessary for more effective dust control.
39. Provide suitable and safe bridges and other crossings where required for accommodation of travel, and to provide access to private property during construction, and remove said structures thereafter.

1.07 SITE CONDITIONS:

- A. Subsurface Conditions: Refer to Appendix A.

PART 2 - PRODUCTS

2.01 GENERAL:

- A. Use only acceptable materials from excavations or borrows.
- B. Provide fine aggregate, impervious fill, common fill material, and crushed stone.
- C. Provide erosion/sedimentation control devices as indicated, including geotextile fabric in accordance with Section 02273.

2.02 EQUIPMENT:

- A. The compaction equipment shall be selected by the Contractor, and shall be capable of consistently achieving the specified compaction requirements. The selected compaction equipment shall meet the following minimum requirements:
 - 1. Manually operated vibratory plate compactors weighing no less than 200 pounds with vibration frequency no less than 1600 cycles per minute.
 - 2. Vibratory steel drum or rubber tire roller weighing at least 12,000 pounds.
 - 3. Small vibratory drum rollers and equipment mounted vibratory plate.

PART 3 - EXECUTION

3.01 SITE MAINTENANCE:

- A. Roadway and Site Leveling: Grade roadway and site as to maintain them in a level unrutted condition and to eliminate puddling of surface and subsurface water.

3.02 EXCAVATION:

- A. Execution of any earth excavation shall not commence until the related dewatering, excavation support systems, and backfill and fill materials submittals are reviewed by the Engineer and all Engineer's comments satisfactorily addressed.
- B. Carry out program of excavation, dewatering, and excavation support systems to eliminate possibility of undermining or disturbing foundations of existing structures or of work previously completed under this contract or adjacent preexisting embankment slopes.
- C. Excavate to widths that give suitable room for building structures or laying and jointing piping.
- D. Do not plow, scrape or dig by machinery near to finished subgrade in a manner that would result in disturbance of subgrade.
- E. Excavate to lines and grades indicated in an orderly and continuous program.
- F. Establish limits of excavation to allow adequate working space for installing forms and for safety of personnel.
- G. Excavate to elevations indicated, or deeper, as directed by the Engineer, to remove unacceptable bottom material.
- H. Exercise care to preserve material below and beyond the lines of excavations.
- I. Place excavated material at the approved stockpile locations and in no case closer than 3 feet from edge of excavations to prevent cave-ins of bank slides.

- J. Regard small, less than one cubic yard, boulders, rock fragments, and concrete encountered during excavation as a normal part of in-place soils and not included for payment as rock.

3.03 SEPARATION OF EXCAVATED MATERIALS FOR REUSE:

- A. Remove only existing pavement that is necessary for prosecution of work.
- B. Carefully remove loam and topsoil from excavated areas. Store separately for further use or furnish equivalent loam and topsoil as directed.
- C. Carefully remove acceptable material from excavated areas and store separately for further use as backfill material.

3.04 TRENCH EXCAVATION:

- A. When pipe is to be laid in gravel bedding or concrete cradle, excavate trench by machinery to, or just below designated subgrade. If material remaining at bottom of trench is disturbed, recompaction shall be required.
- B. When pipe is to be laid directly on bottom of trench, do not excavate lower part of trenches by machinery to subgrade. Remove remainder of material to be excavated just before placing of pipe by use of hand tools. Form a flat or shaped bottom, true to grade, so pipe will have a uniform and continuous bearing. Support on firm and undisturbed material between joints, except for limited areas where use of pipe slings have disturbed bottom.

3.05 DEPTH OF TRENCH:

- A. Excavate trenches to depths so as to permit pipe to be laid at elevations, slopes, or depths of cover indicated on drawings, and at uniform slopes between indicated elevations.

3.06 WIDTH OF TRENCH:

- A. Make pipe trenches as narrow as practicable and do not widen by scraping or loosening materials from the sides. Make every effort to maintain sides of trenches firm and undisturbed until backfilling has been placed and compacted.
- B. Excavate trenches with approximately vertical sides between springline of pipe and elevation 1 ft. above top of pipe.

3.07 TRENCH EXCAVATION IN FILL:

- A. Place and compact material to top of fill or to a minimum height of 1 ft. above top of pipe, whichever is less, when pipe is to be laid in embankment or other recently filled material. Take particular care to ensure maximum consolidation of material under pipe location. Excavate pipe trench as though in undisturbed material.

3.08 EXCAVATION NEAR EXISTING STRUCTURES:

- A. Discontinue digging by machinery when excavation approaches pipes, conduits, or other underground structures. Continue excavation by use of hand tools. Include such manual excavation in work to be done when incidental to normal excavation and under items involving normal excavation.
- B. Excavate test pits when determination of exact location of pipe or other underground structure is necessary for doing work properly.

3.09 REMOVAL OF SUBSURFACE OBSTRUCTIONS:

- A. Remove indicated subsurface structures and related obstructions to extent shown.
- B. Promptly notify the Engineer when any unexpected subsurface facilities are encountered during excavation such as utility lines and appurtenances, walls and foundations.

3.10 UNAUTHORIZED EXCAVATION:

- A. When the bottom of any required excavation is taken out beyond limits indicated or specified, backfill, with the same original material as directed by the Engineer.

3.11 REUSE AND DISPOSAL OF SURPLUS EXCAVATED MATERIALS:

- A. Reuse surplus acceptable excavated materials for backfill; deposit neatly and grade so as to make or widen fills, flatten side slopes, or fill depressions; or legally dispose off-site; all as directed or permitted and without additional compensation.

3.12 SUBGRADE PREPARATION AND PROTECTION:

- A. Remove loam and topsoil, loose vegetable matter, stumps and large roots from areas upon which embankments will be built or material will be placed for grading. Shape subgrade as indicated on drawings, and prepare by forking, furrowing, or plowing so that the first layer of new material placed thereon will be well bonded to it.
- B. As directed by the Engineer, over excavate unacceptable materials below the foundation subgrade. Backfill the over excavation with approved material by the Engineer.
- C. Proof roll the foundation subgrade prior to backfilling and filling operation, or placing foundation concrete.
 - 1. Proof roll the pipe trench foundation subgrade prior to backfilling and filling operation, or placing soil-supported pipeline.
 - 2. Utilize excavating equipment equipped with a toothless or smooth edged, excavating bucket to expose the pipe trench foundation subgrade to avoid disturbance of the bearing surface. Tamp the exposed subgrade with the

excavating bucket prior to backfilling and filling operation, or placing soil-supported pipeline.

3.13 CARE AND RESTORATION OF PROPERTY:

- A. Enclose uncut tree trunks adjacent to work in wooden boxes of such height as may be necessary for protection from injury from piled material, equipment, operations, or otherwise due to work. Operate excavating machinery and cranes of suitable type with care to prevent injury to trees not to be cut and particularly to overhanging branches and limbs.
- B. Cut all branches, limbs, and roots smoothly and neatly without splitting or crushing. Neatly trim, cut the injured portions and cover with an application of grafting wax or tree healing paint as directed.
- C. Protect cultivated hedges, shrubs, and plants which might be injured by the Contractor's operations by suitable means or dig up and temporarily replant and maintain. After construction operations have been substantially completed, replant in original positions and care for until growth is reestablished. If cultivated hedges, shrubs, and plants are injured to such a degree as to effect their growth or diminish in their beauty or usefulness, replace by items of equal kind and quality existing at the start of the work.
- D. Do not use or operate tractors, bulldozers, or other power-operated equipment on paved surfaces when their treads or wheels of which are so shaped as to cut or otherwise damage such surfaces.
- E. Restore surfaces damaged by the Contractor's operations to a condition at least equal to that in which they were found immediately before work commenced. Use suitable materials and methods for such restoration.

3.14 BACKFILLING - GENERAL:

- A. Do not place frozen materials in backfill or place backfill upon frozen material. Remove previously frozen material or treat before new backfill is placed.
- B. Do not place, spread, roll or compact fill material during unfavorable weather conditions. If interrupted by heavy rain or other unfavorable conditions, do not resume until ascertaining that the moisture content and density of the previously placed soil are as specified.
- C. Do not use puddling, ponding or flooding as a means of compaction.

3.15 MATERIAL PLACEMENT AND COMPACTION REQUIREMENTS:

- A. Common Fill for Access Road:
 - 1. Dump and spread in layers not to exceed 8-in. uncompacted thickness.

2. Compact, fill and backfill as indicated but to not less than 95 percent.
3. Crushed Stone:
4. Dump and spread in layers not to exceed 8-in. uncompacted thickness.
5. Compact using self propelled vibratory steel drum or rubber tire rollers with a minimum of 4 passes in directions perpendicular to one another in open areas. In small areas, use manually operated vibratory plate compactors with a minimum of 4 passes.
6. Acceptable materials for use as non-structural fill:
7. Dump and spread in layers not to exceed 12-in. uncompacted thickness.
8. Compact to not less than 90 percent unless otherwise indicated.
9. Backfilling and filling operation shall be suspended in areas where tests are being made until tests are completed and the testing laboratory has advised the Engineer that adequate densities are obtained.

3.16 STRUCTURAL FILL AND BACKFILL UNDER STRUCTURES:

- A. Compact fill and backfill under structures and pavements with crushed stone as specified and indicated.

3.17 NON-STRUCTURAL BACKFILL AROUND STRUCTURES:

- A. Use acceptable materials for non-structural backfill around structures and compacted as specified and indicated.
 1. Deposit material evenly around structure to avoid unequal soil pressure.
 2. Do not place backfill against or on structures until they have attained sufficient strength to support the loads (including construction loads) to which they will be subjected, without distortion, cracking, or other damage.

3.18 MATERIAL FOR FILLING AND EMBANKMENTS:

- A. Use acceptable materials for filling and constructing embankments unless otherwise indicated.

3.19 PLACING AND COMPACTING EMBANKMENT MATERIAL:

- A. Compact fill material as specified and indicated.
- B. Perform fill operation in an orderly and systematic manner using equipment in proper sequence to meet the specified compaction requirements.

- C. Place fill on surfaces which are free of unacceptable materials.
- D. Begin filling in lowest section of work area. Grade surface of fill approximately horizontal but provide with sufficient longitudinal and transverse slope to allow for runoff of surface water from every point.
- E. Conduct filling so that no obstruction to drainage from other sections of fill area is created at any time.
- F. Install temporary dewatering sumps in low areas during filling operation where excessive amounts of rain runoff collect.
- G. Reduce moisture content of fill material, if necessary, in source area by working it over under warm and dry atmospheric conditions. A large disc harrow with two to three foot diameter disks may be required for working soil in a drying operation.
- H. Compact uniformly throughout. Keep surfaces of fill reasonably smooth and free from humps and hollows which would prevent proper and uniform compaction. Do not permit hauling equipment to follow a single track on the same layer but direct equipment to spread out to prevent over compaction in localized areas. Take care in obtaining thorough compaction at edges of fill.
- I. Slightly slope surface of fill to ensure drainage during periods of wet weather. Do not place fill while rain is falling or after a rain-storm until the Engineer considers conditions satisfactory. During such periods and upon suspension of filling operations for any period in excess of 12 hours, roll smooth the surface of fill using a smooth wheel static roller to prevent excessive absorption of rainfall and surface moisture. Prior to resuming compaction operations, remove muddy material off surface to expose firm, compacted material, as determined by the Engineer.
- J. When fill is placed against an earlier fill or against in-situ material under and around structures, including around piping beneath structures or embankments, slope junction between two sections of fill, 1 vertical to 1.5 horizontal. Bench edge of existing fill 24-in. to form a serrated edge of compact stable material against which to place the new fill. Ensure that rolling extends over junction between fills.
- K. When fill is placed directly upon another older fill, clean surface thoroughly of debris and remove any loose material. Then proof roll the entire old surface.
- L. After spreading each loose lift to the required thickness and adjusting its moisture content as necessary, roll with sufficient number of passes to obtain the required compaction. One pass is defined as the required number of successive trips which by means of sufficient overlap will insure complete coverage and uniform compaction of an entire lift. Do not make additional passes until previous pass has been completed.
- M. In case material of any fill sinks and weaves under roller or under hauling units and other equipment, required degree of compaction is not being obtained. Reduce the moisture content. If such sinking and weaving produces surface cracks, suspend operations on that

part of the embankment until it becomes sufficiently stabilized. Ideal condition in fill is that attained when the entire fill below the surface being rolled is so firm and hard as to show only the slightest weaving and deflection as roller passes. Spread out rolling operations over the maximum practicable area to minimize condition of sinking and weaving.

- N. If because of defective workmanship, compaction obtained over any area is less than that required, remedy condition at no cost to Owner. If additional rolling or other means fail to produce satisfactory results, remove material in that area down to a level of satisfactory density. Perform removal, replacement, and rerolling without additional compensation.

3.20 COMPACTION CONTROL OF BACKFILL, FILL, AND EMBANKMENT:

- A. Compact to density specified and indicated for various types of material. Control moisture content of material being placed within $\pm 2\%$ of optimum moisture content.
- B. The soil testing laboratory shall provide inspection during filling or backfilling operations to ensure compaction of crushed stone and record compaction equipment in use.
- C. Moisture control may be required either at the stockpile area, pits, or on embankment or backfill. Increase moisture content when material is too dry by sprinkling or other means of wetting uniformly. Reduce moisture content when material is too wet by exposing the greatest possible area to sun and air in conjunction with harrowing, plowing, spreading of material or any other effective methods.

3.21 ALLOWANCE FOR SHRINKAGE:

- A. Build embankments or backfill to a height above finished grade which will, in the opinion of the Engineer, allow for the shrinkage or consolidation of material. Initially, provide at all points, an excess of at least one percent of total height of backfill measured from stripped surface to top of finished surface.
- B. Supply specified materials and build up low places as directed, without additional cost if embankment or backfilling settles so as to be below the indicated level for proposed finished surface at any time before final acceptance of the work.

3.22 CONTRACT CLOSEOUT

- A. Provide in accordance with Section 01700.

END OF SECTION

SECTION 02222
IMPERVIOUS FILL

PART 1 – GENERAL

1.01 DESCRIPTION:

- A. Provide and compact impervious fill for the dam embankment as specified. Impervious fill shall be used for all earthen embankment fill, or replacement as a result of embankment excavation unless indicated otherwise.

1.02 RELATED WORK:

- A. Section 02210: Earth Excavation, Backfill, Fill and Grading

1.03 REFERENCES:

- A. American Society for Testing and Materials (ASTM) Publications:

1. D1140: Test Method for Amount of Material in Soils Finer than the No. 200 (75 μm) Sieve.
2. D1557: Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³).
3. D4318: Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
4. D6913: Standard Test Methods for Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis

- B. American Association of State Highway and Transportation Officials (AASHTO) Publication:

1. M145: Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes.

1.04 SUBMITTALS:

- A. Submit the following in accordance with Section 01300 - Submittals:

1. Gradation and compaction test results from the soil testing laboratory, at least two (2) weeks prior to hauling material, for the Engineer's acceptance.
2. Submit a 20-lb. sample of the material when requested by the Engineer.

1.05 QUALITY ASSURANCE:

- A. Provide in accordance with Section 01400 and as specified.
- B. Qualifications of the independent soil testing laboratory as specified in Section 02210.
- C. Maximum particle size and gradation analyses shall be performed in accordance with ASTM D6913. Soil compaction test shall be performed in accordance with ASTM D1557 Procedure C.
- D. Material testing frequency and requirements as specified in Section 02210.

PART 2 – PRODUCTS

2.01 MATERIAL:

- A. Impervious fill shall be obtained from approved natural deposits and unprocessed except for the removal of deleterious materials and stones larger than the maximum size permitted.
- B. Impervious fill shall be unfrozen and substantially free from vegetation, roots, loam and other organic matter, snow, frozen particles and other fine or harmful substances.
- C. Impervious fill shall have the physical characteristics of A-4, A-5 and A-6 soils under AASHTO M145, which contain more than 36% by mass passing No. 200 sieve.

PART 3 – EXECUTION

3.01 PLACEMENT AND COMPACTION:

- A. Specified in Section 02210 and where indicated on the drawings.

3.02 CONTRACT CLOSEOUT:

- A. Provide in accordance with Section 01700.

END OF SECTION

SECTION 02225

GRAVEL BORROW

PART 1 – GENERAL

1.01 DESCRIPTION:

- A. Provide and compact select borrow as indicated and specified.

1.02 RELATED WORK:

- A. Section 02210: Earth Excavation, Backfill, Fill and Grading

1.03 REFERENCES:

- A. American Society for Testing and Materials (ASTM) Publications:
- B. C33: Specification for Concrete Aggregates
- C. D422: Test Method for Particle-Size Analysis of Soils.
- D. D1140: Test Method for Amount of Material in Soils Finer than the No. 200 (75 μ m) Sieve.
- E. D1557: Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (600 kN-m/m³).
- F. D2487: Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System).

1.04 SUBMITTALS:

- A. Submit the following in accordance with Section 01300:
- B. Gradation and compaction test results from the soil testing laboratory, at least two (2) weeks prior to hauling material, for the Engineer's acceptance.
- C. Submit a 20-lb. sample of the material when requested by the Engineer.

1.05 QUALITY ASSURANCE:

- A. Provide in accordance with Section 01400 and as specified.

- B. Qualifications of the independent soil testing laboratory as specified in Section 02210.
- C. Maximum particle size and gradation analyses shall be performed in accordance with ASTM D422. Soil compaction test shall be performed in accordance with ASTM D1557 Procedure C.
- D. Material testing frequency and requirements as specified in Section 02210.

PART 2 - PRODUCT

2.01 MATERIAL:

- A. Use only material free from roots, leaves, and organic matter, and free of ice, snow, frost and frozen soil particles.
- B. Select borrow shall be well-graded coarse-grained soil in accordance with ASTM D2487 and shall meet the following gradation:

<u>Sieve Designation</u>	<u>Percentage by Weight Passing Square Mesh Sieves</u>
3 in.	100
1/2 in.	50 - 85
No. 4	40 - 75
No. 50	8 - 28
No. 200	0 - 10

- C. Soil particles shall conform to the physical property requirements of ASTM C33.

PART 3 – EXECUTION

3.01 PLACEMENT AND COMPACTION:

- A. Specified in Section 02210 and as indicated on the drawings.

3.02 CONTRACT CLOSEOUT:

- A. Provide in accordance with Section 01700.

END OF SECTION

SECTION 02226

FOUNDATION PREPARATION

PART 1 - GENERAL

1.01 REFERENCES:

A. American Society for Testing and Materials (ASTM) Publications:

1. C387: Standard Specification for Packaged, Dry, Combined Materials for Concrete and High Strength Mortar

1.02 DEFINITIONS:

A. Foundations:

1. The rock foundation is comprised of the rock surfaces upon which concrete structures are placed.

B. Rock Joints:

1. Rock joints are all planar and/or curvilinear fractures, including cracks, crevices, and seams which separate a rock mass into individual rock blocks of various sizes. They may be open or closed and may be filled with material other than rock material.

1.03 SUBMITTALS:

A. Submit the following in accordance with Section 01300:

1. Product Data
2. Equipment List

PART 2 - PRODUCTS

2.01 MATERIALS:

A. Dental Concrete:

1. Dental concrete shall conform to the requirements of ASTM C387, normal weight and strength.

PART 3 - EXECUTION

3.01 EXAMINATION:

- A. The limits of the proposed foundations for the various parts of the work are approximately as indicated. The Owner reserves the right to change the depth to, or the width of, the foundations if, conditions exposed in the foundation excavations warrant such modifications.

3.02 PREPARATION:

A. Equipment:

- 1. Tools: Submit for approval tabular list of light power tools, to be used in lieu of hand tools, prior to their use on the job site. Hand tools, where required or permitted by these specifications include, but are not limited to shovels, bars, picks, wedges, and brooms. Light power tools may be used in lieu of hand tools only when such use is approved.

- B. Air/Water Jet: An air/water jet shall consist of a 1-1/2 inch nozzle with associated controls and supply hoses connected to suitable sources of compressed air and water. Compressed air shall have a pressure between 90 and 110 psi. Water shall be introduced into the airstream at the nozzle when needed, at a rate of up to 30 gpm. The air and water shall be separately controllable at the nozzle.

3.03 PRELIMINARY CLEANUP:

- A. When the excavation has reached the approximate limits shown or when the Engineer determines that a satisfactory foundation may have been reached, the Engineer may direct that a preliminary cleanup be performed on all or any part of the rock foundation surface. This cleanup shall consist of removing all debris, loose rock, sand, silt, and other objectionable material by hand tools followed by air/water jets or any combination of additional methods approved or directed. The Engineer may require that the excavation be continued and the preliminary cleanup procedure repeated until a satisfactory foundation surface is reached.

3.04 FINAL CLEANUP AND FOUNDATION PREPARATION:

- A. Unless otherwise directed, Final Cleanup and Foundation Preparation shall be performed. This work shall consist of removing loose and/or weather rock and pockets of fines, sand, rock rubble or gravel and other objectionable material from the in-place rock surface including areas of depression, large crevices, and open rock joints. Picking, barring, and hand excavation may be necessary to obtain a foundation surface free from loose, drummy, or shattered materials. Overhangs shall be excavated and backfilled with compacted granular materials. The final rock surface shall be thoroughly cleaned by use of air/water jets or other approved method and shall be maintained in a clean condition until the placement of concrete thereon.

3.05 DENTAL TREATMENT:

- A. Dental treatment shall consist of excavation, if necessary, of the material in joints, cavities, depressions, and overhangs and the placement of concrete such that the final surface is satisfactory for the subsequent placement of concrete.
- B. Joints and cavities shall be excavated to a depth 3 times the width (measured at the base of the excavation) of the joint or cavity.
 - 1. Dental Concrete: Concrete shall be used to fill joints, cavities, depressions, and overhangs except where the use of mortar is required or permitted. Prior to placement, the surfaces of the joint, cavity, depression, or overhang will be thoroughly cleaned using air/water jets. The concrete shall conform with paragraph MATERIALS.

3.06 PROTECTIVE TREATMENT:

- A. Protective Backfill: The final 2 feet of excavation, final cleanup and foundation preparation, inspection, and dental treatment shall all be accomplished within a period of 24 hours.

3.07 TESTS:

- A. General: Establish and maintain quality control for foundation preparation operations to assure compliance with contract specifications and maintain records of the quality control for all operations including but not limited to the following:
 - 1. Equipment: Quantity and type.
 - 2. Foundation Excavation: Strict adherence to foundation excavation limits and depths.
 - 3. Inspection, Mapping, and Cleanup: Orderly prosecution of inspections, mapping, and cleanup of foundation excavation areas.
 - 4. Specialized Operations: Protective treatment and Dental treatment.
- B. Reports: Submit three copies of these records of inspection as well as corrective action taken daily.

3.08 FOUNDATION INSPECTION AND GEOLOGIC MAPPING:

- A. Inspections to determine adequacy of the foundations will be performed by the Engineer in all foundation areas between completion of excavation and placement of concrete, or protective treatment. The Contractor will cooperate to the extent necessary to assist in inspection and mapping activities which may require additional survey control points and access. Coordinate the schedule for foundation excavation and preliminary cleanup with

the Engineer to ensure that the cleanup, inspection, and mapping proceed in an orderly manner.

END OF SECTION

SECTION 02271

RIPRAP

PART 1 - GENERAL

1.01 DESCRIPTION:

- A. Provide labor, materials, and equipment required to place stone riprap as indicated and specified.

1.02 RELATED WORK:

- A. Section 02210: Earth Excavation, Backfill, Fill and Grading

1.03 REFERENCES:

- A. American Society for Testing and Materials (ASTM) Publications:
 - 1. C535: Resistance to Degradation of Large-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
 - 2. C88: Test for Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate.

1.04 SUBMITTALS:

- A. Submit the following in accordance with Section 01300 and as specified herein.
 - 1. Quarry stone source information. Indicate type of stone and include current photographs representative of the intended stone for this project with adequate scale to show the stone sizes. Riprap stone supply shall be subject to inspection and approval by the Engineer as meeting specification prior to utilization.
 - 2. LA Abrasion Test (ASTM C535) test data.
 - 3. Sample of stone for review of color.

PART 2 - PRODUCT

2.01 STONE:

- A. Color to match as close as possible stone color of existing rock toe stone.
- B. Specific gravity 2.5 min., a potential stone supply shall have stone with less than 30% loss in an LA Abrasion Test in accordance with ASTM C 535.
- C. Soundness 5 percent max. loss in accordance with ASTM C88.

D. Facing stone size and gradation smaller than as indicated and uniformly graded.

<u>Designation</u>	<u>Percent Passing</u>
24"	100%
18"	80%
12"	50%
4"	10%

E. Shape:

1. Suitable to form protective structure.
2. Provide quarried, rough, angular stones, no rounded cobbles or boulders allowed.
3. Flat or needle shapes NOT ACCEPTABLE, unless thickness greater than 1/3 length.

2.02 BEDDING STONE:

A. ASTM C33 #2 STONE

PART 3 - EXECUTION

3.01 PLACEMENT:

- A. Trim and dress areas to conform to lines and grades indicated.
- B. Place spread, and compact bedding stone where indicated.
- C. Excavate footing trench along slope toe as indicated, and place larger rocks there.
- D. Placing rocks:
1. Machine place rocks with longitudinal axis normal to embankment face.
 2. Leave minimum voids so that rock above foundation course has 3-point bearing on underlying rocks. Bearing on smaller rocks used for chinking voids and dumping is NOT ACCEPTABLE.
- E. Placing rocks:
1. Provide minimum voids.
 2. Place larger rocks in foundation course and on outside of slope protection.
 3. Dumping and spreading by equipment is ACCEPTABLE.
- F. Dress up outer facing to render.
1. Smooth surface

2. Irregularities not more than 0.5 ft measured normal to the slope.

G. Chink voids in outer facing with smaller stones. Remove loose stones.

3.02 CONTRACT CLOSEOUT:

A. Provide in accordance with Section 01700.

END OF SECTION

SECTION 02273
GEOTEXTILE FABRIC

PART 1 - GENERAL

1.01 DESCRIPTION:

- A. Provide woven geotextile fabric for silt fence as indicated or specified.

1.02 RELATED WORK:

- A. Section 02210: Earth Excavation, Backfill, Fill and Grading
- B. Section 02435: Crushed Stone

1.03 REFERENCES:

- A. American Society for Testing and Materials (ASTM) Publications:
 - 1. D4355: Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture and Heat in a Xenon ARC Type Apparatus.
 - 2. D4491: Test Methods for Water Permeability of Geotextile by Permittivity.
 - 3. D4533: Test Method for Trapezoid Tearing Strength of Geotextiles.
 - 4. D4632: Test Method for Grab Breaking Load and Elongation of Geotextiles.
 - 5. D4751: Test Method for Determining Apparent Opening Size of a Geotextile.
 - 6. D4833: Test Method for Index Puncture Resistance of Geotextiles, Geomembranes and Related Products.

1.04 SUBMITTALS:

- A. Submit the following in accordance with Section 01300:
 - 1. At least two weeks prior to shipment, submit manufacturer's certificate of compliance and physical property data sheet indicating that requirements for materials and manufacture are in conformance as specified.
 - 2. For informational purposes only, submit manufacturer's printed installation instructions.

1.05 QUALITY ASSURANCE:

- A. Provide in accordance with Section 01400 and as specified.

B. General:

1. Producer of geotextile fabric to maintain competent laboratory at point of manufacture to insure quality control in accordance with ASTM testing procedures. Laboratory to maintain records of quality control results.
2. Do not expose geotextile fabric, except the geotextile fabric for silt fence, to ultraviolet radiation (sunlight) for more than 14 days total in period of time following manufacture until geotextile fabric is installed and covered with fill or backfill material.
3. Take all precautions to protect geotextile fabric from damage resulting from any cause. Either repair or replace geotextile fabric to Engineer's satisfaction at no additional cost to the Owner.

1.06 DELIVERY, STORAGE AND HANDLING:

- A. Provide in accordance with Section 01610 and as specified.
- B. Provide geotextile fabric in rolls wrapped with protective covering to protect geotextile fabric from mud, dirt, dust, and debris. Label each roll of geotextile fabric with number or symbol to identify production run.
- C. Protect geotextile fabric from sunlight during transportation and storage. Do not leave geotextile fabric exposed to sunlight for more than two weeks during installation operations.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

- A. Provide the following woven geotextile fabric except for silt fence:
 1. Geotex 200ST as manufactured by Propex.
 2. Mirafi 500X as manufactured by Tencate.
 3. Linq GTF 200 as manufactured by Thrace Linq.
 4. Or acceptable equivalent product.
- B. Provide the following woven geotextile fabric for silt fence:
 1. Geotex 2130 as manufactured by Propex.
 2. Mirafi 100X as manufactured by Tencate Geosynthetics.
 3. Beltech 1935 by Belton Industries Inc.

4. Or acceptable equivalent product.

2.02 MATERIAL:

A. Geotextile fabric shall conform to test requirements for minimum average roll value (weakest principle direction) for strength properties of any individual roll tested from manufacturing lot or lots of particular shipment in excess of minimum average roll value (weakest principle direction) as specified hereafter:

B. Woven geotextile fabric, except for silt fence, shall be:

Property	ASTM Test Method	Units	Value
1. Grab Strength	D4632	lbs	200 (min.)
2. Grab Elongation	D4632	%	15 (min.)
3. Trapezoidal Tear Strength	D4533	lbs	75 (min.)
4. Puncture Strength	D4833	lbs	80 (min.)
5. Permittivity	D4491	sec -1	0.02 (min.)
6. Apparent Opening Size	D4751	Sieve Number	30-70
7. Ultraviolet Stability	D4355	Percent	70 (min.)

C. Physical Properties of Minimum Average Roll of the woven geotextile fabric for silt fence shall be:

Property	ASTM Test Method	Units	Value
1. Grab Strength	D4632	lbs	100 (min.)
2. Permittivity	D4491	sec -1	0.10 (min.)
3. Apparent Opening Size	D4751	Sieve Number	20-30
4. Ultraviolet Stability	D4355	Percent	70 (min.)

PART 3 - EXECUTION:

3.01 INSTALLATION:

A. Install geotextile fabric in accordance with manufacturer's printed instructions.

- B. Place geotextile fabric on the foundation subgrade prior to placing the screened gravel or crushed stone.
- C. Overlap geotextile fabric 18 inches minimum for unsewn lap joint. Overlap fabric 6 inches at seam for sewn joint.
- D. Do not permit traffic or construction equipment to travel directly on geotextile fabric.
- E. Place geotextile fabric in relatively smooth condition to prevent tearing or puncturing. Lay geotextile fabric loosely but without wrinkles or creases so that placement of the backfill materials will not stretch or tear geotextile fabric. Leave sufficient slack in geotextile fabric around irregularities to allow for readjustments.
- F. Patch all tears in geotextile fabric by placing additional section of geotextile fabric over tear with a minimum of 3 feet overlay.
- G. Extend the geotextile fabric and wrap around the screened gravel or crushed stone along the perimeter of the foundation.
- H. Install silt fence in accordance with the manufacturer's printed instructions and as indicated.

3.02 CONTRACT CLOSEOUT:

- A. Provide in accordance with Section 01700.

END OF SECTION

SECTION 02435
CRUSHED STONE

PART 1 - GENERAL

1.01 DESCRIPTION:

- A. Provide and compact crushed stone for drain material as indicated and specified.

1.02 RELATED WORK:

- A. Section 02210: Earth Excavation, Backfill, Fill and Grading

1.03 REFERENCES:

- A. American Society for Testing and Materials (ASTM) Publications:
 - 1. C33: Specification for Concrete Aggregates
 - 2. D6913: Standard Test Methods for Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis

1.04 SUBMITTALS:

- A. Submit the following in accordance with Section 01300:
 - 1. Gradation test result from the soil testing laboratory, at least two (2) weeks prior to hauling material, for the Engineer's acceptance.
 - 2. Submit a 20-lb. sample of the material when requested by the Engineer.

1.05 QUALITY ASSURANCE:

- A. Provide in accordance with Section 01400 and as specified.
- B. Qualifications of the independent soil testing laboratory as specified in Section 02210.
- C. Maximum particle size and gradation analyses shall be performed in accordance with ASTM D6913.
- D. Material testing frequency and requirements as specified in Section 02210.

PART 2 - PRODUCTS

2.01 MATERIAL:

- A. Crushed Stone: Gradation and physical property requirements of crushed stone shall conform to AASHTO No. 57 Coarse Aggregate Stone.

- B. Crushed stone shall be free from roots, leaves, and other organic materials, and free of ice, snow or frost and frozen soil particles.

PART 3 - EXECUTION

3.01 PLACEMENT AND COMPACTION:

- A. Specified in Section 02210 and as indicated on the drawings.

3.02 CONTRACT CLOSEOUT:

- A. Provide in accordance with Section 01700.

END OF SECTION

SECTION 02500
BITUMINOUS PAVEMENT

PART 1 – GENERAL

1.01 DESCRIPTION

- A. Furnish, place and apply subbase, bases, bituminous materials, hot poured joint sealers, prime and tack coats, bituminous concrete and composition and compaction testing in accordance with the Specification, in conformity with the lines, grades, thickness and typical cross sections shown on the Drawings or established by the Engineer.

1.02 MEASUREMENT AND PAYMENT

- A. Measurement and payment for the Work described in this section shall be made in accordance with the provisions of Section 02000, Measurement and Payment.

1.03 REFERENCES

- A. AASHTO Standard Specifications for Highway Bridges.
- B. ASTM Standards as referenced throughout this Section.
- C. National Bureau of Standards Handbook 44.
- D. Massachusetts Department of Transportation Standard Specifications for Highways and Bridges.

1.04 SUBMITTALS

- A. Submit the following in accordance with Section 01300:
 - 1. Submit the following prior to placing base course, tack coat or bituminous mixtures.
 - a. Certification that plant supplying paving material will comply with this Section.
 - b. Batch plant slips with each load of bituminous mixture stating the weight delivered, the mix proportions by weight, and the mix and asphalt cement temperature at the time of batching.
 - c. Test results from a testing laboratory certifying that subgrade, base and bituminous mixture aggregates comply with this Section.
 - d. Test certificates from the Supplier indicating that asphalt cement and tack coat materials comply with this section.
 - e. Test results from a testing laboratory indicating that bituminous mixtures comply with specifications, signed by an officer of bituminous mixture Supplier.
 - f. Job-mix formula for bituminous concrete.
 - g. Schedule of construction for roadways.
 - h. Particle-size distribution and moisture-density relations of the processed gravel base and subbase courses tested in accordance with ASTM C136, ASTM D1140 and ASTM D1557.

1.05 QUALITY ASSURANCE

- A. Provide in accordance with Section 01400 and as specified.
- B. Engineer reserves the right to inspect at any time, the plant producing the paving material for plant conditions and operations, adequacy of equipment, accuracy of scales, temperature, character and proportions of the mixture, aggregates and bitumen and related production procedures.
- C. The field and laboratory testing of paving materials and frequency shall be in accordance with this section and Section 02210.

1.06 DELIVERY, STORAGE AND HANDLING

- D. Provide in accordance with Section 01610 and as specified.

PART 2 – PRODUCTS

2.01 SUBBASE

- A. Description
 - 1. This work shall consist of furnishing and placing one or more courses of aggregate in accordance with the Specification, in conformity with the lines, grades, thickness and typical cross sections shown on the Drawings or established by the Engineer.
 - 2. The new sub-base will consist of the reclaimed base and imported sub-base material.
- B. Materials
 - 1. General
 - a. All material shall be free from organic matter, shale or other deleterious matter and shall be of such quality that it will form a firm, stable course.
 - 2. Grading Requirements
 - a. The material shall consist of uniform mixtures of sand, gravel and/or stone fragments with sand or sand, crusher run coarse aggregate consisting of gravel, crushed stone or any combination of these materials conforming to the following grading requirements:
 - b. The grading is based on aggregates of uniform specific gravity and the percentage passing the various sieves are subject to rejection by the Engineer when aggregates of varying specific gravity are used.

Table 2.01. Grading Requirement for Sub-Base

Normal Sub-Base		Anti-Capillary Sub-Base	
AASHTO Sieve, in. (mm)	Percent Passing (by weight)	AASHTO Sieve, in. (mm)	Percent Passing (by weight)
2 (50.0)	-	2 (50.0)	-
1 (25.0)	100	1 (25.0)	100
3/8 (9.5)	60 - 100	3/8 (9.5)	60 - 100
1/4 (4.75)	50 - 85	1/4 (4.75)	50 - 85
10 (2.0)	40 - 70	10 (2.0)	40 - 70
40 (0.425)	25 - 45	40 (0.425)	25 - 45
200 (0.075)	5 - 20	200 (0.075)	0 - 7

3. Other Requirements

- a. Coarse aggregate retained on the “(2.00 mm)” sieve shall consist of hard, durable particles or fragments of stone or gravel. Materials that break when wetted and dried shall not be used.
- b. Coarse aggregate shall have a percentage of wear, by AASHTO T 96 of not more than 50%.
- c. Fine aggregate passing the (2.00 mm) sieve shall consist of natural or crushed sand, and fine material passing the (0.075 mm) sieve.
- d. The linear shrinkage shall not be greater than 4%
- e. The fraction passing the (0.425 mm) sieve shall have a liquid limit not greater than 25 and plasticity index not greater than 6.
- f. The material shall have a CBR (4 days soaked); at 95% maximum dry density by AASHTO T 180 Method D, of not less than 40%.

4. Acceptance of Production Materials

- a. When the stationary blend method is used, the aggregate will be accepted immediately following mixing based on periodic random samples taken from the pugmill output.
- b. When the road mix method is used, the aggregate will be accepted after necessary blending and before laying, based on random samples taken from the roadbed for each layer.
- c. When the aggregate is a total aggregate, it may be accepted at the borrow pit or crusher. Acceptance of the materials by the Engineer does not constitute acceptance of the sub-base, only that the materials are approved for use as sub-base.

2.02 BASE

A. Description

1. This work shall consist of furnishing and placing one or more layers of crushed aggregate, bound by means of controlled moisture content, on a prepared sub-grade or sub-base in accordance with this Specification, and in conformity with the lines, grades, thickness and typical cross sections shown on the Drawings or established by the Engineer.

B. Materials

1. General

- a. The coarse and fine aggregates for base shall consist of crushed rock, clean, tough, durable, sharp-angled fragments free of any excess of thin or elongated pieces, and reasonably free of soft, disintegrated or decomposed stone, dirt or other deleterious matter.

2. Grading Requirements

- a. Material for base shall be crushed rock and the combined aggregate shall have the following grading:

Table 2.02. Grading Requirement for Base Course

AASHTO Sieve, in. (mm)	Percentage Passing (by weight)
2 (50.0)	100
1 ½ (37.5)	90 - 100
1 (25.0)	75 - 95
¾ (19.0)	60 - 90
3/8 (9.5)	40 - 75
No. 10 (2.00)	20 - 45
No. 40 (0.425)	10 - 26
No. 200 (0.075)	0 - 5

- b. The above grading requirements are for aggregates of uniform specific gravity, and the percentage passing the various sieves may be subject to adjustment by the Engineer when aggregates of varying specific gravity are used.
- #### 3. Other Requirements
- a. Coarse aggregate shall have a percentage wear, by Los Angeles test AASHTO T 96, of not more than 30%.
 - b. Soundness loss shall not be greater than 12% as determined by AASHTO T 104.
 - c. The fraction passing the No. 40 (0.425) mm sieve shall have a liquid limit not greater than 20 and shall be non plastic.

4. Acceptance of Production Materials

- a. The aggregate will be accepted immediately following mixing based on periodic random samples taken from the mixing plant output. Acceptance of the material by the Engineer does not constitute acceptance of the base, only that the material is approved for use in the base.

2.03 BITUMINOUS MATERIALS

- A. All bituminous materials shall conform to the requirements of the specifications as designated hereinafter. The Contractor shall get approval in writing from the Engineer for all types of materials to be used in pavement works 30 days prior to use of these materials.
- B. Unless otherwise stipulated, the sampling of bituminous materials shall be in accordance with AASHTO T40. The following procedure shall be followed in obtaining samples from pressure distributors or tankers used for the transport of bituminous materials:
 1. Distributors and tankers shall be equipped with approved sampling valves. The sampling valves on tankers shall be installed in the rear bulkhead approximately 1/3 of the height from the bottom. The sampling valves on pressure distributors may be located in the side of the tank somewhere in the middle third of the tank depth.
 2. At least 4 liters of material shall be drained off through the sampling valve and discarded before the sample is taken.
 3. Sample containers shall be new, clean and sealed with a tight-fitting cap. Washing of sample containers with solvents or water will not be permitted.
- C. Asphalt Cement: Asphalt cement (Bitumen) is to be used as a binder of bituminous mixtures shall be petroleum derivative with Penetration Grade 60 – 70. It shall be homogenous, free of water, shall not foam when heated to 175 °C (347°F), and shall conform to the requirements set forth by AASHTO M20.
- D. Cutback Asphalts: These materials shall be blends of asphalt cements and suitable solvents. They shall be homogeneous, free from water and conform to the requirements of AASHTO M 81 for the rapid curing type and AASHTO M 82 for the medium curing type.
- E. Asphalt Primer: This material shall be suitable for priming concrete and masonry surfaces prior to the application of waterproofing asphalt. It shall conform to the requirements of AASHTO M 116.
- F. Asphalt Emulsions
 1. Emulsions shall be homogenous, shall show no separation of asphalt or objectionable change in viscosity within three months after delivery. They also shall be in accordance with AASHTO M140 and M208.
 - a. Prime Coats shall be low viscosity, medium curing material such as MC-70.
 - b. Tack Coats shall be high viscosity, rapid curing material such as RC-250.
 2. See 2.06 TACK COAT for more details.
- G. Cationic Emulsified Asphalt: This material shall be a homogeneous asphalt emulsion. It shall remain homogeneous for a minimum of three months. It shall conform to the requirements of AASHTO M 208.

H. Protective Seal Coat Emulsion: This material shall be a homogeneous emulsion consisting of coal tar pitch dispersed in water by means of a mineral colloid. Any separation or coagulation of its components shall be capable of being overcome by moderate stirring. It shall contain no asphaltic materials or chemical emulsifiers. When tested according to prescribed methods it shall meet the following requirements:

Designation	Minimum	Maximum
Percent Water (AASHTO T 55)		50
Percent Non-Volatile Matter (ASTM D 2939, Sec. 7)	48	
Percent Ash in Non-Volatile Matter (ASTM D 2939, Sec. 9)	20	45
Percent Solubility of Non-Volatile Matter in CS, (AASJ-ITO T 44)	40	
Resistance to Water (ASTM D 466)	No blistering, Loss of Adhesion or Re-Emulsification	
Resistance to Petroleum Solvents (ASTM D 466 – with Solvents Substituted for water)	No penetration and no loss of adhesion	

I. Aggregates

1. Aggregates means crushed stone, crushed gravel and gravel composed of hard rock and shall have good adhesion to bituminous materials and durability when heated (when used in hot mixture), such as basalt, andesite, rhyolite, sandstone, limestone, etc.
2. Crushed stone shall have sufficient uniformity, cleanness, strength and durability, and be free of shale and deleterious substances and shall meet the requirements shown in Table 2.03 or as approved by the Engineer.

Property	Surface/Binder Course	Base Course
Bulk specific gravity in Standard Surface Dry condition	2.45 or more	-
Water absorption	3.0% or less	-
Abrasion loss (AASHTO-96)	30% or less	50% or less
Sodium or Magnesium Soundness (AASHTO T104)	12% or less	20% or less

3. Crushed gravel shall have two or more fractured faces accounting for at least 40% by weight. One of those fractures shall have a dimension as large as the diameter of the particle inspected.

4. If gravel is to be used in pavement works, it shall be free of coating of any type and shall be approved by the Engineer. The specifications for quality shall be the same as crushed stone.
5. The Grading of Aggregate materials shall meet the requirements in Table 2.03A.

Table 2.03A. Grading of Aggregates

Type	Sieve Opening Size, in. (mm)										
		2 (50.0)	1 ½ (37.5)	1 ¼ (31.5)	1 (25.0)	¾ (19.0)	½ (12.5)	4 (4.75)	8 (2.36)	40 (0.425)	200 (0.075)
S-40	40-30	100	85-100	0-15							
S-30	30-20		100	85-100		0-15					
S-20	20-13				100	85-100	0-15				
S-13	13-5					100	85-100	0-15			
S-5	5-2.5					100	85-100	0-25	0-5		
M-40	40-0	100	95-100			60-90		30-65	20-50	10-30	2-10
M-30	30-0		100	95-100		60-90		30-65	20-50	10-30	2-10
M-25	25-0			100	95-100		55-85	30-65	20-50	10-30	2-10
C-40	40-0	100	95-100			50-80		15-40	5-25		
C-30	30-0		100	95-100		55-85		15-45	5-30		
C-25	25-0				100	95-100	60-90	20-50	10-35		

Notes:

S: Single Sized Crushed Stone

M: Mechanically Stabilized Crushed Stone

C: Crusher Run

- J. Sand: Fine aggregate shall be either natural or manufactured sand having hard, durable, clean, and uncoated particles, and shall consist of that portion of the total aggregate that passes No. 4 (4.75 mm) sieve. At least 85% of the material produced by crushing gravel

and retained on 2.36 mm sieve shall consist of fragments having at least one mechanically fractured face. Natural uncrushed material in a mixture with crushed fine aggregates shall constitute no more than 25% of the total mass.

- K. Mineral Filler: Mineral filler shall consist of limestone powder, crusher run rock dust, or Portland cement. It shall be sufficiently dry to flow shall be free from agglomerations. Filler materials shall conform to the requirements of AASHTO M17 and shall have grading limits as given in Table 2.03B.

Table 2.03B. Grading of Mineral Filler

AASHTO Sieve	% Passing by Mass
0.6 mm (#30)	100
0.3 mm (#50)	90-100
0.075 mm (#200)	70-100

2.04 HOT POURED JOINT SEALER:

- A. This sealer shall be composed of a mixture of materials which will form a resilient and adhesive compound capable of effectively sealing joints in concrete and shall conform to the requirements of AASHTO M 173.

2.05 PRIME COAT AND TACK COAT:

- A. Prime Coat shall consist of medium curing cut-back asphalt produced by fluxing an asphaltic base with suitable petroleum distillates.
- B. Description: This work covers liquid petroleum products, produced by fluxing an asphaltic base with suitable petroleum distillates, to be used in the treatment of road surfaces, as prime coat.
- C. Materials
 1. It shall show no separation or curdling prior to use and shall not foam when heated to the application temperature and shall conform to all the requirements for grade MC-70 and as specified in AASHTO M82.
 2. Properties: Cut-back asphalt of the grade designated shall conform to the requirements of MC-70 as shown in Table 2.06.

Table 2.06. Cut-Back Asphalt

	MC-30		MC-70		MC-250		MC-800		MC-3000	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Kinematic viscosity at 60 ⁰ C (140 ⁰ F) (See Note1) mm ² /S	30	60	70	140	250	500	800	1600	3000	6000
Flash point (Tag, open-cup), Degrees C (F)	38 (100)	-	38 (100)	-	66 (150)	-	66 (150)	-	66 (150)	-

Table 2.06. Cut-Back Asphalt

	MC-30		MC-70		MC-250		MC-800		MC-3000	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Water percent	-	0.2	-	0.2	-	0.2	-	.02	-	0.2
Distillate, percentage by volume of total distillate to 360°C (680°F)										
To 225°C (437°F)	-	25	0	20	0	10	-	-	-	-
To 260°C (500°F)	40	70	20	60	15	55	0	35	0	15
To 315°C (600°F)	75	93	65	90	60	87	45	80	15	75
Residue from distillation to 360°C (680°F) volume percentage of sample by difference	-	55	-	67	-	75	-	80	-	50
Tests on residue from distillation:										
Absolute viscosity at 60°C (140°F) (See Note (4) Pa's (Poises)	120 (1200)	30 (300)	120 (1200)	30 (300)	120 (1200)	30 (300)	120 (1200)	30 (300)	120 (1200)	30 (300)
Ductility, 5 cm/min, cm (See Note 2)	100	-	100	-	100	-	100	-	100	-
Solubility in Trichloroethylene, percent	99.0	-	99.0	-	99.0	-	99.0	-	99.0	-
Spot test (See Note 3) with:										
Standard naphtha	Negative for all grades									
Naphtha-xylene solvent, percent xylene	Negative for all grades									
Heptane-xylene solvent, percent xylene	Negative for all grades									

NOTE 1 As an alternate, Saybolt-Furol viscosities may be specified as follows:

Grade MC-70-Furol viscosity at 50°C (122°F)-60 to 120 s.

Grade MC-30-Furol viscosity at 25°C (77°F)-75 to 150 s.

Grade MC-250-Furol viscosity at 60°C (140°F)-125 to 250 s.

Grade MC-800-Furol viscosity at 82.2°C (180°F)-100 to 200 s.

Grade MC-3000-Furol viscosity at 82.2°C (180°F)-300 to 600 s.

NOTE 2 If the ductility at 25°C (77°F) is less than 100, the material will be acceptable if its ductility at 15.5°C (60°F) is more than 100.

NOTE 3 The use of the spot test is optional. When specified, the Engineer shall indicate whether the standard naphtha solvent, the naphtha-xylene solvent, or the heptane-xylene solvent will be used in determining compliance with the requirement, and also, in the case of the xylene solvents, the percentage of xylene to be used.

NOTE 4 In lieu of viscosity of the residue, the specifying agency, at its option, can specify penetration at 100 g; 5 s at 25°C (77°F) of 120 to 250 for Grades MC-30, MC-70, MC-250, MC-800, and MC-3000. However, in no case will both be required

3. Sampling and Testing of cut-back asphalt (medium-curing type) shall be in conformity with the following standard methods of the AASHTO:

Sampling	T 40
Solubility in bituminous materials	T 44
Penetration	T 49
Ductility	T 51
Water	T 55
Saybolt Furol viscosity	T 72
Distillation	T 78
Flash point	T 79
Spot test	T 102
Kinematic viscosity	T 201
Absolute viscosity	T 202

2.06 TACK COAT

- A. Tack coat shall consist of rapid curing cut-back asphalt produced by fluxing an asphaltic base with suitable petroleum distillates.
- B. Description: This work covers liquid petroleum products, produced by fluxing an asphaltic base with suitable petroleum distillates, to be used in the treatment of road surfaces, as tack coat.
- C. Materials
 - 1. It shall show no separation or curdling prior to use and shall not foam when heated to the application temperature and shall conform to all the requirements for grade RC-250 and as specified in AASHTO M81.
 - 2. Properties: Cut-back asphalt of the grade designated shall conform to the requirements of RC-250 as shown in Table 2.07.

Table 2.07. Cut-Back Asphalt

	RC-70		RC-250		RC-800		RC-3000	
	Min	Max	Min	Max	Min	Max	Min	Max
Kinematic viscosity at 60°C (140°F) (See Note1) mm ² /s	70	140	250	500	800	1600	3000	6000
Water percent	-	0.2	-	0.2	-	0.2	-	0.2
Distillation test:								
Distillate, percentage by volume of total distillate to 360°C (680°F)								
To 190°C (374°F)	10	-	-	-	-	-	-	-
To 225°C (437°F)	50	-	35	-	15	-	-	-
To 260°C (500°F)	70	-	60	-	45	-	25	-
To 315°C (600°F)	85	-	80	-	75	-	70	-
Residue from distillation to 360°C (680°F) volume percentage of sample by difference Tests on residue from distillation:	55	-	65	-	75	-	80	-
Absolute viscosity at 60°C (140°F) (See Note (3) Pa's (Poises)	60 (600)	240 (2400)	60 (600)	240 (2400)	60 (600)	240 (2400)	60 (600)	240 (2400)
Ductility, 5 cm/min, at 25°C (77°F) cm	100	-	100	-	100	-	100	-
Solubility percent								
Spot test (See Note 2) with:	99.0	-	99.0	-	99.0	-	99.0	-
Standard naphtha	Negative for all grades							
Naphtha-xylene solvent, percent xylene	Negative for all grades							
Heptane-xylene solvent, percent xylene	Negative for all grades							

NOTE 1 As an alternate, Saybolt-Furol viscosities may be specified as follows:

Grade RC-70-Furol viscosity at 50°C (122°F)-60 to 120 s.

Grade RC-250-Furol viscosity at 60°C (140°F)--125 to 250 s.

Grade RC-800-Furol viscosity at 82.2°C (180°F)-100 to 200 s.

Grade RC-3000--Furol viscosity at 82.2°C (180°F)-300 to 600 s.

NOTE 2 The use of the spot test is optional. When specified, the Engineer shall indicate whether the standard naphtha solvent, the naphtha-xylene solvent or the heptane-xylene solvent will be used in determining compliance with the requirement, and also, in the case of the xylene solvents, the percentage of xylene to be used.

NOTE 3 In lieu of viscosity of the residue, the specifying agency, at its option, can specify penetration at 100 g: 5 s at 25°C (77°F) of 80-120 for Grades RC-70, C-250, RC-800, and RC-3000. However, in no case will both be required.

3. Sampling and Testing of cut-back asphalt (rapid-curing type) shall be in conformity with the following standard methods of the AASHTO:

Sampling	T 40
Solubility	T 44
Penetration	T 49
Ductility	T 51
Water	T 55
Saybolt Furol viscosity	T 72
Distillation	T 78
Flash point	T 79
Spot test	T 102
Kinematic viscosity	T 201
Absolute viscosity	T 202

2.07 BITUMINOUS CONCRETE

A. General

1. These mixtures shall be composed of mineral aggregate, mineral filler (if required), bituminous material, and reclaimed asphalt pavement (RAP). The use of RAP shall be at the Contractor's option unless otherwise provided by the special provisions of the contract. The proportion of RAP to virgin aggregate shall be limited to a maximum of 40% for drum mix plants and 20% for modified batch plants. The maximum amount of RAP for surface course shall be 10%.
2. Plants producing recycled mix shall be equipped so that they can properly proportion, blend and mix all components of a recycled mixture so that the end product is in conformance with the designated job-mix formula.

- B. Composition of the Mixture: The mineral aggregate, filler (if required), bituminous material, asphalt modifier (if required) and RAP shall be proportioned and mixed to conform to the designated mixture as shown in the following table.

Allowable Gradation Tolerances:

No. 4 (4.75 mm) and larger sieve $\pm 7.0\%$

No. 8 (2.36 mm) and smaller sieves, except No. 200 (75 μm) $\pm 4.0\%$

No. 200 Passing 75 μm sieve $\pm 2.0\%$

Asphalt $\pm 0.4\%$

C. Type of Asphalt Mixtures

1. Hot Mix Asphalt 19.0mm (3/4"), Machine Method – Type B Binder Course
2. Hot Mix Asphalt 12.5mm (1/2"), Machine Method – Type E Wearing Course
3. Hot Mix Asphalt 9.5mm (3/8"), Machine Method – Type F Wearing Course for Leveling
4. Hot Mix Asphalt 9.5mm (3/8") – Type F Wearing Course for Driveways
5. Temporary Hot Mix Asphalt
6. Job-Mix Formula
 - a. The Contractor shall make written proposals to the Engineer for the Job-Mix Formula for the type of Binder and Surface course specified. This shall be done at least 30 days before beginning production of bituminous binder and surface courses and having received approval of the aggregates from the Engineer and delivery to site of bitumen. These shall be based on trial mixes prepared by the Contractor in the Site Laboratory and in the presence of the Engineer.
 - b. The Marshall Design procedure shall be used to determine the optimum percentage of bitumen to be incorporated into the mixture. The number of blows in preparing the test specimens shall be 75 at each end of the mold. The number of blows may be reduced to 50 with the approval of the Engineer.
 - c. The Job-Mix formula shall combine approved aggregates with different gradations and bitumen to produce a mixture having bitumen content as given in Table 2.07. When tested according to AASHTO T245 the mixture shall have the properties specified in Table 2.07.

Table 2.07. Physical Properties of Mixtures

Type	Designation	Bitumen Content, %	Air void	Marshall Voids filled with bitumen	Marshall Stability, kg	Flow Value
Coarse graded mixture	3B	4.0-6.0	3-6	70-85	>500	20-40
Dense graded mixture	4B	4.5-7.0	3-6	70-85	>500	20-40

Dense graded mixture	4A	4.5-7.0	3-6	70-85	>500	20-40
Coarse graded mixture	3C	4.0-6.0	3-6	70-85	>500	20-40

- d. The asphalt plant production shall be tested at the intervals as instructed by the Engineer and the Contractor shall control the plant to maintain conformity with the Job-Mix Formula. If, during production, the aggregate source is changed, the mix shall be redesigned, and a new Job-Mix Formula approved.
- e. The Contractor is fully responsible for the preparation of the Job-Mix Formula and the production of binder and surface course meeting the requirements of this Specification, whether or not he receives assistance from the Engineer.

7. Asphalt Production

- a. Bitumen shall be heated within a temperature range of 135° to 170°C (275°F to 338°F) at the time of mixing.
- b. Aggregates shall be dried in hot bins in temperatures not exceeding 170°C. If the aggregates contain sufficient moisture to cause foaming in the mixture or their temperature is in excess of 170°C (338°F), they shall be removed from the bins and returned to the stockpiles.
- c. Mixing time shall be the shortest time that will produce a satisfactory and homogenous mixture and shall be set to achieve 95% coating as determined by AASHTO T195 standards. Batch plant dry mixing time shall not exceed 10 seconds; wet mixing time shall not exceed 50 seconds. Timing shall start at the introduction of the bitumen to the heated aggregates.
- d. The temperature of binder shall not be less than 14 °C (57°F) below the temperature of the aggregate at the time the two materials enter the mixer.
- e. The hot mixture shall be spread and finished by an automatically controlled asphalt paver. Hot mixtures may be spread and finished by hand methods only where machine methods are impractical as agreed with the Engineer. The paver shall be operated on a speed which co-ordinates satisfactorily with the rate of delivery of hot mix so as to provide a constant uninterrupted rate of placement.
- f. Hot mixture shall be delivered to the paver in time to permit completion of spreading, finishing, and compaction of the mixture during daylight hours. Delivery temperature shall be between 140°C (284°F) and 165°C (329°F).
- g. Trucks used for hauling hot mixture shall have tight, clean, smooth metal beds, which have been thinly coated with a minimum amount of paraffin oil, Lime solution, or other approved material to prevent the hot mixture from adhering to the metal. Each vehicle shall be fitted with a canvas or similar cover to protect and maintain the temperature of the mixture within the acceptable limits.

8. Reclaimed Asphalt Pavement (RAP)

- a. Reclaimed Asphalt Pavement (RAP) shall consist of the material obtained from highways or streets by crushing, milling or planing existing pavements. This

material shall be transported to the mix plant yard and processed through an approved crusher so that the resulting material will contain no particles larger than 1.5 inches (38 millimeters). The material shall be stockpiled on a free draining base and kept separate from the other aggregates. The material contained in the stockpiles shall have a reasonably uniform gradation from fine to coarse and shall not be contaminated by foreign materials.

D. Bituminous Materials

1. The asphalt cement for the mixture shall be the grade designated by the Engineer.
2. Bituminous material for the tack coat on the existing surface, where required and specified, shall be emulsified asphalt, grade RS-1.
3. For any bituminous mixture containing RAP, the Contractor shall submit in addition to the Job-Mix formula, the amount and type of asphalt modifier to be added to the mixture to restore the asphalt properties of the RAP to a level that is reasonably consistent with the requirements of current specifications for new asphalt. The restored asphalt when recovered by the Abson Method from the recycled mixture shall have a minimum penetration at 25°C (77°F) of 50 and a maximum absolute viscosity at (140°F of 8000 poises) 60°C of 800 pascal seconds at (140°F of 8000 poises).
4. Only asphalt cement, grades AC-5, AC-10, AC-20 or a blend thereof will be used.

E. Plant Requirements

1. Bituminous concrete conforming to these specifications shall be produced either in a batch plant or a drum mix plant. Mix plants shall comply with the following paragraphs.

F. Requirements for Batch Plants

a. Plant Scales

- (1) Scales for measuring materials into the mixtures shall be springless dial or digital type and shall be of standard make and design. Scale graduations and markings shall be plainly visible and dials must be so located as to be easily readable from the operator's normal workstation by direct sight, through repeating dials or digital displays. Parallax effects shall be reduced to the practical minimum with clearance between indicator index and scale graduations not exceeding 0.06 inches (1.5 millimeters). Dials shall be equipped with a full complement of adjustable index pointers for marking the required mass of each material to be weighed into the batch.
- (2) Digital scales will be either electronic/mechanical (load cell and lever system) or fully electronic (all load cell). Digital indicators shall be of standard make and design. Scale graduations and capacity shall be plainly visible on the faceplate of the indicator, if panel mounted. If the unit is of desktop or wall-mount variety, a data sticker shall be located on the side of the unit. Indicators must be located as to be easily readable from the operator's normal workstation by direct sight.

- (3) Bitumen scales shall be accurate to 0.05%, have minimum graduations not greater than 0.025%, and must be readable and sensitive to 0.0125% or less. Scales for any box or hopper shall be accurate to 0.5%, have minimum graduations not greater than 0.5% and must be readable and sensitive to 0.25% or less. The preceding percentages for both bitumen and aggregate scales are to be based on the maximum total batch mass of the mixtures.
2. Truck Scales: Truck scales shall be located on the plant property and shall be within a reasonable walking distance for the plant inspector. Scales shall be accurate to within $\pm 0.5\%$.
3. Testing of Scales
 - a. All plant scales, including truck scales, shall be tested at the expense of the producer by a competent scale technician as follows:
 - (1) Annual prior to use in Department work.
 - (2) At intervals of not more than 90 calendar days.
 - (3) At any time ordered by the Engineer.
 - b. Where appropriate and at the direction of the Engineer, an approved cradle or platform for each scale and at least ten (10) standard 50 lbs. (22 kilogram) test masses shall be provided for testing scales whenever directed by the Engineer. The use of a set of test masses for two (2) or more plants will be permitted only when they can be made readily available with no more than one hour's notice.
4. Automated Batching
 - a. Automatic Proportioning: All Batch Type mixing plants furnishing bituminous concrete mixtures shall be equipped with approved automatic proportioning devices. Such devices shall include equipment for accurately proportioning batches containing the various components of the mixture by mass in the proper sequence and for controlling the sequence and timing of mixture operations. Interlocks shall be provided which will hold or delay the automatic batch cycling whenever the batched quantity of any component is not within the specified mass tolerance, when any aggregate bin becomes empty or when there is a malfunction in any portion of the control system. The mass setting and lime controls shall be so equipped that they may be locked when directed by the Engineer.
 - b. Automatic Recordation: Recordation equipment shall be provided in all plants producing bituminous concrete under the provisions requiring automatic proportioning. Each recorder shall include an automatic printer system. The printer shall be so positioned that the scale dial or the digital display and the printer can be readily observed at one location by the plant inspector and the plant operator. Use of repeating dials or digital displays or an additional printer to achieve this condition will be permitted. The printer will print, in digital form, on a delivery ticket the following data:
 - (a) Date mixed.

- (b) Time of batching.
- (c) Tare mass of aggregate box.
- (d) Tare mass of bitumen bucket.
- (e) Accumulative or net masses as batched for each bin with a batch total for all net ingredients.
- (f) Mass of bitumen.
- (g) Total mass of mix in truck (pay metric tonnage).

This printed ticket will be used in lieu of truck scale masses.

- c. Equipment Failure: If at any time the automatic proportioning or recording system becomes inoperative, the plant will be allowed to batch materials manually for a period not in excess of 2 working days. Manual batching for longer periods will require written permission of the Engineer.
- d. Batching Controls
 - (1) The batching controls shall meet the following delivery tolerances with respect to the various components weighed in each batch:

Tare mass of aggregate box	± 0.5% of total batch mass
Tare mass of bitumen bucket	± 0.1% of total batch mass
Individual aggregate components	± 1.0% of total batch mass
Combined aggregate components	± 1.5% of total batch mass
Mineral filler	± 0.5% of total batch mass
Asphalt	± 0.1% of total batch mass

Truck loads consisting of more than one batch will be deemed acceptable if the average of the deviations of any of the components of the several batches which comprise the load do not exceed the specified tolerance.
 - (2) The total mass of the batch shall not vary more than plus or minus 2% from the theoretical design mass.
 - (3) If directed by the Engineer, provision shall be made for locking controls against tampering.

5. Testing Facilities

- a. A weatherproof building or room shall be furnished at the site of the producing plant suitable for the housing and use of equipment necessary to carry on the various tests required and for recording and processing test results. This building shall be for the exclusive use of the Engineer or his representative for testing and recording purposes. The building or room shall have a least dimension of 7 ft. (2.1 meters) and a minimum of 215 sq. ft. (20 square meters). Windows and doors shall be adequately screened. Satisfactory lighting and climate control shall be provided for a 24-hour day and the facility shall be supplied with water. The room shall have adequate ventilation and be air conditioned. A table, chairs,

desk, work bench, file cabinet, electronic calculator and a minimum of two 5 lb. (2.7 kilogram) fire extinguishers shall be provided.

- b. Provision shall be made for the safe performance of extraction test determinations by providing an adequate exhaust fan and/or hood system and a suitable means of disposing of used solvent and other waste. Testing equipment conforming to current AASHTO standards and meeting the approval of the Engineer shall be furnished as follows and installed in the building for use in testing the materials (and mixtures) supplied by the Plant for the work:
- (1) Approved Rotary Extractor or approved Vacuum Extractor (minimum 3000 gram capacity).
 - (2) Coarse Aggregate Sieve Shaker; power driven with a minimum clear sieve area of 324 sq. inches (0.209 square meters). The shaker shall be attached to a firm anchorage.
 - (3) Each of the following square opening screens for coarse aggregate shaker: 2 in. (50 mm), 1.5 in. (37.5 mm), 1 in. (25 mm), 0.75 in. (19 mm), 0.5 in. (12.5 mm), 0.375 in. (9.5 mm), No. 4 (4.75 mm), and No. 8 (2.36 mm).
 - (4) Fine Aggregate Sieve Shaker, power driven and independent of coarse aggregate shaker, for 8 in. (200 millimeter) minimum diameter sieves.
 - (5) Each of the following standard 8 in. (200 millimeter) minimum diameter square opening sieves: 0.75 in. (19 mm), 0.625 in. (16 mm), 0.5 in. (12.5 mm), 0.375 in. (9.5 mm), No. 4 (4.75 mm), No. 8 (2.36 mm), No. 16 (1.18 mm), No. 30 (600 μ m), No. 50 (300 μ m), No. 100 (150 μ m), and No. 200 (75 μ m) with pan and cover.
 - (6) Sample Splitter with a minimum capacity of 1 cu. ft. (0.03 cubic meters). It shall be of the clam shell type and the chute width shall be adjustable from a minimum of 0.5 in. (12.5 millimeters) up to 2 in. (50 millimeters).
 - (7) Solution Balance, 20-kilogram capacity, weighing directly to 1 gram, with two weighing beams and a taring beam: tare capacity to be 2 kilograms; weight beams to read 1000 grams by 100-gram divisions and 100 gram by 1 gram divisions. Additional matching weights (one - 1 kg, two - 2 kg, and one - 5 kg, and one - 10 kg) shall be provided to fulfill the capacity of 20 kilograms. The platform is to be 280-millimeter diameter. An electronic, direct reading, top loading, 20-kilogram minimum capacity balance with a precision of 0.1 gram may be substituted for the solution balance.
 - (8) Approved scale with a minimum capacity of 2000 grams and a sensitivity of 0.50 grams, or an electronic, top-loading, balance with a capacity of 2000 grams minimum, and reading to 0.1 gram.
 - (9) Approved dial Thermometers, range of 10 ° to 260 °C (50° to 500°F)
 - (10) Approved Hot Plates.

6. Approval of a plant will be contingent upon approval of the aforementioned requirements for Plant Laboratory, including the building and appurtenances, furnishings, facilities including heat, light, power and water, the testing equipment and any other incidentals.
7. Sampling Facilities: Adequate and convenient sampling facilities shall be provided which allow the Inspector to obtain representative samples from the full width and depth of the discharge area of each aggregate bin. The sampling tray shall be structurally supported during the sampling operation. Access to the sampling facilities shall be provided requiring no more difficulty than that to climb a ladder leading to a secure platform with railings.
8. Preparation of Mixtures
 - a. Preparation of Asphalt Cement: The temperature of the bituminous materials when placed in the mixer shall not be less than 135°C (275°F) or more than 190°C (375°F).
 - b. Preparation of Mineral Aggregate: All aggregates shall be thoroughly dried and heated before entering the mixer. The temperature of the aggregates shall be controlled so that the temperature of the completed mixture shall be within the range specified below under Preparation of Bituminous Concrete Mixtures below.
 - c. Preparation of Bituminous Concrete Mixtures: The mineral aggregate, prepared as prescribed above, shall be combined and conveyed into the mixer in the proportionate amounts of each aggregate required to meet the job-mix formula. The required quantity of asphalt cement shall be measured by mass, or approved metering device. The mixture shall be made by first charging the mixer with the required amount of mineral aggregate and mineral filler. After the materials have been thoroughly mixed, the asphalt cement shall be added and the mixing continued for a period of time sufficient to produce a homogenous mixture. The ingredients shall be heated and combined in such a manner as to produce a mixture which shall be at a temperature, when discharged, of not less than 135°C (275°F), or more than 190°C (375°F).
 - d. The temperature of mixture containing RAP as discharged from the modified batch plant shall be within the range of 130° to 150°C (265° to 300°F). Moisture content of the mixture at discharge shall be no greater than 1.0% by mass. All aggregate particles shall be completely and uniformly coated. The recycled mixture shall not contain any visible chunks of unprocessed RAP. The recycled mixture shall be capable of being spread and compacted to a density that is not less than 95% of the density obtained from laboratory compaction of a mixture composed of the same materials in like proportions.

G. Requirements for Drum Mix Plants:

1. The basic components of the drum mix plant are:
 - a. Aggregate cold-feed bins
 - b. Conveyer and aggregate weighing systems

- c. Drum mixer
 - d. Asphalt storage metering system
 - e. Hot-mix conveyer
 - f. Storage and surge silos
 - g. Central Control Panel
2. Aggregate Cold-Feed Bins
- a. The number and capacity of the cold-feed aggregate bins shall be sufficient to keep the plant in continuous operation. There shall be one cold-feed bin for each stockpile of material to be used. Stockpiles shall be established on clean free draining surfaces and shall be so constructed as to minimize segregation. The bins shall be designed to prevent overflow of material from one bin to another. The fine aggregate bin compartments shall be equipped with a vibrator or other anti-bridging device which is automatically actuated when bridging of the material occurs and which automatically shuts off when continuous material flow is restored.
 - b. An interlocking automatic cold-feed shut-off shall be provided so that all production is stopped if flow from any one bin is interrupted for more than five seconds.
3. Mineral Filler Bin: The requirements for a mineral filler bin shall be optional. Mineral filler bin shall be fed from a separate bin, provided with a device that controls the feed at adjustable rates accurately and uniformly. The bin shall be equipped with an interlocking device to shut off all production if the flow of mineral filler is stopped. It shall also be equipped with an automatic anti-bridging device.
4. Aggregate Feeder Control
- a. The plant shall have a mechanical system for feeding the aggregate from each cold bin accurately and uniformly in its proper proportion onto a common collecting belt. The system shall be so designed, and production is automatically stopped if the flow of material from any one of the bins is interrupted for more than five seconds.
 - b. Each aggregate and mineral filler bin shall have an adjustable feed rate control. The accuracy of the aggregate feeder control system shall be such that the total variations for all materials being drawn per interval of time shall not exceed 1.5% of the total mass of bituminous mixture per interval of time. Where the separate addition of mineral filler is required, the variation shall not exceed 0.5% on the same basis as stated above for aggregates.
 - c. For purposes of accurate weight and gradation checks, and calibration of the aggregate proportioning system, suitable means shall be provided for conveniently obtaining representative samples of the full flow of material from each cold feed and the total cold feed. A sampling device for diverting the full flow of the combined aggregate into a suitable container shall be provided. Prior

to entering the drum mixer the combined aggregate on the common feeder belt shall pass through a 2 in. (50 millimeter) scalping screen.

5. Aggregate Weighing Systems
 - a. All aggregates including mineral filler, if required, shall be weighed by a continuous weighing device either as it is proportioned by the individual feeders or after all materials have been deposited on the common belt. The weighing device for weighing the total material accumulated on the common belt shall be located so that the mass reading is obtained after the material has been passed through the 2 in. (50 millimeter) scalping screen. Belt scales shall meet the requirements of the National Bureau of Standards Handbook 44. When tested, the weighing system shall have an accuracy of 0.5%.
 - b. All weighing devices shall be installed in accordance with the manufacturer's recommendations. The weighing devices shall be capable of displaying at the control panel, the aggregate mass flow, in metric tons per hour, and shall continuously accumulate the masses of material during the day's production.
6. Aggregate Moisture Compensator: Moisture content of the aggregate shall be determined manually or electronically, and a moisture compensation device shall be capable of electronically changing the wet aggregate mass to dry aggregate mass.
7. Reclaimed Asphalt Pavement (RAP)
 - a. The modified batch plant shall be equipped with a separate bin suitably located for introduction into the drum mixer. The RAP bin shall be equipped with an interlocking device for automatically stopping production if the RAP bin becomes empty or flow is stopped for any reason.
 - b. A weighing device shall be located on the RAP conveyor for continuous weighing of the RAP. Also, a moisture compensator shall be included in the RAP delivery system to compensate for the moisture in the RAP.
8. Drum Mixer
 - a. The drum mixing unit shall be approved by the Engineer and shall be a revolving type that continuously agitates and mixes the bituminous material. It shall have an automatic burner control and be capable of producing a uniform mix within the job specifications.
 - b. An automatic temperature recording device that continuously records the mix temperature shall be located in the area of discharge and the data transmitted to the control panel.
9. Bituminous Metering System
 - a. The bituminous material shall be introduced into the drum mixer by a metering system that is capable of accurately and continuously measuring the quantity and temperature of the material being introduced. The temperature recording device shall be located so as to record the temperature of the bituminous material prior to entry into the mixer.

- b. The metering system shall be capable of introducing the proper amount of material into the mix, accurate to $\pm 0.1\%$ based on the total mass of the mix.
 - c. The bituminous metering system shall be interlocking with both the aggregate and RAP weight control system so that any change in the aggregate or RAP rate of flow will automatically trigger a change in the bituminous material rate of flow so as to maintain the correct proportions. Also, any interruption in the flow of bituminous material to the mixer shall stop all production. Means shall be provided for conveniently and safely diverting the flow of bituminous material into a suitable container for checking the accuracy of the metering system. A temperature compensating device shall be installed in the metering system to correct the quantity of bituminous material to 15.6°C (60°F).
 - d. The bituminous material flow shall be continuously displayed at the central control panel in metric tons per hour or as the corresponding percentage of the total mix.
10. Hot Mix Conveyor
- a. The mix will discharge onto a hot mix conveyor that carries the mix to a surge silo. The temperature of the mix when discharged onto the conveyor shall not be less than 135°C (275°F) nor more than 163°C (375°F). Means shall be provided for conveniently and safely obtaining a representative sample of the mix as it is discharged from the mixer or from the hot mix conveyor.
 - b. The hot-mix conveyer shall be designed so as to prevent any segregation and excessive temperature variation of the mix as it is transported and dumped into the surge-silo.
11. Surge and Storage Silos
- a. The plant shall be equipped with sufficient surge and storage silos to accommodate the temporary storage of different mixes and to minimize any production interruptions.
 - b. Surge-Storage Silos shall be approved in accordance with the following requirements:
 - (1) All bins shall be designed and equipped so that there will be no segregation of the mix at the time of loading, during storage or at time of discharge. The Engineer reserves the right to reject any material when there is any indication that the material is not in conformance with specifications.
 - (2) The holding bins, together with all equipment and methods pertaining to their use, shall be subject to approval by the Engineer. The use of coatings on the internal surface of the bins shall not be permitted. The use of additives to the bituminous concrete mixes will be permitted only with the approval of the Engineer.
 - (3) Unless otherwise permitted by the Engineer, the mixtures shall not be stored in surge and storage bins longer than the following:

Type of Bin Time	Maximum Holding
Unheated and not insulated	2 hours
Unheated, but insulated (may have heated gate)	15 hours
Insulated and heated	24 hours

- (4) Surge silos for the temporary storage of mix during a day's production shall always be maintained above the one-quarter full level.

12. Proportioning Controls

- a. All proportioning controls for aggregate, mineral filler, bitumen and RAP shall be electronically interlocked so that any interruption of more than 5 seconds in the flow of one component will automatically stop all production. The central control panel shall be equipped with a master control which will increase or decrease the production rate without having to reset the individual controls for each change in the production rate.
- (1) Each aggregate and mineral filler feeder shall have an adjustable-rate control. The controls shall maintain the accuracy of the aggregate feeders to $\pm 1.5\%$ of the total mass of the bituminous mix per interval of time and the mineral filler feeder to $\pm 0.5\%$ of the mass of the bituminous mix per interval of time. The flow rates of the aggregate and mineral filler shall be continuously displayed at the control panels in metric tons per hour and continuously accumulated for each day's production.
 - (2) Provisions shall be made for a moisture compensating device that will electronically correct combined wet aggregate mass to dry aggregate mass.
 - (3) The bitumen control shall be capable of presetting the bitumen content directly as a percentage of the total mass of the mix in increments of 0.1%. The bituminous metering system shall be coupled with the aggregate and RAP feeder systems to automatically maintain the required proportions as the aggregate and RAP flow vary. The bituminous flow rate shall be continuously displayed at the central control panel in metric tons per hour and continuously accumulated.
 - (4) At the start of each production season all plant controls necessary to the production of specification mix shall be calibrated. The method of calibration shall be in accordance with the plant manufacturer's instructions and shall be subject to approval by the Engineer. Calibration points for the delivery of each type of mix shall be determined.
 - (5) The central control panel shall be equipped with an automatic digital recording device, which on a continuing specified interval and on demand, records the mass of aggregate from each bin or the accumulated mass of all aggregates on the common belt, mineral filler and RAP, if used, and bitumen. All print-outs shall show time and date and shall be clearly legible. Copies shall be provided to the Engineer.

13. Plant Controls: All plant controls shall be capable of being locked to prevent tampering. After calibration, no changes will be made to the equipment or operating procedures without the approval of the Engineer.
14. Testing Scales: All plant scales, including truck platform scales shall be subject to the same testing requirements as specified in this section. The plant shall be designed and operated to meet all local air quality requirements.
15. Portable Drum Mix Plants: Whenever a plant is moved from one location to another.
16. Testing Facilities: Testing facilities shall conform to the Testing Facilities specified in this Section.

H. Inspection

1. The Engineer or his authorized representative shall have access at any time to all parts of the plant for:
 - a. Inspections of the conditions and operations of the plant.
 - b. Confirmation of the adequacy of the equipment in use.
 - c. Verification of the character and proportions of the mixture.
 - d. Determination of temperatures being maintained in the preparation of the mixture.
 - e. Inspection of incidental related procedures.

PART 3– EXECUTION

3.01 INSTALLATION

- A. Place and apply subbases, bases, bituminous materials, hot poured joint sealers, prime and tack coats, bituminous concrete including base, binder and surface course and appurtenances in accordance with this Specification as indicated on the Drawings and in accordance with approved shop drawings and as directed by the Engineer.
- B. Remove surplus materials in accordance with Section 02210.
- C. Adjust catch basin grates, manhole frames and covers, valve and meter boxes and similar utility surficial features to conform with the proposed pavement elevations.
- D. Saw cut interfaces with adjacent roads with the longest straight lines possible with a rotary saw.
- E. Mill or cold plane surfaces as required.
- F. Sweep and clean debris and cuttings from surfaces to be topped.

3.02 SUBBASE:

- A. Spreading
 1. Sub-base aggregate shall be spread on subgrade which has been approved by the Engineer. Sub-base which has been placed on a subgrade not approved by the Engineer shall be removed at the Contractor's expense.

2. When the compacted thickness exceeds 8 in. (200 mm), the sub-base shall be constructed of two or more lifts of equal thickness of not exceeding 8 in. (200 mm). In no case shall a layer be less than 4 in. (100 mm) thick.
3. The materials shall be handled so as to avoid segregation and to place the material in uniform depth. Segregated materials shall be re-mixed until uniform. Suitable care shall be taken to prevent rutting of the subgrade during the spreading of the sub-base material. No hauling or placement of material will be permitted when, in the opinion of the Engineer, the weather or road conditions are such that the hauling operations will cause cutting or rutting of the subgrade or cause contamination of the sub-base material.

B. Mixing

1. When the stationary blend method is used, the aggregate shall be mixed in a pugmill capable of incorporating water to provide the optimum moisture content for compaction and homogenous blending. Immediately after mixing, the sub-base material is transported and placed on the roadbed by a mechanical spreader.
2. When the road mix method is used, after placement on the roadway, the aggregate shall be uniformly mixed by motor graders or other approved equipment adding moisture during the mixing operation to provide optimum moisture content for compaction.

C. Compaction

1. The moisture content of the sub-base material shall be adjusted prior to compaction, by watering with approved sprinkler trucks or by drying out, to that appropriate to obtain the specified density for sub-base with the Construction equipment. Sub-base shall be compacted to 95% of maximum dry density determined by AASHTO T 180 Method D. In-place density shall be determined using AASHTO T 191 or T 205. The use of AASHTO T 224 to correct for oversize particles may be required.
2. The sub-base aggregate shall be compacted by means of approved compaction equipment progressing gradually from the outside towards the center with each succeeding pass uniformly overlapping the previous pass. Rolling shall continue until the entire thickness of each layer is thoroughly and uniformly compacted to the specified density. Rolling shall be accompanied by sufficient blading, in a manner approved by the Engineer, to ensure a smooth surface free from ruts or ridges and having the proper section and crown.
3. Any areas inaccessible to normal compaction equipment shall be compacted by means of mechanical tampers until satisfactory compaction is obtained.
4. Each layer of sub-base shall be completely compacted and approved by the Engineer prior to the delivery of materials for a succeeding layer.

D. Compaction Trials

1. Prior to the commencement of his sub-base operations, the Contractor shall construct trial lengths as directed by the Engineer. The materials used in the trials

shall be those approved for use as sub-base and the equipment used shall be that which the Contractor intends to use for the work proper.

2. The objective of these trials is to determine the adequacy of the Contractor's equipment, the loose depth measurements necessary to result in the specified compacted layer depths, the field moisture content, and the relationship between the number of compaction passes and the resulting density of the material.
3. The Contractor shall not proceed with sub-base work until the methods and procedures established in the compaction trials have been approved by the Engineer.
4. Each trial length shall be 300 ft. (100 m) long, and the Engineer may order up to 10 such lengths. The trial lengths will be incorporated in the Works.

E. Finishing

1. The Contractor shall program his operations to avoid the drying out of the sub-base during construction. If any layer of sub-base material or part thereof, is permitted to dry out after compaction, or does not conform to the required density or finish, the Contractor shall, at his own expense, re-work, water or re-compact the material, as directed by the Engineer, to the density specified, before the next layer is placed.
2. The contractor shall ensure that proper drainage of the pavement and shoulder area is maintained at all times.
3. Immediately prior to the placing of the first layer of base on the sub-base the final layer of sub-base shall be at the specified density and to the required grade and section. In order to maintain these requirements while placing the base, the Contractor shall, if necessary, water and reshape the surface of the sub-base at his own cost.
4. No material for base shall be placed until the sub-base has been approved by the Engineer.

F. Tolerances

1. The variation of the surface of finished sub-base from any two points of contact with a 10 ft. (3 m) straight-edge shall in no case exceed ½ in. (12 mm) when placed on or parallel to the centreline or ½ in. (12 mm) when placed perpendicular to the centreline of the roadway.
2. The finished sub-base shall not vary by more than ½ in. (12 mm) above or ½ in. (12 mm) below the required elevation when it is to be used as a running surface.
3. All humps and depressions and thickness deficiencies exceeding the specified tolerances shall be corrected by removing the defective work or by adding new material as directed by the Engineer.

3.03 BASE

A. General

1. The surface on which base is to be placed shall be well compacted, smooth, hard and uniform, with all irregularities having been bladed out and rolled down, and approved by the Engineer prior to the placing of base material.

B. Placing

1. When the thickness of base exceeds 8 in. (200 mm), the base shall be compacted in two layers of equal thickness. The maximum compacted thickness of any layer shall not exceed 8 in. (200 mm).

C. Combining Aggregates and Water

1. Aggregates for base shall be combined into a uniform mixture and water added in a central mixing plant in a manner approved by the Engineer.
2. When binder is to be added, it shall be combined in the central mixing plant.
3. The amount of water added to the aggregate shall be that required to obtain the specified density, giving a mixture which is completely ready for compaction after spreading. In no case will the wetting of aggregates in stockpiles or trucks be permitted.

D. Spreading and Combining Aggregates

1. Immediately after mixing, the base mix material shall be delivered to the roadbed as a uniform mixture and shall be placed on the prepared sub-base or subgrade in a uniform layer or layers.
2. The material shall be so handled as to avoid segregation. All segregated material shall be removed and replaced with well-graded material. No "skin-patching" shall be permitted.
3. Spreading shall be done by an approved self-propelled paving machine or spreader box which distributes the material to the required width and uniform depth without delay. If the paving machine or spreader causes segregation or leaves ridges or other objectionable marks on the surface which cannot be eliminated easily or prevented by adjustment of the paving machine or spreader operation, the use of such a paving machine or spreader shall be discontinued.
4. No hauling or placing of material will be permitted when, in the opinion of the Engineer, the weather or road conditions are such that hauling operations will cause cutting or rutting of the surface or contamination of the base material.

E. Compaction

1. Immediately after placing, the base material shall be compacted to a density of not less than 98% of maximum dry density determined by AASHTO T 180 Method D. In-place density shall be determined by AASHTO T 191 or T 205. The use of AASHTO T 224 to correct oversize particles may be required.
2. Rolling shall be carried out until the entire thickness of each layer is thoroughly and uniformly compacted to the density specified. Rolling shall be accompanied

by sufficient blading in a manner approved by the Engineer, to ensure a smooth surface, free from ruts or ridges and having the proper section. When additional water is required it shall be added in a manner approved by the Engineer.

3. The Contractor shall plan the work and handle the various operations so that the least amount of water will be lost by evaporation from non-compacted surfaces. If the Contractor delays placing of succeeding layers of base material to the extent that additional water must be applied, the application of such water shall be at the Contractor's own cost.
4. Each layer of base shall be completely compacted, and approved by the Engineer, prior to the delivery of material for a succeeding layer.
5. If the material is laid and compacted in more than one layer, the Contractor shall plan and coordinate the work in such a manner that the previously placed and compacted layers be allowed ample time for drying and development of sufficient stability before vehicles hauling materials for the succeeding layers, or other heavy equipment, are permitted on the base.
6. Prior to placing the succeeding layers of material, the top of the under-layer shall be made sufficiently moist to ensure bond between the layers.
7. Additional water shall be applied at such times as directed by the Engineer, and the Engineer shall have full authority to require the suspension of all other work on the project to insure the proper maintenance of previously compacted material.
8. If after the base is compacted, any areas fail to meet the specified density and grading requirements, or are above or below proper grade and true elevations, such areas shall be loosened and after having had additional materials added or excess material removed, as the case may be, shall be reconstructed as described herein.
9. Edges and edge slopes shall be bladed or otherwise dressed to conform to the lines and dimensions shown on the Drawings and present straight, neat and workmanlike lines and slopes as free of loose materials as practicable.

F. Compaction Trials

1. Prior to the commencement of his base operations, the Contractor shall construct trial lengths as directed by the Engineer. The material used in the trials shall be that approved for use as base and the equipment used shall be that which the Contractor intends to use for the work proper.
2. The objective of these trials is to determine the adequacy of the Contractor's equipment, the field moisture content, and the relationship between the number of compaction passes and the resulting density of the material.
3. The Contractor may proceed with base work only after the methods and procedures established in the trials have been approved by the Engineer.
4. Each trial length will be 300 ft. (100 m) long and the Engineer may order up to 10 such lengths. The trial lengths will be incorporated in the Works, and no additional payment will be made for them.

G. Tolerances

1. The variation of the surface of finished base from any two points of contact with a 10 ft. (3-m) straight-edge shall in no case exceed 1/8 in. (3 mm) when placed on or parallel to the centreline or 1/8 (3 mm) when placed perpendicular to the centreline of the roadway.
2. Finished base shall not vary by more than 1/8 (3 mm) from the required elevation.
3. All humps and depressions and thickness deficiencies exceeding the specified tolerances shall be corrected by removing the defective work or by adding new material as directed by the Engineer. Adding new material to areas of thickness deficiency in the form of skin patching will not be permitted.

H. Maintenance of Base

1. Following construction, the compacted base shall be maintained by the Contractor at his own expense. The Contractor shall blade, broom and otherwise maintain the base, keeping it free from ravelling, and other defects until such time as the prime coat is applied. Water shall be applied at such times as directed by the Engineer.
2. The Contractor shall ensure that proper drainage of the pavement and shoulder area is maintained at all times.
3. The Engineer shall determine when the surface of the base is in the proper condition to permit the prime coat to be applied. If the Contractor chooses not to apply the prime coat to the base at that time he shall continue to maintain it at his cost until such time as the prime coat is applied.

3.04 PRIME COAT

A. Preparation of Surface

1. Prior to the application of prime coat, the surface shall be shaped to the required grade and section, free from all ruts, corrugations, segregated materials and uniformly compacted, and cleaned by means of approved mechanical sweepers or blowers and/or hand brooms, until it is as free from dust as is deemed practicable.
2. Delays in priming may require re-processing or re-shaping the roadway to provide a smooth and clean surface.
3. Prime coat shall be applied only when the surface to be treated is dry, or contains moisture not in excess of that which will permit uniform distribution and the desired penetration.
4. If deemed necessary by the Engineer, the cleaned surface shall be given a light application of water and allowed to dry to a surface-dry condition before the bituminous material is applied.
5. No traffic shall be permitted on the surface after it has been prepared to receive the prime coat

B. Heating Equipment

1. Heating equipment for heating bituminous materials shall be of adequate capacity to heat the material properly by circulating steam or hot oil through coils of a tank

or by circulating the material around a system of heated coils or pipes, or by circulating the material through a system of coils or pipes enclosed in a heated jacket or other approved means.

2. Heating equipment shall be operated in a manner that will not damage the material.
3. Heating equipment shall be so constructed that it will prevent the direct flame from a burner from striking the surface of the coils, pipes, or jacket through which the material is circulated.
4. If storage tanks are used, thermometers with a range of 0 to 200°C (32° to 392°F) shall be fixed to the tanks so that the temperature of the material may be determined at all times.
5. Material which has been heated above 125 °C (275°F) will be rejected.
6. All storage tanks, piping, retorts, booster tanks and distributors used in storing, handling or heating material shall be kept clean and in good condition at all times, and shall be operated in such manner that there will be no contamination by foreign material.

C. Pressure Distributors

1. Pressure distributors shall be self-propelled, pneumatic-tired and so designated and equipped as to distribute the prime coat uniformly in variable widths at readily determined and controlled rates. They shall be operated by skilled workmen. The equipment shall include instruments for measuring the speed of travel accurately at low speeds, the rate of flow of bituminous material through the nozzles, the temperature of the contents of the tank, and the pressure and remaining contents. If after beginning the work, the distribution of bituminous material is found to be in error, the equipment shall be withdrawn from the work and calibrated to the satisfaction of the Engineer before proceeding with the work.
2. The nozzles and spray bar shall be adjusted and frequently checked so that uniform distribution is achieved. Spraying shall cease immediately upon any clogging or interference of any nozzle, and corrective measures shall be taken before spraying is resumed.

D. Application

1. Prime coat shall be applied by a pressure distributor in a uniform and continuous spread at the rates directed by the Engineer after the field trials. Any application so determined may be divided into two applications where necessary to prevent prime coat flowing off the surface and additional material shall be applied where localized surface conditions indicate it to be necessary.
2. Prime coat shall not be applied when the surface temperature is below +15 °C (59°F) unless otherwise permitted by the Engineer. The temperature of prime coat at the time of spraying shall be in the range of 27° to 66°C (81° to 151°F).
3. When traffic is maintained, not more than one half the width of the section shall be treated in one application. Care shall be taken so the application of asphalt at the junctions of spread is not in excess of the specified amount.

4. Any skipped areas or recognized deficiencies shall be corrected by means of approved hand sprays. The use of hand sprays will only be allowed for correcting such deficiencies and for priming small patches or areas which are inaccessible to the distributor.
5. Building paper shall be placed over the end of the previous applications, and the joining shall start on the building paper. Building paper used shall be removed and satisfactorily disposed.
6. The Contractor shall spread blotting material on all areas which show an excess of prime. Blotting material shall be applied sparingly and only on areas which have not dried. Blotting material aggregate shall comply with the grading requirements of AASHTO M 43, size 10, and comprise clean non-plastic sand, or fine aggregate, free from organic or deleterious material.
7. When traffic is maintained, one-way traffic shall be permitted on the untreated portion of the roadbed. However, on the treated surface, prime coat shall be allowed to dry without being disturbed for a period of at least 48 hours.
8. The prime coat shall be applied using an approved bitumen distributor at the rate of not less than .04 gal/sq yd 15 kg/m² or, more than .05 gal/sq yd 20 kg/m² of prepared surface.

E. Field Trials

1. The Contractor shall, before he commences the work proper, carry out field trials to permit the Engineer to ascertain the rate of application to be ordered. The trial methods shall be approved by the Engineer and performed by the Contractor in the presence of the Engineer.
2. The rate of application in the field trials shall be .04 gal/sq yd 15 lf/m² minimum and 0.5 gal/sq yd 20 lf/m² maximum.
3. The Engineer may order subsequent field trials and/or change the previously established rates of application when he deems it necessary.

F. Protection of Adjacent Structures

1. When prime coat is being applied, the surfaces of all structures, guard rails, curbs and other roadway appurtenances shall be protected in a manner approved by the Engineer to prevent them from being splattered or damaged.
2. The Contractor shall at his own cost make good to the satisfaction of the Engineer any appurtenances which are splattered or damaged.

G. Maintenance of Primed Surfaces

1. The Contractor shall protect all primed surfaces and keep them in perfect condition until they are covered by succeeding courses.
2. All areas where the prime surface has been damaged by traffic or by the Contractor's operations shall be cleaned of all loose materials, re-primed, and made good to the satisfaction of the Engineer, at the Contractor's own cost.

3.05 TACK COAT

A. Preparation of Surface

1. Prior to the application of tack coat, the surface shall be shaped to the required grade and section, free from all ruts, corrugations, segregated materials and uniformly compacted, and cleaned by means of approved mechanical sweepers or blowers and/or hand brooms, until it is as free from dust as is deemed practicable.
2. Delays in application of the tack coat may require re-processing or re-shaping the roadway to provide a smooth and clean surface.
3. Tack coat shall be applied only when the surface to be treated is dry, or contains moisture not in excess of that which will permit uniform distribution and the desired penetration.
4. No traffic shall be permitted on the surface after it has been prepared to receive the prime coat

B. Heating Equipment

1. Heating equipment for heating bituminous materials shall be of adequate capacity to heat the material properly by circulating steam or hot oil through coils of a tank or by circulating the material around a system of heated coils or pipes, or by circulating the material through a system of coils or pipes enclosed in a heated jacket or other approved means.
2. Heating equipment shall be operated in a manner that will not damage the material.
3. Heating equipment shall be so constructed that it will prevent the direct flame from a burner from striking the surface of the coils, pipes, or jacket through which the material is circulated.
4. If storage tanks are used, thermometers with a range of 0 to 200°C (32° to 392°F) shall be fixed to the tanks so that the temperature of the material may be determined at all times.
5. Material which has been heated above 125 °C (257°F) will be rejected.
6. All storage tanks, piping, retorts, booster tanks and distributors used in storing, handling or heating material shall be kept clean and in good condition at all times, and shall be operated in such manner that there will be no contamination by foreign material.

C. Pressure Distributors

1. Pressure distributors shall be self-propelled, pneumatic-tired and so designated and equipped as to distribute the tack coat uniformly in variable widths at readily determined and controlled rates. They shall be operated by skilled workmen. The equipment shall include instruments for measuring the speed of travel accurately at low speeds, the rate of flow of bituminous material through the nozzles, the temperature of the contents of the tank, and the pressure and remaining contents. If after beginning the work, the distribution of bituminous material is found to be in error, the equipment shall be withdrawn from the work and calibrated to the satisfaction of the Engineer before proceeding with the work.

2. The nozzles and spray bar shall be adjusted and frequently checked so that uniform distribution is achieved. Spraying shall cease immediately upon any clogging or interference of any nozzle, and corrective measures shall be taken before spraying is resumed.

D. Application

1. Tack coat shall be applied by a pressure distributor in a uniform and continuous spread at the rates directed by the Engineer after the field trials. Any application so determined may be divided into two applications where necessary to prevent prime coat flowing off the surface and additional material shall be applied where localized surface conditions indicate it to be necessary.
2. The temperature of tack coat at the time of spraying shall be in the range of 27° to 66°C (81° to 151°F).
3. When traffic is maintained, not more than one half the width of the section shall be treated in one application. Care shall be taken so the application of asphalt at the junctions of spread is not in excess of the specified amount.
4. Any skipped areas or recognized deficiencies shall be corrected by means of approved hand sprays. The use of hand sprays will only be allowed for correcting such deficiencies and for application in small patches or areas which are inaccessible to the distributor.
5. Building paper shall be placed over the end of the previous applications, and the joining shall start on the building paper. Building paper used shall be removed and satisfactorily disposed of.
6. The Contractor shall spread blotting material on all areas which show an excess of material. Blotting material shall be applied sparingly and only on areas which have not dried. Blotting material aggregate shall comply with the grading requirements of AASHTO M 43, size 10, and comprise clean non-plastic sand, or fine aggregate, free from organic or deleterious material.
7. When traffic is maintained, one-way traffic shall be permitted on the untreated portion of the roadbed. However, on the treated surface, tack coat shall be allowed to dry without being disturbed for a period of at least 48 hours.
8. The tack coat shall be applied using an approved bitumen distributor at the rate of .05 lf/m² of prepared surface.

E. Field Trials

1. The Contractor shall, before he commences the work proper, carry out field trials to permit the Engineer to ascertain the rate of application to be ordered. The trial methods shall be approved by the Engineer and performed by the Contractor in the presence of the Engineer.
2. The rate of application in the field trials shall be .05 lf/m².
3. The Engineer may order subsequent field trials and/or change the previously established rates of application when he deems it necessary.

F. Protection of Adjacent Structures

1. When tack coat is being applied, the surfaces of all structures, guard rails, curbs and other roadway appurtenances shall be protected in a manner approved by the Engineer to prevent them from being splattered or damaged.
2. The Contractor shall at his own cost make good to the satisfaction of the Engineer any appurtenances which are splattered or damaged.

G. Maintenance of Primed Surfaces

1. The Contractor shall protect all surfaces and keep them in perfect condition until they are covered by succeeding courses.
2. All areas where the surface has been damaged by traffic or by the Contractor's operations shall be cleaned of all loose materials, redone and made good to the satisfaction of the Engineer, at the Contractor's own cost.

3.06 COMPOSITION AND COMPACTION ACCEPTANCE TESTS

- A. Where plant inspection is maintained, the material will not be considered acceptable for use unless the specified tests from samples obtained at the production plant indicate conformance to the approved job-mix formula.
- B. The applicable tolerances defining reasonably close conformity with the specifications shall be the amount of bitumen, the percentage by weight passing No. 8 (2.36 millimeter) and No. 200 (75 micrometer) sieves as specified under Subsection 2.07B.
- C. For determination of pavement density the Nuclear Density Method ASTM D 2950 at a frequency of 100 linear feet (30 meters) on each lift of each course and/or Bulk Specific Gravity Method AASHTO T 166 shall be used. Where AASHTO T 166 is used, samples for the full depth of the course being laid shall be taken from the mixture incorporated in the work after finishing operations have been completed and the pavement has cooled. The Contractor shall have suitable coring equipment available in order that the required number of samples 6 in. (150 millimeter cores) may be taken. At least one such sample shall be taken from each project containing 3000 tons (2500 metric tons) of mixture. In projects containing more than 3000 tons (2500 metric tons) of mixture, at least one sample shall be taken for each 3000 tons (2500 metric tons); except that any additional number of samples shall be taken as may be deemed necessary by the Engineer.
- D. These samples will be taken by the Contractor in the presence of the Engineer on the day following the placement of the course, weather permitting.

3.07 CONTRACT CLOSEOUT:

- A. Provide in accordance with Section 01700.

END OF SECTION

SECTION 02520

CURBING

PART 1 – GENERAL

1.01 DESCRIPTION:

- A. Reset existing granite curbs.

1.02 MEASUREMENT AND PAYMENT

- A. Measurement and payment for the Work described in this section shall be made in accordance with the provisions of Section 02000, Measurement and Payment.

1.03 SUBMITTALS

- A. Provide submittals of materials in accordance with Section 01300.
- B. A copy of this specification section with addenda and all referenced specification sections with addenda, shall be provided with each paragraph check-marked to indicate specification compliance. Failure to include a copy of the marked-up specification sections will result in rejection of the entire submittal with no further review and consideration.

1.04 REFERENCES

- A. Massachusetts Department of Transportation Standard Specifications for Highways and Bridges.

PART 2 – PRODUCTS

PART 3 – EXECUTION

3.01 GRANITE CURB

- A. Methods of placing granite curb shall conform to the requirements and details shown in the plans.

3.03 CONTRACT CLOSEOUT

- A. Provide in accordance with Section 01700.

END OF SECTION

SECTION 02580
REFLECTORIZED PAVEMENT MARKINGS

PART 1 – GENERAL

1.01 DESCRIPTION:

- A. Furnish and install reflectorized white line (epoxy resin), reflectorized yellow line (epoxy resin) and reflectorized pavement markings (paint).

1.02 MEASUREMENT AND PAYMENT

- A. Measurement and payment for the Work described in this section shall be made in accordance with the provisions of Section 02000, Measurement And Payment.

1.03 REFERENCES:

- A. ASTM Standards as referenced throughout this Section.
- B. National Bureau of Standards Handbook 44.
- C. Massachusetts Department of Transportation Standard Specifications for Highways and Bridges.
- D. 2023 Manual on Uniform Traffic Control Devices

1.04 SUBMITTALS:

- A. In accordance Section 01300 - Submittals.
- B. A copy of this specification section with addenda and all referenced specification sections with addenda, shall be provided with each paragraph check-marked to indicate specification compliance. Failure to include a copy of the marked-up specification sections will result in rejection of the entire submittal with no further review and consideration.

PART 2 – PRODUCTS

2.01 MATERIALS:

- A. For existing pavement marking applications, pavement markings shall be white or yellow reflectorized thermoplastic, epoxy, or other matching material.

PART 3 – EXECUTION

3.01 PLACEMENT AND COMPACTION:

- A. Epoxy Resin reflectorized lines shall be installed only after permanent pavement has been installed and approved.
- B. All painting shall be in accordance with Massachusetts Highway Department Standard Specifications.
- C. Painting will not be allowed on damp, wet or dirty road surfaces.
- D. Painting will not be allowed if the temperature is below 40 deg. F.
- E. The Contractor shall notify the Owner 48 hours in advance of painting.

- F. The Contractor shall furnish adequate protection to freshly painted lines to keep traffic off of them until thoroughly dry.
 - G. Painted reflectorized lines and/or raised temporary pavement markings shall be installed after each course of temporary and permanent paving. Refer to Section 02500 – Bituminous Pavement.
- 3.02 TOLERANCES:
- A. Tolerances shall be in accordance with Massachusetts Department of Transportation Standard Specifications for Road and Bridge Construction..
- 3.03 CONTRACT CLOSEOUT
- A. Provide in accordance with Section 01700.

END OF SECTION

SECTION 02615

DUCTILE IRON PIPE AND FITTINGS

PART 1 - GENERAL

1.01 DESCRIPTION:

- A. Provide and test ductile iron pipe, fittings and appurtenances as indicated and in compliance with Contract Documents.
- B. Provide restrained push-on or mechanical joint fittings with restraint system as indicated and specified herein.
- C. Cast iron pipe and fittings are not acceptable.

1.02 REFERENCES:

- A. American Society of Mechanical Engineers (ASME):
 - 1. B16.1: Cast-Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250, and 800.
 - 2. B16.21: Nonmetallic Flat Gaskets for Pipe Flanges.
 - 3. B16.42: Ductile Iron Pipe Flanges and Flanged Fittings.
 - 4. B31.1: Power Piping.
- B. ASTM International (ASTM):
 - 1. A240: Specification for Heat Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet and Strip for Pressure Vessels.
 - 2. A307: Carbon Steel Bolts and Studs, 60,000 psi Tensile.
 - 3. A530: Specification for General Requirements for Specialized Carbon and Alloy Steel Pipe.
 - 4. A774: Specification for As-Welded Wrought Austenitic Stainless Steel Fittings for General Corrosive Service at Low and Moderate Temperatures.
 - 5. A778: Specification for Welded, Unannealed Austenitic Stainless Steel Tubular Products.
- C. American Water Works Association (AWWA):
 - 1. A21.4: Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water.

2. A21.10: Ductile-Iron and Gray-Iron Fittings, 3 in. through 48 in., for Water and Other Liquids.
3. A21.11: Rubber-Gasket Joints for Ductile-Iron and Gray-Iron Pressure Pipe Fittings.
4. A21.50: Thickness Design of Ductile-Iron Pipe.
5. A21.51: Ductile-Iron Pipe, Centrifugally Cast in Metal Molds, or Sand-Lined Molds, for Water or Other Liquids.

D. Fluid Sealing Association: Technical Handbook.

1.03 SUBMITTALS:

A. Submit the following in accordance with Section 01300:

1. Pipe manufacturer's technical specification and product data.
2. Certified shop and erection drawings. Contractor shall submit electronic files of the piping layout including the following.
 - a. Pipe layouts in full detail.
 - b. Location of hangers and supports.
 - c. Location and type of anchors.
 - d. Location of couplings and expansion joints.
 - e. 1/2-inch = 1 foot-0 inch scale details of all wall penetrations and special fittings.
 - f. Schedules of pipe, fittings, special castings, couplings, expansion joints and other appurtenances.
3. Certificates: Sworn certificates in duplicate showing compliance with material used and shop tests performed.
4. Catalog cuts and technical data for expansion joints, couplings, gaskets, pipe supports and other accessories.
5. Brochures and technical data on coatings and linings and proposed method of application.
6. Manufacturer's descriptive literature and technical data on insulation and proposed method of installation.

- B. A copy of the contract mechanical process, civil, and structural drawings, with addenda that are applicable to the equipment specified in this section, marked to show all changes necessary for the equipment proposed for this specification section. If no changes are required, mark all drawings with “No changes required” or provide a statement that no changes are required.
 - 1. Failure to include all drawings or a statement applicable to the equipment specified in this section will result in submittal return without review until a complete package is submitted.
 - 2. A copy of this specification section with addenda and all referenced specification sections with addenda, with each paragraph check-marked to indicate specification compliance or marked and indexed to indicate requested deviations and clarifications from the specified requirements.
 - a. If deviations and clarifications from the specifications are indicated, therefore requested by the Contractor, provide a detailed written justification for each deviation and clarification.
 - b. Failure to include a copy of the marked-up specification sections and or the detailed justifications for any requested deviation or clarification will result in submittal return without review until marked up specifications and justifications are submitted in a complete package.

1.04 QUALITY ASSURANCE:

- A. Provide in accordance with Section 01400 and as specified.
- B. Provide manufacturer's certification in writing, that materials meet or exceed minimum requirements as specified.
- C. Inspect and test at foundry according to applicable standard specifications.
- D. Owner reserves right to inspect and test by independent service at manufacturer’s plant or elsewhere at his own expense.
- E. Visually inspect before installation.
- F. Job Conditions:
 - 1. Coordinate dimensions and drillings of flanges with flanges for valves, pumps and equipment to be installed in the piping systems.

1.05 DELIVERY, STORAGE AND HANDLING:

- A. Comply with the requirements specified in Section 01610.

- B. During loading, transportation and unloading, prevent damage to pipes and fittings. Load and unload each pipe under control at all times. Under no circumstances will a dropped pipe be used unless inspected and accepted by Engineer. Place skids or blocks under each pipe in the shop and securely wedge pipe during transportation.

PART 2 - PRODUCTS

2.01 PIPE:

A. Ductile Iron:

- 1. Design conforming to AWWA A21.50.
- 2. Manufacture conforming to AWWA A21.15 or AWWA A21.51.
- 3. Thickness class, unless otherwise indicated or specified:
 - a. Minimum Thickness Class 52.
 - b. Minimum thickness Class 53 for use with threaded flanges.
 - c. Minimum thickness Class 53 for use with flanged pipe.
 - d. Minimum thickness for use with grooved couplings conforming to AWWA C606.

2.02 WALL CASTINGS:

A. Provide size and type indicated and specified.

- 1. Piping 24-inches and Smaller: Mechanical Joint with specified restraint or Restrained Push-On.
- 2. Piping 30-inches and Larger: Restrained Push-On.

B. Wall Castings: Conform to requirements of AWWA A21.10 or fabricate of Class 53 ductile iron pipe with screwed on flanges and welded on waterstop. Screwed on mechanical or push-on joints are not acceptable.

C. Provide water stop centered in wall. Weld water stops on in factory under controlled conditions to ensure adequate strength to permit waterstop to absorb thrust up to the pressure rating of the pipe.

Wall Castings with annealed ductile iron water stops	
Pipe Size	Waterstop thickness, inches
24 inch	0.75

Wall Castings with fabricated steel water stops	
Pipe Size	Waterstop thickness, in
24 inch	0.38

- D. On flanged wall castings, provide space between the wall and flange to permit mounting the nuts on the flange bolts.
- E. Flanged wall castings located with the flange flush with the wall are not acceptable.
- F. Locate push-on joint wall castings with space between the bell and the wall to insert the follower bolts.
- G. As an option, fabricated wall pipe of Schedule 40 Type 316L stainless steel may be substituted for wall castings specified above. Provide with waterstops of above dimensions and welded continuously on both sides of stop. Flanges of Type 316 stainless steel. Bolts for connection to buried pipe Type 316 stainless steel. Provide flange insulation gaskets, sleeves and washers for all flanges.
- H. Testing: Factory pressure test all wall castings to pipe and joint pressure rating for a minimum of 5 minutes. No visible leakage is acceptable.

2.03 ADAPTERS:

- A. Furnish and install for joining pipe of different types, unless solid sleeves indicated.
 - 1. Provide ends conforming to above specifications for the correct type of joint, to receive adjoining pipe.
 - 2. Joining two classes of pipe may be of lighter class provided annular space in bell-and-spigot type joints sufficient for jointing.

2.04 JOINTS:

- A. Provide push-on joint and mechanical joint pipe with necessary accessories, conforming to AWWA A21.11.
 - 1. Provide gasket composition designed for exposure to liquid within pipe.
- B. Provide restrained joint on pipe and fittings where indicated. Provide restrained joint which is:
 - 1. Boltless.
 - 2. Capable of being deflected after assembly.
 - 3. Designs using set screws or requiring field welding are not acceptable.
 - 4. Manufacturers:

- a. American Cast Iron Pipe Co. Flex-Ring.
- b. U.S. Pipe TR FLEX.
- c. Clow Super-Lock.

2.05 MECHANICAL JOINT FITTINGS – RESTRAINT SYSTEM:

- A. Provide restraint devices for pipe consisting of multiple gripping wedges incorporated into a follower gland meeting requirements of AWWA A21.10.
 1. Mechanical joint restraint shall require conventional tools and installation procedures per AWWA C600, retaining full mechanical joint deflection during assembly and allowing joint deflection after assembly.
 2. Provide actuation of the gripping wedges ensured with torque limiting twist off nuts.
 3. Provide restraint devices Listed by Underwriters Laboratories (3 inch through 24 inch).
 4. Gland body, wedges and wedge actuating components must be domestic manufactured in the USA.
- B. Working Pressure Rating:
 1. 18-inch thru 48-inch: 250 psi.
 2. Minimum safety factor: 2 to 1.
- C. Materials:
 1. Gland body, wedges and wedge actuating components: Grade 65-45-12 ductile iron in accordance with ASTM A536.
 2. Ductile iron gripping wedges: Heat treated, 370 to 470 BHN.
 3. Provide three (3) test bars incrementally poured per production shift as per Underwriter's Laboratory (U.L.) specifications and ASTM A536. Testing for tensile, yield and elongation in accordance with ASTM E8.
 4. Provide chemical and nodularity tests performed as recommended by the Ductile Iron Society, on a per ladle basis.
 5. Provide an identification number consisting of year, day, plant and shift (YYDDD)(plant designation)(Shift number) cast into each gland body.

6. Record all physical and chemical test results such that they can be accessed via the identification number on the casting. Provide the Material Traceability Records (MTRs) available, in hard copy.
7. Provide coating for restraint devices consisting of the following:
 - a. Process all wedge assemblies and related parts through a phosphate wash, rinse and drying operation prior to coating application.
 - b. Coating: A minimum of two coats of liquid thermoset epoxy coating with heat cure to follow each coat.
 - c. Surface pretreat all casting bodies with a phosphate wash, rinse and sealer before drying. The coating shall be electrostatically applied and heat cured. Coating: Polyester based powder to provide corrosion, impact and UV resistance.
 - d. Coating system: MEGA-BOND by EBAA Iron, Inc.

D. Manufacturer:

1. EBAA Iron MEGALUG Series 1100

2.06 PIPE COATING:

- A. Outside surfaces of piping not encased in concrete: Two coats of high solids NSF 61 certified polyamidoamine epoxy, Themec Series N140 Pota-Pox Plus, or acceptable equivalent product.
- B. Outside surfaces of piping encased in concrete: No coating.
- C. Machined surfaces cleaned and coated with rust-preventative compound at shop.

2.07 CEMENT LINING:

- A. Inside of pipe and fittings: Provide double thickness cement lining and bituminous seal coat conforming to AWWA A21.4.

2.08 GASKETS, BOLTS, AND NUTS:

- A. Provide Type 316 stainless steel bolts, washers, and nuts for all services.

PART 3 - EXECUTION

3.01 HANDLING AND CUTTING:

- A. Mark pipe and fittings "Rejected" and remove from site when cracked or has received a severe blow.

- B. If permitted, cut on sound barrel at a point at least 12 inch from visible limit of crack, at Contractor's expense.
- C. Machine cut with milling type cutters, knives, or saws. Snap cutters, torch, or hammer and chisel NOT ALLOWED. Examine for possible cracks.
- D. Chamfer cut ends if used for push-on joints.

3.02 INSTALLATION:

- A. Visually inspect before installation.
- B. Pitch piping toward low points. Provide for draining low points.
- C. Before assembly, remove dirt and chips from inside pipe and fittings.
- D. Pipe and fittings:
 1. Remove and replace defective pieces.
 2. Clear of all debris and dirt before installing and keep clean until accepted.
 3. Lay accurately to lines and grades indicated or required. Provide accurate alignment, both horizontally and vertically.
 4. Provide firm bearing along entire length of buried pipelines.
 5. Do not allow deflection of alignment at joints to exceed permissible deflection as specified below:

PIPE DEFLECTION ALLOWANCES

Maximum permissible deflection, inches*		
Size of pipe, inches	Push-on joint	Mechanical joint
24	11	9
* Maximum permissible deflection for 20-foot lengths; for other lengths in proportion of such lengths to 20-feet.		

- a. For push-on joint or similar pipe, clean bell of excess tar or other obstruction and wipe out before inserting next pipe spigot. Shove new pipe into place until properly seated and hold securely until joint completed.
- b. Set castings to be encased in concrete accurately with bolt holes, if any, carefully aligned. Clean off rust and scale before setting.

- E. Temporary Plugs: When pipe laying not in progress, close open ends of pipe with temporary watertight plugs. If water in trench, do not remove plug until danger of water entering pipe passed.

3.03 JOINTS AND COUPLINGS:

A. Push-on Joints:

1. Insert gasket into groove bell. Apply thin film of nontoxic gasket lubricant over inner surface of gasket in contact with spigot end.
2. Insert chamfered end into gasket. Force pipe past it until it seats against socket bottom.

B. Bolted Joints:

1. Remove rust-preventive coatings from machined surfaces.
2. Clean pipe ends, sockets, sleeves, housings, and gaskets and smooth all burrs and other defects.
3. Use torque wrench to tighten to correct range of torque not to exceed values specified below:

TORQUE RANGE VALUES		
Nominal pipe size, in	Bolt diameter, in	Range of torque, ft-lbs
24	3/4	75-90

C. Mechanical Joints:

1. Wire brush surfaces in contact with gasket and clean gasket.
2. Lubricate gasket, bell, and spigot with soapy water.
3. Slip gland and gasket over spigot, and insert spigot into bell until seated.
4. Seat gasket and press gland firmly against gasket.
5. After bolts inserted and nuts made finger-tight, tighten diametrically opposite nuts progressively and uniformly around joint by torque wrench. Torque bolts to values specified above.

3.04 FIELD PAINTING:

- A. Contractor to touch-up damaged shop coating with identical product and dry film thickness.

3.05 CONTRACT CLOSEOUT:

- A. Provide in accordance with Section 01700.

END OF SECTION

SECTION 02701

EXFILTRATING BIORETENTION AREAS

PART 1 - GENERAL

1.01 SUMMARY:

A. Section Includes:

1. Geotextiles.
2. Aggregate Layers.
3. Drainage Overflow Structure.
4. Bioretention Soil Materials.
5. Planting and Seeding.

1.02 STANDARDS:

Except as modified herein, comply with the current edition of the following standards:

A. American Association of State Highway and Transportation Officials (AASHTO):

1. AASHTO M105 - Gray Iron Castings.

B. ASTM International:

1. ASTM D75 - Standard Practice for Sampling Aggregates.
2. ASTM D1883 - Standard Test Method for California Bearing Ration (CBR) of Laboratory Compacted Soils.
3. ASTM D5856 - Standard Test Method for Measurement of Hydraulic Conductivity of Porous Material using a Rigid Wall Compaction Mold Permeameter.

C. American Standard for Nursery Stock

1.03 SUBMITTALS:

A. Aggregates: Prior to delivery of aggregates, the supplier must provide the following certificates:

1. Location of material source.
2. That stone is double washed.

3. Test results for gradation, smoothness, and percentage of wear.
- B. Aggregate Samples: Prior to delivery of aggregates, take at least one initial sample in accordance with ASTM D 75. Collect each sample by taking three incremental samples at random locations from source material to make a composite sample. Repeat sampling procedure when source of material is changed or when deficiencies or variations from specified grading of materials are found in testing.
 - C. Stone aggregates: Coarse aggregate used in the construction of the storage reservoir of bioretention systems shall be clean, double washed stone, defined as maximum wash loss of 0.5% when tested with AASHTO T-11. At least 14 working days before construction, the Contractor shall submit to Engineer for approval the product certificate including the AASHTO T-11 test results and gradation for the stone. AASHTO #5, and AASHTO #57 stone are acceptable gradations for the crushed stone reservoir.
 - D. Pea gravel: Pea gravel shall be used as indicated. No geotextile fabric shall be used as horizontal separation at any level within bioretention systems. The pea gravel used in the construction of the storage reservoir of bioretention systems shall be clean, double washed stone, defined as maximum wash loss of 0.5% when tested with AASHTO T-11. At least 14 working days before construction, the Contractor shall submit to Engineer for approval the product certificate including the AASHTO T-11 test results and gradation for the stone. AASHTO #8 stone is the acceptable gradation.
 - E. Soil Samples: Submit, in air-tight containers, 5 lb. sample of each type of Bioretention Soil to testing laboratory.
 - F. Materials Source: Submit name of imported materials source.
 - G. Topsoil: Prior to delivery of topsoil, the supplier must provide the location where topsoil was originally harvested along with results of topsoil analysis and written recommendations by an independent laboratory or university laboratory recognized by the State Department of Agriculture with the experience and testing capability to conduct the topsoil testing indicated below.
 - H. Topsoil samples analyzed must be obtained for analysis from source location no earlier than 90 days prior to the beginning of construction. Testing methods and written recommendations shall comply with USDA's Handbook No. 60 and shall include the following:
 1. Percentages of organic matter as conducted in conformance with ASTM D2974 (loss on ignition test).
 2. USDA gradation of sand, silt and clay content.
 3. Cation exchange capacity (CEC).

4. Nutrient levels by parts per million including phosphorous, potassium, magnesium, manganese, iron, zinc, and calcium. Nutrient test shall include the testing laboratory recommendations for supplemental additions to the soil for optimum growth of the plants specified.
 5. Deleterious material.
 6. Soluble Salt Content.
 7. pH, buffer pH, and recommendations to obtain optimal pH factor.
- I. Compost: At least 14 working days in advance of construction and before delivery of compost, Contractor must submit the following to the Engineer for approval:
1. Sample: A 1-gallon sample of compost that represents compost to be used on actual project in a sealed plastic bag.
 2. Technical data sheet showing the following:
 - a. Feedstock percentage in the final compost product.
 - b. A statement that the compost meets federal and state health and safety regulations.
 - c. A compost technical data sheet from the vendor of the compost. The analysis and report must be consistent with the sampling and reporting requirements of the US Composting Council Seal of Testing Assurance (STA) program as described herein and must demonstrate that the compost meets the physical requirements specified in Table 6 of this specification. The date of analysis shall be no more than 90 calendar days prior to the date of submittal.
- J. Engineered Bioretention Soil: Prior to delivery of the engineered bioretention soil mixture, the supplier must provide the following documentation to the Engineer for approval:
1. Results of the analysis on final engineered bioretention soil mixture, and written report by a qualified soil testing laboratory with the experience and testing capability to conduct the bioretention soil testing indicated below.
 2. Particle gradation analysis as conducted in conformance with ASTM C117/C136 (AASHTO T11/T27). The gradation of the mixture shall meet the following gradation criteria using sieve sizes listed in the table below:

Table 1: Gradation Criteria

Sieve Size	Percent Passing
1 inch	100
#4	75-100
#10	40-100
#40	15-50
#100	5-25
#200	3-6

3. Percentages of organic matter as conducted in conformance with ASTM D 2974 (loss on ignition test), pH, and buffer pH.

K. Drainage and Erosion Control Geotextiles: Product certificates and manufacturer's information.

L. Plants and Seeds

1. Certify, invoice, and order plants for each shipment grown locally in a nursery free of disease and insect pests. Submit certificates to Engineer.
2. For seed mixtures, certificates from the seed vendor(s) shall be submitted to the Engineer for approval at least two weeks prior to application. The certificates shall state the botanical name, common name, number of seeds per unit of weight, germination percentage, the amount of undesirable plant seeds present in the mixtures, date of production and of packaging, and name and address of supplier(s).
3. Submit list of plant material to be used and source at least two weeks prior to planting.

1.04 QUALITY ASSURANCE:

- A. All work shall be performed in accordance with all applicable Federal, State, and Local regulations and permits associated with the project.
- B. Furnish each Bioretention material from single source throughout the Work.
- C. Maintain one copy of certificates and documents on-site.

PART 2 – PRODUCTS

2.01 AGGREGATE LAYERS:

- A. Sand: Clean Natural Sand in accordance with the Aggregates section of the current MassDOT Standard Specifications for Construction.
- B. Coarse aggregate shall consist of clean, tough, durable fragments of crushed stone, or crushed gravel, conforming to the gradations in the following tables and shall also meeting the following:
 - 1. Be double washed, sufficient to remove dust and other coatings, and defined as meeting <0.5 % wash loss when tested with AASHTO T-11.
 - 2. Be free from clay balls, organic matter, and other deleterious substances.

Table 2: Gradation for Base Courses

Pea Gravel	Bioretention Storage/Drainage Layer
AASHTO No. 8	AASHTO No. 5 or No. 57

Table 3: Crushed Stone Gradation Requirements for AASHTO #57

U.S. Standard Sieve Size	Percent Passing
1 ½" (37.5 mm)	100
1" (25 mm)	95-100
½" (12.5 mm)	25-60
No. 4 (4.75 mm)	0-10
No. 8 (2.36 mm)	0-5

Table 4: Gradation requirements for AASHTO #5

U.S. Standard Sieve Size	Percent Passing
1 ½" (37.5 mm)	100
1" (25 mm)	90-100
¾" (19 mm)	20-55
½" (12.5 mm)	0-10

- 3. Pea Gravel shall be a clean, double washed pea gravel following AASHTO No. 8 gradation.

Table 5: Gradation requirements for AASHTO #8

U.S. Standard Sieve Size	Percent Passing
½" (12.5 mm)	100
¾" (9.5 mm)	85-100
No. 4 (4.75 mm)	10-30
No. 8 (2.36 mm)	0-10
No. 16 (1.16 mm)	0-5

2.02 ENGINEERED BIORETENTION SOIL:

- A. The engineered bioretention soil shall consist of a mixture containing the soil components and amendments listed below. The engineered bioretention soil shall be thoroughly mixed off site at a clean location. The material shall be well mixed, homogenous, loose friable, have no visible free water, and be free of wood pieces, plastic and other foreign matter. The soil mixture shall be protected from all sources of contamination, including weed seeds, while at the supplier, in conveyance and at the project site.

- B. The soil mixture shall, with the addition of approved amendments, meet the following criteria:
 - 1. Final organic matter content between 10 and 20 percent.
 - 2. pH of 5.5 to 7.0.
 - 3. Consist of a blend of the following components by volume, for the bottom 18 inches of the bioretention filter layer:
 - a. 60% Sand.
 - b. 30% Topsoil / Loam.
 - c. 10% Shredded Wood.

For the top 6 inch layer of the bioretention filter layer, a 10% compost shall be added to the mix listed above.

- C. Sand: Clean Natural Sand in accordance with the Aggregates section of the current MassDOT Standard Specifications for Construction.

- D. Topsoil/Loam:
 - 1. Shall be free of subsoil, stones 1 inch or larger in any dimension, dense material, hardpan, slag, clay, cinders, sod, roots, sticks, poison ivy, crabgrass, cough grass, noxious weeds, and foreign matter including but not limited to glass, metal,

asbestos, toxins, hazardous wastes, petroleum product contamination, lead and chemicals (such as atrazine and muriatic acid) that may be injurious to humans, animals and plant material.

2. Topsoil / Loam shall have a pH of 5.5 to 7.0, soluble salt content not to exceed 500 parts per million, and shall be composed of approximately 10% sand, 40% silt, 40% clay, with not more than 10% organic matter.

E. Compost:

1. Compost must be mature/stabilized, humus like material aged 12 months and shall be the result of biological degradation and transformation under conditions designed to promote aerobic decomposition. The compost must have a dark brown or black color, be capable of supporting plant growth with ongoing addition of fertilizers or other soil amendments, must not have an objectionable odor and be stable with regard to oxygen consumption and carbon dioxide generation.
2. Compost feedstock may include, but is not limited to: agricultural, food, or industrial residuals, class A biosolids, as defined in the EPA CFR, Title 40, Part 503; yard trimmings, source separated municipal solid waste, or other material designated compostable as defined 1994 PA 451, Part 115 and must be in compliance with all federal and state laws.
3. Compost must be free of plastic, glass, metal and other physical contaminants, substances toxic to plants, over 5% sand, silt, clay, or rock, material by dry weight, as well as viable weed seeds and plant parts capable of reproducing (except airborne weed species).
4. The product must meet all applicable US EPA CFR Title 40, Part 503 Standards for Class A biosolids. The compost moisture content must be such that no visible free water or dust is produced when handling it. The preferred range of moisture content for finished compost is 40-50 percent.

Table 6: Compost Requirements

Parameters	Reported as (units of measure)(a)	Range (b)
pH	pH units (TMECC 04.11-A)	6.0 - 8.5
Soluble Salt Concentration (<i>electrical conductivity</i>)	dS/m (mmhos/cm) (TMECC 04.10-A)	maximum 5
Moisture Content	%, wet weight basis (TMECC 03.09-A)	30 – 60
Organic Matter Content	%, dry weight basis (TMECC 05.07-A)	30 – 65

Medium Grade Particle Size (<i>aggregate size</i>)	% passing a selected mesh size, dry weight basis (TMECC1 02.02-B)	2-inch 100% 1-inch 90% minimum ¾-inch 65% minimum ¼-inch 50% maximum
Fine Grade Particle Size (<i>aggregate size</i>)	% passing a selected mesh size, dry weight basis (TMECC1 02.02-B)	¾-inch or smaller 98% minimum
Stability Carbon Dioxide Evolution Rate	mg CO ₂ -C per g OM per day (TMECC 05.08-B)	< 8
Maturity Seed Germination	%, compared to control (TMECC 05.05-A)	≥ 80%
Trace Elements/Heavy Metals	ppm (mg/kg) on dry weight basis (TMECC 04.06):	Meets or exceeds US EPA Part 503 EQ Concentration Limits
Arsenic	ppm (mg/kg) on dry weight basis (TMECC 04.06):	< 41
Cadmium	ppm (mg/kg) on dry weight basis (TMECC 04.06):	< 39
Copper	ppm (mg/kg) on dry weight basis (TMECC 04.06):	< 1,500
Lead	ppm (mg/kg) on dry weight basis (TMECC 04.06):	< 300
Mercury	ppm (mg/kg) on dry weight basis (TMECC 04.06):	< 17
Molybdenum	ppm (mg/kg) on dry weight basis (TMECC 04.06):	< 75
Nickel	ppm (mg/kg) on dry weight basis (TMECC 04.06):	< 420
Selenium	ppm (mg/kg) on dry weight basis (TMECC 04.06):	< 100
Zinc	ppm (mg/kg) on dry weight basis (TMECC 04.06):	< 2,800
Pathogens	MPN/4 grams or MPN/gram of total solids (TMECC 07.01-B)	Salmonella < 3 MPN/4 grams of total solids or Fecal Coliform <1000 MPN/gram of total solids
Inert contamination (man-made)	%, dry weight (TMECC 03.08-A)	< 1.0% (no visible plastic, glass or metal allowed)

- a. Based on Test Methods for the Examination of Composting and Compost (TMECC) standard listed.
- b. In the event that the requirements of any of the referenced standards and specifications conflict with each other, the more stringent requirement shall prevail.

2.03 GEOTEXTILES

A. Drainage Geotextile: For use as a soil separator where indicated on the Drawings. Woven needle punched geotextile, manufactured for subsurface drainage applications, made from polyolefins or polyesters; with elongation greater than 50 percent meeting the requirements below:

1. Apparent opening size: No. 70 to 100 sieve, maximum ASTM D 4751.

2. Minimum Grab Tensile Strength: 200 lb.; ASTM D4632. Minimum Weight: 6 oz./sq. yd.

2.04 PLANTING AND SEEDING:

- A. Seed the Exfiltrating Bioretention Areas with a wetland seed mix, such as New England Wetland Plants (www.newp.com, 413-548-800) New England Wetmix, or approved equal. Sow at one pound/2,500 square feet (eighteen pounds (185) lbs. per acre. Seed composition shall be comprised of the following, or approved equal: fox sedge (*Carex vulpinoidea*), blunt broom sedge (*C. scoparia*), lurid sedge (*C. lurida*), hop sedge (*C. lupulina*), fowl bluegrass (*Poa palustris*), beggar ticks (*Bidens frondosa*), green bulrush (*Scirpus atrovirens*), swamp milkweed (*Asclepias incarnata*), fringed sedge (*Carex crinita*), New York ironweed (*Vernonia noveboracensis*), soft rush (*Juncus effusus*), starved/calico aster (*Aster lateriflorus/Symphotrichum lateriflorum*), blue flag (*Iris versicolor*), American mannagrass (*Glyceria grandis*), square stemmed monkey flower (*Mimulus ringens*), and spotted Joe Pye weed (*Eupatorium maculatum/Eutrochium maculatum*)

Install perennials and grasses as indicated on the Drawings

2.05 TEMPORARY EROSION CONTROL SEED:

- A. Definition: A nurse or cover crop seed used to stabilize the soil surface to help mitigate erosion. Temporary erosion control seed should only be installed when finish grading occurs outside of the allowable planting/seeding period. Temporary erosion control seed may also be incorporated into the permanent seed mix if indicated on Drawings.

PART 3 – EXECUTION

3.01 OBSERVATION OF THE WORK:

- A. The Engineer shall be informed of the progress of the work so that the work may be observed at key critical stages of construction including completion of excavation and subgrade work, completion of installation of geotextile and double washed stone aggregate (crushed stone and pea gravel) and installation of planting soil. The Engineer shall be afforded a minimum of three (3) working days' notice to schedule visits to the site. Failure of the Engineer to make field observations shall not relieve the Contractor from meeting all the requirements of this specification.

3.02 SUBGRADE SOIL COMPACTION

- A. It is very important to minimize compaction of both the base of the bioretention area and of the side-slopes of the excavation. Operate equipment adjacent to, and not within the footprint of the bioretention areas whenever possible. Equipment operation within the

facility should be avoided to prevent soil compaction. If machinery must operate in the facility, use lightweight, low ground contact pressure equipment (no more than 4 psi) and ensure that existing ground infiltration rate has not been reduced as a result.

- B. Use of equipment with narrow tracks or narrow tires, rubber tires with large lugs, or high-pressure tires will cause excessive compaction resulting in reduced infiltration rates and is not acceptable. Improper compaction will significantly contribute to design failure.
- C. No storage of equipment, materials, debris, or any other items shall be allowed in the areas designated as bioretention areas on the Drawings for any length of time.
- D. Excavation or placement of material will not be allowed if any portion of the bioretention area is wet or saturated or has been subjected to more than ½ inch of precipitation within 48 hours prior to the proposed construction activities. The Engineer shall have final authority to determine if wet or saturated conditions exist.

3.03 EXCAVATION:

A. Excavation:

- 1. Excavate bottom of bioretention areas to the depth shown on the Drawings. Do not use heavy equipment within any area designated as a bioretention area shown on the Drawings. The existing native subgrade material under all bed areas shall NOT be compacted or subject to excessive construction equipment traffic prior to stone bed placement.
- 2. Rototill or scarify surface of subgrade to a depth of 6 inches with the teeth of the backhoe or loader bucket, or other suitable device. Bring subgrade to line, grade, and elevations indicated. Fill and lightly regrade any areas damaged by erosion, ponding, or traffic compaction before the placing of the geotextile fabric.

3.04 OVERFLOW STRUCTURES:

- A. Provide storm inlet for Exfiltrating Bioretention Area No.2 as indicated on the Drawings.
- B. Provide overflow spillway with riprap apron for Exfiltrating Bioretention Area No.1 as indicated on the Drawings.
 - 1. Spillway elevation shall be set as specified on the Drawings.
 - 2. The spillway shall be 3' in length, and 1' in breadth.
 - 3. The spillway shall be lined with a woven geotextile fabric layer and stone riprap to avoid erosion of the spillway. The nonwoven geotextile fabric shall comply with Section 2.03.

4. The spillway shall be followed by a riprap apron at the outlet side. The upstream end of the apron, adjacent to the spillway outlet, shall have a width two (2) times the diameter of the spillway length.

3.05 AGGREGATE LAYERS:

- A. Inspection: The contractor shall notify the engineer a minimum of 7 days prior to aggregate placement work to inspect the preparation of subgrade. The Engineer shall examine the site conditions and provide written approval that design conditions and elevations have been met.
- B. Prior to aggregate installation the Contractor shall do the following:
 1. Verify subgrade preparation, elevations, steepness of side slopes, basin dimensions and placement, overflow structure rim and invert elevations.
 2. Do not install aggregates in overly wet conditions or when wet weather is anticipated within 2 days.
 3. Clean all construction debris and sediment within the placement area.
- C. Immediately after approval of the subgrade, place geotextile along the sides of the excavation. Any accumulation of debris or sediment which has taken place after approval of subgrade shall be removed prior to installation of geotextile or aggregate at no extra cost to the Owner.
- D. Install coarse aggregate (crushed stone and pea gravel) in lifts no greater than 8-inches. Lightly compact each lift with equipment, keeping equipment movement over storage bed subgrades to a minimum. Install aggregate to grades indicated on the Drawings.
- E. Following placement of bed aggregate, the geotextile along the sides of the excavation shall be folded back along all bed edges to protect from sediment washout along bed edges. At least a four-foot edge strip shall be used to protect the filter bed from adjacent bare soil. This edge strip shall remain in place until all bare soils contiguous to beds are stabilized and vegetated. In addition, take any other necessary steps to prevent sediment from washing into beds during site construction.
- F. Make adjustments in placing procedures or equipment to obtain true grades, minimize segregation and degradation to reduce or increase water content, and ensure a satisfactory aggregate base course.

3.06 PROTECTION:

- A. Runoff Control: Construction site runoff from disturbed areas shall not be allowed to enter the bioretention basins during construction. Contractor shall use sediment control measures and flow diversions as necessary to prevent construction site runoff

from entering the bioretention basins during any of the construction phases until the bioretention system is finalized and stabilized.

- B. Contractor shall not construct bioretention basins until all contributing drainage areas are stabilized to the satisfaction of the Engineer. Do not use the bioretention basins as temporary sediment control facilities during construction. Any sediment that enters the bioretention basins during construction shall be removed by the Contractor at no cost to the Owner. The double washed aggregate used within the bioretention system shall remain free of sediment.

3.07 BACKFILLING:

- A. Bioretention Soil: Place Engineered Bioretention Soil in 8" lifts over all areas designated as bioretention areas. Compact soil to a maximum of 75- 85% Proctor density according to ASTM D698. Compaction can be obtained by lightly tamping with bucket as necessary. Test planting soil compaction after placing each lift and at completion using a densitometer or soil- compaction meter calibrated to a reference test value based on laboratory testing according to ASTM D698.
- B. Soil media will be considered defective if it does not pass tests and inspections and should be replaced or restored as directed by Engineer. Place soil with equipment located outside the bioretention excavation. No equipment shall be allowed to drive across installed locations. Any soil observed being driven on may be subject to removal and reinstallation at Contractor's own expense. Contractor shall gain approval from Engineer of installation method prior to beginning installation. Contractor shall provide three (3) working days' notice to Engineer prior to beginning installation.
- C. Final Grading: Grade bioretention soil media to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades. Stabilize in accordance with applicable local regulatory requirements. Avoid erosion of bioretention areas from overwatering, foot traffic, or machine compaction. Repair any damaged areas and areas that have the potential to cause erosion or have caused erosion at no cost to the Owner.
- D. Topsoil: Install topsoil per seeding specification on side slopes. Do not place topsoil over the bioretention soil.
- E. Temporary Erosion Control Seeding: If final grading occurs outside of the recommended planting period, seed entire bioretention basin with temporary erosion control seed mixture as per seeding specification. Irrigate daily until vegetation germinates.
- F. Erosion Control Geotextile: Install erosion control geotextile on all regraded side slopes surrounding all bioretention areas. Install geotextile immediately after finish grading is complete. Install geotextile per manufacturer's instructions.

3.08 PLANTING AND SEEDING:

- A. Seed as per Drawings between April 15 and October 15. Seed mix may be applied by hydroseeding or by hand.
- B. Install plants per numbers and species indicated on Drawings between June 1 and September 15. Protect all slopes and bottom surfaces of bioretention areas from erosion and rutting until planting can be completed.
- C. To install plants, excavate with vertical sides and in accordance with following requirements:
- D. Plant herbaceous plant stock in pits greater in width than diameter of root ball and as necessary to properly set plant at finished grade.
- E. Set plants in center of pits, plumb and straight and at level that top of root ball is 1 inch lower than surrounding finished grade after settlement.
- F. Compact topsoil mixture thoroughly around base of root ball to fill all voids, when plant material is set. Add slow-release fertilizer in accordance with manufacturer's recommendations and backfill tree and shrub/herb pits halfway with planting soil mixture and thoroughly puddle before backfilling tree or shrub/herb pit to remove any air pockets.
- G. Immediately after plant pit is backfilled, form a shallow saucer slightly larger than pit with ridge of soil to facilitate and contain watering.
- H. Seeding and planting shall not occur when the ground is frozen, snow covered, inundated, or otherwise unsuitable. All seeds shall be watered within the same working day on which they are sown. Seeded areas and installed plants shall be watered at a minimum of twice per week for three weeks immediately following sowing/planting, adjusted as local rainfall conditions allow, to allow vegetation to successfully establish, unless otherwise directed by the Engineer.
- I. Install a 1" shredded wood mulch in between the plant plugs. Woodchips should be shredded wood, free of chemicals and dies.
- J. Seed and plants shall be protected from herbivores and other vectors which threaten the establishment of the vegetation

3.09 TOLERANCES

- A. Comply with Quality Requirements.

- B. Finish Grades: plus or minus 1/2-inch.
- C. Overflow Riser Elevation: plus or minus 1/2-inch.

3.11 PROTECTION OF INSTALLED WORK

- A. Prohibit construction traffic over topsoil.

END OF SECTION

SECTION 02820

CHAIN LINK FENCES AND GATES

PART 1 - GENERAL

1.01 DESCRIPTION:

A. Section includes:

1. Chain link fence framework, fabric, and accessories.
2. Excavation for post bases.
3. Manual gates and related hardware.

B. Design Criteria:

1. 6 ft. high fence as indicated with top rail, and bottom tension wire.

1.02 REFERENCES:

A. American Association of State Highway and Transportation Officials (AASHTO):

1. M181: Standard Specification for Chain-Link Fence.

B. ASTM International (ASTM):

1. A53/A53M: Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
2. A392: Standard Specification for Zinc-Coated Steel Chain-Link Fence Fabric.
3. F567: Standard Practice for Installation of Chain-Link Fence.
4. F654: Standard Specification for Residential Chain Link Fence Gates.
5. F900: Standard Specification for Industrial and Commercial Swing Gates.
6. F1184: Standard Specification for Industrial and Commercial Horizontal Slide Gates.

C. Chain Link Fence Manufacturers Institute (CLFMI):

1. PM 2445: Chain Link Fence Manufacturers Institute Product Manual.

1.03 SUBMITTALS:

- A. Submit the following in accordance with Section 01300.
 - 1. Submit Manufacturer's specifications, drawings, details and fence layout with appurtenances.
 - 2. Submit two samples of fencing materials. Mark or tag each sample and submit 30 days prior to erection of fence.
 - 3. Submit certified test reports with results of tests for fence finish.
 - 4. Submit shop drawings, samples and certificates simultaneously as one complete package.

1.04 SPARE PARTS:

- A. Comply with the requirements specified in Section 01600.

1.05 QUALITY ASSURANCE:

- A. Comply with the requirements specified in Section 01400.
- B. Sustainability Standards Certifications.

1.06 DELIVERY STORAGE AND HANDLING:

- A. Comply with the requirements specified in Section 01610.

PART 2 - PRODUCTS

2.01 SYSTEM DESCRIPTION:

- A. General. Entire chain link fence and gate system shall be:
 - 1. Vinyl coated galvanized steel. The color of the vinyl coating shall be black as selected from manufacturer's samples by the Engineer. Entire chain link fence (pipe/tube and fittings) and gate system shall be fuse bonded heavy mil vinyl coated galvanized steel.
- B. Conform to CLFMI PM 2445 for the specified use.
- C. Provide chain link fence in accordance with AASHTO M181; ASTM F-668, M-181 Class 2B.
- D. Provide framework, fabric, accessories and gates in accordance with ASTM F567.
- E. Fence heights as indicated with top rail, and bottom tension wire
- F. Steel pipe dimensions and weights: SS-40. Dimensions specified are nominal pipe sizes.

- G. Dimensions and weight tolerances: Plus or minus 5%.
- H. Gates:
 - 1. Industrial:
 - a. Provide swing gates in accordance with ASTM F900.
 - b. Provide horizontal slide gates in accordance with ASTM F1184.
- 2.02 FENCE FABRIC:
 - A. Colored PVC-coated steel fabric with galvanized and factory-painted steel posts, hardware, and fittings.
 - B. Fabric woven in 2-inch mesh from PVC coated wire in 6 feet height. PVC coating thermally fused and bonded over galvanized plastic primed commercial quality steel wire with minimum coating thickness of 7 mils. Coated wire 9-gage with minimum breaking strength of 1,200 lbs. Color to be selected to match total fence system (0.40 oz. of zinc per sq. ft. of surface).
- 2.03 TENSION WIRE:
 - A. Color matched PVC coated No. 6 gage outside diameter, zinc coated coil spring steel wire having 0.40 oz of zinc coating per sq. ft. of wire surface.
- 2.04 TIE WIRES:
 - A. Tie wires, for fastening fence fabric to line posts and rails, not less than 9 gage (outside diameter) color matched PVC coated galvanized steel wire.
- 2.05 LINE POSTS:
 - A. 2-3/8 inches outside diameter steel pipe weighing not less than 3.65 lb/ft, or 1-7/8 inch high carbon steel H-beams weighing not less than 2.70 lb/ft.
- 2.06 END, CORNER, AND PULL POSTS:
 - A. 2-7/8 inch outside diameter steel pipe weighing not less than 5.79 lb/ft , or 2-1/2 inch square steel tube weighing not less than 5.14 lb/ft, or 3-1/2 inch by 3-1/2 inch roll-formed, steel corner section weighing not less than 5.14 lb/ft .
- 2.07 GATE POSTS:
 - A. 2-7/8 inches outside diameter steel pipe and gate posts, for gate leaves up to and including 6 feet wide, weighing not less than 5.79 lb. per ft., or 2-1/2 inch square steel tube weighing not less than 5.14 lb. per ft., or 3-1/2 inch by 3-1/2 inch roll-formed, steel corner section weighing not less than 5.14 lb/ft.

- B. 4 inch outside diameter steel pipe, gate posts for gate leaves over 6 feet wide and up to and including 13 feet wide and weighing not less than 9.10 lb/ft.
 - C. 6-5/8 inch outside diameter steel pipe, gate posts for gate leaves over 13 feet wide and up to and including 18 feet wide and weighing not less than 18.97 lb/ft.
- 2.08 RAILINGS:
- A. 1-5/8 inch outside diameter steel pipe with minimum weight of 2.27 lb/ft or 1-5/8 inch by 1-1/4 inch, 14-gage roll-form section, for top railing and railings for top middle and bottom braces between terminal posts and adjacent line posts.
- 2.09 TRUSS:
- A. 3/8 inch diameter steel rod diagonal truss braces between terminal and adjacent line posts and for gate framework.
- 2.10 FITTINGS:
- A. Heavy-duty malleable iron or pressed steel fittings of suitable size to produce strong construction.
- 2.11 STRETCHER BARS:
- A. Flat bars with minimum cross section dimensions of 1/4-inch by 3/4 inch, full height of fabric, secured with bar bands of minimum 11-gage sheet steel, spaced approximately 15 inches on centers and bolted with 3/8-inch diameter bolts, for attaching fabric to terminal posts.
- 2.12 GATE LEAF FRAMEWORK:
- A. 1-7/8 inch outside diameter steel pipe weighing 2.72 lb/ft, minimum.
- 2.13 GATE HINGES:
- A. Heavy pattern of adequate strength for gate size, with large bearing surfaces for clamping or bolting in position.
- 2.14 LATCH:
- A. Gates with suitable latch, accessible from both sides and with provision for padlocking.
- 2.15 GATE PADLOCKS:
- A. Manufacturers:
 1. Eaton Corp. Lock & Hardware Div., Yale Marketing Dept., Charlotte, NC.
 2. P&F Corbin, Div. of Emhart Corp., Berlin, CT.

3. Best Universal Lock Co., Inc., Indianapolis, IN. Solid brass cases hardened steel shackles, removable core cylinders, and galvanized steel chains attached to shackle by a clevis.

2.16 CONCRETE FOOTINGS:

- A. Section 03300 Cast-In-Place Concrete, Class A concrete.

2.17 GROUT:

- A. One part Portland cement and three parts of clean, sharp, well-graded sand with minimum water for proper workability for posts set in solid rock.

2.18 ACCESSORIES:

- A. Steel pipe dimensions and weights: ASTM A53/A53M, Schedule 40. Dimensions specified are nominal pipe sizes.
- B. Dimensions and weight tolerances: Plus or minus 5 percent.
- C. Zinc Coating: Minimum 2.0 ounces per square foot.
- D. Provide posts with tops of same material, and designed to fit securely over post and carry top rail. Carry apron around outside of post at base of top fitting.
- E. Ferrous metal fittings, posts, fence, gate framework, and accessories galvanized with heavy coating of 2.0 oz/ft² pure zinc spelter per square foot or surface area to be coated. Use hot-dip process. Thinner zinc coatings, electro-galvanizing, zinc paint or cold galvanizing compounds not used as substitute for hot-dipped galvanized finish not acceptable.
- F. Fabricate and weld before hot-dip galvanizing. Weld conforming to American Welding Society standards.
- G. Hot-dip galvanized gate frame, after welding, if bolted or riveted corner fittings not used.
- H. Galvanize fittings, posts, fence and gate framework, and accessories, then epoxy phenolic primed and top coated with matching PVC, using thermal bond process.
- I. Single and double leaf swing gates with center bolt, center stop, and automatic backstops.

PART 3 - EXECUTION

3.01 EXAMINATION:

- A. Examine conditions under which fence and gates are to be installed. Notify Engineer, in writing, of improper conditions of work.

- B. Do not proceed with work until unsatisfactory conditions have been corrected.
- C. Verify measurements at site.
- D. Check location of underground work to make sure fence footings clear utilities and drainage work.
- E. Do not install fence until final grading is complete and finish elevations are established.
- F. Do not drive equipment on areas to be landscaped, except as accepted by Engineer. Areas not accessible from roads shall be protected with heavy wood planking. Remove barricades and protection at completion of project. Repair damaged landscape surfaces.

3.02 INSTALLATION:

A. Footings:

1. Vertical sides to minimize up-lift. Dispose of excavated material in accordance with Section 01710 Cleaning Up.
2. Rod and compact concrete around posts. Slope top of footings above level of adjacent grade, and trowel finish.
3. Size:
 - a. 6 inches minimum diameter, plus outside dimension of post.
 - b. Set corner, end, pull, and gate posts 42 inches into concrete.
 - c. Set line posts set 36 inches into concrete.
 - d. Total depth of concrete 6 inches greater than required for post embedment.
4. Time of Set: 48 hours before rails are erected or before fabric is applied or stretched.

B. Framing:

1. Install line posts not more than 10 feet apart.
2. Install pull posts not more than 600 feet apart where a straight run of fence exceeds 600 feet and where fence line changes direction by more than 15 degrees but less than 30 degrees.
3. Install corner posts where the fence line changes direction by more than 30 degrees.
4. Set posts in concrete footings, plumb and true to line.
5. Brace and truss end, pull, corner, and gate posts to adjacent line posts. Provide brace to match top rail spaced midway between top rail and tension wire and extending to

adjacent line posts. Provide brace to match top rail spaced midway between top rail and tension wire and extending to adjacent line post. Truss diagonally with 5/16-inch diameter tension rod with turnbuckle.

6. Fasten top rail to end, pull, gate and corner posts. Pass top rail through fittings of line posts.
7. Provide expansion and contraction joints in top rail for each 100 linear feet of fence.
8. Fasten bottom tension wire to end, pull, gate, corner, and line posts.
9. Maximum area of unbraced fence shall not exceed 1,500 square feet.
10. Use galvanized sleeve and grout posts or install with suitable galvanized flange casings and galvanized anchor bolts as accepted by Engineer.
11. When rock is encountered, set posts into rock a minimum depth of 12 inches for line posts and 18 inches for terminal posts. If solid ledge is encountered without overburden of soil. Provide post holes at least 1 inch greater in diameter than post, fill post holes with concrete work post into hole taking care not to cause voids, remove excess concrete and crown remainder at top to shed water. Where solid rock is covered by overburden, do not exceed total setting depth required for setting in earth, grout posts into rock as described.

C. Fabric:

1. Place fabric on outside of posts and stretch to avoid bulging or buckling.
2. Fasten at line posts, top rail, and bottom tension wire with aluminum or zinc PVC coated ties. Space ties not more than 15 inches apart on line posts and not more than 24 inches apart on rail and tension wire.
3. Fasten at terminal posts at intervals not exceeding 15 inches using flat or beveled galvanized steel bands with 5/16-inch x 1-1/4 inch galvanized carriage bolts and nuts.
4. Make tie connections on interior side of fence.
5. Provide steel angle metal closures where finished ground surface is more than two inches below bottom tension wire. Bolt steel angle to fence posts, and install reinforcing rods and bracing members as accepted. Install rods of accepted length vertically. Where drainage ditches cross fence line, provide concrete ditch lining and steel reinforcing bar grill.
6. Install gates plumb, level, and secure for full width of opening and hardware adjusted for smooth operation.

7. Electrical Ground where a power line carrying more than 600 volts passes over fence, install ground rod at nearest point directly below each point of crossing.

3.03 REPAIR:

- A. Remove and replace fencing which is improperly located or is not true to line, grade and plumb within tolerances as indicated.
- B. Repair damaged vinyl-coated components as recommended by manufacturer.

3.04 CLOSEOUT ACTIVITIES:

- A. Provide in accordance with Section 01700.

END OF SECTION

SECTION 02850

PRE-FABRICATED BRIDGE

PART 1 - GENERAL

1.01 GENERAL:

A. Design, furnish and install the preengineered, prefinished, clear span bridge of welded construction on concrete foundations as indicated and as specified.

B. Bridge Configuration:

Type	Aluminum Truss
Span*	60 ft
Width	6'-2"
Height	4'-6"

* Contractor to coordinate bridge span with actual foundation as constructed.

C. The preengineered bridge components shall be provided by and be the product of a single manufacturer.

D. Contractor shall make modifications to the foundations as may be required for the specific bridge provided. All modifications are subject to the approval of the Engineer.

1.02 REFERENCES:

A. American Aluminum Association "Aluminum Construction Manual".

B. Aluminum Association Standard Anodic Finishes (AASAF).

C. American Welding Society AWS:

1. AWS D1.1: Structural Welding Code – Aluminum

2. Code for Welding in Bridge Construction

D. ASTM International (ASTM):

1. B 26: Specification for Aluminum-Alloy Sand Castings.

2. B 209: Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

3. B 211: Specification for Aluminum-Alloy Bars, Rods, Profiles and Tubes.

4. B 221: Specification for Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes.
 5. B241: Specification for Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube.
 6. B 247: Specification for Aluminum and Aluminum-Alloy Die Forgings, Hand Forgings and Rolled Ring Forgings.
 7. B308: Specification for Aluminum-Alloy 6061-T6 Standard Structural Shapes, Rolled or Extruded.
 8. B 429: Specification for Aluminum-Alloy Extruded Structural Pipe and Tube.
- E. International Code Council (ICC):
1. International Building Code
- F. Metal Bridge Manufacturers' Association:
1. Recommended Design Practices Manual
- G. Occupational Safety and Health Administration (OSHA)
1. Safety and Health Standards for the Construction Industry, 29 CFR 1926 Subpart R Safety Standards for Steel Erection.
- H. Public Right-of-Way Accessibility Guidelines (PROWAG)

1.03 SUBMITTALS:

- A. Shop Drawings: Submit the following in conformance with Section 01300:
1. Shop and erection drawings for all structural steel to be approved by Engineer prior to fabrication.
 2. Complete and checked shop and erection drawings for all aluminum components. Show materials, anchor rods, member and connection details, piece marks, appurtenances, shop and field bolting and welding in conformance with Aluminum Construction Manual, and AWS Structural Welding Code.
 3. Submit the welding procedure for each type of weld prior to welding.
 4. Qualification test reports bearing witness certification by an independent testing laboratory for each welder, welding operator and tacker to be employed in the work.

- B. Drawings shall bear the seal and signature of a structural engineer licensed in the state where the bridge is to be installed.
- C. Drawings shall include as minimum information:
 - 1. Span, depth, camber, weight and spacing of bridge elements.
 - 2. Bridge component interface connection bolts and welds.
 - 3. Gravity, wind and seismic design loadings, including concentrated loads and their points of application.
 - 4. Vertical and horizontal support reactions under the various design loading combinations.
 - 5. Member material specifications, sizes and gauges.
 - 6. Bridging member sizes, connections and locations.
- D. A certificate of design shall be submitted to the Engineer prior to the production of the pre-engineered bridge. The certificate of design shall be signed and sealed by a Professional Structural Engineer employed by the bridge manufacturer and holding current registration in the state where the bridge is to be installed.

1.04 QUALITY ASSURANCE:

- A. Provide in accordance with Section 01400 and as specified.
- B. The bridge manufacturer shall have been in the business of design and fabrication of bridges for a minimum of five years and provide a list of ten successful bridge projects, of similar construction, each of which has been in service at least three years. Provide the location, bridge size, owner, and a contact for reference for each project.
- C. The manufacturer shall provide a warranty against defects in material, workmanship and finish for a period of ten years.
- D. Design Responsibility:
 - 1. Submit the Certificate of Design to Engineer prior to manufacture of bridge components.
 - 2. Provide the following support data along with Certificate of Design:
 - a. Codes and specifications to which structural design conforms.
 - b. Certification, signed and sealed by a Professional Structural Engineer employed by the bridge manufacturer and holding current

registration in the state where the bridge is to be installed stating that all members, elements and connections are designed to withstand the required loads and forces.

E. Welding Qualification and Certification:

1. Furnish written welding procedure for all welds in conformance with the AWS D 1.1.
2. Each welder, welding operator and tack welder shall be certified by test to perform type of work required in conformance with AWS D 1.1.
3. If a welder or welding operator has not been engaged in a specific welding process for a period of six months or more, that individual shall be deemed unqualified and shall not perform work on the project until the individual has been qualified again by testing in conformance with AWS D 1.1.

F. Bridge shall be inspected by a Certified Weld Inspector that is qualified under the AWS QC-1 program. This inspection shall include as a minimum requirement the following: review of shop drawings, weld procedures, welder qualifications and weld testing reports, visual inspection of welds and verification of overall dimensions and geometry of the bridge. A report shall be produced indicating the above items were reviewed. The report shall be signed by the CWI, signifying compliance with AWS D1.1 codes.

1.05 DELIVERY, STORAGE AND HANDLING:

- A. Provide in conformance with Section 01610 and as specified.
- B. Transport, handle and store materials to protect from weather, rusting, corrosion or other damage.
- C. Store bridge components off the ground on supports.
- D. Cover and protect from snow, rain and ground splatter.
- E. Use nylon slings or padded cables for handling material. Do not drop or drag material.

PART 2 – PRODUCTS

2.01 DESIGN REQUIREMENTS:

- A. The design of the bridge shall be in accordance with the “Aluminum Construction Manual”; latest edition.

- B. Loading requirements shall be in accordance with 780 CMR, Ninth Edition Massachusetts amendments to the 2015 International Building code and to other codes and references indicated or specified.
- C. Design Criteria: In addition to bridge dead load, the bridge shall be designed for the following:
 - 1. Uniform Live Load: 90 pounds per square foot of deck area.
 - 2. Moving Concentrated Live Load: 2,000 pounds per foot of bridge width.
 - 3. Wind Load: Bridge shall be designed for a minimum ultimate design wind speed of 136 mph in accordance with the 780 CMR, Ninth Edition Massachusetts Amendments to the 2015 International Building Code. The wind shall be calculated on the entire vertical surface of the bridge as if fully enclosed.
 - 4. Seismic: Bridge shall be designed for seismic loads as indicated.
 - 5. Temperature: Bridge shall be designed to accommodate a temperature differential of 120 degrees Fahrenheit. Slip pads of UHMW polyethylene shall be placed between the smooth surface of this setting plate and the smooth bearing plate of the bridge. At least 1" clearance shall be provided between the bridge and concrete abutments.
 - 6. Camber: Bridge shall have vertical camber dimension at midspan equal to the full dead load deflection.
 - 7. Deflection: The vertical deflection of the bridge due to pedestrian live load shall not exceed 1/360 of the span length. The horizontal deflection due to lateral wind load shall not exceed 1/500 of the span length.

2.02 ALUMINUM:

- A. Plates, rolled or extruded shapes, sheets or castings conforming (unless otherwise permitted or indicated) to the following Aluminum Association alloy and temper designations:
 - 1. Rolled structural sheets and plates: ASTM B209-6061-T6
 - 2. Rolled Structural Shapes: ASTM B308 -6061
 - 3. Extruded structural shapes, bars and tubes: ASTM B221 Alloy 6061-T6
 - 4. Extruded structural tube or pipe: ASTM B429 Alloy 6061 T-6
 - 5. Gratings (bearing bars): ASTM B211-6061-T6 (crimp bars): ASTM B211-6061-T5.

6. Castings: ASTM B26-214
7. Sheets: ASTM B209-Alclad 3003-H14 and 3003
8. Bolts and nuts: Type 316 stainless steel
9. Pipe railings: ASTM B241-6061-T6
10. Handrail posts: ASTM B241-6061-T6
11. Die and hand forgings: ASTM B247 Alloy 6061-T6

2.03 WELDING:

- A. Class 5356 electrodes.
- B. Welding filler rods: ASTM B241-6061-T6.
- C. Provide equipment for welding, electrodes, welding wire and fluxes capable of producing indicated welds when used by certified welders under AWS welding procedures. Provide welding materials that comply with requirements of AWS Structural Welding Code.

2.04 FASTENERS:

- A. Provide Type 316 stainless steel stud bolts and nuts with heavy aluminum washer for fastening of aluminum material.
- B. Draw up bolts or nuts tight, and deform threads where possible. Use bolts of lengths required so that bolts do not project more than 1/4-inch beyond face of nut. Do not use washers unless specified. Provide hexagonal head bolts with hexagonal nuts.
- C. Provide holes required for the connection of adjacent or adjoining work wherever noted on drawings. Locate holes for bolting equipment to supports to a tolerance of + 1/16-inch of exact dimensions indicated.

2.05 FRAMING:

- A. Structural members shall have a minimum thickness of material of at least 3/16".
- B. Welding materials shall be in strict accordance with the American Welding Society (AWS). Structural welding code, D1.1.
- C. Structural elements used in the bridge shall be identified by heat number of the member used. Specific mill test reports and individual welder certificates shall be tracked and kept on file to be provided at the request of the Owner or Engineer.

- D. Welding shall utilize 5356 series electrodes.
- E. The connection of bridge end post to top chord shall be a mitered welded joint with the exposed welds ground smooth.

2.06 RAILINGS & ACCESSORIES:

- A. Railings shall have a smooth inside surface with no protrusions or depressions. All ends of angles and tubes shall be closed and ground smooth.
- B. Safety Rails: Continuous rails shall be located on the inside of the trusses. The rails shall be horizontal safety rails with a top rail locate 54" from the floor deck with vertical pickets spaced so that there is no greater than 4" clearance between them.
- C. Toe Plate: A 4" high toe plate shall be located at the floor deck.
- D. Handrails: The top of gripping surfaces of handrails shall be between 34 inches and 38 inches vertically above the floor deck. Handrails shall be at a consistent height above the floor deck. The clearance between the handrail gripping surfaces and adjacent surfaces shall be 1½ inches minimum. The handrails shall be comply with all requirements of the Public Right-of-Way Accessibility Guidelines (PROWAG) Section R409.

2.07 FLOOR DECK:

- A. Horizontal openings in the floor deck shall not allow passage of a sphere larger than ½ inch in diameter. Elongated openings are permitted and shall be placed so that the long dimension is perpendicular to the dominant direction of travel.
- B. The floor deck shall comply with all requirements of the Public Right-of-Way Accessibility Guidelines (PROWAG) Section R302.

PART 3 - EXECUTION

3.01 DELIVERY AND ERECTION:

- A. Bridge shall be delivered by truck to a location nearest to the site accessible by roads. Hauling permits and freight charges are the responsibility of the manufacturer.
- B. The manufacturer will notify the Contractor in advance of the expected arrival at the site.
- C. The manufacturer will advise the Contractor of the actual lifting weights, attachment points and all other information necessary to install the bridge.

- D. The Contractor shall install the anchor bolts in accordance with the bridge manufacturer's approved shop drawing layout. Provide anchor bolts and anchors with templates for correct placement into concrete or other supporting materials.
 - E. The bridge shall be erected on the prepared concrete foundation as indicated.
 - F. The bridge shall be erected complete with all components and accessories in strict accordance with the bridge manufacturer's printed instructions and approved shop drawings.
 - G. Align and adjust members forming parts of a complete assembly before permanent fastening.
 - H. Report errors in shop fabrication or deformation resulting from handling or transportation immediately to Engineer. Replace and remove from job site incorrectly fabricated or deformed material at no additional cost to the Owner.
 - I. Do not enlarge holes or damage metal in the vicinity of holes with drift pins during assembly.
 - J. Enlarge holes to admit bolts for connections only if approved in writing by Engineer. Make enlargements only by drilling.
- 3.02 WELDING:
- A. Workmanship and techniques for welded construction to conform to requirements of AWS Structural Welding Code and as indicated or specified.
 - B. No field welding permitted unless indicated on Engineer approved fabrication shop drawings.
- 3.03 CONTRACT CLOSEOUT:
- A. Provide in accordance with Section 01700.

END OF SECTION

SECTION 02900

PLANTING AND SEEDING

PART 1 – GENERAL

1.01 DESCRIPTION

A. The Work of this Section includes but is not limited to:

1. Fine grading of all planted and seeded areas,
2. Installing deciduous and evergreen trees and shrubs as shown on the contract drawings
3. Topsoil Re-handled and Spread is the Work of SECTION 02701 – EXFILTRATING BIORETENTION AREAS. Requirements for materials, testing, amendments, mixing and use of acceptable Planting Soil is described in this Section.
4. Amending stockpiled or imported loam with soil additives to be spread as planting soil,
5. Drainage test pits for all tree plantings,
6. Fertilizing and pruning trees and shrubs,
7. Mulching planting beds and tree saucers,
8. Maintaining all plantings through 2-year guarantee period,
9. Fine grading and installing tested and approved planting soil in seeded and planted areas to required depths,
10. Seeding including seeding of all disturbed areas at Owner's direction,
11. Maintenance, reseeding, guarantee, and protection of seeded areas,
12. Locating and pre-tagging plant materials specified at nurseries at least two months before construction. Contractor shall also provide full compensation (including time and expenses) for Owner to tag trees at nurseries outside of Massachusetts and for tagging visits to Massachusetts's nurseries where plant material does not meet specifications as determined by Owner.

1.02 RELATED WORK

- A. Section 02210 – Earth Excavation, Backfill, Fill and Grading
- B. Section 02910 – Planting Soils

C. Section 02920 – Site Improvements

1.03 REFERENCES and STANDARDS

A. Comply with applicable requirements of:

1. Commonwealth of Massachusetts, Standard Specifications for Highways and Bridges, Department of Public Works, latest edition, Boston, Massachusetts.
2. ASTM: American Society of Testing Materials.
3. AAN: American Association of Nurserymen.
4. ISA: International Society of Arboriculture.
5. ANSI: American National Standards Institute.
6. AOAC: Association of Official Agricultural Chemists.
7. USDA: United States Department of Agriculture.
8. MA Mass DOT (Massachusetts Department of Transportation) formerly Massachusetts Highway Department (MHD) Standard Specifications (for Highways and Bridges), 1988 edition, including all addenda.
9. UMTC: University of Massachusetts Transportation Center, "Manufactured Loam using Compost Material - Phase 1: Feasibility", October 1966 or latest update.
10. MassDEP: Department of Environmental Protection, Commonwealth of Massachusetts.
11. USEPA: United States Environmental Protection Agency

1.04 DEFINITIONS

- A. Balled and Burlapped Stock: Exterior plants dug with firm, natural balls of earth in which they are grown, with ball size not less than diameter and depth recommended by ANSI Z60.1 for type and size of tree or shrub required; wrapped, tied, rigidly supported, and drum-laced as recommended by ANSI Z60.1.
- B. Container-Grown Stock: Healthy, vigorous, well-rooted exterior plants grown in a container with well-established root system reaching sides of container and maintaining a firm ball when removed from container. Container shall be rigid enough to hold ball shape and protect root mass during shipping and be sized according to ANSI Z60.1 for kind, type, and size of exterior plant required.
- C. Finish Grade: Elevation of finished surface of planting soil.
- D. Subgrade: Surface or elevation of subsoil remaining after completing excavation, or top surface of a fill or backfill, before placing planting soil.

1.05 SUBMITTALS

- A. Do not order or deliver materials until required samples, certifications, manufacturers' literature, and test results have been reviewed by the Owner. Delivered materials shall closely match the samples, as judged by the Owner. If any deviations from specified materials are proposed, submit written request explaining differences and reasons for request. Submit three (3) copies of each document required, or as directed by the Owner.
- B. Soil Additives and amendments: Product or testing certificates signed by manufacturers certifying that their products comply with specified requirements:
 - 1. Manufacturers' certified analysis for all products specified.
 - 2. Analysis for other amendments, such as organic compost, by the University of Massachusetts Agricultural Extension Service or other approved testing laboratory, made according to methods established by the AOAC, where applicable, and as required in this Specification.
 - 3. Sieve and salt analysis of sand proposed as a planting soil amendment or component.
- C. Chemicals and Pesticides: Manufacturers' literature.
- D. Plant Materials: Labels and nursery certificates substantiating that plants, trees and shrubs materials comply with specified requirements set by AAN and others and were grown within USDA hardiness zones specified.
- E. Tagging and planting schedule: Proposed dates for tagging plants at nurseries, and for planting each type of planting, with consideration for fall-hazard species, work coordination, etc.
- F. Seed Mix: Manufacturer's Certificate of Compliance with the specifications for type of seed required. These certificates shall include the guaranteed percentage of purity, weed content and germination of the seed, and the net weight and date of shipment and pounds per acre sowing rate. No seed may be sown until the Contractor has submitted the certificates.
- G. Organic Material: If organic matter is proposed as a soil amendment and is manufactured from biosolids, a letter certifying source and composition of organic material proposed for use as a soil amendment indicating compliance with UMTC "Article 5.4 Standard Compost Specifications for Massachusetts" and that the compost is mature, and if manufactured from biosolids and wood bulking agents, has been aged a minimum of one (1) year, is required for review by Owner. Refer also to requirements included in Article 2.3 Soil Additives for Planting Soil. Letter shall also give description of product and recommendations for use as a planting soil component or amendment.
- H. Samples: Submit samples of:

1. Fertilizer: one (1) sample packet of planting fertilizer; one-pound sample of slow-release pelletized fertilizer; certificate showing composition and analysis; purchasing receipt showing the total quantity purchased for the Project.
2. Organic Material: Two-pound sample and source for review.
3. Bark Mulch: Two-pound sample and source for review.
4. Fertilizer: Submit certificates of analysis for lawn fertilizer.
5. Chemicals (lawn and tree herbicides, fungicides, and pesticides): Manufacturer's literature and analysis.
6. Maintenance: Provide watering and fertilizing schedule to the Client for approval.
7. Maintenance Instructions: Submit recommended procedures for routine year-round maintenance of plantings. Instructions shall be submitted as a condition of Substantial Completion of the Project.

1.06 EXAMINATION OF EXISTING CONDITIONS

- A. Inspect all areas to be planted before starting Work and report any defect, such as incorrect grading, incorrect subgrade elevations, or drainage problems, etc., to the Owner and Engineer prior to beginning Work. Commencement of Work shall indicate acceptance of filled subgrade areas to be planted, and Contractor shall assume responsibility for Work. Inspect areas to be fine graded and seeded before starting work.
- B. The Contractor shall be solely responsible for judging the full extent of Work requirements involved, including but not limited to the potential need for storing and maintaining plants temporarily and re-handling plants prior to final installation.
- C. Determine location of above-grade and underground utilities and perform Work in a manner, which will avoid damage. Review the locations of utilities with the Owner before proceeding. Contact all relevant utility companies, public or private, prior to beginning work; contact DIG SAFE 1-888-344-7233 (serves five N. E. states). Report any conflicts to the Owner and the Client in writing before excavating. Hand-excavate as required. Maintain grade stakes until removal is approved by the Owner.
- D. Coordinate installation of planting materials to assure installation during normal planting seasons for each type of plant material required and as specified in planting schedule. Species designated as "Fall Hazard" by Nursery shall be planted in the Spring, indeterminate of other site and project schedules.
- E. Coordinate planting Work with other Work of this contract being performed on site, or work being performed by others.
- F. Coordinate maintenance of landscape areas installed at different times. Protect completed Work as sequence of planting proceeds.

1.07 PLANT LIST

1. Within 30 days of receipt of Contract, submit plant list for review by Owner which includes:
 - a. plant materials proposed for project and corresponding nursery source where plants are to be selected.
 - b. written documentation indicating nursery(s) have available the plants in the species, quantity and size(s) shown on Drawings.
 - c. for plants indicating names of plants in accordance with American Joint Committee on Horticultural Nomenclature.
2. Schedule for review at nursery source by Owner with Contractor present.
3. Substitutions: plant list shall indicate unavailable materials and document a thorough search for materials. For unavailable materials list sources contacted with telephone number, date, and person's name at source.

1.08 SCHEDULE

1. Submit planting schedule for approval.

1.09 QUALITY ASSURANCE

- A. Contractor shall have at least five (5) years of experience in Landscape Work similar in materials, design, and extent to that indicated for this project and with a record of successful landscape establishment. Installer shall maintain an experienced supervisor on the project site during all times that landscape construction is in progress. Provide written qualification data for firms and persons to be responsible for Work, to demonstrate their capabilities and experience. Include lists of completed projects, with project names, addresses, phone numbers, and names and address of designers and clients.
- B. Contractor shall conduct pre-landscape construction conference at Project site as directed by the Owner, to review landscape construction procedures, site conditions, and submittal requirements required in the Work of this Section, especially the requirements for Planting Soil, before any products are submitted for review and approval, or landscape construction commences.
- C. To extent possible, provide each plant material species or variety from single source.
- D. If required, only herbicides, pre-emergents, fertilizers, fungicides, and pesticides reviewed and approved by the Owner and permitted for use shall be used and applied by appropriately licensed personnel according to manufacturer's recommendations.

- E. Select compatible products where options are provided, provide each material from a single source and only with review and approval of college and Owner.

1.10 SELECTION AND INSPECTION OF PLANTS

- A. Plants shall be selected by Owner at place of growth for conformity to specification requirements as to quality, size, and variety. Such approval shall not impair right of inspection and rejection upon delivery at site or during progress of work. Cost of replacement shall be borne by Contractor.
- B. Notify Owner in writing upon selection of planting subcontractor. State name, address, telephone number and supervisor for planting subcontractor.
- C. Schedule selection and tagging of nursery stock so Owner can tag trees and representative shrubs for project at place of growth. Advise Owner of schedule a minimum of one month (30-day minimum) in advance of selection/tagging dates so Owner can make proper travel arrangements. If Owner must make additional trips to select/tag plants if inadequate, insufficient, or unacceptable plant material was available at the inspection location, then additional travel expenses to be back charged to Contractor.
- D. Notify Owner a minimum of five business days prior to each shipment of proposed arrival of plant material on site.
- E. Layout tree locations, bed outlines and individual planting on site for inspection by Owner prior to planting. Arrange for adequate manpower and equipment on site at time of plant material inspection and installation to provide complete staked layout and to unload, open and handle plant material during inspection.
- F. Plants selected and affixed with an identification number tag by the Owner must arrive on site with the same tag attached for confirmation. Plants without the identification number tag will not be accepted for planting.

1.11 DELIVERY, STORAGE AND HANDLING OF FERTILIZER AND MULCH

- A. Packing and Shipping: deliver materials in unopened containers bearing manufacturer's name and guaranteed statement of analysis. Transport materials without damage. Protect finishes from abrasion, dirt, oils, grease, and chemicals. Pack materials to protect from weather.
- B. Acceptance at Site: verify in writing that delivered materials conform to specifications and approved submittals.
- C. Storage and Protection:
 - 1. Materials shall be uniform in composition, dry and free flowing. Store materials in dry place, on pallets, off ground; protect from sun. Store materials in a manner, which does not diminish their usability and effectiveness.

2. Protect materials from theft, damage, weather, dirt, oils, grease, and construction.

1.12 DELIVERY, STORAGE AND HANDLING OF PLANTS

- A. Plants during shipping and delivery and plants requiring storage on site shall be properly wrapped and covered to prevent wind drying and desiccation of branches, leaves, or buds. Plant balls shall be firmly bound, unbroken, and reasonably moist to indicate watering prior to delivery and during storage. Trees shall be free from fresh scars and damage in handling. Root masses of container grown plants shall be kept moist and containers screened from direct sun.
- B. Wrap tree trunks at nursery prior to shipping then unwrap for inspection by Owner \ prior to installation. Report damaged plants to Owner.
- C. Apply antidessicant to plants before digging at nursery and/or as directed by Owner once plants are delivered to site.

1.13 PROJECT/SITE CONDITIONS

- A. Environmental Requirements: do not deliver or handle soils when dry, wet, or frozen.
 1. Field Test
 - a. Form soil in palm of hand, if soil retains shape and crumbles upon touching, the soil may be worked.
 - b. If the soil will not retain shape it is too dry and should not be worked.
 - c. If the soil retains shape and will not crumble, it is too wet and should not be worked.
 - B. Planting Season: planting seasons shall be those indicated below. Plants planted out-of-season shall receive special attention as directed. Out-of-season planting and or transplanting shall be at Contractor's risk and expense. No planting shall be done in frozen or muddy ground or when snow covers ground, or soil is otherwise in an unsatisfactory condition for planting.

1.14 SEQUENCING AND SCHEDULING

- A. Plant after acceptance of fine grading.
- B. Trees to be installed first.

1.15 SUBSTANTIAL COMPLETION

A. See Section 02930 - Landscape Maintenance.

1.16 MAINTENANCE

A. See Section 02930 - Landscape Maintenance.

1.17 ACCEPTANCE

A. See Section 02930 - Landscape Maintenance.

1.18 GUARANTY

A. Start of Guaranty Period: when Owner issues Letter of Preliminary Acceptance.

B. Term: one year for trees

one year for shrubs.

C. Requirements: plant material to be alive and in healthy, vigorous condition.

1. Quarterly reviews will be made with Contractor and Owner during guaranty period. Reviews will assess condition of installed plant materials.

2. Replace plants that are dead or, as determined by Owner, are in an unhealthy or unsightly condition, and have lost their natural shape due to dead branches, or other causes.

D. End of Guaranty Period: when Owner issues letter of Final Acceptance, one year from date of substantial completion; two years from date of substantial completion for trees.

1.19 FINAL ACCEPTANCE

A. Owner reviews work and finds it complete and in accordance with Drawings and Specifications.

B. Owner will issue a letter of Final Acceptance, at which time project becomes responsibility of Owner.

PART 2 – PRODUCTS

2.01 SOIL MATERIALS

A. Refer to Section 02910 for Planting Soils.

2.02 SOIL ADDITIVES FOR PLANTING SOIL

A. Aluminum sulphate for adjustment of planting soil pH shall be commercial sulfur, unadulterated, delivered in containers with the name of the manufacturer, material analysis and net weight appearing on each container.

- B. Ground limestone for adjustment of planting soil pH shall be agricultural grade ground dolomite limestone containing at least 85% calcium carbonate equivalent, with 50% passing the 100 mesh and 95% passing the 20-mesh sieve.
- C. Organic Compost:
1. Organic compost shall be natural or manufactured mature, composted organic material, and, if biosolid based, aged a minimum of one (1) year. Organic material shall be as specified by UMTC 'Article 5.4 - Standard Compost Specifications for Massachusetts'. Only compost meeting Class A (E.P.A. Federal) or Type I (Massachusetts) compost products shall be acceptable.
 2. Organic compost shall be produced by a DEP-approved composting vendor of material originating from mature leaf compost, mature composted animal manure, other aged, composted vegetable materials such as brewer's waste, or chemically tested toxin-free processed sludge products (biosolids), composted with wood products, safe for plants, humans, and soil organisms (Class A or Type I). Raw (uncomposted or unprocessed) or incompletely composted organic matter shall be rejected. Organic matter manufactured from sludge and other biowaste materials or manure, shall be aged for at least one (1) year without exception, and shall have no objectionable biowaste odor.
 3. Organic compost shall contain no uncomposted bulking agents, such as uncomposted wood chips, and shall be free from hard lumps and free water when handled (at least 60% dry solids). It may be shredded or granular in form. No plastic shall be present. It shall be free from excessive amounts of zinc or unpleasant odor. 100% of material shall pass a 1/2" sieve.
 4. Each and every source of organic material proposed for use as a soil amendment or component of planting soil must be tested on the criteria specified in this Article and results submitted for review and approval by the Owner before construction. Each delivery of organic material must match samples tested by Contractor and approved by the Owner or delivered material will be rejected. Each delivery of compost shall require testing and approval, per specifications, to ensure compliance with previously approved test submittals. Contractor shall provide sufficient quantities of composted organic material to meet requirements of the planting soil specified and detailed in the Drawings after mixing, spreading, and compaction, and may obtain this material from various sources, if material and test results have been reviewed and approved by the Owner.
 5. Other requirements and test results for specific characteristics of the organic matter and results issued for the following criteria shall be:
 - a. According to the methods of testing of AOAC, latest edition, the acidity range shall be approximately 5.5 pH minimum to 8.0 pH maximum.
 - b. The organic matter shall not be less than 40% as determined by loss on ignition for bio-solid compost and may be higher for other compost types. The density shall be 1150 kilos/cubic meter (850 lbs/CY).

- c. The water absorbing ability shall be 200% minimum by weight on an oven dry basis for organic compost other than peat moss.
- d. The Carbon/nitrogen ratio shall be between 10/1 to maximum 25/1 without the addition of nitrogen.
- e. The degree of maturity should be between Grades IV and V, 'curing compost' and 'very stable compost' as measured in a colorimetric-based maturity test. The stability shall be, on the O₂-evolution test, < 7 mg C₀₂ - C/g BVS day or deWar self-heating test < 15 degrees C above room temperature.
- f. There should be no unpleasant or detectable odor of ammonia or hydrogen sulfide, which would indicate immature compost. Color of bio-solid compost shall be dark brown.
- g. Total salinity should be less than 4.0 mmhos/cm (Ds/m) or less than 2560 PPM salt (NaCl)
- h. The material shall contain some nitrogen, phosphorus, copper, boron, manganese, and molybdenum in horticulturally and agriculturally appropriate proportions to prevent ion antagonisms.
- i. Concentrations of arsenic, cadmium, chromium, copper, lead, mercury, molybdenum, nickel, and selenium must be below EPA (EPA CFR Part 503 Regulations, Table 3, p. 93392, Vol. 58 No.32, 1993) and Commonwealth standards for application to soils with human activity. No pesticide residues or chlorinated hydrocarbons of any kind should be present.
- j. Maturity and age of composted organic material intended for use on this project shall be verified in writing by supplier as part of test results.

D. Sand for use as PLANTING SOIL additive or component:

- 1. Sand for use as ingredient or amendment in planting soil shall be medium sand with angular (not round) sand particles (beach sand not acceptable). Sand that meets MassDOT Standard Specifications M4.101.0: Sand Borrow Type a, may be used if material is not self-compacting or overly gravelly, according to the Owner.
- 2. Sand sources and requirements of sand as a planting soil component or amendment may require adjustment at the request of the Owner, depending on the characteristics and proportions of the other planting soil components (stripped topsoil, borrow, organic component) used to mix the approved planting soil. The intent of the installed planting soil is to provide a consistent, stable, well-draining, aerated, nutrient rich, and friable planting soil that will support mature trees and lawns in an irrigated environment.

2.03 SEED MIX

- A. Contractor shall furnish the Owner with the dealer's certificate of the mixture composition for review and approval before seeding operations begin. Seed mixture shall be fresh, clean, new crop seed of the previous year's crop, mixed off site by the seed dealer. Weed seed content shall not exceed 1% by weight. The seed shall be furnished and delivered in the proportion specified below in new, clean, sealed and properly labeled containers. All seed shall comply with State and Federal seed laws; seed that has become wet, moldy, or otherwise damaged will be rejected.
- B. CONSERVATION/WILDLIFE MIX (available from New England Wetland Plants, www.newp.com, 413-548-800 or approved equal) : Sow at thirty five (35) lbs. per acre and shall be comprised of the following:

<u>Botanical Name/Proportion Common Name</u>	<u>by Weight Minimum</u>	<u>Purity Minimum</u>
Andropogon gerardii Big Bluestem	15%	90%
Asclepias syrica Common Milkweed	3%	90%
Aster novae-angliae New England Aster	1%	90%
Chamaecrista fasciculata Partridge Pea	6%	90%
Desmodium canadense Showy Tick Trefoil	4%	90%
Elymus virginicus Virginia Wild Rye	20%	90%
Eupatorium perfoliatum Boneset	1%	90%
Festuca rubra Red Fescue	13%	90%
Helenium autumnale Common Sneezeweed	1%	90%
Panicum virgatum Switch Grass	6%	90%
Rudbeckia hirta Black Eyed Susan	2%	90%

Schizachyrium scoparium Little Bluestem	17%	90%
Solidago juncea Early Goldenrod	1%	90%
Sorghastrum nutans Indian Grass	10%	90%

- C. EMBANKMENT/ EROSION CONTROL SEED MIX (available as Erosion Control/Restoration Mix for Dry Sites from New England Wetland Plants, www.newp.com, 413-548-800 or approved equal), : Sow at five (5) lbs. per 1,000 square feet and shall be comprised of the following:

Agrostis perennans Upland Bentgrass	1%	90%
Elymus canadensis Canada Wild Rye	27%	90%
Festuca rubra Red Fescue	22%	90%
Juncus tenuis Path Rush	1%	90%
Lolium multiflorum Annual Ryegrass	15%	90%
Lolium perenne Perennial Ryegrass	13%	90%
Panicum virgatum Switch Grass	7%	90%
Schizachyrium scoparium Little Bluestem	7%	90%
Sorghastrum nutans Indian Grass	7%	90%

- D. Note: If these specific named varieties and/or cultivars of species listed above are not available at the time of construction, the Contractor may substitute cultivars that display similar proven growth, color, habit, drought tolerance, and disease and insect resistance as patented and named cultivars specified, but only with review and approval of the Owner and only if Contractor demonstrates that these cultivars are equal in

performance and appearance. Species and proportions of species in mix may not be changed.

2.04 PLANT MATERIALS

- A. Plant Identification and Standards: Nomenclature conforms to current edition of Standardized Plant Names, published by American Joint Committee on Horticultural Nomenclature. Plants conform to varieties and sizes specified in plant list, and to code of standards set forth by American Association of Nurserymen, Inc. in American Standard for Nursery Stock, ANSI Z60.1 - latest edition. Substitutions shall not be permitted without consent of Owner. Plants shall be properly identified with plant labels securely attached to plants, in order to identify plants on site. Information regarding sources of plant material shall be furnished to Owner.
- B. The Owner, accompanied by the Contractor, will tag plants at their place of growth, after pre-tagging by Contractor. At least one (1) month prior to the expected planting date, request in writing that the Owner schedule tagging trip(s). No plant material tagged by the Owner shall be delivered to the site of Work without these tags.
- C. The Owner's selection shall not impair the right of inspection and rejection upon delivery at the site or during the progress of the Work. Contractor shall pay cost of replacement of materials rejected by the Owner at the site.
- D. Each tree shall be labeled with securely attached, waterproof tag bearing legible designation of botanical and common name according to AJCHN.
- E. Only plant stock obtained from and grown between latitudes 40-49 degrees north and USDA hardiness Zones 1 through 5, will be accepted. All plants shall be nursery grown, not collected from natural vegetated areas.
- F. Trunks shall be free from sunscald, frost cracks, or wounds resulting from abrasions, fire, or other causes. No tree shall have evidence of ever having had basal suckers. The plants must be in a moist vigorous condition, free from dead wood, bruises or other root, bark, or branch injuries.
- G. Trees shall not be pruned in preparation for transplanting. No wounds from previous pruning shall be present having a diameter exceeding two (2) inches; such wounds shall show vigorous scar tissue on all edges.
- H. Plant List: If there are discrepancies between the quantities shown on plant schedule and work shown on Drawings, Contractor shall supply plants necessary to complete work as shown on Drawings. Where size of plant on the plant list is a variation between a minimum and maximum dimension, the sizes of plants furnished shall be equal to average of two dimensions. Where a single dimension is given, dimension represents the minimum size of plants to be furnished.

- I. General Plants: Unless specified otherwise, plants shall be nursery grown under climatic conditions similar to those in locality of project and shall have been previously transplanted or root pruned at least once in last three years. Plants shall possess a normal balance between height and spread. Plants shall be typical of their species and variety with a normal habit of growth, densely foliated when in leaf, and a well-developed branch structure with a fibrous, healthy root system with no girdling roots. Plants shall be sound and healthy, free from dead wood, defects, disfiguring knots, sun scald, injuries or abrasions of roots or bark. Plants shall be freshly dug. No heeled-in plants or plants from cold storage shall be used. Parts of plant shall be moist and show active green cambium when cut. Plants shall be free of plant diseases, insects, pests, eggs, larvae, and forms of infestations.
- J. Balled and Burlapped Plants: Plants designated on plant list as "B&B" shall be dug with root systems as solid units. Diameter and depth of balls of soil must be sufficient to encompass fibrous and feeding root system necessary for healthy development of plants. Balls shall be wrapped firmly with biodegradable material and bound carefully with twine or cord. Tree balls may also be placed in a wire basket of diameter suitable for the size of the root ball. No plant shall be accepted when ball of earth surrounding roots has been badly cracked or broken, either before or during process of planting, or after burlap, ropes, etc., required for transplanting have been unfastened. Plants and root balls shall remain intact as a unit during operations. Plants that cannot be planted at once must be protected and watered.
- K. Measure trees according to AAN with branches and trunks or canes in their normal position. Take caliper measurements six (6) inches above ground for trees up to 4-inch caliper size, and 12 inches above ground for larger sizes.
- L. Container-Grown Plants: Container plants shall have been acclimatized for one growing season in container. Container plants shall be well established in container and shall have sufficient roots to hold earth intact after removal, without being in a rootbound condition. Plants shall remain in container until planted.
- M. Trees: Trees to be hand dug and balled and burlapped rootballs. Root balls shall be custom dug to special widths and depths to accommodate shallow soil conditions of this Project. Trees, except when a clump form is designated, shall be straight and symmetrical with a crown having a persistent single, main leader, and growing from a single, unmutilated crown of roots. No part of trunk shall be conspicuously crooked as compared with normal trees of same variety. Trunk shall be free from sunscald, frost cracks, or wounds resulting from abrasions, fire, or other causes. No pruning wounds shall be present having diameter of more than two inches (2") and wounds must show vigorous bark on edges. Pruning wounds over 3/4 inch in diameter must be completely calloused over. Evergreen trees shall be branched to within one foot of ground. Height of trees, measured from crown of roots to top of top branch, and caliper, measured as specified herein, shall not be less than minimum size designated in plant list. Take caliper measurements 6 in. above ground on trees up to and including 4 in. caliper, and at 12 in. above ground for larger sizes.

- N. Shrubs and Small Plants: Shrubs and small plants, unless otherwise designated, shall be well-formed and bushy with well-spaced side branches, and shall have a crown and stem(s) typical of species and variety. Plants shall be well-branched to ground. Plants shall meet requirements for spread and/or height stated in Plant List. Measurements for height are to be taken from ground level to average height of top of shrub and not to longest branch. Thickness of each shrub shall correspond to trade classification "No. 1". Single stemmed or thin plants will not be accepted.
- P. Plants larger than those specified in the Plant List may be used if approved by Owner but use of such plants shall not increase the Contract Price. If use of larger plants is approved, spread of roots or ball of earth shall be increased in proportion to size of plant.
- Q. Trees delivered by truck and plants requiring storage on site shall be properly wrapped and covered during delivery to prevent drying of branches, leaves, or buds. Plant root balls shall be firmly bound, unbroken, and reasonably moist to indicate watering prior to delivery and during storage, and tree trunks shall be free from fresh scars and damage in handling.

2.05 BARK MULCH

- A. Bark mulch: shredded granular outer bark of evergreen trees and minimum of hardwood bark and shall be aged for period of at least 6 months and not longer than two years. Bark mulch shall not have been subjected to anaerobic conditions and must be partially decomposed and dark brown in color, Bark chunks shall average 1/2 inch to 2 inches in length and no chunks three inches or more in size and thicker than 1/4 inch shall be left on site. Moisture content shall be 40 percent or more, retained with normal watering and/or rainfall. Mulch shall be free of dirt, leaves, twigs, and other materials deleterious to plant life. Mulch shall not contain chipped construction materials.

2.06 FERTILIZERS

- A. FERTILIZER FOR TREES AND SHRUBS installed by the Contractor shall be provided with through the use of slow-release fertilizer packets, which are designed and certified by the manufacturer to provide controlled release of nutrients over a minimum three-year period. Packets shall remain sealed at delivery to site and until installation. Each packet shall consist of four (4) ounces of water-soluble fertilizer with a minimum guaranteed analysis of available elements by weight as follows:

<u>Nitrogen</u>	<u>Phosphorus</u>	<u>Potash</u>
16%	8%	16%

Note: Fertilizer packets shall not be used for trees located within the 100-foot wetland buffer zone.

- B. FERTILIZER FOR SEEDED AREAS shall be a commercial product complying with the State and United States fertilizer laws. Deliver to the site in the original

unopened containers that shall bear the manufacturer's certificate of compliance covering analysis. At least 50% by weight of the nitrogen content shall be derived from organic materials. Fertilizer shall contain not less than the percentages of weight of ingredients as follows or as recommended by the soil analysis:

<u>Nitrogen</u>	<u>Phosphorus</u>	<u>Potash</u>
10%	6%	4%

2.07 POST PLANTING FERTILIZER

A. Post Planting Fertilizer:

1. Complete, fertilizer made from all-natural ingredients complying with State and Federal fertilizer laws. Fertilizer shall contain the following available plant food by weight, unless soils test indicates a need for different composition:
 - Pro Start 5-3-4 manufactured by North Country Organics, Bradford, Vermont 05033, ph# 802.222.4277.
2. Fertilizer to be delivered in original unopened standard size bags showing weigh, analysis ingredients and manufacturer's name.

2.08 WATER

- ### A. Contractor shall provide all labor and materials required to furnish water to plantings and seeded or sodded lawns, until Final Acceptance at his/her expense. Contractor shall supply temporary soaker hoses, hose connections, and any other appurtenances necessary to connect and draw from existing water lines or water trucks. Contractor shall not cause damage to any vegetation during the watering operation. Water shall potable, free of salt and other impurities injurious to vegetation.

2.09 TREE WRAP

- ### A. Tree wrap may be used to protect tree trunks from damage during digging at the nursery, transport to the site or during planting operations, but the use of tree wrap of any type shall not be allowed on tree trunks and branches after trees are planted.

2.10 ANTIDESSICANT

- ### A. Antidessicants: emulsions or materials which provide a protective film over plant surfaces permeable enough to permit transpiration and specifically manufactured for that purpose. Antidessicant shall be delivered in manufacturer's containers and used according to manufacturer's instructions.

2.11 CHEMICALS, HERBICIDES, FUNGICIDES, AND INSECTICIDES

- A. Provide chemicals, herbicides, fungicides, and insecticides as needed for fungus or pest control. Chemicals and insecticides shall be approved by Massachusetts Department of Environmental Protection for intended use and application rates. No pesticides shall be used on site without knowledge and approval of Owner. Pesticides shall be handled by State licensed operators only.

2.12 PLANT LABELS

- A. Plant labels shall be provided by Contractor and shall be durable, legible labels, stating correct plant name and size, in weather-resistant ink or embossed process lettering, and are easily removable.

2.13 TREE PAINT/TREE WOUND DRESSING

- A. Tree paint or tree wound dressing of any type shall not be used on tree wounds. Allow wound to heal and weather naturally, after trace cutting ragged or loose damaged bark back to live cambium.

PART 3 – EXECUTION

3.01 SITE PREPARATION PRIOR TO COMMENCING PLANTING AND SEEDING

- A. Refer to Section 02210: Earthwork for rough grading which shall be performed before planting commences.
- B. Refer to Section 02910 for Planting Soils.
- C. Before starting work, locate existing underground utilities in areas of Work, call DIG SAFE and other sources of information as necessary. Should uncharted, or incorrectly charted, piping, or other utilities be encountered during excavation, notify the Owner. Cooperate with the Engineer and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to satisfaction of the utility companies and the Client. Do not interrupt existing utilities serving facilities occupied or used by others, during occupied hours, except when permitted in writing by the Client and then only after acceptable temporary utility services have been provided. Provide minimum of 48-hour notice to the Client and obtain written notice to proceed before interrupting any utility.
- D. Protect all existing structures, existing subgrades to remain, utilities, pavements, lawns, planting, and other site improvements from damage due to grading Work.
- E. Submit to Owner any requests for adjustments in grades and alignments found necessary to avoid interference with special conditions encountered.
- F. Stockpile usable excavated materials inside Limit of Work. Place, grade, and shape stockpiles for proper drainage. Locate and retain soil materials away from edge of excavations. Dispose of waste materials legally.

- G. Backfill excavations as promptly as Work permits, but not until completion of inspection, testing, approval and recording locations of underdrainage and irrigation.
- H. Uniformly grade subgrade to pitch a minimum of 1-2% including adjacent transition areas, providing minimum gradients for temporary drainage to catch basins and swales, streets, curbs, and away from plantings and structures.
- I. Protect subgrade areas scheduled for planting from traffic and erosion. Keep free of trash and debris. Repair and re-establish grades in settled, eroded, and rutted areas to specified tolerances. Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, reshape, and compact to required density prior to further construction.
- J. The top four (4) inches of subgrade of all areas to be planted and seeded shall be raked of all rubbish, sticks, roots, existing vegetative material and roots, and debris and stones larger than 1/2-inch and shall be removed off site. Subgrade surfaces shall be harrowed, raked, or otherwise loosened to a depth of 4-inches. Subgrade shall be inspected and approved by the Owner before planting soil is placed. The use of herbicides for vegetation removal shall be proposed only with the permission of the Client.

3.02 PLANTING SOIL PREPARATION, PLACEMENT, AND FINE GRADING

- A. Refer to 02910 Planting Soils.
- B. SOIL ADDITIVE INCORPORATION FOR PLANTED AREAS:
 - 1. Soil additives shall be spread and thoroughly incorporated into the planting soil by harrowing or other methods approved by the Owner. The following soil additives shall be incorporated:
 - a. Ground limestone as required by soil analysis to achieve a pH of 6.0 to 6.5, but the maximum amount applied shall be 1 pound per square yard. Limestone may not be mixed with fertilizer for application and shall be applied a minimum of two (2) weeks prior to fertilizer application.
 - b. Fertilizer at the rate of five (5) pounds per 1,000 square feet, or more, as recommended by the soil analysis. Fertilizer may be applied hydraulically in one operation with hydroseeding and fiber mulching.
 - 2. Lime and fertilizer shall be spread mechanically rather than in one operation with hydroseeding:
 - a. After the planting soil is placed and before it is raked to true lines and rolled, limestone shall be spread evenly over planting soil surface and thoroughly incorporated with planting soil by heavy raking to a least on-half depth of planting soil.

- b. Fertilizer shall be uniformly spread and immediately mixed with the upper 2-in of topsoil.
3. Organic material and other bulk amendments (such as sand) required to be added to topsoil or mixed to make manufactured planting soil shall be thoroughly mixed in soil stockpile locations as specified in Article 3.1 or in a commercial facility, according to proportions determined by soil testing and approved mixing and test results, and not on grade after spreading.

3.03 PREPARATION OF SEEDED AREAS AND INCORPORATION OF ADDITIVES

A. Fine Grading of Seeded Areas and Preparation of the Seed Bed:

1. The whole surface shall then be fine graded by hand raking. Remove large stiff clods, lumps, brush, roots, stumps, litter, and other foreign matter. Remove all stones over one inch (1") in diameter from the top three inches (3") of the loam bed. Loam shall also be free of smaller stones in excessive quantities as determined by the Owner.
2. If seed bed is proposed to be seeded by hand broadcasting, smooth surface to meet finished grades with raking and broadcast seed according to requirements specified. Compact with rolling after seeding. If bed is proposed to be drill seeded or hydroseeded, roll and compact bed before seeding. The surface shall be compacted with a roller or other suitable means to achieve a maximum dry density of 88 to 90% for the placed loam in accordance with compaction standards of ASTM D1557, Method D. During the compaction process, all depressions caused by settlement or rolling shall be filled with additional loam and the surface shall be regraded and rolled until presenting a smooth and even finish corresponding to the required grades.

B. Incorporation of Soil Additives in the Seed Bed:

1. Soil additives shall be spread and thoroughly incorporated into the top four (4) inches of the loam layer by harrowing or as part of hydroseed slurry as approved by the Owner. Owner

3.04 GENERAL INSTALLATION METHODS FOR SEEDED AREAS

- A. Seed shall be fresh, clean, new crop seed. Grass shall be of the previous year's crop and the weed seed content shall not exceed 1% by weight. Where possible, seed stock shall come from a local source. The seed shall be furnished and delivered, in the proportion specified, in new, clean, sealed, and properly labeled containers. All seed shall comply with State and Federal seed laws. Submit manufacturer's Certificates of Compliance. Seed which has become wet, moldy, or otherwise damaged shall not be acceptable. The Contractor shall take care to handle and store the wildflower seed according to grower's recommendations and shall not subject the seed to extremes of heat, cold or moist conditions.

- B. Limits of seeding shall be as designated on plans and as directed by the Client and the Owner. All areas disturbed outside the limit of seeding shall also be seeded. Stake limits of Seeded Lawn Mix, before seeding, for review by the Owner, before seeding to ensure that proper seed mix is being installed to appropriate limits. Different methods for seeding are required, depending upon mix being installed.
- C. The planting of seed shall be done only during periods within the season, which is normal for such work as determined by weather conditions without additional compensation, but subject to the Owner's approval of time and methods.
 - 1. Seeding dates shall be approximately April 1 - June 1 or August 15 - September 30.
 - 2. Seeding outside of season shall occur only with permission of the Owner and may result in the requirement for re-preparing of seed bed and reseeded the following season until specifications requirements are met. Acceptance will not be given to seed outside of season until all the requirements of the specifications have been fulfilled and the lawns have met all grow-in requirements. Out-of-season seeding during hot weather will require shade mulching with netted hay-type erosion control fabric.
- D. Seed only when the bed is in friable condition, not muddy, dried, or frozen, and not in windy or weather or in weather where temperatures are expected to be less than 45 or higher than 75 degrees Fahrenheit during and for two (2) weeks after seeding. After seeding, the seed bed shall be thoroughly and evenly watered with a fine spray to penetrate the soil to a depth of at least six (6) inches, and the seed bed kept evenly moist until germination and acceptance.
- E. Protect all trees to remain with tree protection fencing during construction set to edge of canopy. All loaming and seed work within the fence limit must be done by hand with care not to disturb tree roots (no excavation) or fill more than 2" inches above existing grade. Fencing must remain until seeded lawn areas have been sown and fenced off with protective barriers.
- F. Seed shall be carefully sown and thoroughly raked in twice at right angles at each pass, overlapping by at least 25%, and lightly rolling after raking to ensure good soil to seed contact and even sowing. Specified rates for seeding shall meet or exceed requirements for any method used.

3.05 HYDROSEEDING MIX:

- A. Hydroseeding with hydro mulch and tackifier shall be the preferred method for seeding all seeded areas. Utilize a mobile tank to hydroseed with a capacity of at least 500 gallons, filled with water and seed in quantities so it may be sprayed on prepared loamed bed prepared in the specified proportions per unit of area to be hydroseeded.
- B. The slurry shall be thoroughly mixed by means of positive agitation in the tank. The slurry shall be applied by means of a centrifugal pump using the turret or hose application technique from the mobile tank. The hose or turret shall be equipped

with a nozzle of a proper design to insure even distribution of the hydroseeding slurry over the area to be hydroseeded. The hose or turret shall be operated by a person thoroughly familiar with this type of seeding operation.

- C. Differing quantities of hydro mulch, fertilizer, superphosphate, and limestone shall be included in slurry mix depending on seed type, application requirements, and recommendations for amendments based on results soil testing.

3.06 Owner

3.07 SEEDED AREA PROTECTION AND MAINTENANCE

- A. Protection: Seeded areas shall be protected by a three (3) foot high barrier constructed of two (2) inch x two (2) inch wood stakes set 18 inches in the ground at eight (8) foot spacing supporting plastic snow fencing. Barriers must be raised immediately after seeding and shall be maintained until acceptance. Barriers must be removed at the request of the Owner and not later than two (2) weeks after acceptance. If grass within fencing is damaged for any reason and fencing has not been kept taut and secure by the Contractor, Contractor shall replace grass within two (2) weeks, if during the growing season for that grass, within first two (2) weeks of next growing season.

B. Maintenance

1. Seeded area maintenance, reseeding, and repair shall be required during the one-year guarantee period.
2. Watering: Watering shall be no less than two (2) inches of water per week within a given area, reduced by amount of natural rainfall at installation and between the months of April through October. Provide for daily watering of all grass areas to maintain moist soil to depth of at least six (6) inches. Apply one complete coverage of water in an 8-hour period. Water shall not be applied within three (3) hours of dusk unless specifically approved by the Owner. Prevent erosion due to excessive watering. Prevent damage to seeded areas by watering equipment. All Work injured or damaged due over- or under-watering shall be Contractor's responsibility to correct and at Contractor's expense.
3. Fertilizing: Fertilizing shall be required during the first and second growing seasons. Fertilizing is permissible only in April, May, August, or September, and not before two (2) months of growing time after seeding unless fertilizer is manufactured specifically for newly seeded areas. Use fertilizer applied at rate according to manufacturer's instructions for newly seeded areas after germination. A second application of fertilizer, as specified herein, shall be applied to all seeded areas after one (1) season of growth of two (2) months duration. Fertilizer shall be applied only during the months of April, May, August, or September at rate according to manufacturer's instructions. Adjust nitrogen type and analysis for season of application (slow release in fall).

4. Disease and insect control: Application of all preventative and reactive insecticides or fungicides shall be performed by a turf specialist certified by the Commonwealth of Massachusetts and only after submittal and approval by the Owner of materials, methods, application rates and schedule and permission of the User Agency. The use of granular materials is typically preferred over spray applications.

3.08 SCHEDULING OF PLANTING

- A. Locate plant material sources and ensure that plants are shipped in timely fashion for installation. All trees shall be planted during the same planting season they are dug. Balled and burlapped and potted plant materials from cold storage shall be rejected.

- B. Seasons for Planting:

Spring: Deciduous and Evergreen materials – April 1 through June 15

Fall: Deciduous and Evergreen materials – October 1 through November 15

1. Summer digging of trees shall not be permitted for any reason.
2. Contractor shall secure plant material as soon as possible and with recent Massachusetts's regulations in mind, regarding importing clean out of state nursery stock inspected for the Oak bark beetle.
3. Evergreens planted in April or July-August, or out of season shall be sprayed with anti-desiccant twice during the guarantee period, once at planting and once in mid-winter.

3.09 PLANT MATERIAL DELIVERY, STORAGE AND HANDLING

- A. Deliver and plant only freshly dug trees. Do not use plants "heeled-in" from previous season. Balled and burlapped plant materials from cold storage shall be rejected. Do not prune before delivery, except as approved by the Owner. Protect bark, branches, and root systems from sunscald, drying, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie trees or shrubs in such a manner as to destroy natural shape. Provide protective covering during delivery.
- B. Contractor shall be present at time of delivery of all plants to the site. Remove all tree wrapping at delivery and inspect tree trunks for damage. Report damaged plants immediately to the Owner. Wrap shall not be replaced except as specified herein.
- C. Handle balled and burlapped stock by root ball, not by trunk or branches.
- D. Deliver trees after preparations for planting have been completed and install immediately. If planting is delayed more than six (6) hours after delivery, set plants

vertically in their natural growing orientation in shade, protect from weather, dust, and mechanical damage, and keep roots moist. Set balled stock on ground or heeled into ground, and cover ball with soil, mulch, or as approved by the Owner. Storage for more than two (2) weeks shall not be allowed without permission from the Owner. Plant damage due to Contractor's planting delay shall be the responsibility of the Contractor.

- E. Water root systems of trees stored on site with a fine-mist spray. Water as often as necessary to keep root systems moist during storage and planting.
- F. Deliver packaged materials in containers showing weight, analysis, and name of manufacturer. Protect materials from damage during delivery and while stored at site.

3.10 TREE AND SHRUB PLANTING

- A. Fill entire shrub bed or planting area to depths indicated on Drawings with approved planting soil, according to requirements in Article 2.1.
- B. Take care not to disturb any adjacent site improvements. If, in the opinion of the Owner, any damage to adjacent materials occurs as a result of planting operations, repair the damaged materials at no cost to the Client and/or the Owner.
- C. Stake location for all trees for review by the Owner before any plant pits or beds are dug, and before plant delivery to site. Stake locations with stakes or flagging, outline planting areas for massed planting, and obtain the Owner's review and acceptance before the start of planting work. The Owner reserves the right to determine the exact location of every tree and to change the location of any tree to an area of similar conditions.
- D. Keep plant roots and earth balls moist and protect from sun and wind during entire planting operation.
- E. Set balled and burlapped stock plumb in staked location. If top of rootball needs to be raised to conform to proposed finished grade, use leveling bed of compacted planting soil or existing subgrade to set ball. Set top of root ball for trees slightly higher ($\frac{1}{2}$ inches) than surrounding grade, judging planting height to allow for settling, to meet grade after settling as plant grew in nursery; refer to detail drawing. Scarify soils on sides of pit to facilitate integration of backfill with existing soil for better root penetration as plants grow. Roll back top 12 inches of burlap and remove wire baskets from tops and sides of ball but do not remove materials from under large tree root balls. Planting stock with root balls cracked or broken before or during planting operation will be cause for rejection. Remove all non-biodegradable wrapping or binding material or containers from shrubs.
- F. Place planting soil around ball in six-inch layers, tamping to settle backfill and eliminate air pockets. When pit is approximately half backfilled, water thoroughly until no more is absorbed. Water again after placing and tamping final layer of backfill. Compact planting soil and planting soil mix to approximately 85%

maximum dry density. Do not over compact planting areas; the Owner reserves the right to reject over compacted soil installation and request removal and replacement of soil and plants.

G. All plant roots and earth balls shall be damp and thoroughly protected from sun and wind from the beginning of the digging operation, during transportation and at the site until the final planting. Remove container plants from containers prior to planting. All plants shall be planted in the center of the holes and at the same depth as they previously grew. After completion of planting installations, remove rope, wires, etc. from the top of the root balls. Remove burlap only from top third of root ball. Planting soil mix shall be backfilled in layers of not more than 6 inches and each layer watered sufficiently to settle before the next layer is put in place. Enough planting soil mix shall be used to bring the surface to finished grade when settled. A saucer shall be formed around each plant at a depth of 6 inches for trees and 4 inches for shrubs. All trees shall be planted 3 inches higher than the surrounding grade beyond the saucer.

H. Plant Fertilizing

1. Fertilizer packets for plants: Install one-half of the fertilizer packets at a depth of six (6) to eight (8) inches equally spaced around the plant 12 inches from the root ball, as planting soil is placed. Packets shall not be cut, ripped, or damaged. If it becomes necessary to remove and replace dead or unhealthy plants, used packets shall be replaced with new packets. The application rates for fertilizer packets shall be as follows:

<u>Type of Plant</u>	<u>Rate</u>
Deciduous Shade Tree tree.	One packet for each inch of caliper or four (4) packets, minimum for 3 ½-4-inch cal.
Evergreen Tree	One packet for every 18 inches of height
Shrub	One packet for every 12 inches of height.

I. Within one (1) day of planting, place mulch to 3” depth as indicated on detail drawings, over saucer areas of individual trees and over area of planting beds to a depth of three (3) inches after settlement. No mulch shall be spread within 4-inch diameter from tree or shrub trunk. Mounding of mulch will not be permitted.

J. All plants shall be watered immediately following planting as necessary to thoroughly moisten rootball and planting soil and thereafter shall be inspected frequently for watering needs and watered, as required, to provide adequate moisture in the planting pit. Inspect tree pits 24 hours after initial watering to confirm that they are draining properly. If surface water or excessively saturated plant pit soils exist, immediately notify the Owner.

3.11 PLANTING OF CONTAINERIZED MATERIALS

- A. Planting of containerized materials shall follow guidelines specified above, except that all containers shall be removed before planting. Plants that are pot bound may be rejected by Owner. Rough-up and open the sides of the balls of species which have tough, fibrous roots, to ensure that roots will spread out into the planting soil after establishment. Hand spread granular, pelletized superphosphate in the bottom of each plant pit, in amounts according to manufacturer's instructions and fertilize as required herein.

3.12 TREE PRUNING

- A. Pruning shall be done only to ameliorate minor damage to branches incurred during shipping and planting; any plants with major damage shall be replaced as directed by the Owner. Remove only dead wood, damaged branches, crossed branches, and suckering shoots, in accordance with TCIA standards, minimizing amount of live growth removed. Shape trees only if additional direction is given by the Owner, maintaining natural form. Tree pruning shall be consistent to full height of tree to avoid uneven appearance and structural imbalance. Do not apply tree wound dressing. Prune in accordance with TCIA Standards for Class I, "Fine Pruning," to preserve natural character of the plant.
- B. Never cut tree leader, unless permitted by the Owner.

3.13 TREE WRAPPING

- A. Trees and trunks shall be wrapped with protective fabric during transport and delivery to storage. Trees shall not be wrapped after planting, to avoid accumulation of moisture on bark, which increases susceptibility to hidden insect infestation, and mold.

3.14 CLEANUP AND PROTECTION

- A. Protect work from damage due to landscape operations, operations by other contractors and trades, and trespassers. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged Work as directed by the Owner.
- B. Remove excess planting soil, waste material, and excess subsoil, unsuitable soil, trash, and debris, and legally dispose of material off site.
- C. Repair damage to site or structures to restore them to their original condition at no cost to the Client.

3.15 3.18 MAINTENANCE REQUIREMENTS FOR PLANTINGS

- A. Begin maintenance immediately after each area is planted and continue until the end of the one-year guarantee period after Final Acceptance.
- B. Maintenance shall consist of keeping plants in healthy growing condition and shall include but not be limited to watering, weeding saucers, grass areas, and planting

beds, mowing, cultivating, re-mulching, removal of trash, injured and dead material, resetting plants to proper grades or upright position, and maintaining mulched planting saucer.

- C. Inspect plants for watering needs at least twice each week and water as required to promote plant growth and vitality.
- D. Keep planting and grass areas free of weeds and maintain mulched saucers at required depths and size.
- E. Remove and replace immediately plants that die during the maintenance period and repair, re-seed, or re-sod all lawn areas and erosion control devices, from installation through the one (1) year guarantee period.
- F. Chemicals, pesticides, fungicides, insecticides, or herbicides within planted areas shall be applied by personnel licensed to do so in the Commonwealth of Massachusetts and only after obtaining written permission from the Owner, indicating the materials and dispensing methods allowed the dates, time and weather conditions under which procedures will occur, and traffic control, resident and pedestrian protection plan proposed. Spraying for insects, pests and diseases shall conform to the TCIA Standards under the section entitled "Standards for Pesticide Application Operations", as currently adopted.
- G. Remove trash from all planted areas weekly or as directed by the Client.
- H. During the maintenance period, any decline in the condition of plantings shall require the Contractor to take immediate action to identify potential problems and undertake corrective measures. If required, the Contractor shall engage professional arborists and horticulturists to inspect plant materials and to identify problems and recommend corrective procedures. The Owner shall be immediately advised of such actions. Inspection and recommendation reports shall be submitted to the Client.

3.16 ACCEPTANCE INSPECTION PROCEDURES

- A. Requirements of Division I shall apply to this Section.
- B. The Owner shall inspect work upon written request of Contractor, which shall be received by the Owner at least ten (10) days before the anticipated dates of inspection. Request inspection for acceptance of the plantings only after all aspects of planting operations are completed and maintained according to Specifications, all pertaining test results are acceptable, irrigation system is operating properly, and all extraneous equipment, materials and debris are removed from the project site. Do not request inspections for partially completed work. There will be no acceptance 'in parts' for planting work. All items on the punch list shall be completed to the satisfaction of the Owner before the initiation of the one-year plant establishment period (guarantee period) can commence.

- C. The Owner shall inspect work with Contractor present. At time of inspection if, in the Owner's opinion, a substantial amount of planting, materials or workmanship is deficient, Contractor's responsibility for maintenance of all work shall be extended until plant replacements are made or other deficiencies are corrected.
- D. A written report, or "punch list," issued by the Owner shall indicate to Contractor remedial items to be corrected before Final Acceptance is given.
- E. Acceptance: Acceptable plants are those that are to size and species as shown on the Drawings or accepted by the Owner, which show at least 85% live growth, actively growing or possessing live buds, with no indication of injury, disease, insect infestation, or decline due to environmental or other factors, which are plumb, mulched, and balls moist.
- F. All unsatisfactory plants shall be removed promptly. Replacement plants shall conform in all respects to Specifications for the originals and shall be planted and maintained in same manner until initial acceptance is made.
- G. Inspection request and procedure shall be repeated when remedial items are completed. Date of final acceptance of completed remedial work shall establish end of installation and initial maintenance period and commencement of guarantee period.
- H. Submit typed maintenance instructions for all plantings for the Owner's use.

3.17 PLANT ESTABLISHMENT PERIOD, GUARANTEE, AND FINAL INSPECTION

- A. Guarantee specified herein shall not deprive the Client of other rights it may have under other provisions of Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of Contract Documents.
- B. The Contractor shall guarantee the plantings for two (2) years after acceptance. During guarantee period, make monthly inspections of plant material during April through November to document condition of plants and to provide remedial measures. Continue maintenance as specified. Submit inspection reports to the Owner. Dead plants and plants with less than 85% live wood noted in inspections shall be replaced with new plants of same size and species within one (1) month or in first month of next growing season, whichever comes first, as permitted by specifications. Replacement plants shall be installed according to the Drawings and Specifications.
- C. Notify the Owner at least ten (10) days in advance of requested date of inspection at end of one-year guarantee period. Submit to the Owner, before inspection, a list of plants replaced during guarantee period with species, location, and replacement dates.

- D. All plants will be inspected by the Owner one (1) year after final acceptance and shall be alive and in satisfactory growth at the end of that time. Trees, which have settled out of plumb shall be reset, plumb or be replaced.
- E. At end of guarantee period, all saucers flattened, mulch areas re-mulched and weeded, dead wood pruned and removed, and all replacements completed. All dead or unsatisfactory grass areas shall be weeded, top-dressed, repaired, fertilized, and/or bed prepared and re-seeded until satisfactory growth with intended species has occurred, as a condition of completion of all Work at final inspection.

END OF SECTION

SECTION 02910
PLANTING SOILS

PART 1 – GENERAL

1.01 DESCRIPTION

A. This Section specifies administrative and procedural requirements for manufactured planting soils (planting soils) including, but not limited, to the following:

1. Subgrade preparations.
2. Planting soil material acquisition.
3. Testing and analysis for specification conformance.
4. Layout of drainage lines and installation of drainage layer below planting soils.
5. Preparation of mixes and testing for conformance.
6. Mock Up.
7. Installation and placement of soils.
8. De-compaction and re-compaction of soils.
9. Final in-place testing of soils.
10. Coordination with other contractors.
11. Clean-up.

B. References to other Sections are given that would duplicate provisions in this Section.

1.02 RELATED WORK

- A. Section 02900 – Planting and Seeding
- B. Section 02210 – Earth Excavation, Backfill, Fill and Grading
- C. Section 02701 – Exfiltrating Bioretention Areas

1.03 REFERENCES

A. Definitions:

1. Refer to Section 02900 Planting and Seeding.

2. ASA: American Society of Agronomy.
3. Subgrade: Soil material and levels resulting from the approved rough grading work.
4. Seeded Areas and Planting Soils: Seeded areas and Planting Soils are composed of a blend of three base components: base loam, organic material and sand. The quality of the blend depends on the quality of the original components. Locate and obtain approval of sources for base loam, organic material and sand that meet the Specification requirements. Contractor is then responsible for mixing the components. Approximate mixing ratios are provided, but may require adjustment, depending on the final materials and with the approval of the Architect or their representative, in order to meet Specification requirements for each blend.

1.04 TESTING, SUBMITTALS, MOCK-UPS AND INSPECTIONS

- A. Testing for Subgrade, Planting Soil Components and Planting Soil Mixes: Testing is required at the following intervals:
 1. Testing of individual components (Base Loam, Sand, and Compost) for planting soil mixes prior to blending of any soils for use at the Project Site. Tests are as described in this Section.
 2. After test results for components have been accepted, create sample Planting Soil Mixes of each planting soil mix and perform tests described in this Section.
 3. After the test results for each Planting Soil Mix have been accepted, and during the production of planting soils, test every 200 cubic yards of every Planting Soil Mix blended for: organic matter content, gradation, and pH. Before shipping of any Planting Soil Mix, the Contractor shall confirm that the Owner has accepted the mix. Testing applies to all soil layers of the planting profile. After three consecutive compliant tests, the Contractor may increase the interval of testing to 500 cubic yards.
 4. After horticultural tests have been approved, contractor shall submit representative samples of each soil blend to a geotechnical testing laboratory for ASAM 698 Standard Proctor tests to obtain optimum moisture content and maximum dry density values.
 5. In-place tests: Compaction tests of each type of material (soil layer) placed shall be in accordance with this Section. Infiltration tests shall be in accordance with this Section.
 6. Installation of Drainage Layer: Contractor shall notify Owner at least 5 days prior to the installation of drainage layers. Contractor shall demonstrate layout

and installation of drainage lines and drainage layer. Seeded areas and planting soil shall not be installed until drainage layer is accepted.

B. Test Reports: Submit certified reports for tests as described in this Section.

1. Mechanical gradation (sieve analysis) shall be performed for sand, silt, and clay content and compared to the USDA Soil Classification System using sieve size numbers: 10, 18, 35, 60, 140 and 270. The silt and clay (0.002 mm) content shall be determined by a Hydrometer Test (ASTM D-422-63) of soil passing the #270 sieve.
2. Chemical analysis shall be undertaken for Phosphorus, Potassium, Calcium, Magnesium, Aluminum, Iron, Manganese, Lead, Cation Exchange Capacity, Soluble Salts, organic matter content, acidity (pH) and buffer pH.
3. Tests shall be conducted in accordance with Recommended Soil Testing Procedures for the Northeastern United States, 2nd Edition, Northeastern Regional Publication No. 493; Agricultural Experiment Stations of Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont and West Virginia. Tests include the following:
 - a. Test for soil Organic Matter by loss of weight on ignition, as described in Northeastern Regional Publication No. 493.
 - b. Test for soil CEC by exchangeable acidity method as described in Northeastern Regional Publication No. 493.
 - c. Test for soil Soluble Salts shall be by the 1:2 (v:v) soil:water Extract Method as described in Northeastern Regional Publication No. 493.
 - d. Test for Buffer pH by the SMP method as described in Northeastern Regional Publication No. 493.
 - e. Tests for pH shall be conducted on a 1:1 soil to distilled water ratio.
4. Certified reports on analyses from producers of composted organic materials shall be required and new test reports shall be submitted when compost sources are changed. Analyses shall include all tests for criteria specified in 2.1, K.
5. Saturated Hydraulic Conductivity: Test procedure ASTM D5856-95 (2000).
 - a. Hydraulic Conductivity tests shall be performed on samples during QA/QC testing at the Soil Supplier's facility.
6. Testing Agencies: The following firms are acceptable testing agencies for the various components and blends.

- a. Leaf Yard Waste Compost Comprehensive and Stability Test: Woods End Research Laboratory, P.O. Box 297, Mt. Vernon, ME, 04352, tel: 201.293.2457, fax: 201.293.2488.
 - b. Mechanical Gradation, Chemical Analysis and Organic Matter Content, All Soil Components and Planting Soil Mixes: University of Massachusetts, 203 Paige Laboratory, 161 Holdsworth Way, Amherst, MA 01003, <http://soiltest.umass.edu>, tel: 413.545.2311, fax: 413.545.1931 or approved equal.
7. Laboratory Density Testing: ASTM D698 - 12 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort
- a. Density tests shall be performed on samples collected at the Soil Supplier's facility, to obtain the optimum moisture content and maximum dry density values.
- C. In-Place Testing
8. Density Tests: ASTM D1556 Density of soil and rock in place using "Sand Cone Method" or ASTM D6938-08a Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth). ASTM D698 Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort. (Standard Proctor).
- a. In-place density tests shall be carried out at a rate of one test per each plant bed or seeded area.
 - b. Soil density shall meet the requirements specified herein, see
9. As required, in-place infiltration tests shall be performed using Turf-Tec IN2-W Infiltrometer utilizing manufacturer's operating instructions, or by the perforated canister method established in Section 3.5.
10. At the direction of the Owner, in-place planting soil blends shall be sampled and tested by the Owner for compliance with gradation and organic matter content as specified herein. Non-compliant materials shall be removed from the site or amended as specified by the Owner.
- C. Samples: Prior to ordering the below listed materials, submit representative composite samples to the Owner for selection and approval. Representative composite samples shall be composed of at least five equal-sized subsamples mixed thoroughly and resampled for submittal. Do not order materials until Owner's acceptance has been obtained. Delivered materials shall closely match the approved samples.
1. Components

- a. Compost: duplicate samples of 1 gallon.
 - b. Base Loam: duplicate samples of 1 gallon.
 - c. Medium to Coarse Sand: duplicate samples 1 gallon.
 2. Test Blends
 - a. Planting Bed Soil: duplicate samples of 1 gallon.
 - b. Horticultural Subsoil: duplicate samples of 1 gallon.
 3. Production Stockpiles
 - a. Planting Bed Soil: duplicate samples of 1 gallon.
 - b. Horticultural Subsoil: duplicate samples of 1 gallon.
 4. Materials (as required)
 - a. Filter Fabric Mirafi 140N or equal: duplicate one square foot samples.
 - b. Underdrainage 12” Panel Drain w/Filter Fabric: duplicate samples of 1 foot.
 - c. Underdrainage 6” Non-perforated Pipe: duplicate samples of 1 foot.
- D. Sources for Base Loam, Sand, and Compost: Submit information identifying sources for all soil components and the firm responsible for mixing of planting soil mixes.
1. Owner shall have the right to reject any soil supplier or mixing facility.
 2. Soil mix supplier shall have a minimum of five years experience at supplying custom planting soil mixes.
 3. Submit supplier name, address, telephone and fax numbers and contact name.
 4. Submit certification that accepted supplier/ mixer is able to provide sufficient quantities and qualities of materials for the entire project.
 5. Final approval of soil supplier/ mixer shall be made after on-site review of supplier’s and mixer’s facility(ies) by the Owner.
- E. Subgrade Survey
1. Contractor shall submit for approval by the Owner a survey of final subgrade in all areas where planting soils will be placed. Placement of any drainage layer or planting soil shall not precede acceptance by the Owner.

F. Mock Up and Inspection

1. At the beginning of site work, the contractor shall demonstrate, in the presence of the Owner, subgrade preparations, including de-compaction and re-compaction methods and placement of sand blanket and drain lines that achieve the requirements of this Section. All subsequent subgrade preparations shall be in accordance with approved methods.
2. The Contractor shall not place Planting Soil, Horticultural Subsoil or Seeding Soil on prepared subgrade or drainage layer prior to inspection and approval of Owner for compliance with depth, compaction and percolation rate. The Contractor shall request inspection before proceeding at least ten working days prior to placement of soils.
3. The Contractor shall not plant any plant material prior to inspection and approval of Owner for compliance with soil depth and compaction specifications. The Contractor shall request inspection before proceeding at least ten working days prior to placement of soils.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Refer to Section 02210 Earthwork for overall material handling requirements.
- B. In addition, the following provision is established: Material shall not be handled or hauled, placed or compacted when it is wet as after a heavy rainfall, early spring or if frozen. Soil shall be handled only when the moisture content is compliant with Section 02910 1.6.G. The Owner shall be consulted to determine if the soil is too wet to handle.
- C. Store and handle packaged materials in strict compliance with manufacturer's instructions and recommendations. Protect all materials from weather, damage, injury and theft.
- D. Sequence deliveries to avoid delay. On-site storage space is permissible only with written notice from Construction Manager. Deliver materials only after preparations for placement of planting soil have been completed.
- E. Prohibit vehicular and pedestrian traffic on or around stockpiled planting soil.
- F. Planting Soil that is to be stockpiled longer than two weeks, whether on or off site, shall not be placed in mounds greater than six feet high.
- G. Soil Moisture Content
 1. Contractor shall not move, blend or grade soil when moisture content is so great that free moisture is apparent, nor when it is so dry that dust will form in the air or that clods will not break readily, nor when it is frozen. Apply water, if

necessary, or allow to dry to bring soil moisture between 60% of optimum moisture content and optimum moisture content as determined by ASTM D698 prior to compaction, grading or planting.

2. Field Soil Moisture Test procedure is applicable for general soil moving and placement only and shall not be considered appropriate for compaction of soils, nor is a replacement for the above testing procedure.
 - a. Form soil in palm of hand, if soil retains shape and crumbles upon touching, the soil may be worked.
 - b. If the soil will not retain shape it is too dry and should not be worked.
 - c. If the soil retains shape and will not crumble, it is too wet and should not be worked.
 - d. If the soil glistens or free water is observed when the sample is patted in the palm of hand the soil is too wet and should not be worked.

1.06 QUALIFICATIONS

A. Testing/Testing Agency

1. Refer to Section 02210 Earth Excavation Backfill and Grading
2. Refer to Section 02900 Planting and Seeding
3. Refer to this section, 1.5 B.

B. Contractor is solely responsible for quality control of the Work.

C. The installer shall be a firm having at least 5 years of successful experience of a scope similar to that required for the Work, including the preparation, mixing and installation of custom Planting Soil and planting mixes in urban locations.

1. The installing Contractor shall be the same firm that is installing planting as described in Section 02900 Planting and Seeding.
2. Installer Field Supervision: Installer to maintain an experienced full-time supervisor on Project site when any Planting Soil preparation work is in progress.
3. The installer's crew shall be experienced in the installation of soil, grading and interpretation of grading plans in urban areas.

D. Soil work shall be performed by a firm that has sufficient earthwork machinery at the job site simultaneously to amply provide for the vigorous execution of the site work

without interruption or delay, except for unforeseen circumstances, such as weather. Machinery operators shall be well experienced in this type of work.

- E. Comply with applicable requirements of the laws, codes, ordinances and regulations of Federal, State and municipal authorities having jurisdiction. Obtain necessary approvals from all such authorities.
- F. Comply with all requirements for control of silt and sediment during soil installation work as indicated in the contract documents. Provide additional silt and sediment control to maintain silt and sediments within the working area as required by the progress of the work or as directed by the Owner.
- G. Pre-installation Conference: Conduct conference at project site prior to the start of any work related to Planting Soil preparation
- H. Layout and Grading:
 - 1. Permanent benchmarks shall be established by a registered land surveyor or professional civil engineer, at the Contractor's expense. The Contractor shall maintain established bounds and benchmarks and replace them, if any are destroyed or disturbed.
 - 2. The Contractor shall maintain at the site, sufficient surveying equipment to accurately excavate to the required subgrade and install soil to the required finish grade. The Contractor shall be responsible to install soil profiles at the elevations and thickness shown on the Plans.

PART 2 – PRODUCTS

2.01 SOIL MATERIALS

A. General

1. All plant mix material shall be imported and fulfill the requirements as specified and be tested to confirm the specified characteristics.
2. Samples of individual components of soil mixes in addition to blended soil mixes including mulch materials shall be submitted by the Contractor for testing and analysis to the approved testing laboratory. Comply with specific materials requirements specified.
 - a. No base component material or soil components for soil mixes shall be used until certified test reports by an approved soil testing laboratory and have been received and approved by the Owner.
 - b. As necessary, make any and all soil mix amendments and resubmit test reports indicating amendments until approved.
3. The Owner may request additional testing by Contractor for confirmation of mix quality and/or soil mix amendments at any time until completion. Changes in mix ratios may be required.

B. Soil Testing and Soils Testing Report Submittal

1. All testing of the soil mix components shall be carried out by the Soils Testing Laboratory. Recommendations for amending and/or correcting the soil mix will be provided to the Contractor by the Owner.
2. Failure of any material by testing and/or amendment procedure to meet Specification requirements shall require the Contractor to seek another source for the failed material and the initiation of all testing procedures for the new replacement material shall immediately take place.
3. The Contractor shall be responsible for recognizing that these critical project materials warrant timely and serious attention, that the testing process to achieve Approved materials should be considered a lead time item, and that under no circumstance shall failure to comply with all specification requirements be an excuse for “staying on project construction schedule.”

- #### C. Soil Samples: Contractor is responsible for paying costs for testing. Submit 1-gallon planting soil samples in two phases. Submit samples concurrent with horticultural soil test reports in both phases. Submit as phase one, planting soil base components for approval. Only after approval of phase one components, submit as phase two, soil

blend mixes / mediums for approval. All reports must be from recent analyses, less than 90 days old, and represent materials that are available for delivery to the site.

1. Phase One Submittals of Planting Soil Base Components:
 - a. Base Loam (Imported Topsoil)
 - b. Organic Amendment Materials (Compost)
 - c. Coarse Sand for Amending Soil
 - d. Crushed Stone
 - e. Fill Sand
2. Phase Two Submittals of Planting Mediums: mixing and batching of soil mediums to be submitted in the same manner as bulk soils and will be prepared prior to delivery to site.
 - a. Horticultural Subsoil
 - b. Seeded Area Soil
 - c. Planting Bed Soil
3. Phase Three Submittals shall be identical to Phase Two Submittals and be conducted initially for each 200 cubic yards of soil material prepared for the project site. After three compliant tests the QA/QC submittals may be reduced to every 500 cubic yards.
4. Submit reports for each of the above samples: Submit sample from each proposed source for testing and approval. Deliver samples to both the testing laboratory and the Owner. Send report directly to Owner's Representative.
5. Soil Sample Submittals: Sampling shall be done by the Contractor. The size of the samples and method of sampling shall be as follows: Samples shall be representative of the material to be brought to the site. Each sample shall be a Composite Sample, which consists of 5 separate sub samples taken from a minimum of (5) different locations at each source and mixed together to make the test sample.
6. The Contractor shall schedule this testing in order to permit reasonable time for testing, evaluation, and approvals prior to scheduled installation. Allow for a minimum of 4 weeks to perform testing and obtain approvals.

D. Imported Base Loam

1. Imported Base Loam, as required for blending with sand and compost, shall be a naturally occurring A-Horizon soil formed from geologic soil forming processes without admixtures of sand or organic matter sources (composts). Base Loam, which has been contaminated by incorporation of subsoil, shall not be acceptable for use. Base Loam as required for the work shall be free of subsoil, large stones, earth clods, sticks, stumps, clay lumps, roots or other objectionable, extraneous matter or debris. Base Loam shall also be free of quack-grass rhizomes, Agropyron Repens, and the nut-like tubers of nutgrass, Cyperus Esculentus, and all other primary noxious weeds. Base Loam shall not be delivered or used for planting while in a frozen or muddy condition. Base Loam for mixing shall conform to the following grain size distribution for material passing the #10 sieve:

U.S. Sieve Size Number	Percent Passing	
	Minimum	Maximum
10	---	100
18	85	100
35	70	95
60	50	85
140	36	53
270	32	42
0.002mm	3	6

2. The ratio of the particle size for 80% passing (D80) to the particle size for 30% passing (D30) shall be 8 or less ($D80/D30 < 8$).
3. Maximum size shall be one-inch largest dimension. The maximum retained on the #10 sieve shall be 20% by weight of the total sample. Tests shall be by combined hydrometer and wet sieving in compliance with ASTM D422 after destruction of organic matter by ignition.
4. The organic content shall be between 4.0 and 8.0 percent by weight.
5. pH shall be between 5.8 and 7.0.
6. Chemical analysis shall be undertaken for Phosphorus, Potassium, Calcium Magnesium, Aluminum, Iron, Manganese, Lead, Cation Exchange Capacity, Soluble Salts, acidity (pH) and buffer pH.

E. Medium to Coarse Sand

1. Sand for Planting Soil Blends, protection of filter fabric and for drainage as required, shall be uniformly graded medium to coarse sand consisting of clean, inert, rounded to sub-angular grains of quartz or other durable rock free from loam or clay, mica, surface coatings and deleterious materials with the following grain size distribution for material passing the #10 sieve:

U.S. Sieve Size Number	Percent Passing	
	Minimum	Maximum
10	100	--
18	60	80
35	25	45
60	8	20
140	0	8
270	0	3
0.002mm	0	0.5

2. Maximum size shall be one-inch largest dimension. The maximum retained on the #10 sieve shall be 20% by weight of the total sample.
3. The ratio of the particle size for 70% passing (D70) to the particle size for 20% passing (D20) shall be 2.8 or less ($D70/D20 < 2.8$). Tests shall be by combined hydrometer and wet sieving in compliance with ASTM D422.
4. pH shall be less than 7.5.

F. Fill Sand Layer/Drainage Material

1. Sand for Fill or for Drainage shall meet the requirements of Coarse Sand above, or Alternate Fill Sand Drainage Material may be substituted, provided it meets the Specification ranges below, and is submitted and accepted by the Owner.
2. Free-draining sand and gravel borrow shall consist of inert, hard, durable stone and coarse sand, free from loam, clay, mica, surface coatings and deleterious materials and shall conform with the following gradation:

<u>U.S. Sieve No.</u>	<u>% Passing by Weight</u>	
	Minimum	Maximum
3 inch	100	-
1/2 inch	60	-
# 4	40	100
# 50	8	28
# 200	0	5

3. Fill Sand and drainage fill borrow shall be placed in lifts not more than nine inches thick before compaction. Compaction shall be by vibration to a density between 90 and 95% Standard Proctor. Saturated hydraulic conductivity of the sand and gravel shall be not less than 15 inches per hour according to ASTM D5856-95 (2000) when compacted to a minimum of 95% Standard Proctor, ASTM 698.

G. Organic Amendment (Compost)

1. Organic Matter for amending planting soils shall be a stable, humus-like material produced from the aerobic decomposition and curing of Leaf Yard Waste Compost, composted for a minimum of one year (12 months). The leaf yard waste compost shall be free of debris such as plastics, metal, concrete or other debris. The leaf yard waste compost shall be free of stones larger than 1/2", larger branches and roots. Wood chips over 1" in length or diameter shall be removed by screening. The compost shall be a dark brown to black color and be capable of supporting plant growth with appropriate management practices in conjunction with addition of fertilizer and other amendments as applicable, with no visible free water or dust, with no unpleasant odor, and meeting the following criteria as reported by laboratory tests.
 - a. The ratio of carbon to nitrogen shall be in the range of 12:1 to 25:1.
 - b. Stability shall be assessed by the Solvita procedure. Protocols are specified by the Solvita manual (version 4.0). The compost must achieve a maturity index of 6 or more as measured by the Solvita scale. Stability tests shall be conducted by Woods End Research Laboratory, Mt. Vernon, Maine.
 - c. Organic Content shall be at least 20 percent (dry weight). One hundred percent of the material shall pass a 1/2-inch (or smaller) screen. Debris such as metal, glass, plastic, wood (other than residual chips), asphalt or masonry shall not be visible and shall not exceed one percent dry weight. Organic content shall be determined by weight loss on ignition for particles passing a number 10 sieve.
 - d. pH: The pH shall be between 6.5 to 7.4 as determined from a 1:1 soil-distilled water suspension using a glass electrode pH meter American Society of Agronomy Methods of Soil Analysis.
 - e. Salinity: Electrical conductivity of a one to five soil to water ratio extract shall not exceed 2.5 mmhos/cm (dS/m).
 - f. The compost shall be screened to 1/2-inch maximum particle size and shall contain not more than 3 percent material finer than 0.002mm as determined by hydrometer test on ashed material.

Nutrient content shall be determined by the Soil Testing Laboratory and utilized to evaluate soil-required amendments for the mixed soils. Chemical analysis shall be undertaken for Nitrate Nitrogen, Ammonium Nitrogen, Phosphorus, Potassium, Calcium, Aluminum, Magnesium, Iron, Manganese, Lead, Soluble Salts, Cation Exchange Capacity, soil reaction (pH), and buffer pH.

2.02 PLANTING SOIL MIXES

- A. All existing vegetation shall be removed from stockpiles prior to blending. Uniformly mix ingredients by windrowing/tilling on an approved hard surface area or by

alternately processing materials through a screening plant. All soil components and Organic Amendment shall be maintained moist, not wet, during mixing. Amendments shall not be added unless approved to extent and quantity by the owner and additional tests have been conducted to verify type and quantity of amendment is acceptable. Percentages of components are approximate and will be verified upon completion of individual test results for components of the various mixes. Due to variability of soil materials, mix ratios may require adjustment and re-submittal at the expense of the Contractor.

B. After component percentages are determined by the Owner, each planting soil mix shall be tested for physical and chemical analysis. Component percentages may be modified at any time by the Owner dependent upon the results of testing of the various components or final blends.

C. Planting Bed Soil

1. Planting Bed Soil shall consist of a combination of approximately equal parts by volume Stripped Existing or Imported Base Loam, Coarse Sand and Organic Amendment/Compost (1L:1S:1C) to create a uniform blend which meets the following requirements.
2. Gradation for material passing a Number 10 Sieve shall be achieved in the final mix.

U.S. Sieve Size No.	Percent Passing	
	Minimum	Maximum
10	100	
18	85	95
35	60	85
60	42	65
140	21	44
270	18	24
0.002 mm	2	4

3. Maximum size shall be one half-inch largest dimension. The maximum retained on the #10 sieve shall be 10% by weight of the total sample.
4. The ratio of the particle size for 80% passing (D80) to the particle size for 30% passing (D30) shall be 6 or less ($D80/D30 < 6$).
5. The final mix shall have an organic content between 5 and 7 percent by weight.
6. pH shall be between 6.2 and 6.8.

7. The final mix shall have a hydraulic conductivity of not less than 1.5 inches per according to test procedure ASTM D5856-95 (2000) hour when compacted to a minimum of 86 percent Standard Proctor ASTM D 698. Tests shall be by combined hydrometer and wet sieving in compliance with ASTM D422 after destruction of organic matter by ignition.
8. Chemical analysis shall be undertaken for Phosphorus, Potassium, Calcium Magnesium, Aluminum, Iron, Manganese, Lead, Cation Exchange Capacity, Soluble Salts, acidity (pH) and buffer pH.

PART 3 – EXECUTION

3.01 PRE-INSTALLATION EXAMINATION AND PREPARATION

- A. Reference Other Sections as necessary.
- B. Coordinate activities with other project contractors so that there is no soil disturbance from traffic or other construction activities subsequent to placement.
- C. Pre-Installation Examination Required: The Contractor shall examine previous work, related work, and conditions under which this work is to be performed and shall notify Owner in writing of all deficiencies and conditions detrimental to the proper completion of this work. Beginning work means Contractor accepts substrates, previous work, and conditions. The Contractor shall not place any planting soil until all work in adjacent areas is complete and approved by the Owner.
- D. Kickoff Meeting: At least 10 working days prior to the start of work, the contractor shall request a landscape construction kickoff meeting with the Owner and any other parties involved with the landscaping. The contractor must demonstrate familiarity with this Section 02910 Planting Soils, and other relevant sections of the construction documents. The contractor shall articulate the means and methods of soil blending, subgrade preparation, soil placement and other steps outlined in the Specification.
- E. Examination of Subgrade: The subgrade shall be examined by the Contractor prior to the start of subgrade preparation, soil placement and planting. Any deficiencies shall be noted and related to the Owner in writing prior to acceptance of the subgrade by the Landscape Contractor. Deficiencies include, but shall not be limited to the following:
 - 1. Construction debris present within the planting areas.
 - 2. The subgrade is at incorrect depths for installing the designed soil profile and drainage layer.
 - 3. Incomplete irrigation and/or subsurface drainage installation.
 - 4. Incomplete lighting and exterior electrical installation.
 - 5. Conflict with underground utilities.
 - 6. Subgrade contaminated with oils, compressible material, silt or clay
 - 7. Subgrade without drainage layer must infiltrate water at the rate of at least one inch per hour.

- F. Confirm that the subgrade is at the proper elevation and compacted as required. Subgrade elevations shall slope parallel to the finished grade and/or toward the subsurface drain lines as shown on the drawings.
 - 1. Slope sides of excavations to comply with local codes and ordinances having jurisdiction. Shore and brace slopes where required and maintain sides of slopes of excavations in safe condition until completion of backfilling. Provide protection measures as required for public safety.
 - 2. All subgrade areas to be filled with Drainage Layer, Seeded Area or Planting Soil shall be free of construction debris, refuse, vegetation, compressible or decay able materials, all stones greater than 6 inches, concrete washout or soil crusting films of silt or clay that reduces or stops drainage from the Seeding or Planting Soil into the subsoil; and/or standing water. Such material shall be removed from the site.
 - 3. The subgrade must slope at a minimum of two percent towards the bottom of slopes and subdrains. Subgrade levels shall be adjusted as required to ensure that all planting and seeded areas have adequate drainage.
- G. Do not proceed with the installation of Drainage Layer, Seeding or Planting Soil, until all utility work in the area has been installed.
 - 1. The Contractor shall identify the locations of underground utilities prior to proceeding with soil work and shall protect all utilities from damage.
- H. Planting Soil Preparation: Refer to Section 02900 for planting soil and mixtures. Examine soil and remove foreign materials, stones and organic debris over 1/2" in size. Remove all vegetation from stockpiles prior to blending. Mix-in fertilizers and amendments as required by tests and as approved by Owner. All preparation and mixing shall be accomplished when the soil moisture content is compliant with Section 02900 1.6G and at a moisture content approved by the Owner. If lime is to be added, it shall be mixed with dry soil before fertilizer is added and mixed.

3.02 EXCAVATION AND REMOVAL

- A. Refer to 02210 - Earth Excavation, Backfill, Fill and Grading.

3.03 MIXING OF PLANTING SOIL MIXES

- A. Soil blends shall be produced with equipment that blends together each component in a thorough and uniform manner. This may be accomplished by a minimum of three handling events on a hard-surfaced area with earth moving equipment or by alternately passing soil components through a screener.
- B. Base components and Soil Mix stockpiles should be protected from wind and rain and shall not be permitted to be stored in standing water.

3.04 WORKING AROUND UTILITIES

- A. Carefully examine the civil, record, and survey drawings to become familiar with the existing underground conditions before digging.
- B. . Contact the local Dig Safe organization and give them their required time to respond and mark the property. Determine location of underground utilities and perform work in a manner that will avoid possible damage. Hand excavate, as required. Maintain grade stakes set by others until parties concerned mutually agree upon removal.
- C. Perform work in a manner that will protect utilities from damage. Hand excavate as required and provide adequate means of support and protection of utilities during soil installation operations. Maintain grade stakes set by others until parties concerned mutually agree upon removal. The Contractor shall repair all utilities damaged by soil operations at the Contractor's expense.

3.05 SUBGRADE PREPARATION, INSPECTION AND PERCOLATION TESTING

- A. After subgrade levels have been reached, the Owner shall observe de-compaction and preparation of the subgrade according to this Section and inspect soil conditions to evaluate subsurface drainage conditions.
- B. Coordinate the following scarification work to eliminate subgrade compaction when located in seeded and planting areas. Maintain 12" clearance from any underground utilities during subgrade de-compaction.
 - 1. Heavy Site Subgrade Compaction Mitigation:
 - a. Heavily compacted subgrade areas such as, but not limited to, temporary parking areas, material stockpile areas, temporary roadways, construction areas and areas around structures and other similar areas.
 - b. Heavy Site Subgrade Compaction Mitigation is not required in newly placed fills with material meeting 2.1F Alternate Sand for Fills, or 2.1D Coarse Sand for Blending as provided in this Specification.
 - c. Prior to establishing the final subgrade, these areas shall be dug up or ripped to a depth of (18) inches to break up the soil hard pan, then re-compacted with two passes of the tracks of a wide track bulldozer size D-6 or smaller, or other approved equipment. Vibratory compaction of subgrade in planted areas is prohibited.
 - 2. General Site Subgrade Compaction Mitigation for fills and all seeded areas and planting areas that are not heavily compacted and would be mitigated as specified in Item 1 above:
 - a. Immediately prior to placing drainage layer or Planting Soil, the entire subgrade shall be loosened to a minimum depth of 8-inches using the teeth

of a backhoe or other suitable equipment, then re-compacted with two passes of the tracks of a wide track bulldozer size D-6 or smaller, or other approved equipment. Vibratory compaction of subgrade in planted areas is prohibited.

- C. After Subgrade has been scarified as described above, it shall be recompressed by using the tracks of a wide-tracked bulldozer, multiple passes of a skid steer loader, or the curled bucket of an excavator. In areas of subgrade with no drainage layer, verify the subgrade passes water at or greater than the minimum requirement.
- D. Remove all stones or debris greater than 6” in any dimension from the subgrade prior to placing Drainage Layer or Planting Soils.
- E. After the subgrade has been prepare, Percolation Tests shall be performed according to the following test procedures.
 - 1. Utilize perforated canisters or buckets seven to ten inches in diameter and a minimum of six inches high.
 - 2. A test hole shall be hand dug at the soil horizon to be tested approximately one-inch larger than the diameter of the test canister and approximately six inches deep. The sides of the test hole shall not be smoothed.
 - 3. Place one-half inch of clean coarse sand in the bottom of the hole and place the canister firmly into the hole. The space around the canister shall then be filled with coarse sand. Tamp the coarse sand to firmly fill any void space around the test canister.
 - 4. Fill the canister with water to the soil horizon level and allow to drain until approximately one inch of water remains, or a minimum of 1 hour.
 - 5. Refill the canister to the soil horizon level. After the water level drops approximately one inch, start the test. Record time versus water level as the water level drops. The percolation rate is the length of time for the water level to drop per inch. The rate of percolation shall be recorded for a minimum of one hour or until the water level has dropped a minimum of three inches after the start of measurements.
 - 6. All subgrade must be capable of drainage at a minimum of one inch per hour prior to placement of any seeded areas or planting soil. If the subgrade fails this requirement, contact the Owner to determine if a drainage layer is required.

3.06 BACKFILLING OF HORTICULTURAL SOIL LAYERS

- A. Soil Placement Preparation:

1. Verify that the subgrade preparations have been reviewed and accepted, including de-compaction and removal of large stones.
 2. Notify the Owner of soil placement operations at least seven calendar days prior to the beginning of work.
 3. In areas with no drainage layer, verify that the subgrade passes the minimum water infiltration requirement.
 4. Do not proceed with the installation of Seeded Area or Planting Soils, until all utility work in the area has been installed.
 5. The Contractor shall identify the locations of underground utilities prior to proceeding with soil work and shall protect all utilities from damage.
 - 6.
 7. Protect adjacent walls, walks and utilities from damage or staining by the soil. Use plywood and/or plastic sheeting as directed to cover existing asphalt, concrete, metal and masonry work.
 - a. Clean up any soil or dirt spilled on any paved surface, including at the end of each working day.
 - b. Any damage to the paving or architectural work shall be repaired by the Contractor at the Contractor's expense.
- B. After the subgrade soils have been loosened, re-compressed and inspected, and/or Drainage Layer has been approved, or Seeded Areas and Planting Soil may be spread by using a wide track bulldozer size D-5 or smaller or may be dumped and spread with the bucket of a backhoe from the edge of the loosened area. No rubber-tired equipment or heavy equipment except for a small bulldozer shall pass over the subsoils (subgrade) after they have been loosened and recompressed. If the Contractor plans to utilize such areas for any use of heavy equipment, this work should be carried out prior to beginning the process of loosening soils or filling in that area.
- C. Placement of Planting Bed Soil, Horticultural Subsoil and Seeded Areas Soil:
1. Placement of Planting Bed Soil and plant stock shall be carried out simultaneously to prevent excessive traffic over soil lifts and to maintain the integrity of the soil layers. The contractor shall install plants simultaneously with the installation of the lower soil layers. The upper soil layers shall not be installed before all plants are installed and before the acceptance by the Owner.
 - a. After subgrade preparation and approval, in areas of tree and shrub planting with rootballs 12" in diameter or greater, crate a transition layer and place and compact Horticultural Subsoil as described in this Section.

- b. After inspection and approval of Horticultural Subsoil, place trees and shrubs in locations shown on the plans and at the proper elevations.
 - c. Create a transition layer as described in this Section. Place and compact Planting Bed Soil around trees and shrubs as described in this Section.
 2. Planting Bed Soil, Horticultural Subsoil, and Seeded Areas Soil shall be placed in lifts not to exceed 8 inches in thickness and compacted to meet minimum and maximum requirements as specified below:
 - a. A transition zone shall be formed between the prepared subgrade, drainage layer, Horticultural Subsoil, Seeded Area Soil and Planting Bed Soil by placing one inch of the upper-layer soil and raking into the lower soil to a two-inch thickness.
 - b. Planting Bed Soil shall be compacted to between 82 and 85 percent Standard Proctor.
 - c. Seeded Areas Soil shall be compacted to between 84 and 86 percent Standard Proctor.
 - d. Seeded Areas and Planting Soils shall not be compacted with vibratory equipment. must be compacted with vibratory equipment provided the moisture content is compliant with Section 329115 1.6H.
3. In all cases, the soil being placed shall be in a dry to damp condition. No wet soils shall be placed. All testing of in-place density for planting materials shall be according to ASTM D6938-10 Nuclear Methods after conducting ASTM D698 Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort.
4. Prevention of compacted soils can be accomplished by beginning the work in corner, against walls, or the center of isolated beds, and progressing outwards towards the borders.
5. Seeded Areas Soil and Planting Soils shall never be moved or worked when wet or frozen.
6. The Contractor shall place barricades or steel plates as required to prevent any unnecessary compaction of planting soil from vehicles, equipment, or pedestrian traffic.
7. After Planting Soil and Seeded Area Soil has been spread, it shall be carefully prepared by hand raking. Stones and debris over one inch in any direction shall be removed from the premises. Fine grade planting beds to a smooth even surface with loose uniformly fine texture. Remove ridges and fill depressions as required to meet finish grades. Limit fine grading to areas that can be planted

immediately after grading. Maintain the finished surfaces at the grades shown and spread additional soil to correct settlement or erosion. Surface drainage shall be maintained. Soil shall be damp and free from frost during fine grading operations.

3.07 PROTECTION

- A. The Contractor shall protect landscape work and materials from damage due to landscape operations, operations by other Contractors or trespassers. Maintain protection during installation until acceptance. Treat, repair or replace damaged Planting Soil installation work immediately.
- B. Provide all means necessary, including fences, to protect all soil areas from compaction and contamination by trash, dust, debris, and any toxic material harmful to plants or humans after placement. Any area that becomes compacted, shall be de-compacted and tilled to the extent determined by the Owner and recompressed to the density ranges specified. Any uneven or settled areas shall be filled, re-graded and re-compacted to meet the requirements of this Specification. Soil that becomes contaminated shall be removed and replaced with specified soil material.
- C. Phase the installation of the planting soil blends such that equipment does not have to travel over already installed planting soil. Use of haul roads is acceptable provided that the haul road is completely re-worked to meet the requirements of this Specification.
- D. Apply filter fabric covering and planking or other engineering controls over soil to minimize compaction and collect dust and debris in any area where the Contractor must work after the installation of Planting Soil.
- E. Till compacted Planting Soil and replace Planting Soil that has become contaminated as determined by the Owner. Planting Soil shall be tilled or replaced by the Contractor at no expense to the Owner.

3.08 CLEAN-UP

- A. During installation, keep pavements clean and work area in an orderly condition.
- B. Keep the site free of trash and debris at all times. Immediately dispose of wrappings or waste materials associated with products necessary for the completion of the work.
- C. All trash and debris shall be kept in a central collection container. Do not bury trash and debris in back-fill.
- D. Once installation is complete, remove any excess soil from pavements or embedded in fixtures.

3.09 COORDINATION AND EXCESS MATERIALS

- A. Coordinate activities with other project contractors so that there is no soil disturbance from traffic or other construction activities subsequent to placement.
- B. Excess Planting Soil Mixtures and Materials: Remove the excess planting soil mixture and materials from the site at no additional cost to the Owner unless otherwise requested.

END OF SECTION

SECTION 02920
SITE IMPROVEMENTS

PART 1 – GENERAL

1.01 DESCRIPTION

- A. The principal Work of this Section includes, but may not be limited to:
 - 1. Relocated Boulders
 - 2. Accessible Crushed Stone Paving

1.02 RELATED WORK

- A. Section 02210 - Earth Excavation, Backfill, Fill and Grading
- B. Section 02900 Planting and Seeding

1.03 REFERENCES AND STANDARDS

- A. Where references are made in these Specifications to standard specifications, codes, etc., of the U.S. Government, State or local authorities, or professional and industrial societies and associations, the applicable portions thereof shall govern as fully as if they were recited at length herein and shall include all revisions thereto issued as of the date of the Notice to Contractors pertaining hereto.
 - 1. AASHTO: American Association of State Highway and Transportation Officials
 - 2. MA MassDOT (Massachusetts Department of Transportation) formerly Massachusetts Highway Department (MHD) "Standard Specifications for Highway and Bridges", latest edition and all supplements.

1.04 QUALITY ASSURANCE

- A. Contractor shall have at least five years of experience in Landscape Work similar in materials, design, and extent to that indicated for this project and with a record of successful landscape establishment. Installer shall maintain an experienced supervisor on the project site during all times that landscape construction is in progress. Provide written qualification data for firms and persons to be responsible for Work, to demonstrate their capabilities and experience. Include lists of completed projects, with project names, addresses, phone numbers, and names and address of designers and owners.

- B. Contractor shall attend a pre-construction conference at Project Site with the Engineer and Landscape Architect, to review landscape construction procedures, site conditions, and submittal requirements required in the Work of this Section, especially the requirements for refurbishing the salvaged boulders before any products are submitted for review and approval, or landscape construction commences.

1.05 SUBMITTALS

- A. Submittals shall be made in compliance with Section 01300.
- B. Samples:
 - 1. Provide accessible crushed stone paving material for approval before installation.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Upon receipt at the job site, all materials shall be checked to ensure that no damage occurred during shipping or handling. Materials shall be stored in such a manner to ensure proper ventilation and drainage, and to protect against damage, weather, vandalism, and theft.

1.07 ACCESSIBILITY AND SAFETY CODES

- A. From time to time there are changes made in the federal and /or state accessibility and/or building codes or it is determined that different codes are applicable to a site. Such determinations or changes may occur during the course of the construction of this project. If changes become necessary to meet codes a change order shall be issued by the DCR to cover statutory requirements.
- B. The 521 CMR Rules and Regulations of the AAB and ADA shall be adhered to on this project. The project must be constructed in accordance with the Wheelchair Ramp Standards booklet effective latest edition, and the Construction and Traffic Standard Details, 1996 Metric Edition, and as revised in current standard requirements.

1.08 WARRANTIES/GUARANTEES

- A. The Contractor shall warrant all work of the Site Improvements, both materials and labor, for a period of not less than two years from date of Final Acceptance by the DCR. The Contractor shall be held strictly responsible for all of his work. If failure in the work develops within (1) year of the date of Final Acceptance of the work, the Contractor shall be required to replace all faulty materials at his/her full expense. To this end, the Contractor is advised to purchase materials under a warranty from the manufacturer guaranteeing proper service under the conditions, which are established by the Drawings, Specifications, and local conditions.

- B. The Contractor shall furnish labor and materials to fulfill the requirements of this warranty at no additional cost to the DCR. All labor shall include premium time to correct any faulty material or workmanship and all materials required to complete the work.

PART 2 – PRODUCTS

2.01 RELOCATED BOULDERS

- A. The boulders shall be selected by the Landscape Architect prior to installation.
- B. The boulders shall be cleaned of all dirt and stains (as practical) without damaging the structural integrity of the stone.
- C. The boulders shall be set as shown on the drawings with location and elevation verified in the field with the DCR and the Landscape Architect before final construction.

2.02 ACCESSIBLE CRUSHED STONE PAVING

- A. Refer to the Drawings for dimensions and installation. Stone shall be selected from a range of samples submitted before construction.
- B. Stone shall be durable, hard, inert, clean washed, graded crushed or ‘rotten’ granite or other crushed angular igneous stone mix meeting the following sieve analysis:

<u>Sieve Designation</u>	<u>Percentage by Weight Passing Square Mesh Sieves</u>
½ in.	100
3/8 in.	75-90
No. 4	60-75
No. 100	20-40
No. 200	10-20

- C. Crushed stone material shall be light or medium grey, pink, or tan (or combination of warm colors). Clay, organic materials, rounded beach sand, bank run gravel sands, or dark gray stone are not acceptable. It is intended that some larger stone (3/8” and No. 4 or 1/4 “) be present in the graded mix and that not all material is crushed stone fines.
- D. Wood edging and anchoring pegs shall be manufactured from 1” x 6” nominal pressure treated lightly sanded Southern Yellow Pine with 2” x 4” x 18” long stakes of same material installed every 4’ on center, particularly at joints. Fasteners shall be stainless steel. A composite timber such as *Trex* may be substituted for wood edging, anchored with 18” long hot dipped galvanized steel stakes every 4’ on center. *Trex* color shall match or compliment color of the approved crushed stone mix, tan or light gray depending on approved stone.

- E. Crushed Stone Paving shall be reinforced with an 100% acrylic liquid *Soil Stabilizer M10+50™*, manufactured by Enviroseal Corporation, tel. 1 800 775-9474 email: sales@enviroseal.com or approved equal, or dry additive, *Stabilizer™*, specifically manufactured for stabilizing crushed aggregate pedestrian paths, manufactured by *Stabilizer Solutions, Inc.* 33 South 28th St., Phoenix, AZ 85034; phone (602) 225-5900, (800) 336-2468; fax (602) 225-5902; website stabilizersolutions.com; email info@stabilizersolutions.com and also available from Read Custom Soils, Canton, MA; readcustomsoils.com; tel. 1 888 875 5526 or approved equal.
- F. Path shall include a weed barrier fabric fabricated for use under stone paths or drives, laid on compacted gravel borrow base under the crushed stone layer, lapping up the wood edge sides. Fabric shall match *Dewitt Roc-Kloth™* 3.5 ounces per SF in brown, manufactured by Dewitt, Inc; info@dewittcompany.com; tel; 1 800 888 9669 or approved equal meeting performance and materials specification, Fabric shall be installed with six-inch overlap minimum.

2.03 ADA PARKING SIGNAGE

- A. Signs and posts as shown on Drawings and conforming to MUTCD standards for the type of sign indicated. For signs, see latest edition of MassDOT Standard Specifications.
- B. Posts shall be 1 ½”-2” outside diameter hot-dip galvanized schedule 40 steel tubing in concrete footing.

2.04 BASE COURSES

- A. Gravel base courses typically shall meet the requirements of gravel Borrow type b of the Standard Specifications and SECTION 02210 - Earth Excavation, Backfill, Fill and Grading

PART 3 – EXECUTION

3.01 EXCAVATION

- A. Contractor shall excavate to the lines and grades shown on the project grading plans. Contractor shall take precautions to minimize over-excavation. Over-excavation shall be filled with specified and approved compacted infill material as reviewed by the Designer.
- B. Contractor shall verify location of existing structures and utilities prior to excavation and to contact DIG-SAFE before construction. Contractor shall ensure all surrounding structures are protected from the effects of excavation. Excavation support, if required, is the responsibility of the Contractor.

3.02 GENERAL

- A. Examine all surfaces and contiguous elements to receive Work of this and related Sections. Report to the Designer any defect or anomaly that may affect the Work and correct, as part of the Work of this Contract, any defects that may affect installation. Commencement of work will be construed as complete acceptability of base surfaces and contiguous elements.

3.03 INSPECTIONS

- A. Contractor shall request that the Designer review in the field the layout and proposed elevations of the following items with 48 hours notice for the following items:
 - 1. Site samples and/or field mock-ups of site improvements
 - 2. Layout of all Site Improvements

3.04 FIELD CONDITIONS

- A. Cold-weather procedures shall be followed during construction when ambient temperature falls below 40°F (4°C) for the installation of cementitious materials or the temperature of stone is below 40°F.
 - 1. All material and ground with which stone is to come in contact shall be free from frost, ice, snow, and puddles.

3.05 SITE IMPROVEMENTS INSTALLATION

- A. All items located on the drawings shall be fabricated and installed by the Contractor as detailed on the Drawings, as reviewed by the Designer.
- B. Mark locations of all items in the field for approval by the Designer before commencing installations.
- C. Construct finished grades of stone dust pavement, subgrades, not to exceed minimum longitudinal slopes (1/2 percent) or maximum longitudinal slopes (4.9%) (unless curb ramp <8%) or maximum cross slopes (2%) or as shown on the Drawings, to insure proper drainage. Inform the Designer if these requirements cannot be met on site before construction. Ensure that adjacent landscape areas drain away from landscape pavements and ensure that puddling does not occur.
- D. Any incidence of damage, vandalism, or theft of any item during installation shall be reported immediately to the Designer, remedial action shall be decided, and repairs made to the satisfaction of the Designer. The Contractor is required to secure all items of the Work from access by the Public until Final Acceptance, unless otherwise permitted by the DCR.

3.06 RELOCATED BOULDERS

- A. Install at locations shown on the drawings, and locations as approved and directed by the Owner.

3.07 ACCESSIBLE CRUSHED STONE PAVING INSTALLATION

3.08 BASE COURSES

- A. Install all base courses as shown on the Drawings and ensure positive pitch according to the Drawings.
- B. Crushed stone paving shall be installed on weed barrier fabric on compacted Gravel Borrow type b laid on compacted subgrade to line, grades, and dimensions shown on the Drawings. The Contractor shall verify that path grades do not exceed ADA maximum allowable slopes in the field before final construction. Review layout and grading with the Designer before final construction and notify Designer if discrepancies are discovered that would affect meeting these requirements.
- C. Wood Edges and Weed Barrier Fabric: Wood edges shall be installed plumb and to radial and tangent lines and grades shown on the Drawings, securely set into compacted subgrade with top of edge flush with top of finished, compacted loam and/or mulch as applicable. Edges shall be securely anchored with wood pegs snugly fitting against wood edges and set slightly below finished grade of crushed stone surfacing. Top of edging shall be smooth and joints tight and aligned before installation of Crushed Stone Paving. Specified weed barrier fabric shall be installed on compacted subbase with minimum 6” horizontal overlap and extending up vertically to two inches below finished grade of crushed stone path. Fabric shall not be exposed or visible from the surface of the path.
- D. Environmental Conditions: Crushed Stone Paving shall not be installed when rain has occurred for 48 hours prior to installation, when subgrade or crushed stone is wet or freezing, when rain is expected within 24 hours of construction, or when ambient temperature is at or less than 45 degrees F. or more than 85 degrees F. Application of stabilizer shall be performed for entire length of pathway at one time, and not in short, discrete sections.
- E. Installing Path Stabilizer: Follow manufacturer’s instructions for installing path stabilizer product. Application and compaction procedures vary. The following is provided for costing purposes.
 - 1. Install crushed stone paving with stabilizer only when temperature is above 40 degrees F. and is not expected to fall within 72 hours; when temperature is below 90 degrees F.; and when no rain is expected within 72 hours. Do not install over wet, contaminated, uncompacted, or frozen Gravel Borrow Base or subbase.

2. Crushed stone with stabilizer shall be installed on compacted gravel borrow base on approved weed barrier fabric with wood edges. All materials and product application shall be based on approved field mockup and review of proposed crushed stone by Manufacturer with specific recommendations for application procedures and environmental requirements by the Manufacturer.
3. Liquid *Enviroseal*TM M10+50 Application:
4. *Enviroseal*TM shall be mixed with approved Crushed Stone a minimum of six gallons to a maximum of ten gallons of stabilizer per cubic yard of stone, well mixed, in a rate of gallons per cubic yard determined by the Manufacturer from test results submitted before construction. The Contractor shall provide a minimum of five pounds of the approved crushed stone mix to the Manufacturer for this purpose of testing and developing application rates for field mockup.
 - a. Schedule: The Contractor shall allow enough time for the Manufacturer to test the approved stone mix and stabilizer, to make recommendation for application rate, and for construction of field mockup with stabilizer for review and approval before final construction of the Crushed Stone Paving begins. The Contractor shall schedule construction so that application and mixing of stabilizer and stone and path compaction shall be performed for an entire length or area of pathway in one application, and not in discrete sections over multiple days' time.
 - b. The stabilizer should be installed on a dry sunny day with a forecast of three dry days after installation.
 - c. Added Water Calculation with *Enviroseal*TM: Additional clean water may or may not be required to apply with the stabilizer product and stone mix during construction, as the difference between the on-site moisture content of the stone mix at time of application and the optimum moisture content required for compaction as evidenced by the dry density weight of the stone mix (95% dry density compaction as demonstrated and based on Manufacturer's recommendations for proportions of stabilizer, water, and specified, tested stone and existing conditions).
 - d. Mixing *Enviroseal*TM, or dry mix *Stabilizer*TM follows Manufacturer's instructions for installing path stabilizer, water, and stone mix. The following is provided for costing purposes: The top (4) inches of stone mix shall be blended with the stabilizer pre-blended with water (see par. 2) allowing (1) additional inch of stone mix assuming approximately 20% reduction in crushed stone thickness to 4 inches after compaction. Completely mix the full depth of stone material, stabilizer, and water with a soil mixer or tiller, thoroughly and evenly blending all the materials together. Follow Manufacturer's recommendations for achieving thorough and even mixing in the field.

5. Or dry mix *Stabilizer*TM follows Manufacturer's instructions for installing path stabilizer. The following is provided for costing purposes:
 - a. Blending *Stabilizer*TM: Pre-blend 12- 16 lbs. of *Stabilizer*TM product (exact amount of *Stabilizer*TM shall be specified by the Manufacturer based on tests with specific stone provided by the Contractor to the Manufacturer for that purpose before construction and from approved field mockup) mixed uniformly with absolutely dry crushed stone mix with mixer. Bucket mixing by hand or mixing with rake or shovel is not acceptable.
 - b. Placement: After pre-blending, place the stabilized aggregate on approved weed barrier fabric laid on prepared subbase. Level to desired grade (assume approximately 1-inch additional stone mix to allow for compaction) to desired grade and cross section.
 - c. Water entire pathway evenly for full –depth moisture penetration to the base of the crushed stone profile, as water activates the *Stabilizer*TM. Apply approximately 25-45 gallons of water per 1-ton of crushed stone, quantity to be accurately determined by the Contractor from approved field mockup and as recommended by the Manufacturer. Test to ensure full depth and even penetration without oversaturating base course and eroding top course of stone.

6. Compaction after Application of Stabilizer:
 - a. Liquid *Enviroseal*TM stabilizer: Wait for a minimum of six hours and up to 48 hours after placement to compact crushed stone paving. Compact the crushed stone path with *Enviroseal* stabilizer with 3–5-ton non-vibratory drum roller to 85-95% dry density. Do not use vibratory equipment as larger stones will fall to the bottom. Roll evenly with care not to damage the wood edging during compaction operations. Follow manufacturer's instructions for timing of compaction after stabilizer application.
 - b. *Stabilizer*TM: Upon thorough moisture penetration, compact aggregate screenings to 85% -95% dry density compaction with a 4-to-5-ton double drum roller, depending on depth of pathway to achieve density value. Do not use a vibratory plate compactor or vibration function on roller with *Stabilizer*TM product as vibration will separate large aggregate particles and path will not set up properly. Lightly mist surface of aggregate with clean water if surface has dried significantly more than subbase.

7. Finished surface of crushed stone paving shall be smooth, uniform, and solid, flush with top of wood edging. There shall be no evidence of chipping or cracking, or spongy areas. Loose material should not be present on the surface after installation but may appear in time. Top off or repair shall be minimal (less than 5% of path and less than ¼ inch depth) and shall be mixed into crushed stone material after topping off, misted in, and recompact to 85% minimum dry density with drum roller, meeting all compaction and line and grade requirements specified. Repair of pathway or reconstruction will require complete full depth reinstallation of the approved stone mix and original approved stabilizer as specified and as reviewed in the field.

3.09 ADA PARKING SIGNAGE AND PARK SIGN

- A. ADA Parking Signage and Park Sign shall be installed per the MassDOT Standard Specifications Section 828.
- B. Post signs shall be plumb and level, secure and clean for acceptance.

END OF SECTION

SECTION 02930

LANDSCAPE MAINTENANCE

PART 1 – GENERAL

1.01 DESCRIPTION

- A. Provide labor, materials, equipment, services, and transportation to complete work.
 - 1. Plant and turf maintenance including pruning, watering, drainage, irrigation, fertilizing, weed and pest control, and adjusting tree guys.
 - 2. Guaranty and replacement of unacceptable plants.
 - 3. Providing Owner with Maintenance Manual.

1.02 RELATED WORK

- A. Section 02910 – Planting Soils for fertilizers and soil amendments
- B. Section 02900 – Planting and Seeding for related practices.

1.03 REFERENCES

- A. Comply with applicable requirements of:
 - 1. MA Mass DOT (Massachusetts Department of Transportation) formerly Massachusetts Highway Department (MHD) Standard Specifications (for Highways and Bridges), 1988 editions, including all addenda.
 - 2. American Association of Nurserymen, American Standards for Nursery Stock, (ANSI Z60.1), latest edition, published by the American Association of Nurserymen, 1250 I Street, N.W., Suite 500 Washington, D.C. 20005.

1.04 DEFINITIONS

- A. Maintenance: consists of keeping turf, woody, perennial and annual plants in healthy growing condition including watering, weeding, cultivating, remulching, tightening and repairing of guys, removal and replacement of dead plant material, resetting plants to proper grades or upright positions and maintaining saucer.

1.05 SUBMITTALS

- A. Submittals: in accordance with 01300 - Submittals
- B. Materials List: provide list of materials to be used in maintenance; materials shall be the same as approved in related sections.
- C. Pest and Disease Treatment

1. Submit plan for pest and disease treatment; identify proposed materials and methods.
2. Explain why a problem does or may exist.

D. Maintenance Manual

1. Provide a maintenance manual to Owner describing operations for on-going upkeep of the installed plants. The manual shall address itself to specified types and uses of plants installed and provide information for care of both newly installed plants and long-term maintenance.
2. Provide specific information on the following items:
 - a. Watering: Watering season; diagnosis of watering need; frequency of watering; amount; time of day; methods and equipment; equipment maintenance.
 - b. Fertilization: Fertilizing seasons; analysis for fertilizer selection; application rates and methods; preparation and conditions; application times; application equipment; post-application operations and care; precautions for fertilizer use.
 - c. Liming: Liming season; analysis for liming; application rate; method and equipment for application.
 - d. Pruning: Pruning goals and purposes; methods and techniques (relate to species); equipment; season; cleanup and disposal; precautions.
 - e. Mulching of beds: Depths of mulch; refreshment and replacement of mulch.
 - f. Miscellaneous plant maintenance: Weeding and weed control; pest and disease control; leaf and litter removal; bed edging; professional assistance for plant care; and plant replacement as necessary.
3. Include a month-by-month calendar of maintenance procedures, indicating operations listed above.
4. Include a developed Record Keeping document to be completed by the maintenance staff and submitted weekly to the Owner's Representative during active maintenance period.
5. Submit a copy of maintenance manual to Owner's Representative for approval. Submit prior to planting completion. Owner's Representative may request revisions to manual to meet intent of project design.
6. Submit three copies of manual to Owner at acceptance meeting for planting work. Acceptance shall not be granted until manual has been submitted and approved.

1.06 QUALITY ASSURANCE

A. Qualifications: contractor shall have minimum five years experience in landscape maintenance.

B. Regulatory Requirements

1. Secure permits, licenses, and pay fees including traffic control.
2. Comply with laws, regulations, and quarantines for agricultural and horticultural products.

1.07 DELIVERY, STORAGE AND HANDLING

A. Packing and Shipping: deliver materials in unopened containers bearing the manufacturer's name. Transport materials without damage. Protect finishes from abrasion, dirt, oils, grease, and chemicals. Pack materials to protect from weather.

B. Acceptance at Site: verify in writing that delivered materials conform to specifications and approved submittals.

C. Storage and Protection:

1. Store materials in dry place, on pallets, off the ground; protect from sun.
2. Protect materials from theft, damage, weather, dirt, oils, grease, and construction.

1.08 PROJECT/SITE CONDITIONS

A. Environmental Requirements: do not work soils when dry, wet, or frozen.

1. Field Test

- a. Form soil in palm of hand, if soil retains shape and crumbles upon touching, the soil may be worked.
- b. If soil will not retain shape it is too dry and should not be worked.
- c. If soil retains shape and will not crumble, it is too wet and should not be worked.

B. Planting Seasons: see Section 02900 Planting and Seeding

1.09 SUBSTANTIAL COMPLETION

A. Upon completion of planting, request Owner's Representative's review to determine if work is substantially complete. If work is complete, Owner's Representative will issue a Letter of Substantial Completion that establishes the effective date of the start of the 60 day Maintenance Period for turf, and 18 months for all plantings.

1. If work is not substantially complete, Owner's Representative will make a list of outstanding work to be done on a timely schedule agreed upon by Contractor and Owner's Representative.
2. Contractor shall notify Owner's Representative when outstanding work is accomplished and ready for review. When outstanding work is complete, in the judgment of Owner's Representative, a Letter of Substantial Completion will be issued.

1.10 PRELIMINARY ACCEPTANCE

- A. After the Letter of Substantial Completeness the work will be reviewed for completeness and of Preliminary Acceptance
- B. Plantings and turf shall be in thriving and vigorous condition at the time of review for Preliminary Acceptance. If plantings and turf are acceptable, Owner's Representative will issue a Letter of Preliminary Acceptance establishing the effective date of the Guaranty Period.
 1. If plantings are not thriving, in the judgment of Owner's Representative, remedial actions by Contractor will be required to repair or replace plantings.
 2. Remedial work shall be done immediately and in accordance with related work of other sections.
 3. At the conclusion of remedial work, Owner's Representative will review work and extend the Guaranty Period to incorporate new plantings.

1.11 FINAL ACCEPTANCE

- A. After the 90 day / 2 year Maintenance and Guaranty Period, turf / plantings will be reviewed.
- B. Plantings and turf shall be in thriving and vigorous condition at the time of review for Final Acceptance. If plantings and turf are acceptable, Owner's Representative will issue a Letter of Final Acceptance.
 1. If plantings and turf are not thriving, in the judgment of Owner's Representative, remedial actions by Contractor will be required to replace plantings.
 2. Remedial work shall be done immediately and in accordance with related work of other sections.
 3. At the conclusion of remedial work, Owner's Representative will review work and extend the Maintenance and Guaranty Period until plantings are deemed acceptable.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Materials utilized during the maintenance period shall be the same specified in the work of the related sections:

1. Section 02701 – Exfiltrating BioInfiltration Areas
2. Section 02900 Planting and Seeding
3. Section 02910 Planting Soils

2.02 BIOLOGICAL, HORTICULTURAL, HERBICIDAL AND OTHER PEST CONTROL

A. Material Specification: shall be by a licensed pest control operator, with authority to purchase, utilize, and specify agricultural chemicals and agricultural products.

B. Use the least hazardous, least intrusive materials and methods.

2.03 EQUIPMENT

A. Vehicles: in good working order so oil and grease does not stain pavements and poison plantings. Signs identifying the vehicles shall be clearly displayed.

B. Machinery: in good working order so oil and grease does not stain pavements and poison plantings.

2.04 WATER

A. Water: Furnished by Contractor, suitable for irrigation and free from ingredients harmful to plant life.

B. Hoses and other watering equipment to be furnished by Contractor.

PART 3 – EXECUTION

3.01 REASONABLE MAINTENANCE PRACTICES

A. Contractor shall be responsible for all maintenance activities that will promote good plant growth. Reasonable maintenance practices may be dictated by MassDCR and/or the Town of Oxford..

3.02 EXAMINATION

A. Verification of Conditions: in the event field conditions are not as shown on Drawings and outlined in the Specifications, notify Owner's Representative in writing.

3.03 PREPARATION

A. Protection:

1. Agricultural Chemicals: protect site improvements from contact with agricultural chemicals, soil amendments, and fertilizers.

3.04 DRAINAGE

- A. Observe drainage in plant pits with hand soil augur.
- B. Verify plant pits are draining; plant pits not draining shall be identified on the plan and brought to the attention of Owner's Representative.

3.05 IRRIGATION

- A. Water at a rate of one inch of water every five to seven days. Apply water such that it penetrates the soil to a depth of 6".
- B. Trees require a minimum of ten gallons each and shrubs a minimum of five gallons each per week.
- C. If spring or fall months experience below average rainfall, periodic watering could be extended as part of this contract and at no additional charge as requested by Owner's Representative.
- D. If natural rainfall provides water to meet watering requirements, weekly watering could be reduced but only at the request of Owner's Representative.
- E. Water trucks shall NOT be allowed to drive on sidewalks to water turf and plantings. Temporary irrigation shall be provided to minimize site and user impacts.
- F. Watering schedule shall be deep watering to promote strong drought resistant root growth.

3.06 FINISH GRADE

- A. Maintain finish grades around plantings, at pavement edges, and at irrigation fixtures.

3.07 MULCH

- A. Maintain mulch at 2" depth in planting areas with the exception of at stems and trunks of plants where mulch to be placed to a 0" depth and increasing to a depth of 2" at edge of rootballs and beyond.

3.08 MOWING

- A. Mow turf as soon as top growth is tall enough to cut. Repeat mowing to maintain specified height without cutting more than 1/3 of grass height. Remove no more than 1/3 of grass-leaf growth in initial or subsequent mowing. Do not delay mowing until grass blades bend over and become matted. Do not mow when grass is wet. Schedule initial and subsequent mowing to maintain the following grass height: Mow to a height of 2 1/2 inches to 3 inches.

3.09 TREATMENT OF PEST AND DISEASES

- A. Spray for both insect pests and diseases during maintenance period with notification and permission of Owner's Representative. Apply herbicides, insecticides and fungicides as prescribed by their manufacturer and in accordance with State laws. Contractor shall possess from the Commonwealth of Massachusetts the proper registrations and permits for application of materials or have applications made by approved, qualified firm holding registrations and permits. Furnish copies of permits in connection with materials to Owner's Representative. Spraying to be considered only after full consideration has been given to alternative pest control strategies. The least toxic approach to pest control shall be used.

3.10 ADJUSTING

- A. Re-set settled plants to proper grade and position.
- B. Restore planting saucer and adjacent material.

3.11 CLEANING

- A. Clean up, remove and dispose off-site excess planting mixture, soil and debris generated under work of this section.
- B. Remove and dispose of stakes, guys and other accessories at end of Guaranty Period.
- C. Wash and sweep clean site improvements and building surfaces. Clean spills and oversprays immediately.
- D. Repair damage caused by maintenance operations.

3.12 PROTECTION

- A. Protect work of this section until Final Acceptance.
- B. Protect planted areas and soils from compaction by construction traffic and from contamination by construction materials.

END OF SECTION

SECTION 03100
CONCRETE FORMWORK

PART 1 - GENERAL

1.01 DESCRIPTION:

- A. Provide design and furnish materials for fabricating, erecting and removing formwork, false work and shoring for cast-in-place concrete as shown on the contract drawings and specified herein for a complete installation. The use of stay-in-place forms is expressly prohibited.
- B. Use formwork to cast all cast-in-place concrete structures.
- C. Provide and remove all formwork for architectural, civil, mechanical, and electrical work as shown on the drawings or specified under specified under those disciplines.

1.02 REFERENCES:

- A. American Concrete Institute (ACI):
 - 1. [117/117R](#): Standard Tolerances for Concrete Construction and Materials.
 - 2. [309.2R](#): Identification and Control of Visible Effects of Consolidation on Formed Concrete Surfaces.
 - 3. [318/318R](#): Building Code Requirements for Structural Concrete and Commentary.
 - 4. [347](#): Guide to Formwork for Concrete.
 - 5. [350/350R](#): Code Requirements for Environmental Concrete Structures and Commentary.
- B. Engineered Wood Association (APA)
- C. National Institute of Product Standards and Technology
 - 1. Voluntary Product Standard PS 1 Structural Plywood

1.03 DESIGN REQUIREMENTS:

- A. Design formwork in conformance with methodology of ACI 347R for anticipated loads, lateral pressures, depth of concrete placement and rate of concrete placement. Design shall consider any special requirements due to the use of self consolidating, plasticized and/or retarded set concrete. All forms and shoring shall be designed at the contractor's expense.

1.04 QUALIFICATIONS:

- A. Formwork Designer: Formwork, false work, and shoring design shall be by an engineer licensed in the state where the Project is located.

1.05 SUBMITTALS:

- A. Submit product data for form ties, spreaders, chamfer strips, rustication strips, form liners, form coatings, and bond breakers.
- B. Submit following shop drawings in accordance with 01300.
 - 1. Layout of panel joints and tie hole pattern for architectural formwork.
 - 2. Form Ties: Submit data sheets for form ties proposed for use.
 - 3. Form Ties-Tapered Through-Bolts: Proposed method of sealing and patching form tie holes.

1.06 QUALITY ASSURANCE:

- A. Comply with requirements in section 01400 and as specified.
- B. Design of Formwork:
 - 1. The Contractor shall assume responsibility for the design, engineering and construction of formwork. Forms shall be designed to produce concrete members identical in shape, lines and dimensions to members shown on the Contract Documents.
 - 2. When high range water reducer (superplasticizer) is used in concrete mix or when self consolidated concrete is specified, forms shall be designed for full hydrostatic pressure per ACI 347.
 - 3. The formwork shall be designed for the loads and lateral pressures in accordance with ACI 347 and wind loads as specified by the local building code.
 - 4. Construction and contraction joints, openings, offsets, keyways, recesses, moldings, chamfers, blocking, screeds, bulkheads, waterstops, anchorages, inserts, and other features shall be provided.
 - 5. Formwork shall be designed to be readily removable without impact, shock, or damage to 'green' concrete surfaces and adjacent materials.
 - 6. The maximum panel deflection shall be $L/360$ of the span between structural members.
- C. Unless otherwise specified herein, formwork shall be constructed so that the concrete surfaces will conform to the tolerance limits as given in ACI 117.

- D. Materials, fabrications and workmanship found defective shall be promptly removed and replaced and new acceptable work shall be provided in accordance with Contract requirements at no additional cost to the owner.

1.07 DELIVERY, STORAGE AND HANDLING:

- A. Comply with the requirements in section 01610.
- B. Materials shall be delivered to the site in an undamaged condition and at such intervals as will avoid delay in the work.
- C. Material shall be stored and protected in a clean, properly drained location. Material shall be kept off the ground under a weather-tight covering permitting good air circulation. Formwork materials shall be stored on dry wood sleepers, pallets, platforms or other appropriate supports which have slope for positive drainage. Materials shall be protected from distortion, excessive stresses, corrosion and other damage. Materials shall not be stored on the structure in a manner that might cause distortion or damage to the supporting structure.

PART 2 - PRODUCTS

2.01 LUMBER:

- A. Lumber used in form construction shall be Douglas fir, No. 2 grade, S4S, Standard Grading and Dressing Rules No. 16, West Coast Lumber Inspection Bureau; or Southern Yellow Pine, No. 2, S4S, Standard Grade Rules Southern Pine Inspection Bureau. Boards shall be 6 inches or more in width.

2.02 PLYWOOD:

- A. Only grade-marked plywood conforming to APA shall be provided.
- B. Plywood used in form construction shall be Grade B-B, Class 1 plyform, mill-oiled, and sanded on both sides in conformance with U.S. Product Standard PS 1 Structural Plywood.
- C. Thickness shall be sized to maintain alignment and surface smoothness, but not less than 5/8-inch thick.

2.03 STEEL FORMS:

- A. Commercial grade sheets not less than 16 gage shall be provided.
- B. Stock material that is free from warps, bends, kinks, cracks, and rust or other matter that could stain the concrete shall be provided.

2.04 FORM MATERIAL LOCATIONS:

A. Wall Forms:

1. Materials: Plywood, hard plastic finished plywood or steel in new and undamaged condition, of sufficient strength and surface smoothness to produce specified finish.

B. All Other Forms: Materials as specified for wall forms.

C. Chamfer Strips: Nonabsorbent material, compatible with form surface, fully sealed on all sides prohibiting loss of paste or water between the two surfaces.

2.05 FORM TIES:

A. Locate form ties on exposed surfaces in a uniform pattern. Place form ties so they remain embedded in the concrete except for a removable portion at each end. Form ties shall have conical or spherical type inserts with a maximum diameter of 1 inch. Construct form ties so that no metal is within 1-1/2 inch of the concrete surface when the forms, inserts, and tie ends are removed. Do not use wire ties. Ties shall withstand all pressures and maintain forms within acceptable deflection limits.

B. Flat bar ties for panel forms shall have plastic or rubber inserts having a minimum depth of 1-1/2 inch and sufficient dimensions to permit patching of the tie hole.

C. Tapered form ties shall be tapered through-bolts or through-bolts that utilize a removable tapered sleeve.

D. Water Stop Ties: For water-holding structures, basements, pipe galleries, and accessible spaces below finish grade, furnish one of the following:

1. Integral steel water stop 0.103 inch thick and 0.625 inch in diameter tightly and continuously welded to tie.
2. Neoprene water stop 3/16-inch thick and 15/16 inch diameter whose center hole is one-half diameter of tie, or molded plastic water stop of comparable size.

E. Elastic Vinyl Plug:

1. Design and size of plug shall allow insertion with tool to enable plug to elongate and return to original length and diameter upon removal forming watertight seal.
2. Manufacturer:
 - a. Dayton Superior; A58 Sure Plug.
 - b. Or acceptable equivalent product.

F. Mechanical EPDM Rubber Plug:

1. Mechanical plug for taper tie
2. Manufacturers:
 - a. Sika Greenstreak, St. Louis, MO; X-Plug
 - b. Or acceptable equivalent product.
3. Friction fit plugs shall not be allowed.

2.06 BOND BREAKER:

- A. Bond breaker shall be a V.O.C.-compliant nonstaining type that will provide positive bond prevention.
- B. Manufacturers:
 1. Edoco Burke; Clean Lift 90 W.B..
 2. Nox-Crete, Inc.; Silcoseal 97EC.
 3. Or acceptable equivalent product.

2.07 FORM CAULKING:

- A. Form caulking shall be a one-component, gun-grade silicone sealant that is capable of producing flush, watertight and non-absorbent surfaces and joints. Sealant shall be compatible with the type of forming material and concrete ingredients used.
- B. Products:
 1. Series 1200 Construction Caulking; GE Silicones.
 2. Dow Corning 999-A; Dow Corning Co..
 3. Sikasil WS-295; Sika Corporation.
 4. Or acceptable equivalent product.

2.08 CHAMFER STRIPS:

- A. Provide 3/4 inch by 3/4-inch chamfer strips milled from clear, straight-grain pine, surfaced each side or extruded vinyl type with or without nailing flange unless otherwise shown on the Contract Documents.

2.09 INSERTS:

- A. Provide galvanized cast steel or galvanized welded steel inserts, complete with anchors to concrete and fittings such as bolts, wedges and straps.

2.10 DOVETAIL ANCHOR SLOTS:

- A. Provide dovetail anchor slots manufactured from 22 gage, galvanized steel with removable felt or polyurethane.

2.11 FORM RELEASE AGENT:

- A. Form release agent shall not bond with, stain, or adversely affect concrete surfaces and shall not impair subsequent treatments of concrete surfaces. Form release agent shall be a ready-to-use water-based material formulated to reduce or eliminate surface imperfections and containing no mineral oil or organic solvents.
- B. Manufacturers and Products:
 - 1. BASF; MBT, Rheofinish 211.
 - 2. Cresset Chemical Company; Crete-Lease 20-VOC.
 - 3. Unitex Chemicals; Farm Fresh.
 - 4. Symons Corporation: Magic Kote
 - 5. Or acceptable equivalent product.

PART 3 - EXECUTION

3.01 FORM TOLERANCES:

- A. Comply with the requirements of ACI 117 for tolerances for formed surfaces except as specified in Table 03100-1.

Table 03100-1	
Vertical alignment (plumbness)	1/4-inch in any 10 feet and 1-inch maximum for entire length
Variation in the lines and surfaces of foundation mats, base slabs and walls	1/4-inch in any 10 feet and 1-inch max. for entire length
Variation from the level or from the grades indicated on the drawings	1/4-inch in any 10 feet
Variation of the linear building lines from established position in plan	1/2-inch in any 20 feet and 1-inch maximum for entire length
Variation of distance between walls	1/4-inch in any 10 feet and 1-inch maximum for entire length and height
Variation in the sizes and locations of sleeves, floor openings and wall openings	Minus 1/4-inch. Plus 1/2-inch.
Variation in cross-sectional dimensions of columns and beams and in the thickness of	Minus 1/4-inch. Plus 1/2-inch.

slabs and walls	
Offset between adjacent panels of formwork facing material	1/2-inch (ACI 117 Class C finish).
Offset between adjacent panels of formwork facing material for exposed surfaces where appearance is of importance	1/8-inch (ACI 117 Class A finish).

- B. Tolerances are not cumulative
- C. Where equipment is to be installed, comply with manufacturer's tolerances if more restrictive than above.
- D. Failure of the forms to produce the specified concrete surface and surface tolerance shall be grounds for rejection of the concrete work. Rejected work shall be repaired or replaced at no additional cost to the Owner.

3.02 PREPARATION:

- A. Clean form surfaces to be in contact with concrete of foreign material prior to installation. Tape, gasket, plug, and/or caulk joints, gaps, and apertures in forms so that the joint will remain watertight and withstand placing pressures without bulging outward or creating surface irregularities.
- B. Coat form surfaces in contact with concrete with a form release agent prior to form installation.
- C. Keep form coatings off steel reinforcement, items to be embedded, and previously placed concrete.
- D. Steel Forms: Apply form release agent to steel forms as soon as they are cleaned to prevent discoloration of concrete from rust.
- E. Form liners for architectural concrete finish shall be installed in accordance with the manufacturer's recommendations.

3.03 ERECTION AND INSTALLATION:

- A. Forms shall be constructed in accordance with ACI 347 to required dimensions, plumb, straight and mortar tight. Forms shall be substantial, properly braced, and tied together to maintain position and shape and to resist all pressures to which they may be subject. Unless otherwise indicated on the Contract Documents, formwork shall be constructed so that the concrete surfaces will conform to the tolerance limits in ACI 117 and herein specified.
- B. Provide means for holding adjacent edges and ends of form panels tight and in accurate alignment to prevent the formation of ridges, fins, offsets, or similar surface defects in the finished concrete.

- C. Provide one cleanout and inspection opening 12 inches wide by 18 inches high every 7 feet at the bottom of each lift of forms.
- D. Provide exterior corners of concrete members with chamfers as specified.
- E. Provide means for removing forms without injury to the surface of finished concrete.
- F. Do not embed any form-tying device or part thereof other than metal in the concrete.
- G. Locate large end of taper tie on the "wet" side of the wall.
- H. Use only form or form-tying methods that do not cause spalling of the concrete upon form stripping or tie removal.
- I. Form surfaces of concrete members except where placement of the concrete against the ground is shown in the drawings or as indicated below. The dimensions of concrete members shown in the drawings apply to formed surfaces, except where otherwise indicated. Add 2 inches of concrete where concrete is placed against trimmed undisturbed ground in lieu of forms. Placement of concrete against the ground shall be limited to footings and other nonexposed concrete and only where the character of the ground is such that it can be trimmed to the required lines and will stand securely without caving or sloughing.
- J. Provide openings with continuous keyways and water stops. Provide a slight flare to facilitate grouting and the escape of entrained air during grouting. Provide formed openings with additional reinforcement as shown in the typical structural details. Reinforcing shall be at least 2 inches clear from the opening surfaces and encased items.
- K. Set anchor bolts and other embedded items accurately before placing concrete and hold securely in position until the concrete is placed and set. Check special castings, channels, or other metal parts that are to be embedded in the concrete prior to and again after placing concrete. Check nailing blocks, plugs, and strips necessary for the attachment of trim, finish, and similar work prior to placing concrete.

3.04 PROTECTION:

- A. During installation, the forms shall not be used as a storage platform nor as a working platform until the forms have been permanently fastened in position.

3.05 PIPES AND WALL CASTINGS CAST IN CONCRETE:

- A. Install wall castings, wall flanges, and wall anchors before placing concrete. Do not weld, tie, or otherwise connect the wall castings or anchors to the reinforcing steel.
- B. Pipes or wall castings located below operating water level shall have water stop ring collars and shall be cast in place. Do not block out such piping and grout after the concrete section is cast unless permitted, authorized or directed by the Engineer. Pipes fitted with thrust rings shall be cast in place.

3.06 REMOVAL OF FORMS:

- A. Forms shall be removed in accordance with ACI 347 recommendations without damage to concrete and in a manner to ensure complete safety to the structure. Forms, form ties and bracing shall not be removed without specific permission of the Contractor's Registered Professional Engineer.
- B. The following table indicates the minimum allowable time after the last cast concrete is placed before forms, shoring, or wall bracing may be removed; during which the air surrounding the concrete is above 50 degrees F.

Table 03100-2	
Sides of footings and encasements; Walls; Vertical sides of slabs, beams, girders; Columns; Similar members not supporting loads.	24 hours
Bottom forms of slabs, beams, and girders; and shoring for slabs, beams, and girders with immediate reshoring.	Until concrete strength reaches 70 percent specified 28-day strength
Bottom forms of slabs, beams, and girders; and shoring for slabs, beams, and girders without reshoring	Until concrete strength reaches specified 28-day design strength

- C. Removal times will be increased if the concrete temperature following placement is permitted to drop below 50 degrees F.
- D. Do not remove supports and reshore.

3.07 PATCHING OF TAPERED TIE HOLES:

- A. Clear tie hole of all loose debris with a taper tie void brush and flush debris from tie hole with air or water.
- B. Install plug from larger tie hole end in accordance with manufacturer's instructions using an insertion tool as recommended by the manufacturer.
- C. Fill each side of hole with mortar. Apply mortar to the "wet" side of the wall first. Consolidate mortar solidly into the hole.

3.08 CLOSEOUT:ACTIVITIES:

- A. Provide in accordance with Section 01700.

END OF SECTION

SECTION 03200

CONCRETE REINFORCEMENT

PART 1 - GENERAL

1.01 DESCRIPTION:

- A. Provide concrete reinforcement as indicated and specified:
 - 1. Section Includes:
 - a. Reinforcement bars.
 - b. Welded wire reinforcement.
 - c. Reinforcement accessories.
- B. Provide concrete reinforcement for civil and mechanical, as shown on the drawings or specified under those disciplines.

1.02 REFERENCES:

- A. ASTM International (ASTM):
 - 1. [A184](#): Standard Specification for Fabricated Deformed Steel Bar Mats for Concrete Reinforcement.
 - 2. [A615](#): Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
 - 3. [A616](#): Standard Specification for Rail-Steel Deformed and Plain Bars for Concrete Reinforcement.
 - 4. [A617](#): Standard Specification for Axle-Steel Deformed and Plain Bars for Concrete Reinforcement.
 - 5. [A706](#): Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement.
 - 6. ASTM A1064/A1064M - Standard Specification for Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
- B. American Concrete Institute (ACI):
 - 1. [301](#): Standard Specification for Structural Concrete.
 - 2. [315](#): Details and Detailing of Concrete Reinforcement.

3. [318](#): Building Code Requirements for Structural Concrete.
4. [350](#): Building Code Requirements for Environmental Engineering Concrete Structures

C. Concrete Reinforcing Steel Institute (CRSI):

1. Manual of Standard Practice.
2. Placing Reinforcing Bars.

D. American Welding Society (AWS):

1. [D1.4](#): Structural Welding Code, Reinforcement Steel.

E. Where reference is made to one of the above standards, the version in effect at the time of bid opening shall apply.

1.03 SUBMITTALS:

A. Unless otherwise acceptable to the Engineer, each submittal shall include reinforcement only for a single structure or part thereof. Shop drawings depicting multiple structures on the same sheet are not acceptable.

B. Shop Drawings:

1. Submit bar lists and placing drawings for all reinforced concrete and masonry structures in accordance with Section 01300.
2. Detail reinforcement in conformance with ACI 315.
3. Clearly indicate bar sizes, spacing, locations, quantities and total weight of reinforcement steel and wire reinforcement, bending schedules, and supporting and spacing devices. Show joints, with applicable joint reinforcement and waterstops.
4. Coordinate bar splicing and placement with Contractor's concrete placing schedule and joint locations. Do not add or delete joints without permission from the Engineer.
5. Show wall reinforcement in elevation. Show entire elevation of wall from top to bottom and end to end. Do not show partial elevations. Show all dowels, joints and pockets in walls.
6. Show slab reinforcement in plan view. Show all dowels, joints, openings and recesses in slabs.
7. Show location and size of all penetrations greater than 12-inches in diameter or least dimension of the opening with the corresponding added reinforcement around the penetrations.

8. Clearly show marking for each reinforcement item.
 9. Indicate locations of reinforcement bar cut-offs, splices and development lengths.
- C. Submit Certificates: Submit AWS qualification certificates for welders employed on the Work for the appropriate electrode and class of material. Testing shall be conducted and witnessed by an independent testing laboratory prior to welding reinforcement in work. Maintain qualification and certification records at the job site, readily available for examination of test results.
 - D. Submit certified copies of mill test reports of reinforcement analysis dated within the last three months for each shipment of reinforcement with specific lots in shipments identified.
 - E. Chemical composition of reinforcement steel: Ladle analysis indicating percentage of carbon, phosphorous, manganese and sulfur present in steel.
 - F. Where mechanical couplers are required or permitted to be used to splice reinforcement steel, submit Manufacturer's literature that contains instructions and recommendations for installation for each type of coupler used; certified test reports that verify the load capacity of each type and size of coupler used; and Shop Drawings that show the location of each coupler with details of how they are to be installed in the formwork.
- 1.04 QUALITY ASSURANCE:
- A. Comply with requirements in Section 01600 and as specified.
 - B. Do not fabricate reinforcement until shop and placement drawings have been reviewed and accepted by the Engineer.
 - C. Perform concrete reinforcement work in accordance with CRSI Manual of Practice and ACI 315.
 - D. An independent testing agency accepted by Engineer shall visually inspect and test reinforcing steel welds in accordance with AWS D1.4/D1.4M.
 - E. An independent testing agency accepted by Engineer shall inspect each mechanical coupler and verify each component is installed in accordance with Manufacturer's instructions and ICC Evaluation Services Report or equivalent code agency report.
- 1.05 QUALIFICATIONS:
- A. Welders: AWS qualified within previous 12 months.
- 1.06 INSPECTION AND TESTING:
- A. In no case shall any reinforcement steel be covered with concrete until the installation of the reinforcement has been observed by the Engineer and the Engineer's authorization to

proceed with the concreting has been obtained. The Engineer shall be given a minimum of 48 hours prior notice of the readiness of placed reinforcement for observation. The forms shall be kept open until the Engineer has finished observations of the reinforcement steel.

- B. Provide Engineer with access to fabrication plant to facilitate inspection of reinforcement. Notify Engineer of commencement and duration of shop fabrication, in sufficient time to allow for proper inspection.

1.07 DELIVERY STORAGE AND HANDLING:

- A. Comply with the requirements in Section 01610.
- B. Keep reinforcement steel free from mill scale, rust, dirt, grease or other foreign matter.
- C. Ship and store reinforcement steel with bars of the same size and shape fastened in bundles with durable tags, marked in a legible manner with waterproof markings showing the same "mark" designations as those shown on the submitted placing drawings.
- D. Store reinforcement steel off the ground, protected from moisture and kept free from dirt, oil or other injurious contaminants.

PART 2 - PRODUCTS

2.01 REINFORCEMENT STEEL:

- A. Reinforcement Steel: ASTM A615/A615M, 60 ksi yield strength; deformed billet steel bars.
- B. Reinforcement Steel to be Welded: ASTM A706/A706M, 60 ksi yield strength; deformed low-alloy steel bars.
- C. Reinforcement Steel Plain Bar and Rod Mats: ASTM A704/A704M, ASTM A1064, Grade 60; steel bars or rods, unfinished.
- D. Reinforcement shall be clean and free from loose mill scale, dirt, grease, oil, form release agent, dried concrete or any material reducing bond with concrete.
- E. Welded Wire Reinforcement:
 - 1. Provide welded wire reinforcement conforming to ASTM A1064 in flat sheets.
 - 2. Provide deformed welded wire reinforcement conforming to ASTM A1064 in flat sheets.
 - 3. Provide support bars and reinforcement bar supports as specified herein to obtain the concrete cover indicated.

2.02 ACCESSORY MATERIALS:

- A. Tie Wire: Minimum 16 gage annealed type.
- B. Chairs, Bolsters, Bar Supports, and Spacers: sized and shaped for strength and support of reinforcement during concrete placement including load bearing pad on bottom of base slabs and slabs on grade to prevent puncturing the vapor retarder.
- C. Special Chairs, Bolsters, Bar Supports, and Spacers Adjacent to Weather Exposed Concrete Surfaces: plastic coated steel, stainless steel or plastic type; size and shape as required.
- D. Provide 3-inch by 3-inch plain precast concrete blocks, precast concrete doweled blocks or concrete brick for support of bottom reinforcement in foundation mats, base slabs, footings, pile caps, grade beams and slabs on grade. Provide block thickness to produce concrete cover of reinforcement as indicated.
- E. Mechanical Couplers
 - 1. Reinforcement Tension Bar Splicers:
 - a. Cadweld or Lenton rebar splicers by Erico Products, Inc. and Dayton Barsplice, Inc.
 - b. DB-SAE splicer system by Richmond Screw Anchor Company, Inc., C2D rebar flange coupler by Williams Form Engineering Corporation and Lenton Form Saver by Erico Products, Inc.
 - c. Develop minimum 125 percent of yield capacity of bars spliced in tension when tested as assembly in accordance with ASTM A370 and A615.
- F. Reinforcement Compression Bar Splicers:
 - 1. Manufacturers: G-Loc splicers by Gateway Building Products Division
 - 2. Speed-Sleeve by Erico Products, Inc.
- G. Provide epoxy for grouting reinforcement bars specifically formulated for such application for the moisture condition, application temperature, and orientation of the hole to be filled. Epoxy grout shall meet the requirements in Section 03600 Grout.

2.03 FABRICATION:

- A. Fabricate concrete reinforcement in accordance with CRSI Manual of Standard Practice, ACI 315 and ASTM A184/A184M.
- B. Weld reinforcement in accordance with AWS D1.4 only when permitted by the Engineer.

- C. Locate reinforcement splices not indicated on Drawings, at point of minimum stress.
- D. Cold bend bars. Do not straighten or rebend bars.
- E. Do not heat reinforcement steel to bend or straighten.
- F. Bend bars around a revolving collar having a diameter of not less than that recommended by ACI 318.
- G. Cut bar ends that are to be butt spliced, or threaded by saw cutting. Terminate such ends in flat surfaces within 1-1/2 degrees of a right angle to the axis of the bar.

PART 3 - EXECUTION

3.01 INSTALLATION:

- A. Place, support and secure reinforcement against displacement. Do not deviate from required position. Place reinforcement a minimum of 2 inches clear of any metal pipe or fittings.
- B. Do not displace or damage vapor retarder.
- C. Position dowels accurately. Rigidly support, align and securely tie dowels normal to the concrete surface before concrete placement. Setting dowels into wet concrete is prohibited.
- D. Position wall dowels projecting from base slabs on grade with templates or guides held in place above the concrete placement line. Position the templates to obtain the required clearance between the dowels and the face of the walls.
- E. Bars additional to those indicated that may be found necessary or desirable by the Contractor for the purpose of securing reinforcement in position shall be provided by the Contractor at no additional cost to the Owner.
- F. Do not extend continuous reinforcement or other fixed metal items through expansion joints. Provide 2 inches clearance from each face of expansion joint.
- G. Provide additional reinforcement bars to support top reinforcement in slabs. Do not shift reinforcement bars from positions in upper layers to positions in lower layers as a substitute for additional support bars.
- H. Support reinforcement steel in accordance with CRSI "Placing Reinforcement Bars" with maximum spacing of 4'-0".
- I. Tie reinforcement steel at intersections in accordance with CRSI "Placing Reinforcement Bars":

1. Maximum tie spacing for footings, walls and columns: every third intersection or 3 feet.
 2. Maximum spacing for slabs and other work: every fourth intersection or 3 feet.
 3. Tie a minimum of 25 percent of all intersecting bars in foundation mats, base slabs, footings, pile caps, slabs on grade and elevated slabs.
 4. Secure all dowels in place before placing concrete.
 5. Tie wires shall be bent away from the forms and from finished concrete surfaces in order to provide the required concrete coverage.
- J. Locate reinforcement to avoid interference with items drilled in later, such as concrete anchors.
- K. Extend welded wire reinforcement to within 2 inches of edges of slab or section. Lap sheets at least 12 inches or two wire spaces, whichever is greater, at ends and edges and wire tightly together. Stagger end laps.
- L. Unless shown otherwise on Drawings, place welded wire reinforcement in slabs on grade between the upper third point and mid-point of slab. Placing welded wire reinforcement on the subgrade and pulling it up during concrete placement is not permitted.
- M. Support welded wire reinforcement placed over the ground on wired concrete blocks spaced not more than 3 feet on centers in any direction.
- N. Support welded wire reinforcement placed over horizontal forms on slab bolsters spaced not more than 30 inches on center.
- O. Mechanical coupler systems may be substituted for dowels at Contractor's option when permitted by Engineer.
- P. Provide additional reinforcement bars to support ties and stirrups in beams where top reinforcement is not continuous.
- Q. Securely support and tie reinforcement steel to prevent movement during concrete placement.
- R. Unless otherwise shown on the Drawings or permitted by the Engineer, do not bend reinforcement bars that project from in-place concrete.
- S. Do not weld reinforcement steel bars (including tack welded) either during fabrication or erection unless specifically shown on the Drawings or specified herein, or unless prior written permission has been obtained from the Engineer. Immediately remove bars that have been welded, including tack welds, without such permission from the work. Comply with AWS D1.4 when welding of reinforcement is or called for.

- T. Reinforcement steel interfering with the location of other reinforcement steel, conduits or embedded items may be moved up to 3 inches. Make greater displacement of bars to avoid interference only with the permission of the Engineer. Do not cut reinforcement to install inserts, conduits, mechanical openings or other items without the prior permission from the Engineer.
- U. Setting bars and welded wire reinforcement on layers of fresh concrete as the work progresses or adjusting reinforcement during the placement of concrete is prohibited.
- V. Provide and place safety caps on all exposed ends of vertical reinforcement that pose a danger to injury or life safety.

3.02 REINFORCEMENT AROUND OPENINGS AND PENETRATIONS:

- A. Accommodate placement of formed openings and penetrations.
- B. Unless specific additional reinforcement around openings and penetrations is shown on the Drawings, provide additional reinforcement steel on each side of opening or penetration equivalent to one half of the cross-sectional area of the reinforcement steel interrupted by an opening or penetration. The bars shall have sufficient length to be fully developed at each end beyond the opening or penetration.
- C. Refer to details on Drawings for additional diagonal bars around openings or penetrations and bar extension length on each side of openings or penetrations.

3.03 SPLICING OF REINFORCEMENT:

- A. Splices may be used to provide continuity due to bar length limitations. Do not splice reinforcement that is detailed to be continuous in the Drawings.
- B. Provide tension lap splices at all laps in compliance with ACI 318. Class A splices may be used when 50 percent or less of the bars are spliced within the required lap length. Use Class B splices at all other locations.
- C. Except as otherwise indicated on the Drawings, stagger splices in circumferential reinforcement in circular walls using Class B tension splices. Do not splice adjacent bars within the required lap length.
- D. Make splices for reinforcement in tension tie members, with a full mechanical or full welded splice and staggered at least 30 inches.
- E. Make splices in column spiral reinforcement, when necessary, by a lap of 1-1/2 turns.
- F. Reinforcement shall be continuous through construction joints.
- G. Reinforcement may be spliced at construction joints provided that entire lap is placed within only one concrete placement.

3.04 ACCESSORIES:

- A. Provide accessories such as chairs, chair bars and the like in sufficient quantities and strength to adequately support the reinforcement and prevent its displacement during the erection of the reinforcement and the placement of concrete.
- B. Use precast concrete blocks where the reinforcement steel is to be supported over soil.
- C. Provide stainless steel bar supports or steel chairs with plastic tips where the chairs are set on forms for a concrete surface that will be exposed to weather, high humidity or liquid (including bottom of slabs over liquid containing areas) unless otherwise noted on contract documents.
- D. Do not use metal chairs, ferrous clips, nails, etc. that extend to the surfaces of the concrete. Do not use stones, brick or wood block supports.
- E. Do not use alternate methods of supporting top steel in slabs, such as steel channels supported on the bottom steel or vertical reinforcement steel fastened to the bottom and top mats unless permitted by the Engineer.
- F. Mechanical Couplers:
 - 1. Couplers that are located at a joint face can be a type that can be set either flush or recessed from the face as indicated.
 - 2. Seal couplers during concrete placement to completely eliminate concrete or cement paste from entering.
 - 3. Recess couplers intended for future connections a minimum of 1/2 inch from the concrete surface. After the concrete is placed, plug the coupler with plastic plugs that have an O-ring seal and the recess filled with sealant to prevent any contact with water or other corrosive materials.
 - 4. Unless indicated otherwise, provide mechanical coupler spacing and size to match the spacing and size of the reinforcement indicated for the adjacent section.

3.05 FIELD QUALITY CONTROL:

- A. Remove reinforcement with kinks or bends not shown on shop or placement drawings. Remove such reinforcement from job site and replace with new fabricated steel. Do not field bend of reinforcement unless reinforcement is indicated or specified to be field bent.
- B. Protect reinforcement from rusting, deforming, bending, kinking and other injury. Clean in-place reinforcement that has rusted, or been splattered with concrete using sand or water blasting prior to incorporation into the Work.

3.06 CONTRACT CLOSEOUT:

- A. Provide in accordance with Section 01700.

END OF SECTION

SECTION 03250

CONCRETE JOINTS AND ACCESSORIES

PART 1 - GENERAL

1.01 DESCRIPTION:

- A. This section describes materials, testing, and installation of concrete joints and accessories as specified and as shown on contract drawings.

1.02 REFERENCES:

- A. ASTM International (ASTM):

1. [A276](#): Standard Specification for Stainless Steel Bars and Shapes.
2. [C920](#): Specification for Elastomeric Joint Sealants
3. [C1193](#): Guide for Use of Joint Sealants
4. [D1752](#): Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.

- B. Environmental Protection Agency (EPA):

1. [40 CFR 59](#): National Volatile Organic Compound Emission Standards for Consumer and Commercial Products.

- C. Corps of Engineers:

1. CRD-C 572: Specifications for Polyvinylchloride Waterstop.

- D. Federal Specifications:

1. TT-S-00230C: Sealing Compound: Elastomeric Type, Single Component

1.03 SUBMITTALS:

- A. Submit following shop drawings in accordance with 01300.

1. Manufacturer's printed data and application instructions for specified materials and locations where materials are to be used.
2. Submit one sample of each type of water stop.
3. Submit layouts for joints.

4. Certification that materials used within the joint system are compatible with each other.

1.04 QUALITY ASSURANCE:

- A. Comply with requirements in section 01400 and as specified.
- B. Do not add, relocate or omit joints without written permission from the Engineer.
- C. Reject material exceeding expiration date for use.
- D. Clean concrete surfaces to receive expansion joint compound in accordance with the printed instructions of the joint compound manufacturer.

1.05 DELIVERY, STORAGE AND HANDLING:

- A. Comply with the requirements in section 01610.
- B. Transport, handle and deliver materials to the job site in the manufacturer's sealed bags, unopened containers or banded pallets.
- C. Store materials off the ground on a platform or skids and protect with covers from snow, rain and ground splatter.
- D. Store expansion joint compounds in a dry location where they cannot freeze.
- E. Store plastic products under cover in a dry location, out of direct sunlight.

1.06 MANUFACTURER'S SERVICES:

- A. Prior to joint preparation for joints receiving sealant materials, require joint manufacturer's technical representative to demonstrate, on site, joint preparation, priming, and sealant materials application for the Contractor's personnel performing joint work.

PART 2 - PRODUCTS

2.01 ELASTOMERIC JOINT SEALANT:

- A. Federal Specification TT-S-00230C Type 1, Class A, single component, cold applied, pourable, polyurethane.
 1. Products:
 - a. Euclid Chemical Corp; Eucolastic 1
 - b. Mameco ; Vulkem 45

- c. Or accepted equivalent product.

2.02 JOINT SEALANT FOR CONCRETE STRUCTURES:

- A. Joint sealant shall be a multipart, gray, nonstaining, nonsagging, gun grade polyurethane sealant, which cures at ambient temperature to a firm, flexible, resilient, tear-resistant rubber. Sealant shall comply with ASTM C920, Type M, Grade P, Class 25 for horizontal joints and Grade NS, Class 25 for vertical joints and be recommended by the manufacturer for continuous immersion in water. Troweling of sealants into joints will not be permitted. Sealant shall meet requirements in Table 03250-1.

TABLE 03250-1	
Characteristic or Parameter	Technical Requirements
Pot life	1 to 3 hours
Hardness	35 Shore A, +/- 5
Elongation	650 percent, ASTM D412
Tensile strength	200 psi, ASTM D412
Peel strength on concrete	No adhesion loss at 25 pounds
Temperature service range	40 to 167 degrees F
Immersion in water	Continuous

- B. Products:
 - 1. Tremco; Vulkem 227 or Vulkem 245 (for Type M, Grade P, Class 25)
 - 2. Sika Corporation; Sikaflex-2CNS (for Grade NS, Class 25), Sikaflex-2CSL
 - 3. Or accepted equivalent product.
- C. For applications on walls and surfaces inclined more than 30 degrees from the horizontal, use multi-component chemical resistant polysulfide sealant conforming to ASTM C920, Type M, Grade NS, Class 25.
 - 1. Sonneborn ; Sonolastic Two-part
 - 2. Tamms; Hornflex-L
 - 3. DuPont; Cormax PSC
 - 4. Or accepted equivalent product.

2.03 EPOXY JOINT SEALANT:

- A. 100 percent solids per ASTM D1259, two-part epoxy with an instantaneous Shore D hardness of 50 to 65 per ASTM D2240.

1. Metzger-McGuire Co.; MM80 or Edge Pro50
2. Euclid Chemical Corp. ; Euco700
3. Or accepted equivalent product.

2.04 BOND BREAKER TAPE:

- A. Provide an adhesive-backed glazed butyl or polyethylene tape that will adhere to the premolded joint material or concrete surface. The tape shall be the same width as the joint. The tape shall be compatible with the sealant.

2.05 PREMOLDED JOINT FILLER FOR PAVEMENTS AND SLABS:

- A. Joint filler shall be preformed, nonextruded type constructed of closed-cell neoprene conforming to ASTM D1752, Type I
- B. Bituminous-type preformed expansion joint filler conforming to ASTM D994.

2.06 VOC LIMITS FOR SEALANTS, AND SEALANT PRIMERS:

- A. VOC limits for sealants, and sealant primers to comply with content limits when calculated according to 40 CFR 59, Subpart D (EPA Method 24), or applicable state and local codes containing more stringent requirements.

2.07 BOND BREAKER FOR JOINT COMPOUNDS:

- A. Provide polyethylene tape.

2.08 SCHEDULE 40 PVC PIPE:

- A. Provide 4-inch nominal diameter schedule 40 PVC pipe where shown.
 1. Outer diameter shall be 4.5 inches.
 2. Average Inner diameter shall be 3.998 inches.
 3. Minimum wall thickness shall be 0.237 inches.
 4. Nominal weight per foot shall be 2.118 pounds per foot.
 5. Maximum working pressure shall be 220 pounds per square inch.

2.09 WATERTIGHT JOINT SYSTEM

- A. Provide watertight joint system in accordance with the following:
 1. Sealant system shall be comprised of three components:

- a. Microsphere-modified, 100% acrylic impregnated foam factory-coated on the contact surface with chemical-resistant polysulfide sealant.
 - b. Field-applied epoxy adhesive primer.
 - c. Field-injected polysulfide sealant bands.
2. Impregnation agent to have proven non-migratory characteristics.
 3. Polysulfide coating to be applied to the impregnated foam sealant at a width greater than maximum allowable joint extension and when cured and compressed will form a bellows.
 4. Product must be proved to have been tested under simulated head pressure testing in a suitable testing assembly, to be capable of resisting indefinitely the equivalent of 5-feet of positive liquid head pressure.
 5. Material shall be capable of movements of +25%, -25% (50% total) of nominal material size. Nominal material size to match field-measured joint size at mean-temperature or must be adjusted for mean temperature.
 6. Depth of seal to manufacturer's standard.
- A. Product:
1. EMSEAL Joint Systems, LTD, DSF Systems.

PART 3 - EXECUTION

3.01 JOINTS:

- A. Make joints only at locations shown on the contract drawings or as permitted by the Engineer. Any addition or relocation of construction joints proposed by the Contractor, must be submitted to the Engineer for written permission.
- B. Relocate additional joints where they least impair strength of the member.
- C. Do not use horizontal joints within foundation mats, base slabs, footings, or slabs on grade.
- D. Provide waterstops at locations shown on the contract Drawings. Do not provide metal waterstops unless permitted by Engineer.
- E. Construction Joints
 1. Provide flat ribbed waterstops at construction joints where shown on contract drawings and specified herein.

2. Where joint key ways are shown on contract drawings form keyways by beveled strips or boards placed at right angles to the formed face. Except where otherwise shown on contract drawings or specified, keyways shall be at least 1-1/2 inches in depth over at least 25 percent of the width of the section.
3. After the placement has been completed to the construction joint and the concrete has hardened, thoroughly clean the entire surface of the joint of surface laitance, loose concrete, foreign material, and expose clean aggregate by sandblasting or waterblasting the surface of construction joints before placing the new concrete. Cover horizontal construction joints with mortar. Spread uniformly and work thoroughly into irregularities of the surface. The water-cement ratio of the mortar in place shall not exceed that of the concrete to be placed, and the consistency of the mortar shall be suitable for placing and working.
4. In case of emergency, place additional construction joints. (An interval of 45 minutes between two consecutive batches of concrete shall constitute cause for an emergency construction joint.)

3.02 INSTALLATION OF JOINT SEALANTS:

- A. Immediately before installing the joint sealant, clean the joint cavity by sandblasting or power wire brushing. Install bond breaker tape per manufacturer's instructions.
- B. Apply masking tape along the edges of the exposed surface of the exposed joints.
- C. Application criteria for the sealant materials, such as temperature and moisture requirements and primer cure time, shall be in accordance with the recommendations of the sealant manufacturer.
- D. After the joints have been prepared as described above, apply the joint sealant. Apply the primer, if required, and joint sealant only with the equipment and methods recommended by the joint sealant manufacturer.
- E. Trowel the joints smooth with a tuck pointing tool wiped with a solvent recommended by the sealant manufacturer.
- F. After the sealant has been applied, remove the masking tape and any sealant spillage.
- G. Sealants used in water retaining structures shall achieve final cure at least seven days before the structure is filled with water.

3.03 CLOSEOUT ACTIVITIES:

- A. Provide in accordance with Section 01700.

END OF SECTION

SECTION 03255

NON-EXPANDING WATERSTOPS

PART 1 - GENERAL

1.01 DESCRIPTION:

- A. Provide polyvinyl chloride (PVC) waterstops in construction between dry areas and sources of liquid, between dry areas and the ground, and between sources of liquid and the ground as indicated on the drawings and specified herein.

1. Waterstops shall form a continuous watertight diaphragm to prevent leakage.
2. Provide 6" ribbed waterstops in construction joints.

1.02 REFERENCES:

- A. ASTM International (ASTM):

1. [D412](#): Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers – Tension.
2. [D570](#): Standard Test Method for Water Absorption of Plastics
3. [D624](#): Standard Test method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers.
4. [D638](#): Standard Test Method for Tensile Properties of Plastics
5. [D746](#): Standard Test Method for Brittleness Temperature of Plastics and Elastomers by Impact.
6. [D747](#): Standard Test Method for Apparent Bending Modulus of Plastics by Means of a Cantilever Beam.
7. [D792](#): Standard Test Methods for Density and Specific Gravity of Plastics by Displacement.
8. [D1171](#): Standard Test Method for Rubber Deterioration – Surface Ozone Cracking Outdoors or Chamber (Triangular Specimens)
9. [D1259](#): Standard Test Methods for Nonvolatile Content of Resin Solutions.
10. [D2240](#): Standard Test Method for Rubber Property – Durometer Hardness

- B. Corps of Engineers:

1. CRD-C 572: Specifications for Polyvinylchloride Waterstop.

1.03 SUBMITTALS:

A. Submit following shop drawings in accordance with 01300.

1. Manufacturer's printed data and application instructions for specified materials and locations where materials are to be used.

1.04 QUALITY ASSURANCE:

A. Comply with requirements in section 01400 and as specified.

B. Reject waterstops containing scrap or reclaimed material or pigment.

C. Position waterstops in construction as indicated.

D. Use factory made and tested crosses, tees and ells at corners and intersections.

1.05 DELIVERY, STORAGE AND HANDLING:

A. Comply with the requirements in section 01610.

B. Transport, handle and deliver materials to the job site in the manufacturer's sealed bags, unopened containers or banded pallets.

C. Store materials off the ground on a platform or skids and protect with covers from snow, rain and ground splatter.

D. Store plastic products under cover in a dry location, out of direct sunlight.

PART 2 - PRODUCTS

2.01 PVC WATERSTOP:

A. Provide polyvinyl chloride waterstops manufactured from virgin polyvinyl chloride plastic compound conforming to Corps of Engineers Specification CRD-C572.

B. Provide waterstops of type, shape and size indicated with looped galvanized steel wire or grommets spaced at 12 inches on center along both edges.

C. Provide factory-made crosses, tees and ells fabricated by the waterstop manufacturer using thermostatically controlled electric heat source.

D. Provide waterstops resistant to chemical action with Portland cement, alkalis, acids, and not affected by mildew or fungi. It shall show no effect when immersed for 10 days in a 10 percent solution of sulfuric or hydrochloric acid, saturated lime solution or salt water.

Water stops shall be such that any cross section will be dense, homogeneous, and free from porosity and other imperfections. They shall be symmetrical in shape.

E. The material shall meet the requirements in Table 03255-1.

TABLE 03255-1		
Property	Test Method	Limit
Water Absorption	ASTM D 570	5% maximum
Tear Resistance	ASTM D 624	250 #/inch minimum
Ultimate Elongation	ASTM D 638	300% minimum
Tensile Strength	ASTM D 638	1750 psi minimum
Low Temperature Brittleness	ASTM D 746	No Failure at -35°F
Stiffness in Flexure	ASTM D 747	600 psi minimum
Ozone Resistance	ASTM D 1149	No Failure
Volatile Loss	ASTM D 1203	0.50% maximum
Hardness, Shore A	ASTM D 2240	65 to 80
Tensile strength after accelerated extraction	CRD C 572	1500 psi minimum
Elongation after accelerated extraction	CRD C 572	280% minimum
Effect of Alkalis after 7 days - Weight Change	CRD C 572	-0.10% to +0.25%
Effect of Alkalis after 7 days - Hardness Change	CRD C 572	+5 maximum

F. PVC waterstops for construction joints: Flat ribbed type, 6 inches wide with a minimum thickness of 3/8-inches.

1. Products:
 - a. Greenstreak: Model 679
 - b. Vinylex; Model R638
 - c. BoMetals, Inc.; Model TFR-638
 - d. Or accepted equivalent product.

PART 3 - EXECUTION

3.01 FABRICATION:

- A. Make all splices on a bench following manufacturer's printed instructions and splicing procedures.
- B. Use miter guide and portable power saw to cut spliced ends.
- C. Maintain continuity of characteristic features of waterstop cross section including ribs through splice.
- D. Remove looped steel wire along both edges of waterstop adjacent to saw cut prior to splicing.
- E. Make splices by heat sealing adjacent surfaces using a thermostatically controlled electric heat source in conformance with manufacturer's printed instructions.
- F. Reform waterstop at splices using a remolding iron having a pattern matching the waterstop.
- G. If splice shows any separation or lack of fusion, reject the splice, re-cut back at least one inch from rejected splice each side, re-weld.
- H. Replace or repair damaged or punctured waterstops in conformance with manufacturer's printed instructions at no additional cost to the Owner.
- I. Clean waterstops of curing compound, foreign materials and protrusions of hardened concrete and mortar.
- J. Provide waterstops with an integral fastening system consisting of grommets or pre-punched holes.

3.02 INSTALLATION:

- A. Place waterstop to form a continuous watertight diaphragm in joints.
- B. Center waterstops in joints unless otherwise indicated.
- C. Install waterstops in continuous lengths to minimize field splices.
- D. Maintain 1-in. minimum clearance between waterstop and reinforcement and embedded items.
- E. Use factory-made crosses, tees and ells at all corners and intersections.
- F. Do not fold waterstops against bulkhead forms.

- G. Secure waterstops in position with tie wire from loops to adjacent reinforcement on both sides every 12 in. along each edge.
 - H. Consolidate concrete during placement in vicinity of waterstop without damaging or dislodging waterstop.
 - I. Protect exposed waterstop from damage.
 - J. Terminate vertical waterstops three inches below top of concrete walls in open tanks, at the underside of elevated framed slabs that are above maximum process liquid levels and above finish grade in exterior foundation walls.
 - K. Do not use split waterstops.
- 3.03 CLOSEOUT ACTIVITIES:
- A. Provide in accordance with Section 01700.

END OF SECTION

SECTION 03256

EXPANDING WATERSTOPS

PART 1 - GENERAL

1.01 DESCRIPTION:

- A. This section describes materials, testing, and installation of concrete joints and accessories as specified and as shown on contract drawings.

1.02 REFERENCES:

- A. ASTM International (ASTM):

1. [D638](#): Test Method for Tensile Properties of Plastic.
2. D1149: Test Method for Rubber Deterioration - Surface Ozone Cracking in a Chamber
3. D1203: Test Methods for Volatile Loss from Plastics Using Activated Carbon Methods.
4. [D2240](#): Standard Test Method for Rubber Property – Durometer Hardness

1.03 SUBMITTALS:

- A. Submit following shop drawings in accordance with 01300.

1. Manufacturer's printed data and application instructions for specified materials and locations where materials are to be used.

1.04 QUALITY ASSURANCE:

- A. Comply with requirements in section 01400 and as specified.
- B. Reject and replace waterstops which have become wet or exhibit swelling prior to concrete placement.
- C. Position waterstops in joints as indicated.
- D. Provide waterstops in maximum practical lengths to minimize joints.
- E. Use adhesives manufactured by or recommended by the waterstop manufacturer for attachment of the waterstop to concrete.
- F. Waterstops shall be positioned to provide a minimum of 3" concrete cover.

1.05 DELIVERY, STORAGE AND HANDLING:

- A. Comply with the requirements in section 01610.
- B. Transport, handle and deliver materials to the job site in the manufacturer's sealed bags, unopened containers or banded pallets.
- C. Store materials off the ground on a platform or skids and protect with covers from snow, rain and ground splatter.
- D. Store hydrophilic waterstops under cover in a dry location, out of direct sunlight.
- E. Waterstop shall be maintained in a dry condition until concrete placement.

PART 2 - PRODUCTS

2.01 HYDROPHILIC GASKET WATERSTOP:

- A. Provide a bentonite free rubber waterstop. Waterstop shall expand by a minimum of 80 percent of dry volume in the presence of water to form a watertight joint seal without damaging the concrete in which it is cast. Provide minimum concrete cover as recommended by the waterstop manufacturer.
- B. Provide hydrophilic rubber gasket waterstops fabricated of non-vulcanized rubber, chloroprene rubber, urethane polymers, vinylester polymers or combinations of these materials.
- C. Provide waterstop as recommended by manufacturer for specific installation.
- D. Provide hydrophilic gasket waterstops which meet the criteria in Table 03256-1.

Property	Test Method	Limit
Ultimate Elongation	ASTM D 638	70% minimum
Tensile Strength	ASTM D 638	25 psi minimum
Ozone Resistance	ASTM D 1149	No Failure
Volatile Loss	ASTM D 1203	0.50% maximum
Hardness, Shore A	ASTM D 2240	20 to 60

- E. Provide hydrophilic rubber gasket waterstops as manufactured by:
 - 1. Duroseal Gasket Waterstop manufactured by BBZ USA;
 - 2. Adeka Ultraseal MC-2010M manufactured by Adeka North America;

3. Swellseal 8 manufactured by de neef Construction Chemicals, Inc.;
4. Or accepted equivalent product.

2.02 HYDROPHILIC PASTE WATERSTOPS:

- A. Provide hydrophilic rubber paste waterstops of urethane paste, thixotropic vinyl monomer or similar materials.
- B. Hydrophilic rubber paste shall be compatible with gasket waterstop material.
- C. Hydrophilic paste shall be 100% solids.
- D. Provide hydrophilic paste waterstops which meet or exceed the criteria in Table 03256-2.

Table 03256-2		
Property	Test Method	Limit
Ultimate Elongation	ASTM D 638	50% minimum
Tensile Strength	ASTM D 638	25 psi minimum
Ozone Resistance	ASTM D 1149	No Failure
Volatile Loss	ASTM D 1203	0.50% maximum
Hardness, Shore A	ASTM D 2240	20 to 60

- E. Provide hydrophilic rubber paste as manufactured by:
 1. Duroseal Paste manufactured by BBZ USA;
 2. Adeka Ultraseal P-201 manufactured by Adeka North America;
 3. de neef; Swellseal WA
 4. Or acceptable equivalent product.

PART 3 - EXECUTION

3.01 INSTALLATION:

- A. Provide hydrophilic rubber gasket and paste waterstops where specifically indicated.
- B. Center waterstops in joints unless otherwise indicated.
- C. Consolidate concrete during placement in vicinity of waterstop without damaging or dislodging waterstop.

- D. Clean joint surface of dirt, dust, debris and laitence immediately before applying waterstop and remove standing water.
- E. Protect waterstops from moisture until concrete is placed. Waterstops which exhibit swelling prior to concrete placement shall be removed and replaced at the contractor's expense.

3.02 HYDROPHILIC GASKET WATERSTOPS:

- A. Install hydrophilic gasket waterstops in continuous lengths to minimize joints. Provide waterstop in one continuous length insofar as practicable. Butt ends at joints of waterstop or overlap a minimum of 2" per manufacturer's instructions.
- B. Seal joints in hydrophilic gasket waterstops with a hydrophilic rubber paste compound as recommended by the manufacturer.
- C. Do not bend hydrophilic gasket waterstop. Cut square and butt joints at corners.
- D. Waterstop shall be in continuous contact with the concrete surface.
- E. Attach hydrophilic gasket waterstop to concrete surface by one of the following methods:
 - 1. Fix hydrophilic gasket waterstop to concrete surface with continuous bead of hydrophilic rubber paste or adhesive. Paste or adhesive shall be provided by or as recommended by the waterstop manufacturer.
 - 2. Fix hydrophilic gasket waterstop to concrete surface with masonry or concrete nails or power activated fasteners at a maximum 12 inch spacing.
- F. Provide one fastener one inch from the top and a second fastener four inches from the top of vertical hydrophilic gasket waterstops regardless of which fastening method is used.
- G. Do not compress or otherwise deform hydrophilic gasket waterstop when fastening to concrete.
- H. Do not wrap hydrophilic gasket waterstops around pipes less than the minimum diameter recommended in the manufacturer's printed instructions.

3.03 HYDROPHILIC PASTE WATERSTOPS:

- A. Clean dirt and debris from area to receive hydrophilic paste waterstop.
- B. Bead of hydrophilic paste waterstop shall be a minimum of 1/4 by 1/2 inches.
- C. Apply hydrophilic paste waterstop such that there is no break in the bead.

- D. Place hydrophilic paste waterstop bead continuously around pipe near the center of the wall where used for sealing pipe penetrations. Allow hydrophilic paste waterstop to cure for 24 hours before placing concrete.
- E. Install hydrophilic paste waterstops in accordance with the manufacturer's printed instructions.

3.04 CLOSEOUT ACTIVITIES:

- A. Provide in accordance with Section 01700.

END OF SECTION

SECTION 03300

CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 DESCRIPTION:

- A. Provide all labor, materials, equipment and incidentals necessary to furnish and install cast-in-place concrete as specified and as shown on contract drawings.
- B. Provide cast-in-place concrete for architectural, civil, mechanical, and electrical work as shown on the drawings or specified under specified under those disciplines.

1.02 REFERENCES:

A. American Concrete Institute (ACI):

- 1. [ACI 211.1](#): Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete
- 2. [ACI 301](#): Specifications for Structural Concrete
- 3. [ACI 304R](#): Guide for Measuring, Mixing, Transporting and Placing Concrete
- 4. ACI 304.2R: Placing Concrete by Pumping Methods
- 5. [ACI 305.1](#): Specification for Hot Weather Concreting
- 6. [ACI 306.1](#): Standard Specification for Cold Weather Concreting
- 7. [ACI 308.1](#): Specification for Curing Concrete
- 8. [ACI 318](#): Building Code Requirements for Structural Concrete
- 9. [ACI 350](#): Code Requirements For Environmental Engineering Concrete Structures

B. ASTM International (ASTM) Publications:

- 1. [A 123](#): Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
- 2. [A 153](#): Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
- 3. [C 31](#): Standard Practice for Making and Curing Concrete Test Specimens in the Field

4. [C 33](#): Standard Specification for Concrete Aggregates
5. [C 39](#): Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
6. [C 40](#): Standard Test Method for Organic Impurities in Fine Aggregates for Concrete
7. [C 42](#): Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
8. [C 87](#): Standard Test Method for Effect of Organic Impurities in Fine Aggregate on Strength of Mortar
9. [C 88](#): Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
10. [C 94](#): Standard Specification for Ready-Mixed Concrete
11. [C 109](#): Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in or (50-mm) Cube Specimens)
12. [C 123](#): Standard Test Method for Lightweight Particles in Aggregate
13. [C 136](#): Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
14. [C 138](#): Standard Test Method for Unit Weight, Yield, and Air Content (Gravimetric) of Concrete
15. [C 143](#): Standard Test Method for Slump of Hydraulic Cement Concrete
16. [C 150](#): Standard Specification for Portland Cement
17. [C 157](#): Standard Test Method for Length Change of Hardened Hydraulic Cement, Mortar and Concrete
18. [C 171](#): Standard Specification for Sheet Materials for Curing Concrete
19. [C 172](#): Standard Practice for Sampling Freshly Mixed Concrete
20. [C 192](#): Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory
21. [C 231](#): Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
22. [C 260](#): Standard Specification for Air-Entraining Admixtures for Concrete
23. [C 295](#): Standard Guide for Petrographic Examination of Aggregates for Concrete

24. [C 309](#): Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
25. C 311: Standard Test Methods for Sampling and Testing Fly Ash or Natural Pozzolans for Use as a Mineral Admixture in Portland Cement Concrete
26. [C 494](#): Standard Specification for Chemical Admixtures for Concrete
27. [C 595](#): Standard Specification for Blended Hydraulic Cements
28. [C 618](#): Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
29. C 881: Standard Test Method for Epoxy Resin Base Bonding Systems for Concrete
30. [C 882](#): Standard Test Method for Bond Strength of Epoxy Resin Systems Used with Concrete by Slant Shear
31. [C 989](#): : Standard Specification for Slag Cement for Use in Concrete and Mortars
32. [C 1017](#): Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete
33. [C 1064](#): Standard Test Method for Temperature of Freshly Mixed Portland Cement Concrete
34. [C 1107](#): Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
35. [C 1116](#): Standard Specification for Fiber Reinforced Concrete
36. [C 1240](#): Standard Specification for Silica Fume Used in Cementitious Mixtures
37. C 1260: Standard Test Method for Potential Alkali Reactivity of Aggregates (Mortar-Bar Method)
38. C 1293: Standard Test Method for Determination of Length Change of Concrete Due to Alkali-Silica Reaction
39. C 1567: Standard Test Method for Determining the Potential Alkali-Silica Reactivity of Combinations of Cementitious Materials and Aggregate (Accelerated Mortar-Bar Method)
40. C 1602: Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete
41. [D 75](#): Standard Practice for Sampling Aggregates

42. [E 154](#): Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover
43. [E 329](#): Standard Specification for Agencies Engaged in the Testing and/or Inspection of Materials used in Construction

C. American Association of State Highway and Transportation Officials (AASHTO):

[M182](#): Standard Specification for Burlap Cloth Made from Jute or Kenaf and Cotton Mats

1.03 SUBMITTALS:

A. Section 01300- Submittal Procedures: Requirements for submittals.

B. Product Data:

1. Manufacturer's specifications and instructions for all admixtures, and curing materials. Manufacturer's certification of compatibility of all admixtures.

C. Shop Drawings:

1. Provide certification that cement used complies with ASTM C150 and these specifications.
2. Provide certification that aggregates comply with ASTM C33. Submit gradation analysis with concrete mix designs.
3. Provide certification of compliance with these specifications from the manufacturer of the concrete admixtures.
4. Prepare mix designs in accordance with ACI 318, except as modified herein.
 - a. Submit concrete mix designs, laboratory 7-day and 28-day compressive test results and laboratory shrinkage test results for review and approval by the Engineer.
 - b. Alternatively, submit test reports of 7- and 28-day compressive tests and shrinkage test results of the proposed mix where that same mix has been used on two previous projects in the past twelve months.
 - c. Do not use any concrete mixes in the work that have not been approved by the Engineer.
5. Plant Qualification: Submit certification from the National Ready Mixed Concrete Association indicating compliance with the specified qualification requirements.

D. Test and Evaluation Reports

1. Provide results of drying shrinkage tests from trial concrete mixes by the Contractor's testing laboratory firm.
- E. Manufacturers' Instructions
1. Provide epoxy bonding compound manufacturer's specific instructions for use. Provide manufacturer's certifications as to suitability of product to meet job requirements with regard to surface, pot life, set time, vertical or horizontal application, and forming restrictions.
- F. Field Quality Control Submittals
1. Provide delivery tickets for ready-mix concrete or weigh masters certificate per ASTM C94, including weights of cement and each size aggregate and amount of water added at the plant and record of placements. Record the amount of water added on the job on the delivery ticket. Water added at the plant shall account for moisture in both coarse and fine aggregate and liquid admixtures.
 2. Batch tickets shall include the following information:
 - a. Load number, truck number and driver's name
 - b. Strength of concrete (compression strength)
 - c. Amount of concrete (cu. yds.)
 - d. Time truck was charged with cement
 - e. Type, brand and amount of cement
 - f. Type, brand and amount of admixtures
 - g. Amount of water withheld at the plant (if any)
 - h. Information necessary to calculate total mixing water
 - i. Maximum size of aggregate
 - j. Weights of fine and coarse aggregates
 - k. Signature of ready-mix representative
 - l. Concrete temperature at batching plant
 - m. Type and amount of fly ash, other pozzolan or slag cement.

1.04 SHRINKAGE TESTS:

- A. The testing laboratory shall perform drying shrinkage tests for the trial batches as specified herein. Shrinkage limitations apply only to concrete for liquid containing structures.
- B. Fabricate, cure, dry, and measure specimens in accordance with ASTM C157 modified as follows:
 - 1. Remove specimens from molds at an age of 23 hours +/- 1 hour after trial batching, place immediately in water at 70 degrees F +/- 3 degrees F for at least 30 minutes, measure within 30 minutes thereafter to determine original length, and then submerge in saturated lime water at 73 degrees F +/- 3 degrees F.
 - 2. At age seven days, take measurements to determine expansion, expressed as a percentage of original length. This length at age seven days shall be the base length for drying shrinkage calculations (zero days' drying age).
 - 3. Immediately place specimens in a humidity-controlled room maintained at 73 degrees F +/- 3 degrees F and 50 percent +/- 4 percent relative humidity for the remainder of the test.
 - 4. Report measurements to determine shrinkage expressed as percentage of the base length separately for 7, 14, 21, and 28 days of drying after 7 days of moist curing.
- C. Compute the drying shrinkage deformation of each specimen as the difference between the base length (at zero days' drying age) and the length after drying at each test age.
 - 1. Compute the average drying shrinkage deformation of the specimens to the nearest 0.0001 inch at each test age.
 - 2. If the drying shrinkage of any specimen departs from the average of that test age by more than 0.0004 inch, disregard the results obtained from that specimen.
 - 3. Report results of the shrinkage test to the nearest 0.001 percent of shrinkage.
- D. Take compression test specimens in each case from the same concrete used for preparing drying shrinkage specimens. These tests shall be considered a part of the normal compression tests for the project.
- E. Acceptance of Test Results: The maximum concrete shrinkage for specimens cast in the laboratory from the trial batch, as measured at 21-day drying age or at 28-day drying age, shall be 0.028 percent or 0.032 percent, respectively.
 - 1. Use only mix designs for construction that have first met the trial batch shrinkage and compression requirements.

2. If the trial batch specimens do not meet both the strength and shrinkage requirements, revise the mix designs and/or materials and retest.

1.05 QUALITY ASSURANCE:

- A. Provide in accordance with Section 01400.
- B. Concrete not meeting the minimum specified 28-day design strength shall be cause for rejection and removal from the work.
- C. Perform concrete work in conformance with ACI 301 unless otherwise specified.
- D. Do not use calcium chloride or admixtures containing calcium chloride.
- E. Do not place concrete until design mix, material tests and trial concrete batch mix compression and shrinkage test results are approved by the Engineer. Approvals shall be obtained at least 30 days prior to the need for use on the job site.
- F. The Contractor shall employ an independent testing laboratory, acceptable to the Engineer, to develop concrete mix designs and testing.
- G. The Contractor shall employ an independent testing laboratory, acceptable to the Engineer, to test the conformity of materials proposed for use in the concrete mixes to the project specifications and to design and test concrete mixes proposed for use. Concrete testing shall be performed by an ACI Concrete Field Technician, Grade I or equivalent. The Contractor shall allow free access to obtain test samples.
- H. The Owner shall employ an independent testing laboratory, acceptable to the Engineer, to test conformity of materials placed into the work during construction. Concrete testing shall be performed by an ACI Concrete Field Technician, Grade I or equivalent. The Contractor shall allow free access to obtain test samples.
- I. Methods of Sampling and Testing:
 1. Fresh Concrete Sampling: ASTM C 172
 2. Specimen Preparation: ASTM C 31
 3. Compressive Strength: ASTM C 39
 4. Air Content: ASTM C 231
 5. Slump: ASTM C 143
 6. Temperature: ASTM C 1064
 7. Unit Weight: ASTM C 138
 8. Obtaining Drilled Cores: ASTM C 42

9. Drying Shrinkage: ASTM C 157

- J. Acceptance of Structure: Acceptance of completed concrete work requires conformance with dimensional tolerances, appearance and strength as indicated or specified.
- K. Hot weather concrete to conform to ACI 305 and as specified herein.
- L. Cold weather concrete to conform to ACI 306 and as specified herein.
- M. Reject concrete delivered to job site that exceeds the time limit specified.
- N. Reject concrete delivered to job site that exceeds the concrete temperature limitations specified.
- O. Do not place concrete in water or on frozen or uncompacted ground.

1.06 WORKABILITY:

- A. Concrete shall be of such consistency and composition that it can be worked readily into the forms and around the reinforcement without excessive vibrating and without permitting the materials to segregate or free water to collect on the surface.

1.07 DELIVERY, STORAGE, AND HANDLING:

- A. Provide in conformance with Section 01610 and as specified herein.
- B. Deliver concrete to discharge locations in watertight agitator or mixer trucks without altering the specified properties of water- cementitious materials ratio, slump, air entrainment, temperature and homogeneity.
- C. Reject concrete not conforming to specification, unsuitable for placement, exceeding the time or temperature limitations or not having a complete delivery batch ticket.

1.08 SITE CONDITIONS:

- A. Do not place concrete until conditions and facilities for making and curing control test specimens are in compliance with ASTM C 31 and as specified herein.

PART 2 - PRODUCTS

2.01 MATERIALS:

- A. Cement:
 - 1. Portland cement, ASTM C150, Type II; or blended hydraulic cement, ASTM C595, Type IP (MS).

2. Type IP (MS) shall not be used for concrete to come in contact with potable water.
3. Use only one brand of cement in any individual structure. Use no cement that has become damaged, partially set, lumpy, or caked. Reject the entire contents of the sack or container that contains such cement. Use no salvaged or reclaimed cement.
4. Maximum tricalcium aluminate shall not exceed 8 percent. The maximum percent alkalis shall not exceed 0.6 percent.

B. Fly Ash:

1. Provide fly ash conforming to the following requirements:
 - a. Class F fly ash conforming to ASTM C 618 for chemical and physical properties.
 - b. Supplemental requirements in percent:
 - (1) Maximum carbon content: 3%
 - (2) Maximum sulfur trioxide (SO₃) content: 4%
 - (3) Maximum loss on ignition: 3%
 - (4) Maximum water requirement (as a percent of control): 100%
 - (5) Fineness, maximum retained on No. 325 sieve: 25%

C. Slag Cement:

1. Slag cement, when used, shall meet the requirements of ASTM C989, Grade 100 or better.

D. Silica Fume:

1. Silica fume, when used, shall meet the requirements of ASTM C1240.
 - a. Products:
 - (1) BASF Corporation; MasterLife SF 100.
 - (2) Sika Corporation; Sikacrete 950DP
 - (3) Euclid Chemical Company; Eucoshot MSA
 - (4) Or accepted equivalent product.

E. Fine Aggregates:

1. Clean, sharp, natural sand conforming to requirements of ASTM C33 with a fineness modulus between 2.50 and 3.0.
2. Confirm aggregates intended for use in concrete do not contain pyrrhotite or other deleterious materials by petrographic testing.
3. Test conformity of aggregate and confirm that aggregates intended for use in concrete are potentially non-reactive when tested in conformance with ASTM C1260, ASTM C1293 or ASTM C1567.

F. Coarse Aggregate:

1. Well graded crushed stone, natural rock conforming to requirements of ASTM C33.
2. Limit deleterious substances in accordance with ASTM C33, Table 3, Severe Weathering Regions, limit clay lumps not to exceed 5.0 percent by weight, and limit loss when tested for soundness using magnesium sulfate to 12 percent.
3. Test conformity of aggregate and confirm that aggregates intended for use in concrete are potentially non-reactive when tested in conformance with ASTM C1260, ASTM C1293 or ASTM C1567.
4. Confirm aggregates intended for use in concrete do not contain pyrrhotite or other deleterious materials by petrographic testing.

G. Water and Ice:

1. Use water and ice free from injurious amounts of oil, acid, alkali, salt, organic matter or other deleterious substances and conforms to requirements of ASTM C1602.
2. Water shall not contain more than 500 mg/L of chlorides or more than 500 mg/L of sulfate.
3. Heat or cool water to obtain concrete temperatures specified, and in conformance with ACI 305.1 and ACI 306.1.

H. Color Additive for Exterior Electrical Duct Encasement:

1. For exterior electrical duct concrete encasements, use a color additive for identification purposes.

I. Concrete Admixtures:

1. Maintain compressive strength and maximum water-cementitious materials ratios specified in Table 03300-1 when using admixtures. Include all admixtures in

solution form in the water-cementitious materials ratio calculations. Do not use any admixture that contains intentionally-added chlorides or other corrosive elements. Admixtures shall be used in compliance with the manufacturer's printed instructions. The manufacturer shall certify the compatibility of multiple admixtures used in the same mix. Do not use admixtures in greater dosages than recommended by manufacturer.

2. Air Entrainment:
 - a. Air-entraining admixture shall conform to ASTM C260.
 - b. Products:
 - (1) BASF Corporation – MasterAir AE 90, MasterAir VR 10, or MasterAir AE 200
 - (2) Sika Corporation, AER.
 - (3) WR Grace & Co.; Darex II-AEA
 - (4) Or accepted equivalent product.
 - c. Adjust the admixture content to accommodate fly ash or other pozzolan requirements, and other admixtures when used, in order to obtain the specified air content.
3. Water Reducing:
 - a. Water-reducing admixture shall conform to ASTM C494, Type A and be compatible with the air-entraining admixture.
 - b. Products:
 - (1) BASF Corporation; MasterPozzolith Series or MasterPolyHeed Series
 - (2) Sika Corporation, Plastocrete 161
 - (3) WR Grace & Co.; Daracem 65
 - (4) Euclid Chemical Company; Eucon NW
 - (5) Or accepted equivalent product.
4. Water Reducing and Retarding:
 - a. Water-reducing and retarding admixture shall conform to ASTM C494, Type D and compatible with the air-entraining admixture.
 - b. Products:

- (1) BASF Corporation; MasterPozzolith Series
 - (2) Sika Corporation; Plastiment
 - (3) WR Grace & Co.; WRDA 64
 - (4) Or accepted equivalent product.
5. Accelerating:
 - a. Accelerating admixture shall conform to ASTM C494, Type C or E.
 - b. Products:
 - (1) BASF Corporation – MasterSet AC 534 or MasterSet FP 20
 - (2) WR Grace & Co.; Lubricon NCA or Polarset
 - (3) Euclid Chemical Company: Accelguard NCA
 - (4) Or accepted equivalent product.
6. High-Range Water-Reducing Admixture (Superplasticizer):
 - a. High-Range water-reducing admixture shall conform to ASTM C494, Type F or ASTM C1017, Type I.
 - b. Products:
 - (1) BASF Corporation; MasterRheobuild 1000 or MasterGlenium Series
 - (2) WR Grace & Co.; Daracem 100
 - (3) Euclid Chemical company; Eucon SPC
 - (4) Or accepted equivalent product.
7. Workability-Retaining Admixture:
 - a. Workability-enhancing admixture shall conform to ASTM C 494, Type S.
 - b. Products:
 - (1) BASF Corporation – MasterSure Z 60
 - (2) WR Grace & Co.; Adva XT2
 - (3) Or accepted equivalent product.
8. Shrinkage Reducing Admixture:

- a. Shrinkage-reducing admixture is permitted to be used in the mix to meet shrinkage limitations provided that specified strength are met and there is no reduction in sulfate resistance and no increase in permeability. Quantity of shrinkage-reducing admixture used in the mix shall be added to the quantity of water for purposes of determining the water/cementitious materials ratio.
- b. Products:
 - (1) BASF Corporation; MasterLIFE SRA 20
 - (2) WR Grace & Co.; Eclipse 4500
 - (3) Euclid Chemical company; Eucon SRA
 - (4) Or accepted equivalent product.

J. Epoxy Bonding Agent:

1. Epoxy bonding agent shall conform to ASTM C881 Type I, II, IV or V; Grade 2 for epoxy resin adhesives, depending on the application. The class of epoxy bonding agent shall be suitable for all ambient and substrate temperatures.
2. Products:
 - a. Sika Corp.; Sikadur 32 Hi-Mod
 - b. Euclid Chemical Company; Duralcrete
 - c. BASF Corporation; MasterEmaco ADH 326
 - d. Or accepted equivalent product

K. Vapor Retarder: 10 mil polyethylene sheet conforming to ASTM E 154

L. Curing Compound:

1. Liquid form, which will form impervious membrane over, exposed surface of concrete when applied to fresh concrete by means of spray gun. Compound shall not inhibit future bond of floor covering or concrete floor treatment. Use Type I-D compound with red fugitive dye, Class B, having 18 percent minimum solids conforming to ASTM C 309.
2. Products:
 - a. BASF Corporation; MasterKure EC 1315
 - b. Euclid Chemical Company; Super Diamond Clear VOX
 - c. W. R. Meadows, Inc.; VOCOMP-30

- d. Dayton Superior Corp; Safe Cure and Seal 30% J23UV
- e. Or accepted equivalent product.

M. Burlap Mats:

- 1. Conform to AASHTO M182.

N. Sisal-Kraft Paper and Polyethylene Sheets for Curing:

- 1. Conform to ASTM C171.

2.02 MIXES:

A. Conform to ASTM C94, except as modified by these specifications.

B. Air content as determined by ASTM C231:

5 ± 1 1/2 percent for concrete using 1-1/2 inch maximum aggregate size.

6 ± 1 1/2 percent for concrete using 3/4 inch maximum aggregate size.

C. Provide minimum cementitious material content as follows in Table 03300-1:

Table 03300- 1		
Nominal Maximum Aggregate Size (in.)	Coarse Aggregate (ASTM C 33) Size No.	Minimum Cementitious Materials (lb/yd³)
1 - 1/2	467	515
1	57	535
3/4	67	560
1/2	7	580
3/8	8	600

D. Provide concrete with the following compressive strengths at 28 days and proportion it for strength and quality requirements in accordance with ACI 318 and ACI 350. The resulting mix shall not conflict with limiting values specified in Table 03300-2.

Table 03300- 2		
Type of Work	28-Day Minimum Compressive Strength (in psi)	Maximum Water/Cement Ratio
Pavement	3,000	0.54
Mud mats and concrete under foundations	1,500	0.76
Concrete not otherwise specified	4,000	0.44

E. Measure slump in accordance with ASTM C143:

1. Proportion and produce the concrete to have a maximum slump of 4 inches. A tolerance of up to 1 inch above the indicated maximum is allowed for individual batches provided the average for all batches or the most recent 10 batches tested, whichever is fewer, does not exceed the maximum limit. Concrete of lower than usual slump may be used provided it is properly placed and consolidated.
2. Mixes containing water reducers shall have a maximum slump of 6 inches after the addition of a mid-range water reducer and maximum slump of 8 inches after the addition of a high range water reducer.

F. Pozzolan Content:

1. Fly ash shall not exceed 20 percent of the total cementitious content.
2. Slag cement will be permitted as a substitute for fly ash at no additional cost to the Owner, in the event that Class F Fly Ash is not available. The slag substitution shall be in the same proportions and percentages of the total cementitious material as shown for fly ash.
3. Use silica fume concrete where indicated on the drawings. Silica fume not to exceed 10 percent of the total weight of the silica fume plus cement.

G. Aggregate Size:

1. The maximum aggregate size shall be:
 - a. 1-½ inches for walls greater than 18 inches in thickness, grade beams, footings, foundation mats, and base slabs.
 - b. 3/8 inches for floor fill in clarifiers, in congested areas where approved by the engineer, for fireproofing around structural steel beams and columns and to fill cored holes.
 - c. 3/4 inches for all other concrete.
2. Combined aggregate grading shall be as specified in Table 03300-3:

Table 03300-3				
Maximum Aggregate Size	1-1/2"	1"	3/4"	3/8"
Aggregate Grade per ASTM C33	467	57	67	8

PART 3 - EXECUTION

3.01 INSPECTION:

- A. Contractor shall examine the substrate and the conditions under which work is to be performed and notify the Engineer in writing of unsatisfactory conditions. Do not proceed with the work until unsatisfactory conditions are corrected in a manner acceptable to the engineer.

3.02 MIXING AND TRANSPORTING CONCRETE:

- A. General: Conform to concreting procedures set forth in ASTM C 94, ACI 304R and as specified herein.
 - 1. Transport concrete to discharge locations without altering the specified properties of water-cement ratio, slump, air entrainment, temperature and homogeneity.
 - 2. Discharge concrete into forms within 1-1/2 hours after cement has entered mixing drum or before the drum has revolved 300 revolutions after the addition of water, whichever occurs first.
 - 3. Do not add water at the jobsite unless permitted by the engineer. If it is necessary to add water to obtain the specified slump, add water per ASTM C 94, but do not exceed the amount of water that has been held back at the plant. Added water shall be incorporated by additional mixing of at least 35 revolutions. Quality control sampling shall be done after the water has been added and the batch thoroughly mixed.
 - 4. Do not add water to concrete containing high range water reducing admixture.
 - 5. Keep a record showing time and place of each placement of concrete, together with transit-mix delivery slips certifying the contents of the placement.

Discharge of concrete shall be completed within the limits set out in Table 03300-4.

Table 03300-4	
MAXIMUM TIME TO CONCRETE DISCHARGE	
Concrete Temperature	Limit
Over 90 Degree F	Remove concrete from jobsite and discard concrete
86 to 90 Degree F	45 minutes
81 to 85 Degree F	60 minutes

70 to 80 Degree F	75 minutes
Below 70 Degree F	90 minutes

B. Conveying: Convey concrete from agitator or mixer truck to place of final deposit in forms by one of the following methods:

1. Buckets or hoppers with discharge gates having a clear opening equal to not less than one-third the maximum interior horizontal area or five times the maximum aggregate size being used, whichever is greater, and side slopes of not less than 60 degrees to horizontal.
2. Buggies or wheelbarrows equipped with pneumatic tires.
3. Round bottom, metal or metal-lined chutes with inclined slope of between two to three feet horizontally to one foot vertically and of sufficient capacity to avoid overflow.
4. Circular drop pipes with a top diameter of at least eight times the maximum aggregate size, but not less than 6 inch, or tapered to not less than six times maximum aggregate size.

3.03 CONCRETE ACCEPTANCE:

- A. The Contractor shall accept or reject each batch of concrete delivered to the point of agitator or mixer truck discharge. The signature of a Contractor's authorized representative on the delivery batch ticket shall indicate concrete acceptance.
- B. The Contractor shall reject concrete delivered without a complete concrete delivery batch ticket as specified herein. The concrete supplier will furnish copies of the signed batch ticket to the Contractor and Engineer.
- C. The testing agency shall perform field tests at the point of agitator or mixer truck discharge. Accept or reject concrete on the basis of conformity with slump, air content and temperature specified.
- D. The testing agency shall inspect concrete transit truck's barrel revolution counter and gauge for measuring water added to the concrete. Reject concrete which exceeds the maximum barrel revolution of 300, the limits in Table 03300-3 or concrete that has water content exceeding the specified water-cement ratio.
- E. The Contractor shall reject concrete not conforming to specification before discharging into the forms.

3.04 PREPARATION AND COORDINATION:

- A. Contractor shall notify the Engineer or the Engineer's Representative of readiness to place concrete in any portion of the work a minimum of 48 hours prior to concrete

placement. Failure to provide this notification will be cause for delay in placing until inspections can be completed and arrangements for testing established.

- B. All reinforcement, installation of waterstop, positioning of embedded items, and condition of formwork shall be inspected by the Engineer or the Engineer's representative prior to concrete placement.
- C. Coordinate the sequence of placement to assure that construction joints will occur only where indicated on the drawings.
- D. Schedule sufficient equipment for continuous concrete placement. Provide for backup equipment and procedures to be implemented in case of an interruption in placement.
- E. Compact the subbase and/or bedding. The subbase and/or bedding shall be uniformly moist at the time of concrete placement. Spraying water on the subbase and/or bedding may be necessary prior to placement of concrete. Concrete shall not be placed on standing water, mud, and foreign matter.
- F. Provide mud slabs to obtain a dry and stable working platform for placement of slabs on grade and foundation mats as indicated on the drawings or as may be required.
- G. Install a granular base beneath slabs on ground where shown on contract drawings, Place granular material on a compacted subgrade and compact the granular base.
- H. Place vapor retarder under structural slabs and buildings and where shown on contract drawings. Install material with 6 inch lap at joints and seal joints with tape as recommended by the vapor retarder manufacturer. Tape material cut for slab penetrations to the pipe, conduit or other items passing through the slab. Use tape recommended by the vapor retarder manufacturer.
- I. Install vapor retarder without punctures or tears and protect against punctures and breaks.
- J. Where concrete is required to be placed and bonded to existing concrete, coat the contact surfaces with epoxy bonding agent. The method of preparation and application of the bonding agent shall conform to the manufacturer's recommendations.

3.05 JOINTS AND EMBEDDED ITEMS

- A. Provide construction joints as specified in Section 03250:
 - 1. Clean all construction joints to remove loose concrete and laitance before placing adjoining concrete. Do not damage exposed concrete edges, key grooves, waterstops or reinforcement.
 - 2. Intentionally roughen surfaces of set concrete to receive new concrete to 1/4" amplitude in a manner to expose bonded aggregate uniformly at joints.

3. Do not place concrete against construction joints for at least 72 hours after initial concrete set.

B. Embedded Items:

1. Secure castings, inserts, conduits and other metalwork encased in concrete to prevent them from being displaced or deformed during concrete work. Use templates to secure items in place.
2. Clean embedded items of oil and all foreign matter.
3. Install inserts, anchors, sleeves and other items into formwork where indicated or specified under other sections of these specifications.
4. Build dovetail anchor slots into new concrete against which facing brick, concrete masonry units, tile, stone or any type ashlar is to be installed. Provide vertically at 16-in. centers where facing brick, etc., passes by concrete. Provide one continuous anchor slot where facing brick, etc., abuts the concrete work.
5. Aluminum embedded in concrete shall be coated to prevent galvanic corrosion with a zinc chromate primer and one of the following products:
 - a. Bitumastic Super Service Black by Koppers Co., Inc.
 - b. Tarmastic 100 by Porter Coatings Division, Porter Paint Co.
 - c. 450 Heavy Tnemecol by Tnemec Company.
 - d. Or accepted equivalent product.
6. Check location and support of piping, electrical conduits and other embedded items before depositing concrete. Correct locations as required and secure in place.
7. Complete required tests on embedded piping before starting concrete placement.

C. Embedded Pipes And Conduit:

1. Embedded pipes and conduit in concrete shall conform to the requirements and limitations of ACI 318, ACI 350 and these specifications and shall be as approved by the engineer.
2. Conduits, pipes, and sleeves of any material not harmful to concrete and within the limitations specified herein shall be permitted to be embedded in concrete with the approval of the Engineer.
3. Conduits and pipes of aluminum shall not be embedded in concrete.

4. Pipes passing through walls of a liquid-containing structure shall include an integral waterstop.
5. Conduits, pipes, and sleeves passing through a slab, wall, or beam shall not impair significantly the strength of the construction.
6. Conduits and pipes, with their fittings, embedded within a column shall not displace more than 4 percent of the area of cross section.
7. Except when drawings for conduits and pipes are approved by the structural engineer, conduits and pipes embedded within a slab, wall, or beam (other than those merely passing through) shall satisfy the following:
 - a. Conduits and pipes shall not be larger in outside dimension than 1/3 the overall thickness of the slab, wall, or beam in which they are embedded.
 - b. Conduits and pipes shall not be spaced closer than 3 times the outside diameters on center.
 - c. Conduits and pipes shall be placed within the middle third of the element and between reinforcement layers. Do not install runs of piping or conduit between formwork and reinforcement.
 - d. Avoid crossing pipes and conduit in concrete.
8. Pipes and fittings shall be designed to resist the effects of the material, pressure, and temperature to which they will be subjected.
9. No liquid, gas, or vapor, except water not exceeding 90 F or 50 psi pressure, shall be placed in the pipes until the concrete has attained its design strength.
10. Reinforcement with an area not less than 0.002 times area of concrete section shall be provided perpendicular to piping or conduit at a maximum spacing of 12 inches.
11. Piping and conduit shall be so fabricated and installed that cutting, bending, or displacement of reinforcement from its proper location will not be required.
12. Close ends of conduits, piping and sleeves embedded in concrete with caps or plugs prior to concrete placement.

3.06 CONCRETE PLACEMENT:

- A. Placement shall conform to ACI 304R as modified by these specifications.
- B. Intentionally roughen surfaces of set concrete to receive new concrete to ¼” amplitude in a manner to expose bonded aggregate uniformly at joints.

- C. Do not place adjacent sections of walls and slabs until seven days after placement of the previously placed concrete.
- D. Do not place concrete until all free water has been removed from the forms, clear of the work. Do not permit free or storm water to flow over surfaces of concrete so as to injure the quality or surface finish.
- E. Do not place concrete during inclement weather. Protect concrete placed from inclement weather. Keep sufficient protective covering ready at all times for this purpose.
- F. Deposit concrete at or near its final position to avoid segregation caused by rehandling or flowing. Do not deposit concrete in large quantities in one place to be worked along the forms with a vibrator.
- G. Deposit concrete continuously and in level layers 1 to 2 feet thick. Avoid inclined layers and cold joints. Place concrete at lower portion of slope first on sloping surfaces.
- H. Do not deposit partially hardened concrete in forms. Retempering of partially hardened concrete is not permitted. Remove all partially hardened concrete from site at no additional compensation.
- I. Do not allow concrete to fall freely in forms to cause segregation (separation of coarse aggregate from mortar). Limit maximum free fall of concrete to 4 feet. Do not move concrete horizontally more than four feet from point of discharge. Space points of deposit not more than eight feet apart.
- J. At least two hours shall elapse after depositing concrete in the columns or walls before depositing in beams, girders, or slabs supported thereon. Place beams, girders, brackets, column capitals, and haunches monolithically as part of the floor or roof system, unless otherwise shown on contract drawings.
- K. Consolidate concrete using mechanical vibrators operated within the mass of concrete and/or on the forms conforming to procedures set forth in ACI 309R and as specified herein.
- L. Conduct vibration to produce concrete of uniform texture and appearance, free of honeycombing, streaking, cold joints or visible lift lines.
- M. Conduct vibration in a systematic manner with regularly maintained vibrators. Furnish sufficient backup units at job site. Use vibrators having minimum frequency of 8,000 vibrations per minute and of sufficient amplitude to consolidate concrete. Use not less than one vibrator with crew for each 35 to 40 cubic yards of concrete placed per hour.
- N. Insert and withdraw vibrator vertically at a uniform spacing over the entire area of placement. Space distances between insertions such that spheres of influence of each insertion overlap.

O. Use additional vibration with pencil vibrators on vertical surfaces and on all exposed concrete to bring full surface of mortar against the forms so as to eliminate air voids, bug holes and other surface defects. Employ the following additional procedures for vibrating concrete as necessary to maintain proper consolidation of concrete:

1. Reduce distance between internal vibration insertions and increase time for each insertion.
2. Insert vibrator as close to face of form as possible without contacting form or reinforcement.
3. Thoroughly vibrate area immediately adjacent to waterstops without damaging the waterstop.
4. Use spading as a supplement to vibration where particularly difficult conditions exist.

P. Pumping Concrete:

1. Conform to the recommendations of ACI 304.2R except as modified herein.
2. Use equipment and procedures and schedule deliveries to maintain steady flow of concrete at the discharge end of pipe.
3. Maintain concrete properties of slump, air content and temperature. Make adjustments in concrete proportions as necessary to provide concrete properties in accordance with the approved concrete design mix and as specified herein.
4. Use pipe with inside diameter of at least three times the maximum coarse aggregate size, but not less than 4 inches.
5. Do not use aluminum pipes for delivery of concrete to the forms.
6. Take samples at the point of agitator or mixer truck discharge.
7. Furnish labor and assistance as required by the testing laboratory in obtaining and handling test specimens.

3.07 CURING AND PROTECTION:

A. General:

1. Protect concrete from premature drying, hot or cold temperatures, and mechanical injury, beginning immediately after placement and maintain concrete with minimal moisture loss at relatively constant temperature.
2. Comply with curing procedures set forth in ACI 301, ACI 308.1 and as specified herein.

3. Perform hot weather concreting in conformance with ACI 305.1 and as specified herein when the ambient atmospheric temperature is 80 degrees F or above.
4. Perform cold weather concreting in conformance with ACI 306.1 and as specified herein when the ambient atmospheric temperature is 40 degrees F or below.
5. Concrete required to be moist cured shall remain moist for the entire duration of the cure. Repeated wetting and drying cycles of the curing process will not be allowed.

B. Curing Duration:

1. Start initial curing after placing and finishing concrete as soon as free moisture has disappeared from unformed concrete surfaces. Initial curing starts as soon as concrete achieves final set. Forms left tightly in place are considered as part of the curing system, provided that wooden forms are kept continuously moist. Keep continuously moist for not less than 72 hours.
2. Begin final curing procedures immediately following initial curing and before the concrete has dried. Continue final curing for at least 7 days and in accordance with ACI 301 procedures for a total curing period, initial plus final, of at least 10 days.
3. Avoid rapid drying at the end of the final curing period

C. Curing Requirements:

1. Unformed Surfaces: Cover and cure entire surface of newly placed concrete immediately after completing finishing operations and water film has evaporated from surface or as soon as marring of concrete will not occur. Protect finished slabs from direct rays of the sun to prevent checking, crazing and plastic shrinkage.
2. Formed Surfaces: Minimize moisture loss for formed surfaces exposed to heating by the sun by keeping forms wet until safely removed. Keep surface continuously wet by warm water spray or warm water saturated fabric immediately following form removal.
3. Liquid containing and below grade structures: Moist cure by the application of water to maintain the surface in a continually wet condition. Use water that is free of impurities that could etch or discolor exposed concrete surfaces.
4. Other concrete: Moist cure by moisture-retaining cover curing, or by the use of curing compound.

D. Curing Methods:

1. Water Curing: Use water curing for unformed surfaces. Continuously water cure all exposed concrete for the entire curing period. Provide moisture curing by any of the following methods:
 - a. Keeping the surface of the concrete continuously wet by ponding or immersion.
 - b. Continuous water-fog spray or sprinkling.
 - c. Covering the concrete surface with curing mats, thoroughly saturating the mats with water, and keeping the mats continuously wet with sprinklers or porous hoses. Place curing mats so as to provide coverage of the concrete surfaces and edges, with a 4-inch lap over adjacent mats. Weight down the curing cover to maintain contact with the concrete surface, as necessary.

2. Sealing Materials:
 - a. Use common sealing materials such as plastic film or waterproofing (kraft) paper when permitted by the Engineer.
 - b. Lap adjacent sheets a minimum of 12 inches. Seal edges with waterproof tape or adhesive. Use sheets of sufficient length to cover sides of concrete member.
 - c. Place sheet materials only on moist concrete surfaces. Wet concrete surface with fine water spray if the surface appears dry before placing sheet material.
 - d. The presence of moisture on concrete surfaces at all times during the prescribed curing period is proof of acceptable curing using sheet material.

3. Membrane Curing Compound:
 - a. Apply membrane-curing compound uniformly over concrete surface by means of roller or spray at a rate recommended by the curing compound manufacturer, but not less than 1 gallon per 150 sq. ft. of surface area. Agitate curing material in supply container immediately before transfer to distributor and thoroughly agitate it during application for uniform consistency and dispersion of pigment
 - b. Do not use curing compounds on construction and expansion joints or on surfaces to receive liquid hardener, dustproofer/sealer, concrete paint, tile, concrete fills and toppings or other applications requiring positive bond.
 - c. Reapply membrane-curing compound to concrete surfaces that have been subjected to wetting within 3 hours after curing compound has been applied by method for initial application.

- E. Protection from environmental conditions: Maintain the concrete temperature above 50 degrees F continuously throughout the curing period. Make arrangements before concrete placing for heating, covering, insulation or housing as required to maintain the specified temperature and moisture conditions continuously for the curing period.
 - 1. When the atmospheric temperature is 80 degrees F and above, or during other climatic conditions which will cause too rapid drying of the concrete, make arrangements before the start of concrete placing for the installation of wind breaks or shading, and for fog spraying, wet sprinkling, or moisture-retaining covering.
 - 2. Protect the concrete continuously for the entire curing period.
 - 3. Maintain concrete temperature as uniformly as possible, and protect from rapid atmospheric temperature changes.
 - 4. Avoid temperature changes in concrete that exceed 5 degrees F in any one hour and 50 degrees F in any 24-hour period.
- F. Protection from physical injury: Protect concrete from physical disturbances such as shock and vibration during curing period. Protect finished concrete surfaces from damage by construction equipment, materials, curing procedures and rain or running water. Do not load concrete in such a manner as to overstress concrete.
- G. Protection from Deicing Agents: Do not apply deicing chemicals to concrete.

3.08 FIELD QUALITY CONTROL:

- A. Hot Weather Requirements
 - 1. During hot weather, give proper attention to ingredients, production methods, handling, placing, protection, and curing to prevent excessive concrete temperatures or water evaporation in accordance with ACI 305.1 and the following.
 - 2. When the weather is such that the temperature of the concrete as placed would exceed 90 degrees F, use ice or other means of cooling the concrete during mixing and transportation so that the temperature of the concrete as placed will not exceed 90 degrees F.
 - 3. Take precautions when placing concrete during hot, dry weather to eliminate early setting of concrete. This includes protection of reinforcing from direct sunlight to prevent heating of reinforcing, placing concrete during cooler hours of the day, and the proper and timely application of specified curing methods.
 - 4. There will be no additional reimbursement to the Contractor for costs incurred for placing concrete in hot weather.

B. Cold Weather Requirements

1. Provide adequate equipment for heating concrete materials and protecting concrete during freezing or near-freezing weather in accordance with ACI 306.1 and the following.
2. When the temperature of the surrounding atmosphere is 40 degrees F or is likely to fall below this temperature, use heated mixing water not to exceed 140 degrees F. Do not allow the heated water to come in contact with the cement before the cement is added to the batch.
3. When placed in the forms during cold weather, maintain concrete temperature at not less than 55 degrees F. All materials shall be free from ice, snow, and frozen lumps before entering the mixer.
4. Maintain the air and the forms in contact with the concrete at temperatures above 40 degrees F for the first five days after placing, and above 35 degrees F for the remainder of the curing period. Provide thermometers to indicate the ambient temperature.
5. There will be no additional reimbursement made to the Contractor for costs incurred for placing concrete during cold weather.

C. Backfill Against Walls

1. Do not place backfill against walls until the concrete has obtained a compressive strength equal to the specified 28-day compressive strength. Where backfill is to be placed on both sides of the wall, place the backfill uniformly on both sides.
2. Do not backfill the walls of structures that will be laterally restrained or supported by suspended slabs or slabs on grade until the slab is placed and the concrete has reached the specified compressive strength.

D. Concrete Testing

1. Concrete Quality Test Specimen:
 - a. Perform sampling and curing of test specimen in accordance with ASTM C31.
 - b. Testing agency personnel will record truck and load number from the delivery batch ticket, the concrete placement location of each specimen, the date, concrete strength, slump, air content and temperature.
 - c. For each 50 cu. yd. of each mix design of concrete but not less than once a day nor less than once for each 5,000 sq. ft. of surface area of foundation mats, base slabs, footings, slabs on grade, grade beams, walls, or elevated slabs, the testing agency will cast a minimum of:

- (1) One set of four (4) 6"x12" test specimens or
 - (2) One set of seven (7) 4"x8" test specimens
- d. Once a cylinder size has been selected, the size and number of specimens representing a strength test for each concrete mix shall remain constant.
- e. For 6"x12" test cylinders:
- (1) The testing agency will compression test one (1) of each set of four 6"x12" specimens at 7 days.
 - (2) Test two (2) of the remaining cylinders at 28 days for concrete strength acceptance.
 - (3) The fourth cylinder shall be held for testing at 56 days only if the 28 day cylinder strengths are deficient. The fourth cylinder of each set shall be discarded if the 28 day strengths meet or exceed the specified minimum strength.
- f. For 4"x8" test cylinders:
- (1) The testing agency will compression test two (2) of each set of seven 4"x8" specimens at 7 days.
 - (2) Test three (3) of the remaining cylinders at 28 days for concrete strength acceptance.
 - (3) The last two cylinders shall be held for testing at 56 days only if the 28 day cylinder strengths are deficient. The 6th and 7th cylinders of each set shall be discarded if the 28 day strengths meet or exceed the specified minimum strength.
2. The laboratory firm shall immediately notify the Contractor and the Engineer if the seven day strength is deficient.
 3. The acceptance test result is the average of the strengths of the two specimens tested at 28 days.
 4. The laboratory firm shall submit compression test results to both the Contractor and the Engineer. Concrete acceptance shall be based on the requirements of ACI 318 and ACI 350.
 5. Field cured cylinders conforming to ASTM C31 will be required to determine field compressive strength of concrete. Laboratory cured cylinders for concrete quality testing shall not be used for determining field compressive strength.

E. Concrete Coring:

- a. When the concrete quality test specimen compression tests fail to be in compliance with the Contract Documents or when the Engineer detects deficiencies in the concrete, the Contractor will take concrete cores at least 4 inches in diameter from the structure in conformance with ASTM C 42 at locations determined by the Engineer.
- b. Obtain at least three representative cores from each member or area of concrete that is considered potentially deficient.
- c. Obtain additional cores to replace cores that show evidence of having been damaged subsequent to or during removal from the structure.
- d. The testing agency shall compression test the cores taken from the structure in conformance with ASTM C 39 and submit test strength test results of cores specified above to the Contractor and to the Engineer.
- e. All costs associated with coring and testing of cores will be borne by the Contractor at no additional cost to the Owner.

3.09 REPAIRS:

- A. Provide in accordance with Section 03730.

3.10 CONCRETE FINISHES:

- A. Do not use curing compound where epoxy, urethane, mortar bed, grout, additional concrete or other toppings or adhesive will be applied.
- B. Do not sprinkle with dry cement or add water when finishing concrete surfaces.
- C. Finish concrete surfaces in accordance with the following schedule:

Table 03300-5	
Finish Designation	Area Applied
F-1	Exterior walls not exposed to liquids or view.
F-3	Walls exposed to view.
E-1	Exposed edges.
E-2	Top of walls and similar unformed surfaces.

- 1. Finish F-1: Repair defective concrete, fill depressions deeper than 1/2-inch, and fill tie holes.
- 2. Finish F-3: Repair defective concrete, remove fins, fill depressions 1/4-inch or deeper, and fill tie holes, fill depressions and airholes with mortar. Dampen surfaces and then spread a slurry consisting of one part cement and one and one-

half parts sand by damp loose volume, over the surface with clean burlap pads or sponge rubber floats. Remove any surplus by scraping and then rubbing with clean burlap.

3. Finish E-1: Provide 3/4 inch chamfer on external corners of exposed concrete walls, beams columns, equipment pads and exposed edges of construction joints. Do not chamfer columns flush with concrete block walls.
 4. Finish E-2: Strike smooth and float to an F-3 or F-4 finish.
- D. Protect finished concrete surfaces from damage by construction equipment, materials, curing procedures and rain or running water.

3.11 FINISHING OF FORMED SURFACES:

- A. Cure surfaces until finishing and repairing are completed.
- B. Perform finish work in accordance with the schedule in Table 03300-5 as soon as possible after forms are removed.
- C. Conform to the requirements specified in Section 03100 for tolerances for formed surfaces.

3.12 FINISHING OF UNFORMED SURFACES:

- A. Perform finish work in accordance with the schedule in Table 03350-5.

3.13 CLOSEOUT ACTIVITIES:

- A. Provide in accordance with Section 01700.

END OF SECTION

SECTION 03600

GROUT

PART 1 - GENERAL

1.01 DESCRIPTION:

- A. Furnish all labor, materials, equipment, and incidentals required, and install grout complete as shown on the Drawings and as specified herein.

1.02 SUMMARY:

A. Section Includes:

1. Material for grouting reinforcing bars, anchor bolts into existing or newly placed concrete.
2. Material for grouting under bearing plates for columns or beams.
3. Materials for grouting under equipment.
4. Materials for grouting under and around steel tanks.
5. Materials for miscellaneous grouting including but not limited to railing posts, equipment guides, bollards, precast concrete joints and supports etc.

1.03 REFERENCE STANDARDS:

A. American Association of State Highway and Transportation Officials (AASHTO):

1. [M182](#): Burlap Cloth made from Jute or Kenaf

B. American Petroleum Institute (API):

1. [RP 686](#): Recommended Practice for Machinery Installation and Installation Design

C. ASTM International (ASTM):

1. [C33](#): Standard Specification for Concrete Aggregates
2. [C109](#): Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in or (50-mm) Cube Specimens)
3. [C150](#): Standard Specification for Portland Cement

4. [C531](#): Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical Resistant Mortars, Grouts, and Monolithic Surfacing
5. C579 Standard Test Methods for Compressive Strength of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing, and Polymer Concretes
6. [C827](#): Standard Test Method for Change in Height at Early Ages of Cylindrical Specimens from Cementitious Mixes
7. C939 Standard Test Method for Flow of Grout for Preplaced-Aggregate Concrete (Flow Cone Method)
8. [C1107](#): Standard Specification for Packaged Dry, Hydraulic, Cement Grout (Non-shrink)
9. [D695](#): Standard Test Method for Compressive Properties of Rigid Plastics

D. U.S. Army Corps of Engineers Standard (CRD):

1. [C621](#): Corps of Engineers Specification for Non-shrink Grout

1.04 SUBMITTALS:

A. Submit the following shop drawings in accordance with Section 01300.

B. Product Data:

1. Commercially manufactured non-shrink, non-metallic cementitious grout:
 - a. Include catalog cuts, technical data, storage requirements, product life, working time after mixing, temperature considerations, conformity to referenced ASTM standards, and Material Safety Data Sheet.
2. Commercially manufactured non-shrink epoxy grout:
 - a. Include catalog cuts, technical data, storage requirements, product life, working time after mixing, temperature considerations, conformity to referenced ASTM Standards and Material Safety Data Sheet.
3. Cement grout:
 - a. Include the type and brand of the cement, the gradation of the fine aggregate, product data on any proposed admixtures, and the proposed mix of the grout.
4. Concrete grout:
 - a. Include data for concrete as delineated in Section 03300. This includes the mix design, constituent quantities per cubic yard, and the water/cement ratio.

5. Bonding Agent:
 - a. Include catalog cuts, technical data, storage requirements, product life, working time after mixing, temperature considerations, conformity to referenced ASTM standards, and Material Safety Data Sheet.
 - C. Laboratory Test Reports.
 1. Submit laboratory test data as required under Section 03300 for concrete to be used as concrete grout.
 - D. Mill test reports for each shipment of cement, regardless of quantity, prior to incorporation into the work.
 - E. Manufacturer's specifications and instructions for all admixtures, curing materials, adjustable inserts and non-shrink non-metallic grout. Manufacturer's certification of compatibility of all admixtures.
- 1.05 QUALITY ASSURANCE:
- A. Qualifications
 1. Grout manufacturer to have a minimum of 5 years of experience in the production and use of the type of grout proposed for the Work.
 - B. Field Testing
 1. Field testing and inspection services required will be provided by the Owner. Provide assistance in the sampling of materials and provide any ladders, platforms, etc. for access to the Work. Comply with the applicable ASTM Standards for testing.
 2. The field testing of concrete grout will be as specified for concrete in Section 03300.
 3. Take compression test specimens from the first placement of each type of grout to ensure compliance with these Specifications.
 - a. Compression tests and fabrication of specimens for cement grout and non-shrink grout will be performed as specified in ASTM C109 at intervals during construction as selected by the Engineer. A set of three specimens will be made for testing one at seven days and two at 28 days.
 - b. Compression tests and fabrication of specimens for epoxy grout will be performed as specified in ASTM C579, Method B. A set of three specimens will be made for testing at seven days.

1.06 RESPONSIBILITIES:

- A. Assist the Owner in obtaining specimens for testing and furnish all materials necessary for fabricating the test specimens.
- B. The cost of laboratory tests on grout will be paid by the Owner except where test results show the grout to be defective. In such case, the Contractor shall pay for the tests, removal and replacement of defective work, and re-testing all at no cost to the Owner.

1.07 WARRANTY:

- A. Warrant the materials and products specified in this Section against defective materials and workmanship with the manufacturer's standard warranty, but for no less than one year from the date of substantial completion.
- B. Warrant the work against defects for one year from the date of substantial completion.

1.08 DELIVERY, STORAGE, AND HANDLING:

- A. Comply with the requirements in Section 01610.
- B. Deliver materials to the jobsite in original, unopened packages, clearly labeled with the manufacturer's name, product identification, batch numbers, and printed instructions.
- C. Store materials in accordance with the manufacturer's recommendations. Total storage time from date of manufacture to date of installation shall be limited to six months or the manufacturer's recommended storage time, whichever is less.
- D. Reject material that becomes damp, lumpy or otherwise unacceptable and immediately remove from the site and replace with acceptable material at no cost to the Owner.
- E. Deliver non-shrink cement based grouts as pre-blended, prepackaged mixes requiring only the addition of water.
- F. Deliver non-shrink epoxy grouts as premeasured, prepackaged, three component systems requiring only blending as directed by the manufacturer.

PART 2 - PRODUCTS

2.01 GENERAL:

- A. Provide materials produced by one manufacturer or supplier in order to provide standardization of appearance.

2.02 APPLICATION:

- A. Unless indicated otherwise, provide grouts as listed below:

Table 03600-1	
Type of Grout	Application
Cement Grout	Surface repairs
Non-Shrink – Class I	Storage tanks and other non-motorized equipment.
	Filling block-out spaces for embedded items such as railing posts, gate guide frames, etc. (Where placement time is less than 20 min.).
	Repair of holes and defects in concrete members that are not water bearing and not in contact with soil or other fill material.
Non-Shrink – Class II	Column base plates.
	Filling block-out spaces for embedded items such as railing posts, gate guide frames, etc. (where placement time exceeds 20 min.)
	Under precast concrete elements.
Non-Shrink Epoxy	Machinery subject to severe shock loads and high vibration.
Concrete Grout	Toppings and concrete/grout fill.

2.03 MATERIALS:

A. Non-shrink Class I Grout:

1. Non-shrink Class I Grout shall have a minimum 28-day compressive strength of 5,000 psi, when mixed at a fluid consistency.
2. Non-shrink Class I grout shall meet the requirements of ASTM C1107, Grade B or C, when mixed to fluid, flowable and plastic consistencies.
3. Products:
 - a. Sika Corporation; SikaGrout 212
 - b. BASF Corporation; MasterFlow 713
 - c. Euclid Chemical Comany; Euco NS
 - d. Or acceptable equivalent product.

B. Non-shrink Class II Grout:

1. Non-shrink grout shall be a high precision, fluid, extended working time grout. The minimum 28-day compressive strength shall be 7,500 psi, when mixed at a fluid consistency.

2. Grout shall have an extended working time of 30 minutes minimum when mixed to a fluid consistency as defined in ASTM C827 at temperature extremes of 45 to 90 degrees F in accordance with ASTM C1107.
3. Non-shrink grouts shall meet the requirements of ASTM C1107; Grade B or C when tested using the amount of water needed to achieve fluid consistency per ASTM C939.
4. The grout when tested shall not bleed or segregate at maximum allowed water.
5. Products:
 - a. BASF Corporation; Masterflow 928
 - b. Euclid Chemical Co.; Hi-Flow Grout
 - c. Sika Corporation; SikaGrout 212
 - d. Or acceptable equivalent product.

C. Cement Grout:

1. Cement grouts shall be a mixture of one part Portland cement conforming to ASTM C150 types I, II, or III and one to two parts sand conforming to ASTM C33 with sufficient water to place the grout. The water content shall be sufficient to impart workability to the grout, but not to the degree that it will allow the grout to flow.
2. Cement grout materials shall be as indicated in section 03300 cast-in-place concrete.

D. Concrete Grout:

1. Concrete grout shall conform to the requirements of Section 03300 except as specified herein. Proportion with cement, coarse and fine aggregates, water, water reducer, and air entraining agent to produce a mix having an average strength of 4,000 psi at 28 days. Coarse aggregate size shall be 3/8-inch maximum. Keep the W/C ratio as low as practical while still retaining sufficient workability.

E. Non-shrink epoxy-based grout:

1. Provide a pre-proportioned, three component, 100 percent solids system consisting of epoxy resin, hardener, and blended aggregate. It shall have a compressive strength of 14,000 psi in seven days when tested in conformity with ASTM D695 and have a maximum thermal expansion of 30×10^{-6} when tested in conformity with ASTM C531.
2. Products:

- a. BASF Corporation; MasterFlow 648
- b. Five Star Products, Inc.; HP Epoxy Grout
- c. Sika Corporation; Sikadur 42 Grout-Pak
- d. Euclid Chemical Company; High Strength Epoxy Grout
- e. Or acceptable equivalent product.

F. Dry Pack Grout:

1. Dry pack (to be packed or tamped in place) shall be mixed to a zero slump consistency.
2. When mixing the batch, add only enough water to the dry materials to produce a rather stiff mixture. Additions of water shall be made in small increments until the desired consistency is obtained.

G. Non-epoxy Bonding Compound:

1. Provide non-epoxy bonding compound that is re-wettable for up to two weeks.
2. Products:
 - a. Larsen Products Corporation; Weld-Crete
 - b. Sta-Dry Manufacturing Corporation; Link
 - c. Euclid Chemical Company; Euco Weld
 - d. Or acceptable equivalent product.

2.04 CURING MATERIALS:

- A. Curing materials for cement grout shall be as specified in Specification 03300 and as recommended by the manufacturer for prepackaged grouts.

PART 3 - EXECUTION

3.01 GENERAL:

- A. Grout shall not be placed until base concrete or masonry has attained its design strength.
- B. Prepare surfaces for curing, and protection of cement grout in accordance with Section 03300 Cast-in-Place Concrete.

- C. Shade the work sites from sunlight for at least 24 hours before and 48 hours after grouting.
- D. Contact the grout manufacturer's representative for assistance on hot and cold weather grouting techniques and precautions if applicable.

3.02 PREPARATION:

- A. Clean concrete surfaces to receive grout free of ice, frost, dirt, grease, oil, curing compounds, laitance and paints, and free of all loose or unsound material or foreign matter that may affect the bond or performance of the grout.
- B. Roughen concrete surfaces by chipping, sandblasting, or other mechanical means to ensure bond of the grout to the concrete. Remove loose or broken concrete. Irregular voids or projecting coarse aggregate need not be removed if they are sound, free of laitance and firmly embedded into the parent concrete.
- C. Remove all loose rust, oil or other deleterious substances from metal embedments prior to the installation of the grout.
- D. Wash concrete surfaces clean and keep them moist for at least 24 hours prior to the placement of cementitious or cement grout. Saturate by covering the concrete with a plastic sheet or using either a soaker hose, flooding the surface or other method acceptable to the Engineer. Remove visible water from the surface upon completion of the 24-hour period prior to grouting. Use an accepted adhesive bonding agent in lieu of surface saturation when accepted by the Engineer for each specific location of grout installation.
- E. Epoxy based grouts do not require the saturation of the concrete substrate. Surfaces in contact with epoxy grout shall be completely dry before grouting.
- F. Construct grout forms or other leak proof containment. Forms shall be lined or coated with release agents recommended by the grout manufacturer.
- G. Support equipment during alignment and installation of grout by shims, wedges, blocks, or other accepted means. Prevent the shims, wedges, and blocking devices from bonding to the grout by appropriate bond breaking coatings and remove them after grouting unless otherwise accepted by the Engineer.

3.03 GROUTING MACHINERY FOUNDATIONS:

- A. After the machinery has been set in position and placed at the proper elevation by steel wedges, the space between the bottom of the machinery base and the original placement of concrete shall be filled with a pourable non-shrink grout. Grout and grouting procedure shall be in accordance with API 686.

3.04 INSTALLATION:

A. Cement Grouts and Non-shrink Cementitious Grouts:

1. Mix in accordance with manufacturer's recommendations. Do not add cement, sand, pea gravel, or admixtures without prior approval by the grout manufacturer and the Engineer.
2. Avoid mixing by hand. Pre-wet the mixer and empty excess water. Add premeasured amount of water for mixing, followed by the grout. Begin with the minimum amount of water recommended by the manufacturer and then add the additional water required to obtain workability. However, do not exceed the manufacturer's maximum recommended water content.
3. Place grout into the designated areas in a manner that will avoid segregation or entrapment of air. Do not vibrate grout to release air or to consolidate the material. Placement should proceed in a manner that will ensure the filling of all spaces and provide full contact between the grout and adjoining surfaces. Provide grout holes as necessary. Place grout rapidly and continuously to avoid cold joints. Do not place cement grouts in layers. Do not add additional water to the mix (re-temper) after initial stiffening.
4. Just before the grout reaches its final set, cut back the grout to the substrate at a 45-degree angle from the lower edge of bearing plate unless otherwise accepted by the Engineer.
5. Begin curing immediately after form removal, cutback, and finishing. Keep grout moist and within its recommended placement temperature range for at least 24 hours after placement or longer if recommended by the manufacturer.

B. Non-shrink Epoxy Grouts:

1. Mix in accordance with the procedures recommended by the manufacturer. Do not vary the ratio of components or add solvent to change the consistency of the grout mix. Do not over mix. Mix full batches only to maintain proper proportions of resin, hardener, and aggregate. Partial mixes will be rejected and will require the suspect grout to be removed and be replaced.
2. Monitor ambient weather conditions and contact the grout manufacturer for special placement procedures to be used for temperatures below 60 degrees F or above 90 degrees F.
3. Place grout into the designated areas in a manner that will avoid trapping air. Placement methods shall ensure the filling of all spaces and provide full contact between the grout and adjoining surfaces. Provide grout holes as necessary.
4. The extension of grout horizontally beyond base plate shall be less than or equal to the grout thickness.

5. Epoxy grouts are self-curing and do not require the application of water. Maintain the formed grout within its recommended placement temperature range for at least 24 hours after placing, or longer if recommended by the manufacturer.

C. Concrete Grout:

1. Provide the underlying concrete surface with a broomed finish. Protect and keep the surface clean until placement of concrete grout.
2. Remove the debris and clean the surface of all dirt and other foreign materials.
3. Saturate the concrete surface for at least 24 hours prior to placement of the concrete grout. Remove excess water just prior to placement of the concrete grout. Place a cement slurry immediately ahead of the concrete grout so that the slurry is moist when the grout is placed. Work the slurry over the surface with a broom until it is coated with approximately 1/16- to 1/8-inch thick cement paste.

D. Dry Pack:

1. Dry pack consistency shall be such that the grout is plastic and moldable but will not flow.
2. The use of pneumatic pressure for dry-packed grouting requires acceptance of the Engineer.

3.05 CLOSEOUT ACTIVITIES:

- A. Provide in accordance with Section 01700.

END OF SECTION

SECTION 03730

CONCRETE REPAIR

PART 1 - GENERAL

1.01 DESCRIPTION:

- A. Provide materials labor, equipment, and services necessary to repair concrete as specified.
- B. Complete concrete repair operations in accordance with these specifications and the various system manufacturers' instructions regarding surface preparation, application, inspection and requirements for safety.
- C. Complete crack repair work in accordance with these specifications and crack repair material manufacturer's instructions.
- D. Complete joint repair work in accordance with these specifications and the joint repair material manufacturer's instructions.
- E. The areas of concrete repair shall be determined by the Contractor and the Engineer and shall include any location where acidic attack of the concrete surfaces has reached a depth of ½" or deeper and at any air voids, bug holes or poorly consolidated concrete areas where the specified filler/surfacer materials cannot be used for filling or surfacing of the concrete.
- F. If repair work is required for an area indicated to receive protective lining or coating, provide such repair in accordance with the requirements of this specification and the related lining or coating specifications.
- G. The repair work specified herein is intended to cover the requirements for repair of concrete only, to a maximum depth of approximately 4-inch. If after blasting and cleaning, an area is discovered that requires a repair greater than 4-inch deep, or an area is discovered that requires repair or replacement of reinforcing steel notify the Engineer so that details may be provided to the Contractor to complete the repair.

1.02 REFERENCES:

- A. National Association of Corrosion Engineers (NACE):
 - 1. 6D-173: "A Manual for Painter Safety"
 - 2. 6F-163: "Surface Preparation of Steel or Concrete Tank Interiors"
 - 3. TPC2: "Coatings and Linings for Immersion Service"
- B. American Concrete Institute (ACI):

1. [503.4](#): Standard Specification for Repairing Concrete with Epoxy Mortars

C. ASTM International (ASTM):

1. [C33](#): Standard Specifications for Concrete Aggregates

2. [C150](#): Standard Specification for Portland Cement

3. [C321](#): Standard Test Method for Bond Strength of Chemical-Resistant Mortars

4. [C882](#): Test Method for Bond Strength of Epoxy Resin Systems

5. [D570](#): Test Method for Water Absorption of Plastics

6. [D638](#): Test Method for Tensile Properties of Plastics

7. [D695](#): Test Method for Compressive Properties of Rigid Plastics

8. [D790](#): Standard Test Method for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials

9. [D4262](#): L.R. Standard Test Method for pH of Chemically Cleaned or Acid Etched Concrete Surfaces

10. E329: Standard Specification for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction

11. [E337](#): L.R. Standard Practice Test Method for Measuring Humidity with a Psychrometer.

1.03 MEASUREMENT:

A. Crack Repair: The quantities in linear feet to be measured for payment shall be the actual length of cracks repaired by the methods and materials specified under.

1. Epoxy crack repair.

2. Flexible polyurethane crack repair.

3. Rigid polyurethane crack repair.

B. Spall Repair Depth 4-inch or less: The quantities in square feet to be measured for payment shall be the actual square footage of spalled concrete repaired by the method and materials specified under spall repair.

C. Spall Repair Depth Greater Than 4-inch: The quantities in cubic feet to be measured for payment shall be the actual cubic footage of spalled concrete repaired by the method and materials specified under spall repair.

- D. Crystalline Waterproofing Crack and Joint Repair: The quantities in linear feet to be measured for payment shall be the actual length of joints repaired by the methods and materials specified under crystalline waterproofing crack and joint repair.
- E. Pipe Penetrations: The quantities in linear feet to be measured for payment shall be the actual circumference repaired by the methods and materials specified under pipe penetrations.
- F. Waterproofing Treatment: The quantities in square feet to be measured for payment shall be the actual square footage of concrete surface to which the coating shall be applied specified under waterproofing treatment.

1.04 SUBMITTALS:

- A. Submit the following in accordance with Section 01300.
 - 1. Procedures proposed for the accomplishment of repair work. Include a detailed description of the methods and equipment to be used for each operation, and the sequence of operations to be coordinated with other works in progress.
 - 2. Manufacturer's recommendations and product data sheets for all repair materials including performance criteria, surface preparation, ambient condition requirements and applications, curing requirements, volatile organic compound (VOC) data, and safety requirements.
 - 3. Material Safety Data Sheets (MSDS) for any materials brought on-site including all repair system materials, solvents and abrasive blast media.
 - 4. Qualifications of foreman and epoxy gun operators and demonstration of meeting the minimum requirements specified.
 - 5. Design Mixes: Provide concrete and cement mortar in conformance with Section 03300 and as specified herein.

1.05 QUALITY ASSURANCE:

- A. Comply with the requirements specified in Section 01400.
- B. Furnish the names of all subcontractors proposed for use for this work including necessary evidence and/or experience records to ascertain their qualifications in the application of epoxy, polyurethane, polymer-modified and cement-based compounds.
- C. Include in accepted applicator qualifications:
 - 1. A minimum of five years experience in applying epoxy, polyurethane and polymer-modified and cement-based compounds, and crystalline waterproofing repair systems similar to those specified in this Section.

2. A letter from the manufacturer of the specified materials, on the manufacturer's letterhead, signed by an officer of the company, stating that the subcontractor/applicator has been trained in the proper techniques for the preparation of the surface, and proper methods for mixing, placing, curing, and caring of the manufacturer's products. This letter shall further state that the subcontractor/applicator is on the manufacturer's approved list of contractors.
- D. Adhere strictly to the manufacturer's printed recommendations supplied with the product regarding temperature at time of application for all work. Do not use epoxy materials when either the temperature of the concrete to be repaired or the ambient temperature is below 50 degrees F 24 hours before, during, or for a period of 48 hours after the completion of the repair. Do not use crystalline waterproofing materials when either the temperature of the concrete to be repaired or the ambient temperature is below 40 degrees F 24 hours before, during, or for a period of 48 hours after the completion of the repair. Temporary heat may be used to meet the specified requirements.
 - E. Use new materials and use within the shelf life limitations set forth by the manufacturer. Clearly mark the shelf life limitations of each container.
 - F. The Contractor is ultimately responsible for the concrete repair work. Inspections by the Engineer or others do not limit the Contractor's responsibility.
 - G. Make all parts of the work accessible for inspections by the Engineer. Correct any conditions not in conformance with the specifications at no additional cost to the Owner.
 - H. Provide a Representative on site at all times when work is ongoing to represent the Contractor and to have authority to receive and execute all instructions given by the Engineer.
 - I. Allow changes in the specified repair work methods only with the permission of the Engineer.
 - J. Provide technical field support or training services required by the accepted material manufacturers at no additional cost to the Owner.
 - K. Provide materials from a single manufacturer for all components of a single repair.
- 1.06 SERVICES OF MANUFACTURERS REPRESENTATIVES:
- A. Provide the services of a qualified manufacturer's technical representative to instruct the Contractor's personnel in the mixing, proper use and application of the epoxy, polyurethane, polymer-modified, crystalline repair systems and cement-based compounds.
 - B. Provide written certification from the manufacturers' representative that materials have been mixed and applied properly and surfaces to receive these products have been prepared properly, all in conformance with manufacturer's requirements.

- C. Provide on-site time required for the manufacturer's representative to achieve a successful installation at no additional cost to the Owner.

1.07 DELIVERY, STORAGE AND HANDLING:

- A. Comply with the requirements in section 01610.
- B. Provide shelter to store materials in area or areas designated by the Owner solely for this purpose. Confine mixing, thinning, clean-up and associated operations and storage of repair mortar materials debris before authorized disposal, to these areas.
- C. Mix all specified materials in the sheltered mixing operation and materials from direct sunlight and inclement weather. Protect facilities from staining and damage.
- D. Do not dispose of waste materials on-site.
- E. Store waste temporarily in closed, nonflammable containers until final disposal. Keep no rubbish in Contractor's area longer than 24 hours.
- F. Deliver all materials to the job site in new, unopened containers. Each container shall bear the manufacturer's name and label. Labels on all material containers shall contain the following information:
 - 1. Name of product.
 - 2. Federal Specification Number if applicable.
 - 3. Manufacturer's batch number.
 - 4. Manufacturer's name.
 - 5. Generic type of material.
 - 6. Hazardous material identification label.
 - 7. Shelf life date.
- G. Clearly mark all containers indicating any safety hazards associated with the use of or exposure to the materials.
- H. Handle and store materials to prevent damage or loss of label. Protection of materials is the Contractor's responsibility.

1.08 PROJECT/SITE CONDITIONS:

- A. Environmental Requirements:
 - 1. Comply with the repair material manufacturer's recommendations as to environmental conditions under which materials can be applied and cured.

2. Do not apply materials when dust is being generated.
- B. Protection:
1. Cover or otherwise protect finish work or other surfaces not being repaired.
- C. Ventilation:
1. Provide ventilation to meet product requirements prior to, during, and after application.

PART 2 - PRODUCTS

2.01 WATER:

- A. Use water free from injurious amounts of ice, oil, acid, alkali, salt, organic matter, or other deleterious substances and conforms to requirements of ASTM C1602.
- B. Water shall not contain more than 500 mg of chlorides or more than 500 mg of sulfates.
- C. Heat or cool water to obtain concrete repair product temperatures in accordance with manufacture's printed recommendations, and in accordance with ACI 305.1 and ACI 306.1.

2.02 AGGREGATE:

- A. All aggregates shall conform to ASTM C33 and section 03300.

2.03 EPOXY BONDING AGENT:

- A. Epoxy bonding agent shall conform to ASTM C881 Type I, II, IV or V; Grade 2 for epoxy resin adhesives, depending on the application. The class of epoxy bonding agent shall be suitable for all ambient and substrate temperatures.

B. Products:

1. Sika Corporation; Sikdur 32 Hi-Mod
2. Euclid Chemical Company; Duralcrete
3. BASF Corporation; MasterEmaco ADH 326
4. Or acceptable equivalent product.

2.04 ANTI-CORROSION COATING:

- A. Anti-corrosion coating shall be a three-component, solvent free, and moisture tolerant epoxy-modified cementitious material.

B. Products:

1. Sika Corporation; Sika Armatec 110
2. Sto Corporation; CR 246
3. Euclid Chemical Company; Duralprep A.C.
4. Or acceptable equivalent product.

2.05 EPOXY CRACK REPAIR BINDER:

A. Epoxy crack repair binder shall be a two-component, 100 percent solids, high-modulus, low viscosity epoxy adhesive suitable for crack grouting by injection or gravity feed.

B. Products:

1. Sika Corporation; Sikadur 52
2. Euclid Chemical Company; Duralcrete LV
3. BASF Corporation; MasterInject 1380
4. Or acceptable equivalent product.

2.06 RIGID POLYURETHANE CRACK REPAIR MATERIAL:

A. Rigid polyurethane crack repair material shall be a one-component, water-activated polyurethane hydrophobic injection grout capable of 700 percent expansion. Polyurethane grout shall form a tough rigid foam seal that is impenetrable to water.

B. Products:

1. Euclid Chemical Company; Dural Aqua-Dam LV
2. Prime Resins; Prime Flex 920
3. Sika Corporation; Sikafix HH LV
4. Or acceptable equivalent product.

2.07 EPOXY REPAIR MORTAR:

A. Epoxy Repair Mortar shall be two-component, 100 percent solids, and 100 percent reactive epoxy resin system.

B. Spall repair mortar for use in horizontal applications.

1. Products:

- a. BASF Corporation; MasterEmaco ADH 327
 - b. Sika Corporation; Sikadur 22 Lo-Mod
 - c. Euclid Chemical Company; Euco #4565 Mortar
 - d. Or acceptable equivalent product.
- C. Spall repair mortar for use in vertical and overhead applications.
- 1. Products:
 - a. Sika Corporation; Sikadur 23 Lo-Mod Gel
 - b. BASF Corporation; MasterEmaco ADH 327
 - c. Or acceptable equivalent product.
- 2.08 SPALL REPAIRS USING NON-SHRINK CEMENTITIOUS MORTAR:
- A. Products:
- 1. BASF Corporation; MasterEmaco S 488CI
 - 2. Sika Corporation; Sika Repair 224
 - 3. Sauereisen, Inc.; Restokrete Underlayment No. F-120
 - 4. Or acceptable equivalent product.
- 2.09 SPALL REPAIRS USING POLYMER MODIFIED CEMENTITIOUS MORTAR:
- A. Repair spalls repair not requiring formwork using a two-component, polymer-modified cementitious mortar having a minimum 28-day compressive strength of 6,000 psi.
- B. Spall repair mortar for use in horizontal applications.
- 1. Products:
 - a. Sika Corporation; Sikatop 122 Plus
 - b. Euclid Chemical Company; Duraltop Flowable Mortar
 - c. BASF Corporation; MasterEmaco T302
 - d. Or acceptable equivalent product.
- C. Spall repair mortar for use in vertical applications.
- 1. Products:

- a. Sika Corporation; Sikatop 123 Plus
- b. Euclid Chemical Company; Duraltop Gel
- c. BASF Corporation; MasterEmaco N 423RS
- d. Or acceptable equivalent product.

2.10 SPALL REPAIRS REQUIRING FORMWORK:

- A. Repair spalls repair requiring formwork using a two-component, polymer-modified cementitious mortar/pea gravel mixture and shall have a minimum 28-day compressive strength of 5,000 psi. Mix each unit of mortar with Saturated Surface Dry (SSD) pea gravel to form the repair material following the manufacturer's recommendations.
- B. Products:
 - 1. Sika Corporation; Sikatop 111 Plus
 - 2. Euclid Chemical Company; Duraltop Flowable Mortar
 - 3. BASF Corporation; MasterEmaco N 1500HCR Self Consolidated-Extended
 - 4. Or acceptable equivalent product.

PART 3 - EXECUTION

3.01 GENERAL REQUIREMENTS:

- A. Perform exterior work during dry weather and appropriate temperature conditions in accordance with the manufacturer's recommendations. Protect unfinished work during inclement weather with tarpulins or heavy gage polyethylene sheeting.
- B. Perform work in spaces within structures at temperature and conditions suitable for proper curing in accordance with the manufacturer's recommendations.
- C. Coordinate concrete rehabilitation work with other work being performed.
- D. Remove scaling, broken, loose and disintegrating materials by use of hand tools or power driven saws, down to solid unyielding material.
- E. Clean surfaces thoroughly of efflorescence, oils, grease and other objectionable material in area to be repaired in accordance with the manufacturer's recommendations.

3.02 EPOXY BONDING AGENT:

- A. Use epoxy bonding agent to adhere fresh mortar to existing concrete. Roughen existing concrete surfaces prior to application of bonding agent. Concrete surface shall be clean

and sound, free of all foreign particles and laitance. Place repair material while bonding agent is still tacky or per the written instructions of the manufacturer. Reapply bonding agent if bonding agent cures prior to placement of repair material.

- B. Conform to all the requirements of ACI 503.4, and as specified herein.

3.03 ANTI-CORROSION COATING:

- A. Sandblast, clean and coat reinforcing steel that is cut or exposed during alteration and/or repair operations with an anti-corrosive coating.
- B. Cover all exposed parts of the steel with the coating and apply according to manufacturer's recommendations.

3.04 EPOXY CRACK REPAIR:

- A. Cracks on horizontal surfaces: When permitted by the Engineer repair existing cracks by gravity feeding an epoxy crack repair binder into the prepared crack.
 1. Rout concrete surface at the crack to form a minimum 1/4-inch wide by 1/4-inch deep V-notch and clean to remove all loose and foreign particles. Fill crack with clean, dry sand and pour epoxy crack repair binder into V-notch, completely filling crack.
 2. As binder penetrates into crack, apply additional binder to the V-notch.
- B. Cracks on vertical or horizontal surfaces: Repair cracks by pressure injecting an epoxy crack repair binder into the prepared crack. Seal cracked surfaces and install injection ports per manufacturer's recommendations.
 1. Do not damage reinforcement steel when drilling holes for injection ports. If rebar is encountered during drilling, abandon the hole and relocate. Patch the abandoned hole immediately with epoxy mortar flush with the surface of the existing concrete.
 2. Inject crack with epoxy crack repair binder once the surface sealing material has cured as directed by the manufacturer.
 3. Remove injection ports upon satisfactory completion of crack injection and patch with epoxy mortar.

3.05 RIGID POLYURETHANE CRACK REPAIR:

- A. Repair leaking cracks by pressure injecting with a waterproof hydrophobic injection grout as directed by the Structural Engineer of Record. Seal crack surfaces and install injection ports per manufacturer's recommendations.

- B. Do not damage rebar when drilling holes for injection ports. If rebar is encountered during drilling, abandon the hole and patch immediately with epoxy mortar flush with the surface of the existing concrete.
- C. Inject crack with hydrophobic injection grout as directed once the surface sealing material has cured, as directed by the manufacturer.

3.06 SPALL REPAIR:

- A. Saw cut the perimeter of the repair area to a minimum depth of 1/4-inch below the surface of the concrete. Chip all loose concrete in the repair area to remove loose and degraded concrete to a minimum of 1/4-inch or until a sound substrate is reached. Clean the area to be repaired and restore to the original dimensions with spall repair patching material according to the manufacturer's recommendations.
- B. Make final finished surface of patches flat, level and even with the existing concrete surface. Do not feather repair mortar to meet existing concrete surface.
- C. Finish final patches on horizontal surfaces consistent with the finish on the existing structure.

3.07 CURING:

- A. Cure repair materials in accordance with manufacturer's printed instructions.

3.08 CLEANING:

- A. Mechanically remove excess material from walls, floors, etc. after material has cured.
- B. Clean excess materials caused by work under this Section from existing surfaces by the use of power sanders. Vacuum surfaces to receive final cleaning and finishing specified under other sections of the specifications. Sand cracks flush to adjacent surfaces.
- C. Remove misplaced sealants using methods and materials recommended by the manufacturers. Leave finished work and work area in a neat and clean condition.

3.09 CLOSEOUT ACTIVITIES:

- A. Provide in accordance with Section 01700.

END OF SECTION

SECTION 05120
STRUCTURAL STEEL

PART 1 - GENERAL

1.01 DESCRIPTION:

- A. The term "Structural Steel" is used as defined in accordance with the AISC Code of Standard Practice.
- B. Provide structural steel as specified and as shown on contract drawings.
- C. Detailing, fabrication and erection of structural steel shall comply with all applicable OSHA regulations.

1.02 REFERENCES:

- A. American Institute of Steel Construction AISC:
 - 1. ANSI/AISC 360-5: Specification for Structural Steel Buildings
 - 2. AISC Manual of Steel Construction, Thirteenth Edition
 - 3. AISC Code of Standard Practice for Steel Buildings and Bridges
 - 4. AISC Specification for Structural Joints using ASTM A 325 or A 490 Bolts
 - 5. AISC Structural Steel Detailing Manual
- B. American Welding Society AWS:
 - 1. [AWS D1.1](#): Structural Welding Code – Steel
- C. Steel Structures Painting Council (SSPC) Publications:
 - 1. [SSPC-PA 1](#): Shop, Field, and Maintenance Painting.
 - 2. [SSPC-PA 2](#): Measurement of Dry Paint Thickness with Magnetic Gages.
 - 3. [SSPC-SP 1](#): Solvent Cleaning.
 - 4. [SSPC-SP 3](#): Power Tool Cleaning.
 - 5. [SSPC-SP 6](#): Commercial Blast Cleaning.
 - 6. [SSPC-SP10](#): Near-White Blast Cleaning.
- D. ASTM International (ASTM):

1. [A 6/A 6M](#): Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling
2. [A 36/A 36M](#): Specification for Carbon Structural Steel
3. [A 123](#): Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
4. [A 143](#): Practice for Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedures for Detecting Embrittlement
5. [A 153](#): Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
6. [A 194/A 194M](#): Specification for Carbon and Alloy-Steel Nuts for Bolts for High-Pressure and High-Temperature Service
7. [A 307](#): Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength
8. [A 325](#): Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
9. [A 384](#): Practice for Safeguarding Against Warpage and Distortion During Hot-Dip Galvanizing of Steel Assemblies
10. [A 385](#): Practice for Providing High Quality Zinc Coatings (Hot-Dip)
11. [A 449](#): Specification for Quenched and Tempered Steel Bolts and Studs
12. [A500/A500M](#): Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
13. [A 563](#): Specification for Carbon and Alloy Steel Nuts
14. [A 572](#): Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel
15. [A 780](#): Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
16. [A 992](#): Standard Specification for Steel for Structural Shapes for Use in Building Framing
17. [F 436](#): Specification for Hardened Steel Washers
18. [F 1554](#): Standard Specification For Anchor Bolts, Steel, 36, 55, and 105 ksi Yield

E. Occupational Safety and Health Administration (OSHA)

1. Safety and Health Standards for the Construction Industry, 29 CFR 1926 Subpart R
Safety Standards for Steel Erection

1.03 DESIGN CRITERIA:

- A. Structural Connections: AISC Specification for Structural Steel Buildings. Design connections not fully detailed on the Drawings to resist the loads shown on the Contract Drawings or specified.
- B. Where beam end reactions are not shown, design the connection for one-half the total allowable uniform load in kips for beams laterally supported at the given span, as determined by the tables for allowable loads on beams in the AISC Manual of Steel Construction, in addition to any axial loads identified on the Drawings.
- C. Unless otherwise noted on Contract Drawings, design connections for ASTM A325 bolts, bearing-type connection with threads included in shear plane.

1.04 SUBMITTALS:

- A. Submit the following shop drawings in accordance with Section 01300.
 1. Submit in advance of fabrication complete information necessary for the fabrication of each component and part of the structural steel framing. Include the following:
 - a. Member size and length.
 - b. Bill of materials.
 - c. Material specifications.
 - d. Bolt hole size and bolt size.
 - e. Cuts, copes, and bevels.
 - f. Piece marks for field assembly.
 - g. Splices.
 2. Submit erection drawings showing complete information necessary for the erection of each component part of the structural steel framing. Include the following:
 - a. Dimensions for alignment and elevations of each member.
 - b. Location of members and attachments by match-marking of piece numbers.
 - c. Type, location and details of each field connection.
 - d. Number of shear connectors on each member.

- e. Anchor bolts and setting plans.
3. Do not develop shop drawings by using reproductions of contract drawings.
4. Submittals for Evidence of Conformity to Specifications: Certified mill test reports containing results of chemical and mechanical test as specified by ASTM A6 for the following material:
 - a. Structural steel shapes.
 - b. Structural steel bars.
 - c. Structural steel plates.
5. In addition to the certified mill test reports, the fabricator shall provide an affidavit stating that the structural steel furnished meets the requirements of the ASTM specification for the grade furnished. Qualification test reports bearing witness certification by an independent testing laboratory for each welder, welding operator and tacker to be employed in the work.

1.05 QUALITY ASSURANCE:

- A. Comply with requirements in Section 01400 and as specified.
- B. Provide structural steel in accordance with AISC Standard for Structural Steel Buildings and the Code of Standard Practice for Steel Buildings and Bridges, unless otherwise specified herein.
- C. Design connections not detailed on the Drawings under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the jurisdiction where the Project is located.
- D. Steel fabricator shall have 5 years experience minimum in structural steel fabrications.
- E. Steel erector shall have 5 years experience minimum in structural steel erection.
- F. Welding Qualification and Certification:
 1. Furnish written welding procedure for welds in conformance with the AWS D 1.1.
 2. Each welder, welding operator and tack welder shall be certified by test to perform type of work required in conformance with AWS D 1.1.
 3. If a welder or welding operator has not been engaged in a specific welding process for a period of six months or more, that individual shall be deemed unqualified and shall not perform work on the project until the individual has been qualified again by testing in conformance with AWS D 1.1.

4. Maintain duplicate qualification and certification records at the job site readily available for examination.

G. Tolerances:

1. Maintain tolerances conforming to AISC Code of Standard Practice.
2. Permissible variation tolerances conforming to ASTM A 6.

H. Tension Calibrator:

1. Provide certification by an independent testing laboratory confirming the accuracy of the tension-measuring device when slip-critical connections and connections subject to direct tension are being used. Confirm accuracy not more than 30 days prior to use on project and at intervals not more than six months thereafter.
2. Provide tension calibrator measuring device at the job site when high-strength bolts in slip-critical connections and connections subject to direct tension are being installed and tightened.
3. Frequency and of number confirmation tests to be performed and the test procedure to be employed to conform to the AISC Specification for Structural Joints.
4. Return tension calibrator measuring device to the independent testing laboratory for certification if Engineer questions its accuracy.

1.06 DELIVERY, STORAGE AND HANDLING:

- A. Comply with the requirements in Section 01610.
- B. Load structural members in such a manner that they may be transported and unloaded without being over-stressed, deformed or otherwise damaged.
- C. Protect structural steel members and packaged materials from corrosion and deterioration. Store material in a dry area.
- D. Support materials stored outdoors above ground surfaces on wood runners and protected with acceptable effective and durable covers.
- E. Do not place materials on the structure in a manner that might cause distortion or damage to the members or the supporting structures. The Contractor shall repair or replace damaged materials or structures as directed by the Engineer.

1.07 FIELD MEASUREMENTS:

- A. The Contractor shall verify dimensions and shall make any field measurements necessary and shall be fully responsible for accuracy and layout of the work.

- B. The Contractor shall review the Contract Drawings and any discrepancies shall be reported to the Engineer for clarification prior to starting fabrication.

PART 2 - PRODUCTS

2.01 STRUCTURAL STEEL:

- A. W shapes in conformance with ASTM A 992 unless otherwise indicated or specified.
- B. C, M, S and HP shapes in conformance with ASTM A 572, Grade 50, unless otherwise specified or shown on contract drawings.
- C. Angles, plates and bars in conformance with ASTM A 36.
- D. Round, square and rectangular structural tube members (HSS) in conformance with ASTM A 500, Grade B.
- E. Steel pipe in conformance with ASTM A 53, Grade B.
- F. Hot-Dip Galvanized Carbon Steel in conformance with ASTM A 123.

2.02 FASTENERS:

- A. Carbon Steel Bolts, Nuts and Washers: ASTM A 307, Grade A.
- B. High-strength fasteners in conformance with ASTM A325, Type 1.
- C. Nuts and washers ASTM A 563 and F 436.
- D. Hot-dip Galvanized Bolts, nuts and washers in conformance with ASTM A 153.

2.03 ANCHOR BOLTS:

- A. Steel anchor bolts in conformance with ASTM F1554, grade 36.

2.04 WELDED STUDS:

- A. Weld studs in conformance with the requirements of ASTM A108, Grade 1015 or 1020.

2.05 WELDING:

- A. Class E70XX electrodes.
- B. Provide equipment for welding, electrodes, welding wire and fluxes capable of producing indicated welds when used by certified welders under AWS welding procedures. Provide welding materials that comply with requirements of AWS Structural Welding Code.

2.06 SHOP FABRICATION:

- A. Fabricate each element and connection as indicated on the fabrication shop drawings accepted by the Engineer. Fabricate and shop assemble work to the greatest extent practical in conformance with following publications:
 - 1. AISC Manual
 - 2. AISC Specification for Structural Joints
 - 3. AISC Detailing Manual
 - 4. AWS Structural Welding Code
- B. Perform shearing, manual flame cutting with mechanically guided torch and chipping such that it will not induce residual stress in metal being cut. Radii of re-entrant corners shall be as large as practicable but not less than 3/4 inch. Perform flame cutting so that metal being cut is not carrying stress. Finish exposed edges.
- C. Provide full cross section bearing on milled ends of columns, crane rails, monorails and bearing stiffeners.

2.07 CONNECTIONS:

- A. Connect members with ASTM A 325 high strength bolts unless otherwise specified or shown on contract drawings. Provide clean-cut holes without torn or ragged edges and remove outside burrs.
- B. Provide high-strength bolted construction assemblies in accordance with the AISC Specifications for Structural Joints.
 - 1. Bolted parts shall fit solidly together when assembled and shall not be separated by gaskets or any other interposed compressible material.
 - 2. Joint surfaces shall be free of burrs and foreign materials. Score hot-dipped galvanized contact surfaces with a wire brush or blasted prior to assembly. Grinding of surfaces is not permitted.
 - 3. If the thickness of the material is not greater than the normal diameter of the bolt plus 1/8 inch, the holes may be punched. If the thickness of the material is greater than the normal diameter of the bolt plus 1/8 inch, drill it full size or subpunch 1/16 inch smaller than the bolt diameter and ream to full size.
 - 4. Provide bolt hole diameters not more than 1/16 inch in excess of the nominal bolt diameter unless otherwise specified in contract drawings.

5. Provide required slotted or oversize bolt holes as specified in the AISC Specification for Structural Joints. Tighten each bolt to provide the minimum tension shown in the AISC Specification for Structural Joints for the size and grade of bolts used
 6. Provide required slotted or oversize bolt holes as specified in the AISC Specification for Structural Joints.
- C. Provide full cross section bearing on milled ends of columns, crane rails, monorails, and bearing stiffeners.
- D. Welded Connections:
1. Weld connections indicated or specified.
 2. Provide complete weather seal weldments made with 1/16 inch minimum continuous fillets to members having Type S and E Service and to welded connections that will be galvanized.
- E. Make connections with ASTM A 307 carbon steel bolts only when specified or shown in contract drawings.
- F. Provide ASTM F 1554 anchor bolts with washer and heavy hex nuts. Provide hot-dip galvanized anchor bolts, washers and heavy hex nuts with galvanized steel.

2.08 SHOP PAINTING:

- A. Apply shop prime coat to structural steel, except to members or portions of members to be embedded in concrete or masonry, surfaces and edges to be field welded, and galvanized surfaces, unless otherwise specified. Provide surface preparation as described for the specified coating system.
- B. Immediately after surface preparation, apply primer. Use painting methods that will result in full coverage of joints, corners, edges, and exposed surfaces.
- C. Structural steel encased in masonry or which will be inaccessible in the finished work shall receive two shop coats of primer.
- D. Provide prime coats compatible with fire proofing system.

2.09 GALVANIZE:

- A. Provide hot-dip galvanizing in conformance with ASTM A 123, Grade 100 to steel indicated or specified to be galvanize coated.
- B. Provide hot-dip galvanizing, in conformance with ASTM A 153, to bolts, nuts and washers that will be used with galvanized steel.

- C. Complete fabrication and prepare surfaces of steel by removing weld spatter, flux, residue, burrs and metal surface defects before galvanizing. Clean weldments with power wire brush prior to galvanizing.
 - D. Provide steel dipped into solution of zinc chloride plus ammonium chloride immediately prior to galvanizing. Do not use galvanizing process utilizing flux blanket overlaying molten zinc.
 - E. Chromate treat pieces that will be in contact with or encased in concrete or masonry after galvanizing.
 - 1. Two coats of one of the following coating systems may be substituted for the chromate treatment:
 - a. Series 161 Tneme-Fascure by Tnemec Co. Inc.
 - b. Kop-Coat Super Hi-Gard by Kop-Coat Inc.
 - c. Valspar-Series 89 by Valspar Corp., Baltimore
 - d. Or accepted equivalent product.
 - 2. Prepare the steel surface in conformance with the manufacturer's printed instructions immediately before applying the initial coat of the two coat system.
 - F. Tap bolt nuts after hot-dip galvanizing in conformance with ASTM A 563.
 - G. Inspect galvanized material for compliance with these specifications. Mark the material with a clearly visible stamp indicating the name of the galvanizer, the ASTM number and the weight of zinc coating in ounces per sq. ft.
- 2.10 GALVANIZE TOUCH-UP:
- A. Galvanize Touch-Up: Where galvanizing is damaged, touch-up abraded areas, using brushed-on method, with zinc-rich coating. Touch-up repair with zinc-rich coating of not less than 3 mil and not more than 6 mil dry film thickness.
 - B. Touch-up damaged galvanized surfaces with one of the following zinc rich coatings:
 - 1. Endupor, zinc-rich coating by Dampney Manufacturing Co., Everett, MA
 - 2. ZiRP, zinc-rich coating by Duncan Galvanizing Corp., Everett, MA
 - 3. ZRC Cold Galvanizing Compound or ZRC Galvilite by ZRC Worldwide, Division of Norfolk Corp., Marshfield, MA;
 - 4. Or accepted equivalent product.

PART 3 - EXECUTION

3.01 ERECTION OF STRUCTURAL STEEL:

- A. Conform to the referenced AISC standards. Brace and secure work until permanent connections are completed. Provide accessories and fasteners to secure the work in place whether or not shown or specified.
- B. Erect work plumb, square, and true to line and level and in precise positions. Provide temporary bracing and guys to counteract loads and stresses to which structure may be subjected, including those due to erection equipment and its operation.
- C. Align the various members to the lines and elevations indicated within the specified erection tolerances. Make adjustments to members prior to making permanent connections. Permanently connect the work in a sequence that will minimize lock-in stress.
- D. Splice members only where shown or specified. On exposed welded connections, remove erection bolts, fill holes with plug welds, and grind smooth at exposed surfaces. Comply with AISC specifications for bearing, adequacy of temporary connections, alignment, and the removal of paint on surfaces adjacent to field welds.
- E. Do not enlarge holes in members by burning or the use of drift pins, except in secondary bracing members. Ream holes that must be enlarged to place bolts. Do not use gas-cutting torches in the field for correcting fabrication errors in the structural framing.

3.02 DAMAGED MEMBERS:

- A. Replace members that are bent, twisted, or damaged. Remove members that are impaired in appearance, strength, or serviceability and replace with new members at no additional cost to Owner.

3.03 MISFITS AT BOLTED CONNECTIONS:

- A. Immediately notify the engineer where misfits in erection bolting are encountered. The Contractor shall submit a method to remedy the misfit for review by the Engineer. The Engineer will determine whether the remedy is acceptable or if the member must be refabricated.
- B. Do not enlarge incorrectly sized or misaligned holes in members by burning or by the use of drift pins. The Contractor shall notify the Engineer immediately and submit a proposed method of remedy for review by the Engineer.

3.04 ANCHOR BOLTS:

- A. Install anchor bolts by using templates, setting drawings, and instructions provided by the fabricator. Verify positions of bolts prior to delivery of steel; report errors or deviation for

adjustment. After anchor bolts have been embedded, protect threads by applying grease and by having the nuts screwed on until the metalwork is installed.

3.05 COLUMN BASEPLATES AND BEARING PLATES:

- A. Set columns with base plates attached and bearing plates for beams and similar structural members to their proper alignment and elevation using shim packs. Tighten anchor bolts after members have been positioned and plumbed. Protruding wedges, shims, or other leveling devices shall not be removed but cut off flush with the base plate prior to packing with grout.

3.06 HIGH STRENGTH BOLTS:

- A. Provide workmanship and techniques for bolted construction in conformance with requirements of AISC Specification for Structural Joints and as indicated or specified.
- B. Install ASTM A 325 bolts with hardened washer under element being turned in tightening. Install plate washers in both outer plies when using oversize and slotted holes. Install galvanized washer under bolt head and nut when using galvanized bolts.
- C. Do not reuse galvanized high-strength bolts, nuts and washers.

3.07 WELDING:

- A. Workmanship and techniques for welded construction to conform to requirements of AWS Structural Welding Code and as indicated or specified.
- B. No field welding permitted unless indicated on Engineer approved fabrication shop drawings.
- C. No field welding permitted on galvanized steel.

3.08 CRANE RAILS:

- A. Installation: Provide in conformance with crane manufacturer's printed instructions and as specified or as shown on contract drawings.
- B. Fasten crane rails to runway beam with rail clamps, in pairs, one each side of rail, spaced not more than 30 inch centers. Bolt each clamp to runway beam top flange with two bolts and self-locking nuts. Allow 1/32 inch clearance between clamp plate and top of rail flange and 1/4 inch clearance between clamp plate and edge of rail flange to provide a "floating rail" in conformance with AISC Manual. Do not use hook bolts. Center crane rail on the runway beam. In no case shall the crane rail eccentricity be greater than three-fourths of the runway beam web thickness. The entire assembly will be rejected if the crane rail eccentricity exceeds the three-fourths limitation. Replace and remove entire rejected assembly from job site at no additional cost to the Owner.

- C. Install crane rails with milled ends and tight joints at splices. Use bolted splice bars to maintain joint alignment in conformance with AISC Manual. Do not use welded butt joints.
- D. Retighten splice bolts within 30 days and every three months thereafter in conformance with AISC Manual.

3.09 CLEAN-UP:

- C. Upon completion of the work, remove surplus materials, rubbish, and debris resulting from the operations, including disused equipment and implements of service, and leave the entire structure and site, insofar as the work of this section is concerned, in a neat, clean, and acceptable condition.

3.10 CLOSEOUT ACTIVITIES:

- A. Provide in accordance with Section 01700.

END OF SECTION

SECTION 05500

MISCELLANEOUS METAL

PART 1 - GENERAL

1.00 DESCRIPTION:

- A. Provide, erect, set and fasten miscellaneous metal items as indicated and specified including surface preparation and shop prime/painting, except as noted below.
- B. Items to be cast in concrete which are to be furnished under this Section for installation under Division 3:
 - 1. Sleeves and inserts.
 - 2. Aluminum Grating and frames.
 - 3. Anchor bolts with layout templates (except anchor bolts for structural steel and anchor bolts for equipment).

1.01 REFERENCES:

- A. Aluminum Association (AA):
 - 1. AA M12C22A41.
 - a. M12: Mechanical Finish, Non-Specular.
 - b. C22: Chemical Finish, Medium Matte.
 - c. A41: Clear Anodic Coating, Class I.
 - 2. AAM12C22A42:
 - a. M12: Mechanical Finish, Non-Specular.
 - b. C22: Chemical Finish, Medium Matte.
 - c. A42: Dark Bronze Anodic Coating, Class 1.
- B. American Institute of Steel Construction (AISC):
 - 1. Specification for the Design, Fabrication and Erection of Structural Steel for Buildings.

C. American Welding Society (AWS):

1. D1.1: Structural Welding Code Steel.

D. Aluminum Association Standard Anodic Finish (AASAF).

E. ASTM International (ASTM):

1. A167: Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
2. A269: Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
3. A276: Specification for Stainless and Heat-Resisting Steel Bars and Shapes.
4. A312: Specification for Seamless and Welded Austenitic Stainless Steel Pipe.
5. B26: Specification for Aluminum-Alloy Sand Castings.
6. B209: Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
7. B211: Specification for Aluminum-Alloy Bars, Rods, and Wire.
8. B221: Specification for Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes.
9. B241: Specification for Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube.
10. B247: Specification for Aluminum and Aluminum-Alloy Die Forgings, Hand Forgings and Rolled Ring Forgings.
11. B308: Specification for Aluminum-Alloy 6061-T6 Standard Structural Shapes, Rolled or Extruded.
12. B429: Specification for Aluminum-Alloy Extruded Structural Pipe and Tube.

1.02 DESIGN REQUIREMENTS:

A. Railings and Guardrails:

1. Railings and guardrails shall be designed for a live load of 100 plf vertical plus 50 plf horizontal applied concurrently or a concentrated load of 200 pounds applied in any direction at any point along the rail, whichever produces the most extreme condition.

2. Intermediate rails, balusters and panels or fillers shall be designed for a uniform load of 25 psf over the gross area of the guard of which they are a part. This loading need not be added to the loading of the main members prescribed above.
3. Handrails shall be designed for a live load of 50 plf applied in any direction or a concentrated load of 200 pounds applied in any direction at any point along the handrail, whichever produces the most extreme condition.

B. Aluminum grating design shall be based upon the following criteria:

1. Design Live Loads:
 - a. Uniform Live Load: 200 psf
 - b. Concentrated @ Center Span: 500 plf
2. Maximum bending stress = 12,000 psi
3. Maximum shear stress = 8,000 psi
4. Modulus of Elasticity = 10,000 ksi
5. Maximum deflection under 100 psf uniform live load = $\frac{\text{Span}}{300}$

1.03 SUBMITTALS:

A. Shop Drawings: Submit the following in accordance with Section 01300:

1. Manufacturer's literature describing standard items.
2. Shop drawings showing materials, sizes, finishes, locations, attached hardware and fittings, and details for manufactured items and fabricated metalwork, including field erection details showing cuts, copes, miter connections, holes, thread fasteners and welds. Indicate welds, both shop and field, by symbols conforming to AWS standards. Indicate coatings or other protection against corrosion.
3. Setting diagrams, erection plans, templates and directions for installation of backing plates, anchors, and other similar items.
4. Manufacturer's specifications, load tables, anchor details, installation details for grating.
5. Material, product data and specifications with standards designated.

6. One sample of finished railing proposed for use. Submit with shop drawing submittal.

1.04 QUALITY ASSURANCE:

- A. Provide in accordance with Section 01400 and as specified.
- B. Obtain field measurements prior to preparation of shop drawings and fabrication.
- C. Welding Qualification and Certification:
 1. Furnish written welding procedure for all welds in conformance with AWS Structural Welding Code.
 2. Each welder, tacker and welding operator shall be certified by test within the past six months to perform type of work required in conformance with AWS Structural Welding Code. Testing shall be conducted, and witnessed by an independent testing laboratory.
 3. Maintain duplicate qualification and certification records at the job site readily available for examination.

1.05 DELIVERY, STORAGE AND HANDLING:

- A. Provide in accordance with Section 01610 and as specified.
- B. Identify and match-mark, materials, items and fabrications, for installation and field assembly.
- C. Deliver items to jobsite as complete units, wherever practicable, ready for installation or erection, with anchors, hangers, fasteners and miscellaneous metal items required for installation.
- D. Carefully handle and store materials, protected from weather, rusting and other damage.
- E. Store structural shapes, pipes, tubes and sheets off the ground on suitable supports, with webs of flanged shapes vertical.

PART 2 - PRODUCTS

2.01 MATERIALS:

- A. Stainless Steel:
 1. Type 304 unless otherwise indicated or specified.

2. Type 316 unless otherwise indicated or specified.
3. General: Type (or Grade) 304L for welding, otherwise Type (or Grade) 304.
4. Shapes and Bars: ASTM A276
5. Plate, Sheet, and Strip: ASTM A167
6. Tubing: ASTM A269
7. Pipe: ASTM A312, Schedule 40S

B. Aluminum:

1. Plates, rolled or extruded shapes, sheets or castings conforming (unless otherwise permitted or indicated) to the following Aluminum Association alloy and temper designations:
 - a. Rolled structural sheets and plates: ASTM B209-6061-T6
 - b. Rolled Structural Shapes: ASTM B308-6061
 - c. Extruded structural shapes, bars and tubes: ASTM B221 Alloy 6061-T6
 - d. Extruded structural tube or pipe: ASTM B429 Alloy 6061 T-6
 - e. Gratings (bearing bars): ASTM B211-6061-T6
(crimp bars): ASTM B211-6061-T5
 - f. Castings: ASTM B26-214
 - g. Sheets: ASTM B209-Alclad 3003-H14 and 3003
 - h. Bolts and nuts: Type 316 stainless steel
 - i. Pipe railings: ASTM B241-6061-T6
 - j. Handrail posts: ASTM B241-6061-T6
 - k. Die and hand forgings: ASTM B247 Alloy 6061-T6
 - l. Welding filler rods: ASTM B241-6061-T6
 - m. Plank: ASTM B211-6061-T6 or ASTM B221-6063-T6

C. Bolts, washers and nuts: Type 316 stainless steel

D. Welding:

1. Provide filler materials appropriate and compatible for the alloys and tempers in accordance with the AWS Structural Welding Code.
2. Provide Class 5356 electrodes.

2.02 FABRICATION:

A. General:

1. Fabricate true to shape, size and tolerances as indicated and specified with straight lines, square corners or smooth bends; free from twists, kinks, warps, dents, and other imperfections. Straighten work bent by shearing or punching.
2. Dress exposed edges and ends of metal smooth, with no sharp edges and with corners slightly rounded. Construct connections and joints exposed to weather to exclude water.
3. Provide sufficient quantity and size of anchors for the proper fastening of work.
4. Fabricate details and connection assemblies in accordance with drawings and with projecting corners clipped and filler pieces welded flush.
5. Weld shop connections, bolt or weld field connections, unless otherwise noted or specified.
6. Provide clips, lugs, brackets, straps, plates, bolts, nuts, washers, and similar items, as required for fabrication and erection.
7. Use connections of type and design required by forces to be resisted, and to provide secure fastening.
8. Welding:
 - a. Grind exposed edges of welds to a 1/8-inch minimum radius. Grind burrs, jagged edges and surface defects smooth.
 - b. Prepare welds and adjacent areas such that there is (1) no undercutting or reverse ridges on weld bead, (2) no weld spatter on or adjacent to weld or any other area to be painted, and (3) no sharp peaks or ridges along weld bead. Grind embedded pieces of electrode or wire flush with adjacent surface of weld bead.

9. Bolting:

- a. Provide Type 316 stainless steel stud bolts and nuts with heavy aluminum washer for fastening of aluminum material.
- b. Draw up bolts or nuts tight, and deform threads where possible. Use bolts of lengths required so that bolts do not project more than 1/4-inch beyond face of nut. Do not use washers unless specified. Provide hexagonal head bolts with hexagonal nuts.

- c. Provide holes required for the connection of adjacent or adjoining work wherever noted on drawings. Locate holes for bolting equipment to supports to a tolerance of + 1/16-inch of exact dimensions indicated.
 - d. Provide plastic protection caps.
- B. Fit work together in fabrication shop and deliver complete, or in parts, ready to be set in place.
- C. Fabricated Products:
- 1. Pipe Sleeves in Concrete Construction: Weld standard weight, black steel pipe, with anchors to exterior to accommodate passage of conduits, pipes ducts and similar items.

2.03 ALUMINUM PIPE RAILS:

- A. Provisions: All-welded assembly fabricated from 1-1/2-in. IPS, schedule 80 aluminum pipe, alloy 6061-T6 for posts, top rails and intermediate rails. Provide mitered connections at the intersections of posts and railings. Provide radius connections as indicated. Alloy of welding filler rods shall be compatible with alloy of posts and railings. Grind exposed welds smooth. Reinforce pipe rail posts with 14-inch long solid aluminum rod inserts at bottom of stanchions.
- 1. Complete railing, including anchorage and framing, and post spacing at a maximum of 4 feet on centers to withstand specified loading. Provide 1/4-inch thick aluminum kick plates as indicated.
 - 2. Provide cast aluminum brackets for wall-mounted handrails.
 - 3. Weld posts, to be mounted on top of stair stringers, to aluminum angle brackets. Fasten brackets to stringers with 1/2-inch diameter stainless steel bolts.
 - 4. Side mount guard rail posts, to concrete. Weld to extruded aluminum brackets. Secure brackets to concrete with four 1/2-inch diameter stainless steel expansion bolts.
 - 5. Set posts into concrete curbs, and into preformed holes. Secure in place with nonshrinking non-metallic grout. Provide holes at least 1 inch greater in diameter than outside diameter of posts and minimum of 6 inches deep.
 - 6. Fabricate removable pipe railings in same manner as fixed railings.
 - 7. Provide panels as large as practicable with joints between panels made neat and inconspicuous with exposed welds ground smooth.

2.04 ALUMINUM BAR GRATINGS:

A. Manufacturers:

1. Type B as manufactured by Harsco Industrial IKG.
2. Type SG Series as manufactured by Ohio Gratings, Inc.
3. Type GW as manufactured by McNichols Co.
4. Or acceptable equivalent product.

B. Provide as indicated and specified.

1. 3/16-inch thick bearing bars by depth indicated on drawings, 1-3/16 inches center to center with cross bars pressure locked on 4-inch centers.
2. Fabricate in standard size sections, secure in place with four (minimum), stainless steel acceptable removable-type fasteners per panel.
3. Apply bearing bar banding at ends of grating sections and at fixture or pipe openings where two or more bearing bars are cut. Cutout for obstructions shall provide 1-inch [25 mm] clearance of the obstruction.
4. Provide serrated top surfaces.
5. Provide angle frame for gratings in concrete surrounds: Miter and weld corners, weld on anchors, grind exposed welds smooth.
6. Provide hinged gratings with 180 degree double-acting Type 316 stainless steel hinges where indicated. Fasten to bearing bars with Type 316 stainless steel bolts.
7. Before coating application, clean contact surfaces, remove dirt, grease, oil, foreign substances, followed by immersing in, or wipe thoroughly with, an acceptable solvent. Rinse with clean hot water and dry thoroughly.
8. Stainless steel saddle clips, z-clips or other approved fasteners for grating.

2.05 ALUMINUM FINISHES:

- A. After fabrication, provide exterior aluminum pipe railing assemblies, kick plates and posts with Aluminum Association Standard clear anodized finish, Designation C22A41.

2.06 ALUMINUM PROTECTION:

A. Protect aluminum against electrolysis from all sources as specified in Section 01063. Under no circumstances shall aluminum contact a dissimilar metal.

1. Members Encased in Concrete: Zinc chromate primer.
2. Members in Contact with Concrete: Coal tar epoxy.

B. Manufacturers:

1. 46H-413 Hi-Build Tneme Tar by Tnemec Co., Inc.
2. Bitumastic 300M by Carboline Co.
3. Targuard by Sherwin Williams.
4. Or acceptable equivalent product.

2.07 GUARD POSTS:

A. 8-inch diameter ASTM A53 Schedule 80 seamless, galvanized steel pipe filled solidly with Class A concrete, slope top 15 degrees as indicated.

2.08 BOLLARDS:

- A. 6-inch diameter ASTM A53, Schedule 80 seamless, galvanized steel pipe filled solidly with Class A concrete, slope top 15 degrees as indicated.
- B. Weld 1-inch thick galvanized steel plate to pipe bottom and provide four (4) holes for galvanized steel expansion bolts and washers as indicated.

2.09 MISCELLANEOUS ITEMS:

A. Provide items of miscellaneous metalwork not particularly specified, of the shape, size, material and detail indicated and suitable for the purpose intended.

PART 3 - EXECUTION

3.01 GENERAL:

A. Accurately set and properly secure in place as indicated and specified. Where bolted connections are used, draw closely together and draw nuts tightly. Use bolts of lengths so that they do not project more than 1/4-inch beyond face of nut. Do not use washers unless specified. Provide hexagonal head bolts with hexagonal nuts.

- B. Locate anchors and anchor bolts and build into connecting work. Insert expansion bolts into drilled holes.
- C. After erection, clean aluminum with mild soap and water, followed by clear water rinse, after erection.
- D. Furnish all embedded items to General Contractor for installation into concrete formwork.
- E. Miscellaneous metal items specified shall be installed as indicated, specified and in accordance with accepted shop drawings.

3.02 ALUMINUM PROTECTIVE COATING:

- A. Protect aluminum from contact with dissimilar metals, concrete, masonry, mortar or grout.
- B. Coat surfaces of aluminum with heavy coat of bitumastic paint.
- C. Before coating application, clean contact surfaces, remove dirt, grease, oil, foreign substances, followed by immersing in, or wipe thoroughly with, an acceptable solvent. Rinse with clean hot water and dry thoroughly.

3.03 ALUMINUM PIPE RAILINGS:

- A. Set posts plumb and align railings horizontal or parallel to rake of stairs to within 1/4 inch in 10 feet unless otherwise indicated.
- B. Side mount posts to concrete with aluminum brackets as indicated.
- C. Set top mounted posts in concrete curbs into preformed holes.
 - 1. Provide holes at least 1 inch greater in diameter than outside diameter of posts and a minimum of 6 inches deep.
 - 2. Moisten interior of holes and surrounding surfaces.
 - 3. Set railing in position and brace until grout sets.
 - 4. Secure in place with non-metallic, non-shrink grout. Provide 1/8-inch build up of grout around base of posts, sloped away from posts.
- D. Provide butt splice joints with internal sleeves bonded with adhesive.
- E. Provide expansion joints at intervals of not more than 32 feet.

1. Locate joints within 6 inches of posts.
2. Provide slip joint with internal sleeve extending 2 inches beyond joint on each side.
3. Fasten internal sleeve securely to one side only.
4. Provide gap of 0.002 inch per foot per degree Fahrenheit.

3.04 ALUMINUM HANDRAILS:

- A. Install aluminum handrail brackets spaced at a maximum of 4 feet on center.

3.05 ALUMINUM GRATINGS AND FRAMES:

- A. Accurately set and properly secure frames and gratings in place. Where bolted connections are used, draw closely together and draw nuts tightly.
- B. Provide standard panel widths.
- C. Perform cutting and fitting as required for installation.
- D. Place grating panels such that cross bars align.
- E. Cutouts for pipes or circular obstructions shall be 2 inch larger in diameter than the diameter of the obstruction.
- F. Provide saddle clips, z-clips or other approved fasteners to secure grating at every four square feet. Provide a minimum of four fasteners per grating section.
- G. Attachments shall permit removal of the grating panels.

3.06 GUARD POSTS:

- A. Install guard posts as indicated and in accordance with accepted shop drawings.

3.07 BOLLARDS:

- A. Install bollards as indicated and in accordance with accepted shop drawings.

3.08 CONTRACT CLOSEOUT:

- A. Provide in accordance with Section 01700.

END OF SECTION

SECTION 05510

ALUMINUM STAIRS AND PLATFORMS

PART 1 - GENERAL

1.00 DESCRIPTION:

- A. Provide, erect, set and fasten aluminum stairs and platforms as indicated and specified.

1.01 REFERENCES:

- A. American Welding Society (AWS):
 - 1. D1.1: Structural Welding Code - Aluminum.
- B. Aluminum Association Standard Anodic Finishes (AASAF).
- C. ASTM International (ASTM):
 - 1. B 26: Specification for Aluminum-Alloy Sand Castings.
 - 2. B 209: Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
 - 3. B 211: Specification for Aluminum-Alloy Bars, Rods, Profiles and Tubes.
 - 4. B 221: Specification for Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes.
 - 5. B 247: Specification for Aluminum and Aluminum-Alloy Die Forgings, Hand Forgings and Rolled Ring Forgings.
 - 6. B 429: Specification for Aluminum-Alloy Extruded Structural Pipe and Tube.

1.02 DESIGN CRITERIA:

- A. Stairs shall be designed to withstand a minimum uniform live load of 100 psf or a concentrated live load of 300 pounds applied on an area of 4 square inches at any point along the element.
- B. Platforms shall be designed to withstand the live loads indicated. If the design live load does not appear on the drawings, platforms shall be designed for a

minimum uniform live load of 100 psf or a concentrated live load of 300 pounds applied on an area of 4 square inches at any point along the element.

1.03 QUALITY ASSURANCE:

- A. Provide in accordance with Section 01400 and as specified.
- B. Obtain field measurements prior to preparation of shop drawings and fabrication.
- C. Welding Qualification and Certification:
 - 1. Furnish written welding procedure for all welds in conformance with AWS Structural Welding Code.
 - 2. Each welder, tacker and welding operator shall be certified by test within the past six months to perform type of work required in conformance with AWS Structural Welding Code. Testing shall be conducted and witnessed by an independent testing laboratory.
 - 3. Maintain duplicate qualification and certification records at the job site readily available for examination.

1.04 SUBMITTALS:

- A. Shop Drawings: Submit the following in accordance with Section 01300:
 - 1. Manufacturer's specifications, load tables, anchor details and installation details.
 - 2. Shop drawings showing materials, sizes, finishes, locations, attached hardware and fittings, and details for grating and frames.
 - 3. Setting diagrams, erection plans, templates including field erection details showing cuts, copes, connections, holes, threaded fasteners and welds. Indicate welds, both shop and field, by symbols conforming to AWS standards.

1.05 DELIVERY, STORAGE AND HANDLING:

- A. Provide in accordance with Section 01610 and as specified.
- B. Identify and match-mark, materials, items and fabrications, for installation and field assembly.
- C. Deliver items to job site as complete units, wherever practicable, ready for installation or erection, with anchors, hangers, fasteners and miscellaneous metal

- items required for installation.
- D. Carefully handle and store materials, protected from weather, rusting and other damage.
 - E. Store material off the ground on suitable supports.

PART 2 - PRODUCTS

2.01 MATERIALS:

- A. Aluminum plates, shapes, pipe and castings shall conform to the following ASTM specifications, alloy and temper designations.

1. Extruded structural shapes, bars and tubes: ASTM B 221 Alloy 6061-T6
2. Extruded structural tube or pipe: ASTM B 429 Alloy 6061-T6
3. Sheet and plate: ASTM B 209 Alloy 6061-T6
4. Die and hand forgings: ASTM B 247 Alloy 6061-T6
5. Castings: ASTM B 26-214
6. Bolts, washers and nuts: Type 304 stainless steel
7. Gratings (bearing bars): ASTM B 211 Alloy 6061-T6
(connecting bars): ASTM B 211 Alloy 6061-T5

- B. Welding:

1. Provide filler materials appropriate for the alloys and tempers in accordance with the AWS Structural Welding Code.
2. Provide Class 4043 electrodes.

2.02 FABRICATION:

- A. General:

1. Fabricate true to shape, size and tolerances as indicated and specified.
2. Straighten work bent by shearing or punching.
3. Dress exposed edges and ends of metal smooth, with no sharp edges and with corners slightly rounded.

4. Provide sufficient quantity and size of anchors for the proper fastening of the work.
5. Fabricate details and connection assemblies in accordance with drawings, with projecting corners clipped and filler pieces welded flush.
6. Provide clips, lugs, brackets, straps, plates, bolts, nuts, washers, and similar items, as required for fabrication and erection.
7. Use connections of type and design required by forces to be resisted, and to provide secure fastening.
8. Fit work together in fabrication shop and deliver complete, or in parts, ready to be set in place.

B. Welding:

1. Grind exposed edges of welds to a 1/8 inch minimum radius. Grind burrs, jagged edges and surface defects smooth.
2. Prepare welds and adjacent areas such that there is no undercutting or reverse ridges on the weld bead and no sharp peaks or ridges along the weld bead.
3. Grind embedded pieces of electrode or wire flush with adjacent surface of weld bead.

C. Bolting:

1. Provide holes required for the connection of adjacent or adjoining work wherever noted on drawings. Locate holes for bolting to supports to a tolerance of + 1/16 inch of exact dimensions indicated.
2. Provide stainless steel stud bolts and nuts with heavy aluminum washer for fastening aluminum material.

2.03 ALUMINUM STAIRS:

- A. Provide aluminum stairs fabricated from structural aluminum channel stringers, aluminum pipe rails and aluminum treads.

B. Bar Grating Treads:

1. Provide stair treads of the same type and bar spacing as grating specified.

2. Provide serrated top surface of bearing bars.
3. Provide 3" x 3/16" carrier end plates welded to stair treads and punched for bolting to stringers.
4. Provide 1-1/4 inch abrasive nosings.
5. Manufacturers:
 - a. Type B as manufactured by IKG Borden Metal Products Co.
 - b. Type SG Series as manufactured by Ohio Gratings, Inc.
 - c. Type A as manufactured by McNichols Co.
 - d. Or acceptable equivalent product.

2.04 ALUMINUM PLATFORMS:

- A. Provide aluminum platforms fabricated from structural aluminum shapes, grating, plates, pipes and tubes as indicated.
- B. Provide aluminum rectangular bar grating as specified in Section 05500.

2.05 RAILINGS AND HANDRAILS:

- A. Provide aluminum pipe railing as specified in Section 05500 with flush welded joints ground smooth and secured to stringers as indicated.

2.06 FINISHES:

- A. Aluminum:
 1. Provide aluminum channel stringers, supports, angle hangers, struts, rod hangers, closure plates, brackets, sheet risers and tread plates with a natural mill finish.
 2. After fabrication, provide exterior aluminum pipe railing assemblies, kick plates, posts and chains, with Aluminum Association Standard clear anodized finish, Designation C22A31.

PART 3 - EXECUTION

3.01 GENERAL:

- A. Set and secure in place as indicated. Where bolted connections are used, draw

together and draw nuts tightly. Use bolts of lengths required so that they do not project more than 1/4-inch beyond face of nut. Do not use washers unless specified. Provide hexagonal head bolts with hexagonal nuts.

- B. Locate anchors and anchor bolts and build into connecting work. Insert expansion bolts into drilled holes.
- C. After erection, clean aluminum with mild soap and water, followed by clear water rinse.

3.02 PROTECTION:

- A. Protect aluminum from contact with dissimilar metals or concrete.
- B. Apply one coat of one of the following products:
 - 1. 46H-413 Hi-Build Tneme Tar by Tnemec Co.
 - 2. Bitumastic 300 M by Carboline Co.
 - 3. Targuard by Sherwin Williams Co.
 - 4. Or acceptable equivalent product.
- C. Before coating application, clean contact surfaces, remove dirt, grease, oil, foreign substances, followed by immersing in, or wipe thoroughly with, an acceptable solvent. Rinse with clean hot water and dry thoroughly.

3.03 STAIRS:

- A. Provide structural aluminum angle hangers, struts, rod hangers, closure plates and brackets indicated.

3.04 CONTRACT CLOSEOUT:

- A. Provide in accordance with Section 01700.

END OF SECTION

SECTION 05519

POST-INSTALLED CONCRETE ANCHORS

PART 1 - GENERAL

1.00 DESCRIPTION:

- A. Provide open drilled in concrete anchors and concrete as indicated and specified.

1.01 REFERENCES:

A. ASTM International (ASTM):

1. ASTM A307: Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength
2. ASTM A449: Specification for Quenched and Tempered Steel Bolts and
3. ASTM A563: Specification for Carbon and Alloy Steel Nuts
4. ASTM F436: Standard Specification for Hardened Steel Washers
5. ASTM A36: Specification for Carbon Structural Steel
6. ASTM A193: Standard Specification for Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications
7. ASTM A510: Standard Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel, and Alloy Steel
8. ASTM A108: Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished
9. ASTM F593: Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs
10. ASTM F594: Standard Specification for Stainless Steel Nuts
11. ASTM B633: Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel
12. ASTM A153: Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
13. Reinforcing Dowels: ASTM A615

1.02 SUBMITTALS:

A. Submit the following after award.

1. Product specifications with recommended design values and physical characteristics for epoxy dowels, expansion and undercut anchors.
2. Quality Assurance Submittals:
 - a. Test Reports: Certified test reports showing compliance with specified performance characteristics and physical properties.
 - b. Certificates: ICC ES Evaluation Reports.
3. Manufacturer's installation instructions.
4. Installer Qualifications & Procedures: Submit installer qualifications as stated in Section 1.03.B. Submit a letter of procedure stating method of drilling, the product proposed for use, the complete installation procedure, manufacturer training date, and a list of the personnel to be trained on anchor installation.

B. ICC ESR document for each type and size of anchor to be installed in the work.

1.03 QUALITY ASSURANCE:

A. Comply with the requirements specified in Section 01400.

1. Installer Qualifications:
 - a. Drilled-in anchors shall be installed by an installer with at least five years of experience performing similar installations.
2. Installer Training: Conduct a thorough training with the manufacturer or the manufacturer's representative for the installer on the project. Training to consist of a review of the complete installation process for drilled-in anchors, to include but not limited to:
 - a. hole drilling procedure
 - b. hole preparation & cleaning technique
 - c. adhesive injection technique & dispenser training / maintenance
 - d. rebar dowel preparation and installation
 - e. proof loading/torqueing
3. Certifications: Unless otherwise authorized by the Engineer, anchors shall have one of the following certifications:

- a. ICC ES Evaluation Report indicating conformance with current applicable ICC ES Acceptance Criteria.

1.04 DELIVERY STORAGE AND HANDLING:

- A. Comply with the requirements specified in Section 01610.
- B. Store anchors in accordance with manufacturer's recommendations.

PART 2 - PRODUCTS:

2.01 FASTENERS AND ANCHORS:

- A. Bolts and Studs: ASTM A307; ASTM A449 where "high strength" is indicated on the Drawings.
- B. Carbon and Alloy Steel Nuts: ASTM A563.
- C. Carbon Steel Washers: ASTM F436.
- D. Carbon Steel Threaded Rod: ASTM A36; or ASTM A193 Grade B7; or ISO 898 Class 5.8.
- E. Wedge Anchors: ASTM A510; or ASTM A108.
- F. Stainless Steel Bolts, Hex Cap Screws, and Studs: ASTM F593.
- G. Stainless Steel Nuts: ASTM F594.
- H. Zinc Plating: ASTM B633.
- I. Hot-Dip Galvanizing: ASTM A153.
- J. Reinforcing Dowels: ASTM A615

2.02 DRILLED-IN ANCHORS

- A. Wedge Anchors: Wedge type, torque-controlled, with impact section to prevent thread damage complete with required nuts and washers. Provide anchors with length identification markings conforming to ICC ES AC01 or ICC ES AC193. Type and size as indicated on Drawings. The use of drop-in type anchors is prohibited.
 - 1. Interior Use: Unless otherwise indicated on the Drawings, provide carbon steel anchors with zinc plating in accordance with ASTM B633, Type III Fe/Zn 5 (SC1).
 - 2. Exterior Use: As indicated on the Drawings, provide stainless steel anchors. Stainless steel anchors shall be AISI Type 316 stainless steel provided with

stainless steel nuts and washers of matching alloy group and minimum proof stress equal to or greater than the specified minimum full-size tensile strength of the externally threaded fastener. Stainless steel nuts shall conform to ASTM F594 unless otherwise specified. Avoid installing stainless steel anchors in contact with galvanically dissimilar metals.

3. Where anchor manufacturer is not indicated, subject to compliance with requirements and acceptance by the Engineer, provide the following:
 - a. Hilti Kwik Bolt TZ, ICC ESR-1917 (carbon steel and AISI Type 304 Stainless Steel).
 - b. Or equal
- B. Screw Anchors: Screw type. Pre-drilling of the hole requires a standard ANSI drill bit with the same diameter as the anchor and installing the anchor will be done with an impact wrench. Provide anchors with a diameter and anchor length marking on the head. Type and size as indicated on Drawings.
 1. Interior Use: Unless otherwise indicated on the Drawings, provide carbon steel anchors with zinc plating equivalent to DIN EN ISO 4042 (8 μ m min.).
 2. Where anchor manufacturer is not indicated, subject to compliance with requirements and acceptance by the Engineer, provide the following:
 - a. Hilti Kwik-HUS-EZ, ICC-ESR 3027.
 - b. Hilti Kwik-HUS EZ-I, ICC-ESR 3027.
 - c. Or equal
- C. Cartridge Injection Adhesive Anchors: Threaded steel rod, inserts or reinforcing dowels, complete with nuts, washers, polymer or hybrid mortar adhesive injection system, and manufacturer's installation instructions. Type and size as indicated on Drawings.
 1. Interior Use: Unless otherwise indicated on the Drawings, provide carbon steel threaded rods conforming to ASTM A36, ASTM A 193 Type B7 or ISO 898 Class 5.8 with zinc plating in accordance with ASTM B633, Type III Fe/Zn 5 (SC1) [or carbon steel HIT TZ rods conforming to ASTM A510 with chemical composition of AISI 1038].
 2. Exterior Use: As indicated on the Drawings, provide stainless steel anchors. Stainless steel anchors shall be AISI Type 316 stainless steel provided with stainless steel nuts and washers of matching alloy group and minimum proof stress equal to or greater than the specified minimum full-size tensile strength of the externally threaded fastener. All nuts shall conform to ASTM F594 unless otherwise specified. Avoid installing stainless steel anchors in contact with galvanically dissimilar metals.

3. Reinforcing dowels shall be A615 Grade 60.
4. Where anchor manufacturer is not indicated, subject to compliance with requirements and acceptance by the Engineer, provide the following:
 - a. Hilti HAS threaded rods with HIT-HY 200 Safe Set System using Hilti Hollow Drill Bit System for anchorage to concrete, ICC ESR-3187.
 - b. Hilti HIT-Z anchor rods with HIT-HY 200 Safe Set System for anchorage to concrete, ICC ESR-3187.
 - c. Hilti HAS threaded rods with RE 500 SD Injection Adhesive Anchoring System for anchorage to concrete, ICC ESR-2322.
 - d. Hilti HAS threaded rods with RE 500 Injection Adhesive Anchoring System for anchorage to concrete.
 - e. Or equal
5. Reinforcing dowels shall be A615 Grade 60.

PART 3 - EXECUTION

3.01 DRILLED-IN ANCHORS:

- A. Drill holes with rotary impact hammer drills using carbide-tipped bits or hollow drill bit system. Drill bits shall be of diameters as specified by the anchor manufacturer. Unless otherwise shown on the Drawings, all holes shall be drilled perpendicular to the concrete surface.
 1. Cored Holes: Where anchors are permitted to be installed in cored holes, use core bits with matched tolerances as specified by the manufacturer. Properly clean cored hole per manufacturer's instructions.
 2. Embedded Items: Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Exercise care in coring or drilling to avoid damaging existing reinforcing or embedded items. Notify the Engineer if reinforcing steel or other embedded items are encountered during drilling. Take precautions as necessary to avoid damaging prestressing tendons, electrical and telecommunications conduit, and gas lines.
 3. Base Material Strength: Unless otherwise specified, do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
- B. Perform anchor installation in accordance with manufacturer instructions.
- C. Wedge Anchors, Heavy-Duty Sleeve Anchors, and Undercut Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed

with sleeve fully engaged in part to be fastened. Set anchors to manufacturer's recommended torque, using a torque wrench. Following attainment of 10% of the specified torque, 100% of the specified torque shall be reached within 7 or fewer complete turns of the nut. If the specified torque is not achieved within the required number of turns, the anchor shall be removed and replaced unless otherwise directed by the Engineer.

- D. Cartridge Injection Adhesive Anchors: Clean all holes per manufacturer instructions to remove loose material and drilling dust prior to installation of adhesive. Inject adhesive into holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive. Follow manufacturer recommendations to ensure proper mixing of adhesive components. Sufficient adhesive shall be injected in the hole to ensure that the annular gap is filled to the surface. Remove excess adhesive from the surface. Shim anchors with suitable device to center the anchor in the hole. Do not disturb or load anchors before manufacturer specified cure time has elapsed.
- E. Observe manufacturer recommendations with respect to installation temperatures for cartridge injection adhesive anchors and capsule anchors.

3.02 REPAIR OF DEFECTIVE WORK

- A. Remove and replace misplaced or malfunctioning anchors. Fill empty anchor holes and patch failed anchor locations with high-strength non-shrink, nonmetallic grout. Anchors that fail to meet proof load or installation torque requirements shall be regarded as malfunctioning.

3.03 FIELD QUALITY CONTROL

- A. Testing: 10% of each type and size of drilled-in anchor shall be proof loaded by the independent testing laboratory. Adhesive anchors and capsule anchors shall not be torque tested unless otherwise directed by the Engineer. If any of the tested anchors fail to achieve the specified torque or proof load within the limits as defined on the Drawings, all anchors of the same diameter and type as the failed anchor shall be tested, unless otherwise instructed by the Engineer.
 - 1. Tension testing should be performed in accordance with ASTM E488.
 - 2. Torque shall be applied with a calibrated torque wrench.
 - 3. Proof loads shall be applied with a calibrated hydraulic ram. Displacement of adhesive and capsule anchors at proof load shall not exceed $D/10$, where D is the nominal anchor diameter.
- B. Minimum anchor embedment, proof loads and torques shall be as recommended by the manufacturer.

3.04 CLOSEOUT ACTIVITIES:

- A. Provide in accordance with Section 01700.

END OF SECTION

SECTION 05520
METAL RAILINGS

PART 1 - GENERAL

1.00 FILED SUB-BID REQUIREMENTS:

- A. This section of the Specification is a part of the filed sub-bid for Division 5 – Metals. See Section 05500 – MISCELLANEOUS METAL.

1.01 DESCRIPTION:

- A. Design, furnish and install handrails, guardrails and railing systems, including connectors, fasteners, and system required accessories as indicated and in compliance with Contract Documents.

1.02 REFERENCES:

A. Aluminum Association (AA):

- 1. Aluminum Association Designation System for Aluminum Finishes
- 2. AAMA 607.1: Voluntary Guide Specification and Inspection Methods for Clear Anodic Finishes for Architectural Aluminum

B. American Society of Civil Engineers (ASCE):

- 1. 7: Minimum Design Loads for Buildings and Other Structures.

C. ASTM International (ASTM):

- 1. A36/A36M: Standard Specification for Carbon Structural Steel
- 2. A53: Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
- 3. A123/A123M: Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
- 4. A500: Cold Formed Welded and Seamless Carbon Steel Structural Tubing.
- 5. A501: Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing

6. A780: Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
7. B210: Standard Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes
8. B221/B221M: Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
9. B241: Standard Specification for Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube
10. B429: Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube
11. C1107: Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
12. E935: Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings
13. E985: Standard Specification for Permanent Metal Railing Systems and Rails for Buildings

D. American Welding Society (AWS):

1. C5.6: Recommended Practices for Gas Metal Arc Welding
2. D1.1-1.17: Structural Welding Code.

E. International Code Council:

1. IBC: International Building Code.

F. National Ornamental & Miscellaneous Metals Association (NOMMA):

1. Guideline 1: Joint Finishes.
2. Metal Rail Manual.

1.03 PERFORMANCE/ DESIGN CRITERIA:

- A. Design and provide handrail and guardrail system to meet IBC, OSHA and the criteria specified herein. Railing shall be capable of withstanding the loads specified in Section 05500 without exceeding design allowable stress of materials for handrails, railing anchors and connections.
- B. Thermal movements: Provide adequate expansion within the system to allow for thermal expansion and contraction caused by a temperature change of 120 degrees F to -20

degrees F without buckling or warping, opening of joints, overstressing of components, failure of connections and other detrimental effects.

- C. Control of corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1.04 SUBMITTALS:

- A. Submit the following shop drawings in accordance with Section 01300.
 - 1. Show fabrication and installation of handrails and railings assembled from standard components. Include plans, elevations, component details, materials, finishes, connection and joining methods, and mounting details to adjoining work.
 - 2. Identify location and type indicated.
- B. Product Data:
 - 1. Manufacture's literature.
 - 2. Assembly and installation instructions.
- C. Certificates:
 - 1. Welders' Certificates: Certifying welders employed on the Work, verifying AWS qualification within the previous 12 months.
 - 2. Submit certification that the railing system is in compliance with IBC and OSHA
- D. Operation and Maintenance Data:
 - 1. Manufacturer's instructions describing procedures for maintaining including cleaning materials, application methods, and precautions as to use of materials which may be detrimental to finish when improperly used.

1.05 QUALITY ASSURANCE:

- A. Comply with the requirements specified in Section 01600.
- B. Obtain field measurements prior to preparation of shop drawings and fabrication.
- C. Handrails provided shall be end products of one manufacturer to achieve standardization for appearance, maintenance and replacement.
- D. Manufacturer shall have minimum five years experience specializing in manufacturing products specified in the section.
- E. Welding Qualification and Certification:

1. Furnish written welding procedure for all welds in conformance with AWS Structural Welding Code.
2. Each welder, tacker and welding operator shall be certified by test to perform type of work required in conformance with AWS Structural Welding Code. Testing shall be conducted, and witnessed by an independent testing laboratory.
3. Maintain duplicate qualification and certification records at the job site readily available for examination.

1.06 DELIVERY STORAGE AND HANDLING:

- A. Comply with the requirements specified in Section 01610.
- B. Deliver, store and handle materials in manner preventing damage to finished surfaces.
- C. Store materials in a dry, well ventilated, weather tight place away from uncured concrete or masonry.

1.07 SITE CONDITIONS.

- A. Field verify measurements prior to fabrication and indicate measurements in shop drawings.

PART 2 - PRODUCTS

2.01 ALUMINUM RAILING SYSTEM AND COMPONENTS:

- A. Material: ASTM B429, alloy 6063-T6, Schedule 40, 1-1/2 inch diameter minimum extruded structural pipe or tube rails and schedule 80 posts.
- B. Railings at open-side construction shall consist of two members with posts. Locate intermediate rails between top rail and finish floor as indicated on Drawings.
- C. Provide 1/4-inch thick by 4 inch high or "S" type toe plate except on stairs and where concrete curb provided. Provide 1/4-inch clearance above floor level. Expansion joint location to match railing joint location.
- D. Fabrication:
 1. Angles, offsets, other changes in alignment, and joining of posts and rails shall be made with welded connections. Miter and weld joints by fitting post to top rail and intermediate rail to post, mitering corners, groove welding joints, and grinding smooth. Run top rails continuously over post.
 2. Rail splices shall be butted and reinforced by tight fitting interior sleeve not less than 6 inch long.

3. Fabricate wall railings with wall brackets for intermediate support and wall return fittings at ends. Brackets and end fittings shall be of cast or formed metal of same material and finish as supported rails and shall be of proper size to provide 3 inch clear space between wall and railing. Provide wall brackets not more than 4 feet on center.
 4. Provide expansion joint splices at 30 feet maximum spacing, with slip joint internal sleeve extending minimum of 4 inch beyond each side of joint. Weld to one side only. Locate within 12 inch of posts.
 5. Space posts as shown on Drawings. Where spacing is not shown, space posts not more than 4 feet on center. Erect posts plumb in each direction.
 6. Fabricate joints which will be exposed to weather so as to exclude water. Provide weep holes at the lowest possible point on all railing system posts.
- E. Railings at walls shall be single member.
1. Support wall rails on brackets spaced not more than 4 feet on center and at each end of rail. Cantilevered extensions not allowed.
- F. Anchorage;
1. Interior Railings: Provide concrete anchorage for posts by means of pipe sleeves set into concrete. Sleeves shall be pipe of inside diameter of approximately 1/2-inch more than outside diameter of post, not less than 6 inches long, and having closure plate secured to bottom of sleeve. Wedge posts into sleeves as required. Fill space between post and sleeve solid with nonshrink nonmetallic grout. Slightly taper top of grout away from posts.
 1. Interior Railings: Provide concrete anchorage for posts by means of base flange welded to post and anchored to concrete with minimum of with minimum of 4 concrete anchors.
 2. Masonry Anchorage for Rail Ends and wall Railings: Cast or formed metal of same material and finish as supported rails welded, bolted or threaded to rail ends and anchored into wall with minimum of two concrete anchors.
 3. For posts set on stair or platform stringers, provide base flange welded to post and bolted to stringer with minimum of two 1/2-inch bolts, or weld post to stringer.
- G. Finishes:
1. Aluminum Association Finish Designation: AA-M12A41 (Mechanical finish, nonspecular, anodic coating, architectural Class I, clear coating 0.7 mil complying with AAMA 607.1 on exposed surfaces.
 - a. Extruded Components: 0.7 mil anodized.

b. Cast Components: 0.4 mil anodized.

2.02 DISSIMILAR METAL:

1. Keep surfaces of dissimilar metal from direct contact by coating the dissimilar metal with a heavy coat of asphalt paint.
2. Keep surfaces of aluminum components from direct contact with cement or mortar by coating with a heavy coat of asphalt paint.

2.03 GROUT AND ANCHORING CEMENT:

- A. Nonshrink, nonmetallic, nonstaining and noncorrosive grout premixed and factory packaged. Provide grout conforming to requirements of ASTM C 1107.

2.04 GATES:

- A. Fabricate gates as shown on drawings.

PART 3 - EXECUTION

3.01 INSTALLATION:

- A. Install as shown on Drawings and accepted Shop Drawings.
- B. Set posts plumb and aligned in each direction to within 1/4-inch in 12 feet.
- C. Set rails horizontal or parallel to rake of steps to within 1/4 inch in 12 feet.
- D. Fit exposed connections together to form tight, hairline joints.
- E. Provide anchorage devices and fasteners for securing handrails and railings and for transferring loads structures.
- F. Provide mechanical joints for permanently connecting railing components at nonwelded connections.

3.02 CLEANING:

- A. Wash thoroughly using clean water and soap, rinse with clean water.
- B. Do not use acid solution, steel wool or other harsh abrasive.
- C. When stain remains after washing, remove finish and restore in accordance with manufacturer's instructions.

3.03 PROTECTION:

- A. Protect surfaces of completed installations to prevent damage during construction activities.

3.04 REPAIR OF DEFECTIVE WORK:

- A. Remove stained or otherwise defective work and replace with no additional cost to Owner.

3.05 CLOSEOUT ACTIVITIES:

- A. Provide in accordance with Section 01700.

END OF SECTION

SECTION 09940

SHOP PAINTING

PART 1 - GENERAL

1.01 DESCRIPTION:

- A. Provide labor, materials, equipment and incidentals required for the surface preparation and application of shop primers and finish coats, as specified herein.

1.02 RELATED WORK:

- A. Section 09941: Field Painting for painting of shop painted surfaces.
- B. Factory prefinished items as specified.

1.03 SUBMITTALS:

- A. Submit the following in accordance with Section 01300:
 - 1. Manufacturer's specifications and data on the proposed primers and detailed surface preparation, application procedures and dry mil thicknesses, including list of items and surfaces to receive shop painting.

1.04 DELIVERY, STORAGE AND HANDLING:

- A. Provide in accordance with Section 01610 and as specified.
- B. Deliver materials to application area in original, unbroken containers, plainly marked with name and analysis of product, manufacturer's name, and shelf life date. Do not store or use contaminated, outdated, prematurely opened, or diluted materials.
- C. Store coated items to prevent damage or dirtying of coatings. Avoid need for special cleaning, and store coated items out of contact with ground or pavement. Place suitable blocking under coated items during storage.
- D. Do not expose surfaces to weather for more than six months before being topcoated, or less time if recommended by coating manufacturer.
- E. Protect surfaces not to receive paint coatings during surface preparation, cleaning, and painting.
- F. Protect coatings from damage during shipment and handling by padding, blocking, use canvas or nylon slings, and use care when handling.

- G. At time of delivery of shop painted items to job site, ensure coatings are undamaged and in good condition.

1.05 JOB CONDITIONS:

A. Environmental Requirements:

1. Comply with manufacturer's recommendations as to environmental conditions under which coatings and coating systems can be applied.
2. Do not apply coatings when dust is being generated.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. Coatings are divided into the following service types, as determined by conditions:

1. Non-Potable Water:

- a. All ferrous metals not subject to potable water provide one coat with a dry film thickness of 2.5 to 3.0 mils with one of the following or equal:
 - (1) Series 1 Omnithane by Tnemec Co.
 - (2) Carbozinc 859 by Carboline Co.
 - (3) Multiprime EFD Epoxy Fast Day Inhibitive Primer 94-109 made by PPG Protective & Marine Coatings (4.0 – 6.0 DFT).
 - (4) Or acceptable equivalent product.

2. Potable Water:

- a. Ferrous metals submerged or which are subject to splash action in contact with potable water, provide one coat with a dry mil thickness of 3.0 to 3.5 mils of a certified NSF Standard 61 product by one of the following or equal:
 - (1) 91 H2O Urethane Zinc Rich Primer made by Tnemec Co.
 - (2) Carboguard 561 made by Carboline Co.
 - (3) Aquapon High Build Potable Water Epoxy 95-132 Series made by PPG Protective & Marine Coatings (4.0 – 6.0 DFT).

(4) Or acceptable equivalent product.

- B. Shop prime with primers guaranteed by the manufacturer to be compatible with their corresponding primers and finish coats specified in Section 09941 for use in the field and which are recommended for use together.

PART 3 - EXECUTION

3.01 APPLICATION:

A. Surface Preparation and Priming:

1. Sandblast clean in accordance with SSPC-SP-6, Commercial Grade, immediately prior to priming non-submerged components scheduled for priming, as defined above.
2. Sandblast clean in accordance with SSPC-SP-10, Near White, immediately prior to priming submerged components scheduled for priming, as defined above.
3. Before priming, provide surfaces dry and free of dust, oil, grease and other foreign material.
4. Shop prime in accordance with approved manufacturer's printed recommendations.

- B. Non-primed Surfaces: Apply approved coating in accordance with manufacturer's printed recommendation.

3.02 TOUCH-UP:

- A. Repair or replace damaged or defective coated areas. Resultant shop painting: Paint items as specified.
- B. Remove damaged or defective coatings by specified blast cleaning to meet surface cleaning requirements, just before recoating. When small areas of coating need touch up, surface preparation may be done with suitable power needle gun to match specified blast cleaning.

3.03 CONTRACT CLOSEOUT:

- A. Provide in accordance with Section 01700.

END OF SECTION

SECTION 15103

STAINLESS STEEL SLIDE GATES AND APPURTENANCES

PART 1 - GENERAL

1.01 DESCRIPTION:

- A. Provide and test stainless steel slide gates and appurtenances as indicated and in compliance with Contract Documents.

1.02 REFERENCES:

- A. ASTM International (ASTM):

1. A240: Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
2. A276: Standard Specifications for Stainless Steel Bars and Shapes.
3. B584: Standard Specification for Copper Alloy Sand Castings for General Applications.
4. D2000: Standard Classification System for Rubber Products in Automotive Applications.
5. D4020: Standard Specification for Ultra-High-Molecular-Weight Polyethylene Molding and Extrusion Materials.

- B. American Welding Society Code.

- C. American Water Works Association (AWWA):

1. C561: Fabricated Stainless Steel Slide Gates.

1.03 SUBMITTALS:

- A. Submit the following shop drawings in accordance with Section 01300:

1. Certified shop and erection drawings. Contractor shall submit electronic files of the proposed equipment in the capacity, size, and arrangement as indicated and specified.
2. Data for gate and actuator characteristics and performance.
3. Complete description of all materials, material thicknesses of all components.

4. Maximum bending stress and deflection of the slide under design head specified and indicated.
 5. Installation drawings showing the details required for installation, dimensions, clearances and anchor bolt locations
 6. Shop drawing data for accessory items.
 7. Certified setting plans, with tolerances, for anchor bolts.
 8. Manufacturer's literature as needed to supplement certified data.
 9. Operating and maintenance instructions and parts lists.
 10. For manufacturers not named provide a listing of reference installations as specified with contact names and telephone numbers.
 11. Certified results of gate shop testing, including shop leakage test results of each gate at the design unseating head specified and indicated
 12. Certified results of actuator shop testing from the actuator manufacturer.
 13. List of recommended spare parts other than those specified.
 14. Shop and field inspection reports.
 15. Qualifications of field service engineer.
 16. Recommendations for short and long-term storage.
 17. Shop and field testing procedures and set up
 18. Special tools.
 19. Manufacturer's product data, specifications and color charts for shop painting.
 20. Motor shop test results.
 21. The latest ISO 9001 series certification or quality system plan.
- B. A copy of the contract mechanical process and structural drawings, with addenda that are applicable to the equipment specified in this section, marked to show all changes necessary for the equipment proposed for this specification section. If no changes are required, mark all drawings with "No changes required" or provide a statement that no changes are required.

1. Failure to include all drawings or a statement applicable to the equipment specified in this section will result in submittal return without review until a complete package is submitted.
- C. A copy of this specification section with addenda and all referenced specification sections with addenda, with each paragraph check-marked to indicate specification compliance or marked and indexed to indicate requested deviations and clarifications from the specified requirements.
1. If deviations and clarifications from the specifications are indicated, therefore requested by the Contractor, provide a detailed written justification for each deviation and clarification.
 2. Failure to include a copy of the marked-up specification sections and or the detailed justifications for any requested deviation or clarification will result in submittal return without review until marked up specifications and justifications are submitted in a complete package.
- 1.04 SPARE PARTS:
- A. Comply with the requirements specified in Section 01600.
 1. Provide two spare removable cranks.
 2. One set of all remaining special tools.
- 1.05 QUALITY ASSURANCE:
- A. Comply with the requirements specified in Section 01400.
 - B. The Contractor to obtain the gates, actuators, and specified appurtenances from a single gate manufacturer as a complete and integrated package.
 - C. Gates to be the manufacturer's standard cataloged product and modified to provide compliance with the drawings, specifications and the service conditions specified and indicated.
 - D. Slide gates and appurtenances to be fabricated, assembled, and tested in the United States of America.
 - E. Welding: In accordance with latest applicable American Welding Society Code, ASME Welding Code, or equivalent.
 - F. Shop tests as specified, including shop leakage testing of each gate at the design unseating head to confirm compliance with the leakage rate specified and indicated.
 - G. Services of Manufacturer's Representative as stated in Section 01400 and as specified herein.

H. Provide services of factory-trained field service technician, specifically trained on type of equipment specified:

1. Service technician to be present on site for all items listed below. Person-day requirements listed are exclusive of travel time, and do not relieve Contractor of the obligation to place equipment in operation as specified.
2. Installation: Inspect grouting, location of anchor bolts; setting, leveling, alignment, field erection; coordination of electrical connection:
 - a. 1/2 person-day.
3. Functional Testing: Calibrate, check alignment and perform a functional test. Tests to include all items specified.
 - a. 1/2 person-day.
4. Field Performance Testing: Field performance test equipment specified.
 - a. 1/2 person-day.
5. Vendor Training: Provide classroom and field operation and maintenance instruction including all materials, slides, videos, handouts and preparation to lead and teach classroom sessions.
 - a. 1/2 person-day.
6. Credit to the Owner, all unused service person-days specified above, at the manufacturer's published field service rate.
7. Any additional time required of the factory trained service technician to assist in placing the equipment in operation, or testing or to correct deficiencies in installation, equipment or material shall be provided at no additional cost to the Owner.

I. Manufacturer of gates to have a minimum of (5) operating installations with gates of the size specified and in the same service as specified operating for not less than (5) years or manufacturer of gates shall utilize a Project Manager that is experienced in stainless steel gate design and construction. The Project Manager to be an employee of the gate manufacturer and to have designed a minimum of (5) operating installations with gates of the size specified and in the same service as specified operating for not less than (5) years.

1.06 DELIVERY, STORAGE AND HANDLING:

A. Comply with the requirements specified in Section 01610.

PART 2 - PRODUCTS

2.01 SYSTEM DESCRIPTION:

- A. Gate sizes and operating data are indicated in the Slide Gate Schedule.

2.02 MANUFACTURERS:

- A. Stainless Steel Slide Gates:
 - 1. Whipps.
 - 2. RW Gate Co.
 - 3. Acceptable equivalent product with unitized single piece frame.

2.03 SEISMIC DESIGN REQUIREMENTS:

- A. Conform to the requirements indicated on the structural drawings and as specified in Section 01900.
- B. The Contractor to conform to the seismic design requirements for this project and for the work of this specification section.
- C. Provide all equipment bases, anchorage, supports and foundations designed in accordance with the seismic requirements indicated and specified.
- D. Additionally, provide with the Certificate of Unit Responsibility, certification for all equipment signed by a registered structural engineer stating that computations were performed and that all components have been sized for the seismic forces specified and indicated.

2.04 SLIDE GATE CONSTRUCTION:

- A. Provide all gates produced by a single manufacturer and designed for installation in the channels and structures as specified and indicated.
- B. Gate configuration: As indicated in the Slide Gate Schedule.
- C. Provide all gates in conformance with AWWA C561 and as specified.
- D. Self-contained, rising stem, flush bottom type with self-adjusting seals.
- E. Gates with adjustable wedges or wedging devices are not acceptable.
- F. Provide all structural components with minimum 1/4-inch thickness.

- G. Gate assemblies to be media blasted or passivated in accordance with ASTM A380 prior to shipment to remove all mill scale, weld splatter, discoloration, or other surface imperfections.
- H. Leakage rate:
 - 1. Seating head and unseating head conditions: Leakage not to exceed 0.05 gpm per foot of seating perimeter.
- I. Assembly to consist of the following:
 - 1. Frame.
 - 2. Slide.
 - 3. Stem.
 - 4. Seals.
 - 5. Stem guides and wall brackets.
 - 6. Floorstand with operator type as indicated in the Slide Gate Schedule.
- J. Materials:
 - 1. Frame assembly and retainers: ASTM A240 Type 316L stainless steel.
 - 2. Slides and stiffeners: ASTM A240 Type 316L stainless steel.
 - a. 1/4-inch minimum thickness.
 - 3. Seat, seals, and facing: ASTM D4020 UHMW (Ultra-High Molecular Weight) polyethylene.
 - 4. Invert seal for upward acting gates only: ASTM D2000 Neoprene or EPDM.
 - 5. Stems: ASTM A276 Type 316 stainless steel, minimum 1-1/2-inch diameter.
 - 6. Lift nuts: ASTM B584 Bronze.
 - 7. Floorstand and wall brackets: ASTM A276 Type 316L stainless steel.
 - 8. Gear operator housing: Ductile iron.
 - 9. Hardware, studs, and nuts: ASTM A276 Type 316 stainless steel.
 - 10. Anchor bolts: Type 316 stainless steel, minimum 1/2-inch diameter.
- K. Slide:

1. Slide and reinforcing stiffeners welded to the slide.
 - a. Stainless steel plate, minimum 1/4-inch.
 - b. Reinforcement: Provide a minimum of two horizontal stiffeners welded to the slide and two vertical stiffeners welded to outside of the horizontal stiffeners.
 - c. Provide slide to engage the guide a minimum of 1 inch on each side and have a minimum material thickness of a 1/4 inch.
 - (1) Gates with the width of the gate opening x maximum design head is 80 ft² or greater, provide the portion of the slide that engages the guide members 1/2 inch thick edge design where it engages the guide.
 - (2) Gates with the width of the gate opening x maximum design head is 120 ft² or greater, provide the portion of the slide that engages the guide members 3 inch thick edge design where it engages the guide.
 - d. Provide the stem connector constructed of two angles or plates welded to the slide. Provide a minimum of two bolts connecting the stem to the stem connector.
2. Deflection: Maximum of 1/720 of the span or 1/16 inch whichever is smaller, under design head specified.

L. Seals:

1. Provide a self-adjusting seal system suitable for the leakage, frequent cycling and velocities specified herein, and mounted such that there is no obstruction to the specified gate opening size.
2. Provide gates equipped with UHMW polyethylene seat/seals to restrict leakage and to prevent metal to metal contact between the frame and slide.
3. Extend the seat/seals to accommodate the 1.50 x the slide height with the gate in the fully open or fully closed position.
4. Provide all upward opening gates with a resilient flush bottom seal for sealing the invert of the gate.
5. Provide all downward opening weir gates with self-adjusting UHMW seat/seals across the invert member.
6. Provide all seals mechanically fastened to the frame or slide, force fit seals or seals attached with adhesive are not acceptable.

7. Provide all seats and seals to be field replaceable without the need to remove grout or concrete and without the need to remove the frame from the wall or wall thimble.
8. Gates using “J” or “P” seals are not acceptable.

M. Frames:

1. Provide frame assembly including guide members, invert members and yoke members constructed of formed stainless steel plate with a minimum thickness of 1/4-inch.
2. Provide gussets to support the guide members for unseating gates as required by the design head specified and indicated.
 - a. Provide gussets extended to support the outer portion of the guide assembly and positioned to transfer the load to the anchor bolts or the wall thimble studs.
3. Provide frames for mounting type as indicated in the Slide Gate Schedule:
 - a. Embedded.
 - b. Channel mounted.
 - c. Wall mounted with stainless steel anchor bolts and non-shrink, non-metallic grout, or EPDM gasket
 - d. Thimble mounted with stainless steel mounting studs and mastic gasket
4. Provide all wall mounted and thimble mounted gates with a flanged frame. Flat frame gates are not acceptable.
5. Provide all wall mounted and wall thimble mounted frames with a minimum guide weight of 11 lbs/ft and a minimum guide extension weight of 6.5 lbs/ft.
6. Provide guide extensions constructed of C-channel shape or similar. Angles are not acceptable guide extensions.
7. Frame Guides and Invert Members: Provide frames as a unitized one-piece, fully welded assembly.
 - a. Bolt together two-piece guide frames are not acceptable and will not be approved.
 - b. Bolt-on yokes are acceptable when necessary to facilitate slide removal.

- c. Frames that require field assembly are not acceptable unless the overall frame size exceeds a size suitable for shipment on a standard flatbed truck.
- 8. Provide the frame guides extending to accommodate the entire height of the slide when the slide is in the fully opened position on upward opening slide gates or downward opening weir gates.
- 9. For self-contained gates, provide a yoke across the top of the frame guides with the yoke formed by two structural members fixed to the top of the guides to provide a one-piece rigid frame.
 - a. Provide the yoke designed to allow removal of the slide.
- 10. Provide a rigid stainless steel invert member across the bottom of the opening.
 - a. Invert member: Flush bottom type on upward opening gates with a minimum weight as specified
- 11. Provide a rigid stainless steel top seal member across the top of the opening on gates designed to cover submerged openings.
- 12. Provide a rigid stainless steel member across the invert of the opening on downward opening weir gates.

N. Stems:

- 1. Provide a threaded operating stem to connect the operating mechanism to the slide.
- 2. For rising stem gates provide the threaded portion engaging the operating nut in the manual operator or motor actuator.
- 3. For non-rising stem gates provide the threaded portion engaging the nut on the slide.
- 4. Minimum stem outside diameter of 1-1/2 inches.
- 5. Stem extension pipes are not acceptable.
- 6. Provide the stem constructed of solid stainless steel bar for the entire length
- 7. Tensile strength: Not less than 60,000 psi for stems.
- 8. Provide the stem threaded to allow full travel of the slide unless otherwise specified or indicated.
- 9. L/R: Not to exceed 200.

10. Provide the stem, in tension, designed to withstand a load caused by a 40 pound effort on the crank or handwheel without exceeding 1/5 of the ultimate tensile strength of the stem material.
11. Provide the threaded portion of the stem machined rolled or cut full depth ACME type threads with 16 micro-inch or better finish. Stub threads are not acceptable.
12. Provide stems of more than one piece joined by bronze or stainless steel couplings with the coupling bolted to the stem.
13. Provide dual stems for upward opening gates wider than 60-inch when the opening width is 2 x greater or more than the height of the slide. Provide dual stems for downward opening gates wider than 48 inch when the opening width is 2 x greater or more than the height of the slide.
14. Provide stems on manually operated gates with an adjustable stop collar to prevent over closing of the gate.
15. For rising stem gates, provide clear plastic covers with 1-inch graduations. Provide vent holes to prevent condensation.

2.05 STEM GUIDES:

- A. Provide stem guides where required to maintain L/R of 200 or less for the unsupported length of the stem
- B. Provide stem guides and brackets of Type 316L stainless steel.
 1. Adjustable in two directions.
 2. Minimum thickness: 1/4-inch.
 3. Bushings: UHMW or bronze.

2.06 MANUAL OPERATORS:

- A. Floorstands and Wall Brackets:
 1. Provide a manually operated Type 316 stainless steel floorstand with removable crank, mounted on a wall bracket that is fastened to the operating platform.
 2. Provide Type 316 stainless steel floorstands of a height such that the crank operated pinion shaft is located 36 inches above the operating level.
 - a. Provide pinion shaft of sufficient length so the crank extends beyond the hand railing.
 3. Provide Type 316 stainless steel wall brackets to support floorstands.

- a. Provide wall brackets reinforced to withstand in compression a minimum of 2 x rated output of the operator with an 80 pound effort on the crank.
- 4. Provide two spare removable cranks.
 - B. Provide a gearbox with 316 stainless steel or CF8M housing, suitable for use with a portable operator.
 - C. Provide a threaded cast bronze lift nut to engage operating stem.
 - D. Provide roller bearings above and below a flange on the operating nut to support both opening and closing thrusts.
 - E. Operate gates under the operating head and design head, as specified and indicated, with no greater than a 40 pound effort on the crank.
 - F. Gears, where required, steel with machined cut teeth designed for smooth operation.
 - G. Provide Type 304 or 400 Series stainless steel pinion shafts on crank operated floorstands supported on tapered roller bearing or ball bearings with all components totally enclosed in a weatherproof housing with a removable cover.
 - 1. Design bearing arrangement for use with portable operators specified herein.
 - H. Provide mechanical seals on the operating nut and the pinion shafts to exclude moisture and dirt and prevent leakage of lubricant out of the hoist mechanism.
 - I. Provide lubricating fittings for the lubrication of all gears and bearings.
 - J. Floorstands: Provide a Type 316L stainless steel pedestal, constructed of minimum Schedule 40 tube and 3/8-inch thick base plates.
 - K. Permanently attach or cast an arrow with the word "OPEN" on the floorstand, indicating the direction of rotation to open the gate.
 - L. Cranks: Cast aluminum or stainless steel with revolving nylon grip and removable.
- 2.07 SHOP PAINTING:
 - A. Primer and Finish Paint: Shop apply to all exterior ferrous surfaces, (2) coats of high solids epoxy in accordance with Section 09940. Do not paint stainless steel.
 - B. Ferrous surfaces which are not to be painted to be given a shop applied coat of grease or rust resistant coating.
- 2.08 SHOP TESTING:
 - A. Assemble each gate and inspect for proper seating.

1. Check clearance between frame and disc seating surfaces.
- B. Fully open and close each gate in guide system to insure gates operate freely as recommended by the gate manufacturer.
- C. Conduct a shop leakage test at the design unseating head on each gate to confirm leakage as specified and indicated for Field Testing.
- D. Operate floorstand to insure proper assembly and operation.
- E. Repeat tests until specified results are obtained.
- F. Correct or replace promptly all defects or defective equipment revealed by or noted during tests at no additional cost to the Owner.

PART 3 - EXECUTION

3.01 INSTALLATION:

- A. Install items in accordance with shop drawings, manufacturer's printed instructions and as indicated.
- B. Clean debris, dirt, and gravel, from inside of gates and channels before placing gates.
- C. Install slide gates in completely assembled condition.
- D. Erect and support slide gates in positions free from distortion and strain on appurtenances during handling and installation.
- E. Inspect material for defects in workmanship and material.
- F. Clean out debris and foreign material from gate opening and seats, test operating mechanisms to check proper functioning, and check nuts and bolts for tightness. Repair gates and other equipment which do not operate easily or are otherwise defective.
- G. Set floorstand operators and stem guides so stems run smoothly in true alignment. Anchor guides firmly to walls. Check distances from centerlines of gates to operating level or base of floorstand and adjust if necessary to suit actual conditions of installation.

3.02 FIELD TESTING:

- A. Field testing will not be conducted without a procedure accepted by the Engineer.
- B. After installation of gates, and after inspection, operation, testing and adjustment have been completed by the manufacturer's field service technician, conduct operating and leakage test for each gate in presence of the Engineer to determine its ability to operate as specified, and to operate smoothly without jamming under specified conditions.

- C. Test all operators.
 - D. Leakage Test: Leakage not to exceed 0.05 gpm per foot of seal perimeter.
 - 1. Conduct tests at design heads shown in the slide gate schedule.
 - E. Immediately correct or replace all defects or defective equipment revealed by or noted during tests at no additional cost to the Owner.
 - F. Repeat tests until specified results are obtained.
 - G. Contractor to provide all water labor, piping, testing equipment for conducting tests.
 - H. Make all adjustments necessary to place equipment in specified working order at time of above tests.
 - I. Remove and replace equipment at no additional cost to the Owner with equipment that will meet all requirements specified and indicated if unable to demonstrate to the satisfaction of the Engineer that equipment will perform the service specified, indicated and as submitted.
- 3.03 CONTRACT CLOSEOUT:
- A. Provide in accordance with Section 01700.

END OF SECTION

SECTION 15112

STOP LOGS AND APPURTENANCES

PART 1 - GENERAL

1.01 DESCRIPTION:

- A. Provide stainless steel stop logs and appurtenances as indicated and in compliance with Contract Documents.

1.02 REFERENCES:

- A. ASTM International (ASTM):
 1. A240: Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
 2. A276: Standard Specifications for Stainless Steel Bars and Shapes.
 3. D2000: Standard Classification System for Rubber Products in Automotive Applications.
 4. D4020: Standard Specification for Ultra-High-Molecular-Weight Polyethylene Molding and Extrusion Materials.
- B. American Welding Society Code (AWS):
 1. D1.6: Structural Welding Code – Stainless Steel.

1.03 SUBMITTALS:

- A. Submit the following shop drawings in accordance with Section 01300:
 1. Detailed scope of supply.
 2. 11x17 certified to-scale drawings with title block specific to this job. Include plan, section, and details with dimensions in US customary units. Key all components to a short description with materials. Identify all connections with name, type, and size. Show anchor details and equipment weight.
 3. Product brochures for all components, annotated so it is clear which models, options, materials, and accessories are being provided. Cross out information that does not apply.
 4. Data for stop log characteristics and performance.
 5. Complete description of all materials, material thicknesses of all components.

6. Maximum bending stress and deflection of the stop logs under design head specified and indicated.
 7. Installation drawings showing the details required for installation, dimensions, clearances, and anchor bolt locations.
 8. Shop drawing data for accessory items.
 9. Certified setting plans, with tolerances, for anchor bolts.
 10. Manufacturer's literature as needed to supplement certified data.
 11. Operating and maintenance instructions and parts lists.
 12. Shop and field inspection reports.
 13. Qualifications of field service engineer.
 14. Recommendations for short and long-term storage.
 15. Field testing procedures and set up
 16. Special tools.
 17. The latest ISO 9001 series certification or quality system plan.
- B. A copy of the contract mechanical process and structural drawings, with addenda that are applicable to the equipment specified in this section, marked to show all changes necessary for the equipment proposed for this specification section. If no changes are required, mark all drawings with “No changes required” or provide a statement that no changes are required.
1. Failure to include all drawings or a statement applicable to the equipment specified in this section will result in submittal return without review until a complete package is submitted.
- C. A copy of this specification section with addenda and all referenced specification sections with addenda, with each paragraph check-marked to indicate specification compliance or marked and indexed to indicate requested deviations and clarifications from the specified requirements.
1. If deviations and clarifications from the specifications are indicated, therefore requested by the Contractor, provide a detailed written justification for each deviation and clarification.
 2. Failure to include a copy of the marked-up specification sections and or the detailed justifications for any requested deviation or clarification will result in submittal return without review until marked up specifications and justifications are submitted in a complete package.

1.04 SPARE PARTS:

- A. Comply with the requirements specified in Section 01600.
 - 1. One set of all special tools is required.

1.05 QUALITY ASSURANCE:

- A. Comply with the requirements specified in Section 01400.
- B. The Contractor to obtain stop logs, guide frames (grooves), and specified appurtenances from a single manufacturer.
- C. Stop logs to be the manufacturer's standard cataloged product and modified to provide compliance with the drawings and specifications.
- D. Stop logs and appurtenances to be fabricated, assembled, and tested in the United States of America.
- E. All welding to be accordance with latest applicable American Welding Society Code, ASME Welding Code or equivalent.
- F. Provide all welds performed by welders with AWS D1.2 certification for aluminum and AWS D1.6 or ASME Section IX certification for stainless steel.
- G. Finish: Mill finish on aluminum and stainless steel.
 - 1. Provide welds on aluminum cleaned to provide a uniform finish.
 - 2. Provide weld on stainless steel passivated in accordance with ASTM A380 to remove weld burn and scale.
- H. Provide the services of a factory-trained field service technician, specifically trained on type of equipment specified:
 - 1. Service technician to be present on site for all items listed below. Person-day requirements listed are exclusive of travel time, and do not relieve Contractor of the obligation to place equipment in operation as specified.
 - 2. Installation: Inspect grouting, location of anchor bolts; setting, leveling, alignment and field erection:
 - a. 1/2 person-day.
 - 3. Functional Testing: Check alignment and perform a functional test. Tests to include all items specified.
 - a. 1/2 person-day.

4. Testing: Field performance test equipment specified.
 - a. 1/2 person-day.
 5. Vendor Training: Provide classroom and field operation and maintenance instruction including all materials, slides, videos, handouts and preparation to lead and teach classroom sessions.
 - a. 1/2 person-day.
 6. Credit to the Owner, all unused service person-days specified above, at the manufacturer's published field service rate.
 7. Any additional time required of the factory trained field service technician to assist in placing the equipment in operation, or testing or to correct deficiencies in installation, equipment or material shall be provided at no additional cost to the Owner.
- I. Manufacturer of stop logs to have a minimum of (10) operating installations with stop logs of the size specified or larger and in the same service and head as specified operating for not less than (5) years or manufacturer of stop logs to utilize a Project Manager that is experienced in stop log design and construction. The Project Manager to be an employee of the gate manufacturer and to have designed a minimum of (10) operating installations with stop logs of the size specified or larger and in the same service and head as specified operating for not less than (5) years.

1.06 DELIVERY, STORAGE AND HANDLING:

- A. Comply with the requirements specified in Section 01610.

PART 2 - PRODUCTS

2.01 SYSTEM DESCRIPTION:

- A. Stop log sizes and operating data are indicated in the Stop Log Schedule.

2.02 MANUFACTURERS:

- A. Stop Logs:
 1. Whipps.
 2. RW Gate Co.
 3. Or an acceptable equipment product.

2.03 DESIGN CRITERIA:

- A. Stop log quantity, dimensions, and design head: As indicated in the Stop Log Schedule.
- B. Leakage rate: Maximum 0.05 gpm per foot of wetted seal perimeter.
- C. Provide all structural components of stop logs with strength to prevent distortion during normal handling, installation, and while in service as specified and indicated.

2.04 FRAMES GUIDES (GROOVES) AND INVERT MEMBERS:

- A. ASTM A240, Type 316L stainless steel plate with minimum 1/4-in thickness.
- B. Provide frame design to allow for embedded mounting or mounting directly to a wall with stainless steel anchor bolts and grout.
- C. Provide mounting style as indicated in the Stop Log Schedule.
- D. Provide a flush bottom invert member across the bottom of the guides.
- E. Frame mounted seals are not acceptable.

2.05 STOP LOGS:

- A. ASTM B308, 6061-T6 extruded aluminum with minimum 5/16-in thickness.
- B. Maximum bending stress at maximum operating head: 7,600 psi.
- C. Log design to prevent buoyancy and be self-draining.
- D. Stop logs to be capable of being stacked in any order and placed into grooves under their own weight without applying a downward force.
- E. Provide two slots in the top of each log for removal by stop log lifting device or hooked pike poles. Stop logs with protruding hooks or pins are not acceptable.
- F. Each stop log to have a welded nameplate indicating manufacturer, model number, opening width, design head, and seal material.
- G. Each stop log to have welded tags indicating dry and wet sides.
- H. Provide stop logs designed to prevent buoyance and to allow drainage.

2.06 SEALS:

- A. Lip seals: Urethane ASTM D4020, Neoprene ASTM D2000, or EPDM.
- B. Provide stop logs with a continuous resilient seal along the bottom and both sides to restrict leakage to the specified rate.

- C. All seals to be replaceable and mechanically retained to the stop logs.
- D. Stop logs using rubber “J” or “P” seals are not acceptable.

2.07 ANCHOR BOLTS:

- A. Type 316 stainless steel.
- B. Manufacturer to provide the necessary anchor studs, bolts, and nuts.
- C. Manufacturer to determine quantity and location.
- D. Minimum 1/2-in diameter.

2.08 LIFTING DEVICE:

- A. Manufacturer to provide (6x) 15-ft long pike poles with hand holds and hooks compatible with the lifting slots in the logs.

2.09 STORAGE RACKS:

- A. Not required.

PART 3 - EXECUTION

3.01 INSTALLATION:

- A. Install items in accordance with shop drawings, manufacturer's printed instructions and as indicated.
- B. Clean debris, dirt, and gravel, from inside of stop logs, guide frames and channels before placing stop logs.
- C. Install guide frames in a true vertical position and grout all voids between guide frames and walls.
- D. Inspect material for defects in workmanship and material.

3.02 FIELD TESTING:

- A. Field testing will not be conducted without a procedure and/or checklist accepted by the Engineer.
- B. After installation of guide frames, and after inspection, operation, testing and adjustment has been completed by the manufacturer’s field service technician, conduct an operating and leakage test for each stop log in the presence of the Engineer to determine its ability to operate as specified, and to operate smoothly without jamming under specified conditions.

- C. Test installation and removal of each stop log location with the number of stop logs as indicated.
 - D. Leakage Test: Leakage not to exceed 0.05 gpm per foot of seal perimeter.
 - 1. Conduct tests at design heads shown in the Stop Log Schedule.
 - E. Immediately correct or replace all defects or defective equipment revealed by or noted during tests at no additional cost to the Owner.
 - F. Repeat tests until specified results are obtained.
 - G. Contractor to provide all water labor, piping, testing equipment for conducting tests.
 - H. Make all adjustments necessary to place equipment in specified working order at time of above tests.
 - I. Remove all replace equipment at no additional cost to the Owner with equipment that will meet all requirements specified and indicated if unable to demonstrate to the satisfaction of the Engineer that equipment will perform the service specified, indicated and as submitted.
- 3.03 CONTRACT CLOSEOUT:
- A. Provide in accordance with Section 01700.

END OF SECTION

SECTION 15150

FLAP GATES AND APPURTENANCES

PART 1 - GENERAL

1.01 DESCRIPTION:

- A. Provide and test stainless steel pontoon type flap gates and appurtenances as indicated and in compliance with Contract Documents.

1.02 REFERENCES:

- A. ASTM International (ASTM):

1. A240: Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications
2. A276: Standard Specifications for Stainless Steel Bars and Shapes.
3. B584: Standard Specification for Copper Alloy Sand Castings for General Applications.
4. D2000: Standard Classification System for Rubber Products in Automotive Applications.

- B. American Welding Society Code.

1.03 SUBMITTALS:

- A. Submit the following shop drawings in accordance with Section 01300:

1. Certified shop and erection drawings. Contractor to submit electronic files of the proposed equipment in the capacity, size, and arrangement as indicated and specified.
2. Data for gate characteristics and performance.
3. Complete description of all materials, material thicknesses of all components.
4. Maximum bending stress and deflection of the slide under design head specified and indicated.
5. Installation drawings showing the details required for installation, dimensions, clearances and anchor bolt locations
6. Shop drawing data for accessory items.

7. Certified setting plans, with tolerances, for anchor bolts.
 8. Manufacturer's literature as needed to supplement certified data.
 9. Operating and maintenance instructions and parts lists.
 10. For manufacturers not named provide a listing of reference installations as specified with contact names and telephone numbers.
 11. List of recommended spare parts other than those specified.
 12. Shop and field inspection reports.
 13. Qualifications of field service engineer.
 14. Recommendations for short and long-term storage.
 15. Shop and field testing procedures and set up
 16. Special tools.
 17. The latest ISO 9001 series certification or quality system plan.
- B. A copy of the contract mechanical process and structural drawings, with addenda that are applicable to the equipment specified in this section, marked to show all changes necessary for the equipment proposed for this specification section. If no changes are required, mark all drawings with "No changes required" or provide a statement that no changes are required.
1. Failure to include all drawings or a statement applicable to the equipment specified in this section will result in submittal return without review until a complete package is submitted.
- C. A copy of this specification section with addenda and all referenced specification sections with addenda, with each paragraph check-marked to indicate specification compliance or marked and indexed to indicate requested deviations and clarifications from the specified requirements.
1. If deviations and clarifications from the specifications are indicated, therefore requested by the Contractor, provide a detailed written justification for each deviation and clarification.
 2. Failure to include a copy of the marked-up specification sections and or the detailed justifications for any requested deviation or clarification will result in submittal return without review until marked up specifications and justifications are submitted in a complete package.

1.04 SPARE PARTS:

- A. Comply with the requirements specified in Section 01600.
 - 1. One set of all special tools.

1.05 QUALITY ASSURANCE:

- A. Comply with the requirements specified in Section 01400.
- B. All flap gates to be the product of one manufacturer.
- C. Flap gates to be the manufacturer's standard cataloged product and modified to provide compliance with the drawings, specifications and the service conditions specified and indicated.
- D. Flap gates and appurtenances to be fabricated, assembled and tested in the United States of America or Canada.
- E. Welding: In accordance with latest applicable American Welding Society Code, ASME Welding Code, or equivalent.
- F. Factory tests as specified, including factory leakage testing of each flap gate at the design seating head to confirm compliance with the leakage rate specified and indicated.
- G. The Contractor to obtain the flap gates and appurtenances from the gate manufacturer, as a complete and integrated package to insure proper coordination and compatibility and operation of the system.
- H. Services of Manufacturer's Representative as stated in Section 01400 and as specified herein.
- I. Provide services of factory-trained Service Technician, specifically trained on type of equipment specified:
 - 1. Service Technician must be present on site for all items listed below. Person-day requirements listed are exclusive of travel time, and do not relieve Contractor of the obligation to place equipment in operation as specified.
 - 2. Installation: Inspect grouting, location of anchor bolts; setting, leveling, alignment, field erection:
 - a. 1/2 person-day.
 - 3. Functional Testing: Calibrate, check alignment and perform a functional test. Tests to include all items specified.
 - a. 1 person-day.

4. Field Performance Testing: Field performance test equipment specified.
 - a. 1 person-day.
 5. Vendor Training: Provide classroom and field operation and maintenance instruction including all materials, slides, videos, handouts and preparation to lead and teach classroom sessions.
 - a. 1/2 person-day.
 6. Credit to the Owner, all unused service person-days specified above, at the manufacturer's published field service rate.
 7. Any additional time required of the factory trained service technician to assist in placing the equipment in operation, or testing or to correct deficiencies in installation, equipment or material shall be provided at no additional cost to the Owner.
- J. Manufacturer of flap gates shall have a minimum of five (5) operating installations with gates of the size specified and in the same service as specified operating for not less than five (5) years.

1.06 DELIVERY, STORAGE AND HANDLING:

- A. Comply with the requirements specified in Section 01610.

PART 2 - PRODUCTS

2.01 SYSTEM DESCRIPTION:

- A. Flap gate sizes and operating data are indicated in the Flap Gate Schedule.

2.02 MANUFACTURERS:

- A. Flap Gates:
 1. Whipps
 2. RW Gate
 3. Acceptable Equivalent Product with unitized single piece frame as approved by the Engineer.

2.03 SEISMIC DESIGN REQUIREMENTS:

- A. Conform to the requirements indicated on the structural drawings and as specified in Section 01900.

- B. The Contractor shall conform to the seismic design requirements for this project and for the work of this specification section.
- C. Provide all equipment anchorage and supports designed in accordance with the seismic requirements indicated and specified.
- D. Additionally, provide with the Certificate of Unit Responsibility, certification for all equipment signed by a registered structural engineer stating that computations were performed and that all components have been sized for the seismic forces specified and indicated.

2.04 FLAP GATE CONSTRUCTION:

- A. Provide all flap gates produced by a single manufacturer and designed for installation in the channels, piping and structures as specified and indicated.
- B. Flap Gate Configuration: As indicated in the Flap Gate Schedule.
- C. Provide flap gates as specified herein and as indicated for each service. Provide flap gates utilizing a resilient seal around the perimeter of the opening. All structural components of the frame and flap to be fabricated of stainless steel having a minimum thickness of 1/4-inch (6.3 mm), as specified and adequate strength to prevent distortion during normal handling, during installation and while in service. Provide all welds performed by welders with AWS D1.6 certification.
- D. Provide gate assemblies media blasted or passivated in accordance with ASTM A380 prior to shipment to remove all mill scale, weld splatter, discoloration, or other surface imperfections.
- E. Leakage Rate:
 - 1. Seating head: Zero leakage.
- F. Materials:
 - 1. Frame: ASTM A240 Type 316L stainless steel.
 - 2. Flap, Stiffeners and Hinge Arms: ASTM A240 Type 316L stainless steel.
 - 3. Hinge Pin: ASTM A276 Type 316 stainless steel.
 - 4. Seal: ASTM D2000 Neoprene or EPDM
 - 5. Hinge Block: ASTM B584 Bronze
 - 6. Hardware, studs and nuts: ASTM A276 Type 316 stainless steel
 - 7. Anchor Bolts: ASTM A276 Type 316 stainless steel

G. Flap Gates:

1. Fabricate the frame of formed stainless steel plate with a minimum thickness of 3/8-inch.
 - a. Provide frame design of the flanged back type suitable for mounting directly to a wall with stainless steel anchor bolts and grout, a pipe flange or thimble as indicated.
 - b. Provide the flap gate with the angle of the flap when seated against the frame between 3 degrees and 7 degrees from the vertical. Provide lifting lugs on the top of the frame to facilitate installation.
2. Provide the hinge arms fabricated of formed stainless steel plate and provide dual hinge arms on all flap gates.
 - a. Provide hinge pins of a minimum diameter of 1-inch (25 mm) and constructed of solid stainless-steel rod.
 - b. Provide hinge arms designed based on 4 times the loads incurred while the flap is held in a horizontal position by its lifting eye.
 - c. Provide accessible Type 316 stainless steel grease fittings at all hinge points. Provide grease fittings for the upper hinge pins accessible from grade or operating level.
3. Provide the cellular pontoon flaps of welded stainless steel construction with individual foam filled compartments with a minimum metal thickness of 1/4-inch (6.3 mm).
 - a. Provide the flap designed to not deflect more than 1/360 of the span under the maximum design head.
 - b. Provide reinforcing stiffeners welded to the flap.
 - c. Provide a lifting lug on the bottom of the flap.
 - d. Provide internal compartments filled with urethane foam to form a watertight seal.
 - e. Provide the manufacturer's name, opening size and maximum head rating etched or cut from a stainless steel plate and welded on the flap.
 - f. Provide the flap designed to open when the upstream head exceeds the downstream head by 6 inches (150 mm).
4. Provide all flap gates with a seal system to restrict leakage in accordance with the requirements specified.

- a. Provide a resilient seal mounted to the seating surface of the frame to restrict leakage and hold the seals in place by a stainless steel retainer and stainless steel attachment bolts.
 - b. Provide the attachment bolts with a minimum diameter of 5/16-inch (8 mm).
 - c. Provide the seal system designed to accommodate frequent operation without loosening or suffering any damage.
 - d. Provide all seals bolted or mechanically fastened to the frame and mounted so as not to obstruct the water way opening.
 - e. Arrangements with seals that are force fit and/or held in place with adhesives are not acceptable.
5. All anchor bolts to be provided by the flap gate manufacturer for mounting the gates. Quantity and location to be determined by the flap gate manufacturer.
- a. Provide anchor bolts with a minimum diameter of 3/4-inch (19 mm) with maximum 12-inch (300 mm) centerline to centerline spacing.

2.05 FACTORY TESTING:

- A. Assemble each gate and inspect for proper seating.
 - 1. Shop assemble the flap gate and suspend vertically in the shop.
 - 2. Adjust the flap gate to excluded 0.004-inch feeler gauge between the seats.
- B. Repeat tests until specified results are obtained.
- C. Correct or replace promptly all defects or defective equipment revealed by or noted during tests at no additional cost to the Owner.

PART 3 - EXECUTION

3.01 INSTALLATION:

- A. Install items in accordance with shop drawings, manufacturer's printed instructions and as indicated.
- B. Clean debris, dirt, and gravel, from inside of flap gates and channels before placing flap gates.
- C. Install flap gates in completely assembled condition.
- D. Erect and support slide gates in positions free from distortion and strain on appurtenances during handling and installation.

- E. Inspect material for defects in workmanship and material.
- F. Clean out debris and foreign material from gate opening and seats, test operating mechanisms to check proper functioning, and check nuts and bolts for tightness. Repair gates and other equipment which do not operate easily or are otherwise defective.

3.02 FIELD TESTING:

- A. Field testing will not be conducted without a procedure accepted by the Engineer.
- B. After installation of flap gates, and after inspection, operation, testing and adjustment have been completed by the manufacturer's field service technician, conduct operating and leakage test for each gate in presence of the Engineer to determine its ability to operate as specified, and to operate smoothly without jamming under specified conditions.
 - 1. Leakage Allowance: Zero Leakage.
 - a. Conduct tests at design heads indicated in the Flap Gate Schedule.
- C. Immediately correct or replace all defects or defective equipment revealed by or noted during tests at no additional cost to the Owner.
- D. Repeat tests until specified results are obtained.
- E. Contractor to provide all water labor, piping, testing equipment for conducting tests.
- F. Make all adjustments necessary to place equipment in specified working order at time of above tests.
- G. Remove and replace equipment at no additional cost to the Owner with equipment that will meet all requirements specified and indicated if unable to demonstrate to the satisfaction of the Engineer that equipment will perform the service specified, indicated and as submitted.

3.03 CONTRACT CLOSEOUT:

- A. Provide in accordance with Section 01700.

END OF SECTION

APPENDIX A

SITE CONDITIONS

Project Number: Client: DCR			<div style="text-align: center;"> AECOM 250 Apollo Drive Chelmsford, Massachusetts </div>					Boring								
Site Location: Lowes Pond Dam Oxford, MA								Boring Number: B19-01 Sheet: 1 of 1 Surface Elevation (ft-asl): Equipment: Dietrich D-25				Well Data				
Project Manager: Wei Song			Field Tec Tony Wong-Li		Date Started: 6/13/2019		Inside Diameter: 4" Casing				Boring Depth: 18.5 ft					
Drilling Contractor: Northern Drilling			Driller: Justin Stevens		Date Completed: 6/13/2019		3" Casing				Screen length: Water Level:					
Depth	Sample Depth	Sample Number	Blow Counts (24")				Rec (%)	Sorting	Moisture	PID (ppm)	Field Identification	Description	p	Tube	Fill Mat	Depth
			0-6	6-12	12-18	18-24										
1	0-2	S-1	1	1	2	1	4	poor	dry		Refusal - off set 2 ft					1
2																2
3	2-4	S-2	2	2	4	5	2	well	dry		Black/white, well graded sand (SW), few (5%) fine gravel. Crushed rock in spoon					3
4																4
5	4-6	S-3	7	9	6	6	6	poor	dry		Brown, poorly graded sand and silt (SP-SM), C-F grained sand, little (15%) fines, few (5%) fine gravel, few (5%) brick fragments, wood, ash					5
6																6
7	6-8	S-4	2	3	15	7	10	poor	dry		Brown, SILTY SAND (SM), C-F grained sand, few (11%) gravel, little (18%) silt	11.4% Gravel, 70.2% Sand, 18.4% Fines				7
8																8
9	8-10	S-5	20	22	82	100/1	9	poor	dry		Brown, poorly graded sand with gravel (SP), C-F grained sand, some (40%) fine angular gravel. Weathered rock					9
10																10
11																11
12																12
13	13.5 -18.5										NX Core Barrel Fine grained Schist or Gneiss					13
14																14
15																15
16											13.5-14.5 feet - 6:12 min					16
17											14.5-15.5 feet - 5:24 min					17
18											15.5-16.5 feet - 6:47 min					18
19											16.5-17.5 feet - 6:53 min					19
20											17.5-18.5 feet - 6:50 min					20
21											End of Boring at 18.5 feet bgs					21
22																22
23																23
24																24
25																25
26																26
27																27
28																28
29																29
30																30
31																31
32																32
33																33
34																34
35																35
36											BDL = Below Detection Limits F=Fine, M=Medium, C=Coarse					36

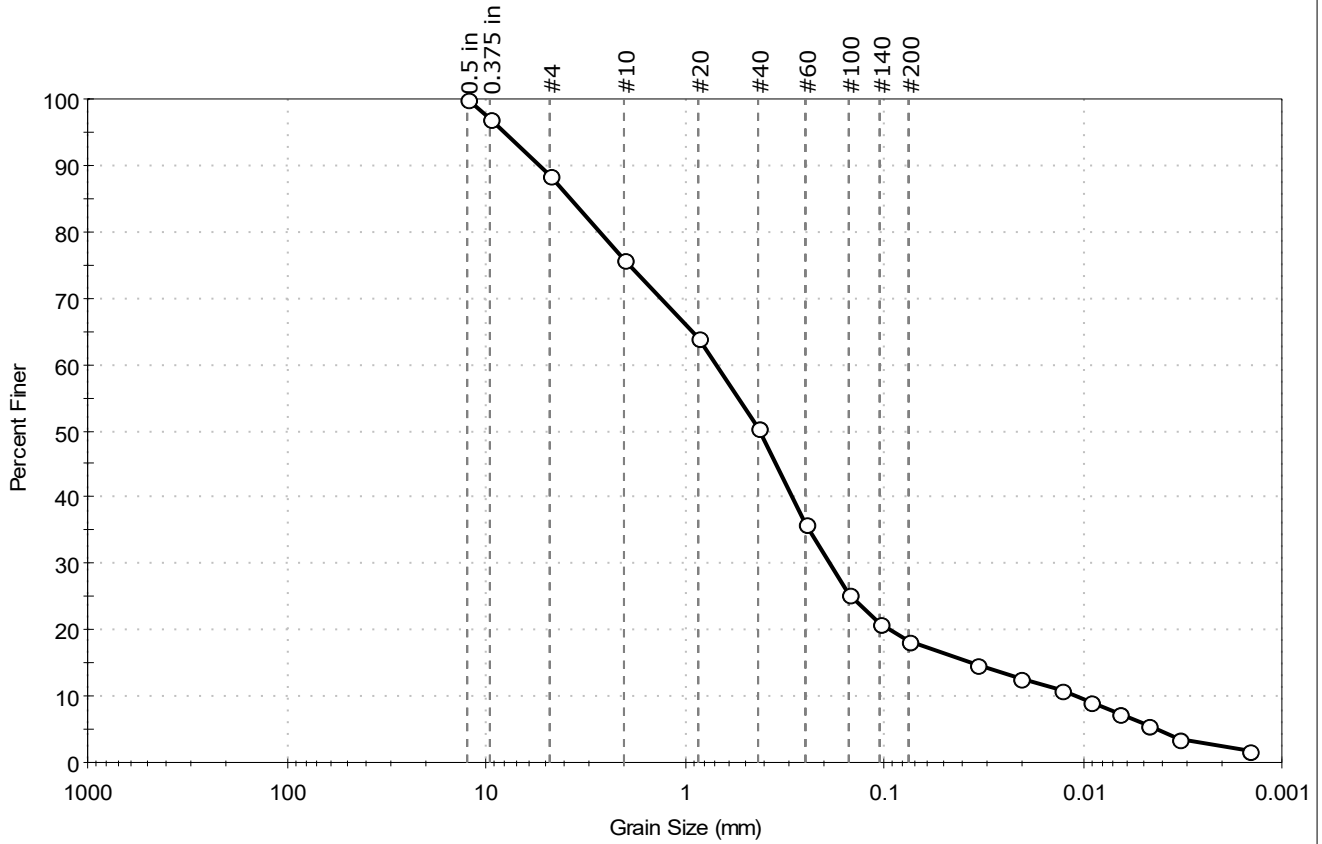
Project Number: Client: DCR			AECOM 250 Apollo Drive Chelmsford, Massachusetts							Boring						
Site Location: Lowes Pond Dam Oxford, MA										Boring Number: B19-02 Sheet: 1 of 1 Surface Elevation (ft-asl): Equipment: Dietrich D-25			Well Data			
Project Manager: Wei Song			Field Tec Tony Wong-Li			Date Started: 6/14/2019		Boring Depth: 15.5 ft								
Drilling Contractor: Northern Drilling			Driller: Justin Stevens			Date Completed: 6/14/2019		Screen length: 3' Casing								
Water Level:																
Depth	Sample Depth	Sample Number	Blow Counts (24")				Rec (%)	Sorting	Moisture	PID (ppm)	Field Identification	Description	p	Tube	Fill Mat.	Depth
			0-6	6-12	12-18	18-24										
1	0-2	S-1	2	3	3	8	7	poor	dry		Brown/black, poorly graded sand (SP), C-F graded sand, few (10%) fines, few (5%) fine rounded gravel trace roots and grass					1
2																2
3	2-4	S-2	7	10	17	40	5	poor	dry		Brown, poorly graded sand with gravel (SP), C-F graded sand, little (15%) fine gravel and broken rock fragments, few (10%) fines					3
4																4
5	4-6	S-3	6	6	4	11	6	poor	dry		Brown, SILTY SAND (SM), C-F graded sand, few (10%) fine gravel, little (20%) fines	9.7% Gravel, 70.4% Sand, 19.9% Fines				5
6																6
7	6-8	S-4	7	11	13	15	6	poor	dry		SAA					7
8																8
9	8-10	S-5	6	89	100/2	3	12	poor	dry		SAA - more rock fragments and weathered rock. Boulder at 7-9 feet 4" casing set at 9 ft					9
10											3" casing set at 10.5 ft					10
11	10.5-15.5										NX Core Barrel					11
12											10.5-11.5 feet - 3:52 min					12
13											11.5-12.5 feet - 4:15 min					13
14											12.5-13.5 feet - 3:16 min					14
15											13.5-14.5 feet - 3:48 min					15
16											14.5-15.5 feet - 4:33 min					16
17											Highly fractured fine grained schist					17
18											7% RQD					18
19											End of Boring at 15.5 feet bgs					19
20																20
21																21
22																22
23																23
24																24
25																25
26																26
27																27
28																28
29																29
30																30
31																31
32																32
33																33
34																34
35																35
36																36

BDL = Below Detection Limits
 F=Fine, M=Medium, C=Coarse



Client:	AECOM		
Project:	MADCR Six Dams		
Location:	Ashburnham, Oxford, Pittsfield, Walpole, & Freetow		Project No: GTX-310217
Boring ID:	B19-01	Sample Type:	jar
Sample ID:	SS-4	Test Date:	07/09/19
Depth:	6-8	Test Id:	512609
Test Comment:	---		
Visual Description:	Moist, gray silty sand		
Sample Comment:	---		

Particle Size Analysis - ASTM D6913/D7928



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	11.4	70.2	18.4

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.5 in	12.50	100		
0.375 in	9.50	97		
#4	4.75	89		
#10	2.00	76		
#20	0.85	64		
#40	0.42	50		
#60	0.25	36		
#100	0.15	25		
#140	0.11	21		
#200	0.075	18		
Hydrometer	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0339	15		
---	0.0207	13		
---	0.0127	11		
---	0.0093	9		
---	0.0065	7		
---	0.0047	5		
---	0.0033	4		
---	0.0015	2		

<u>Coefficients</u>	
D ₈₅ = 3.7159 mm	D ₃₀ = 0.1886 mm
D ₆₀ = 0.6892 mm	D ₁₅ = 0.0365 mm
D ₅₀ = 0.4183 mm	D ₁₀ = 0.0107 mm
C _u = 64.411	C _c = 4.823

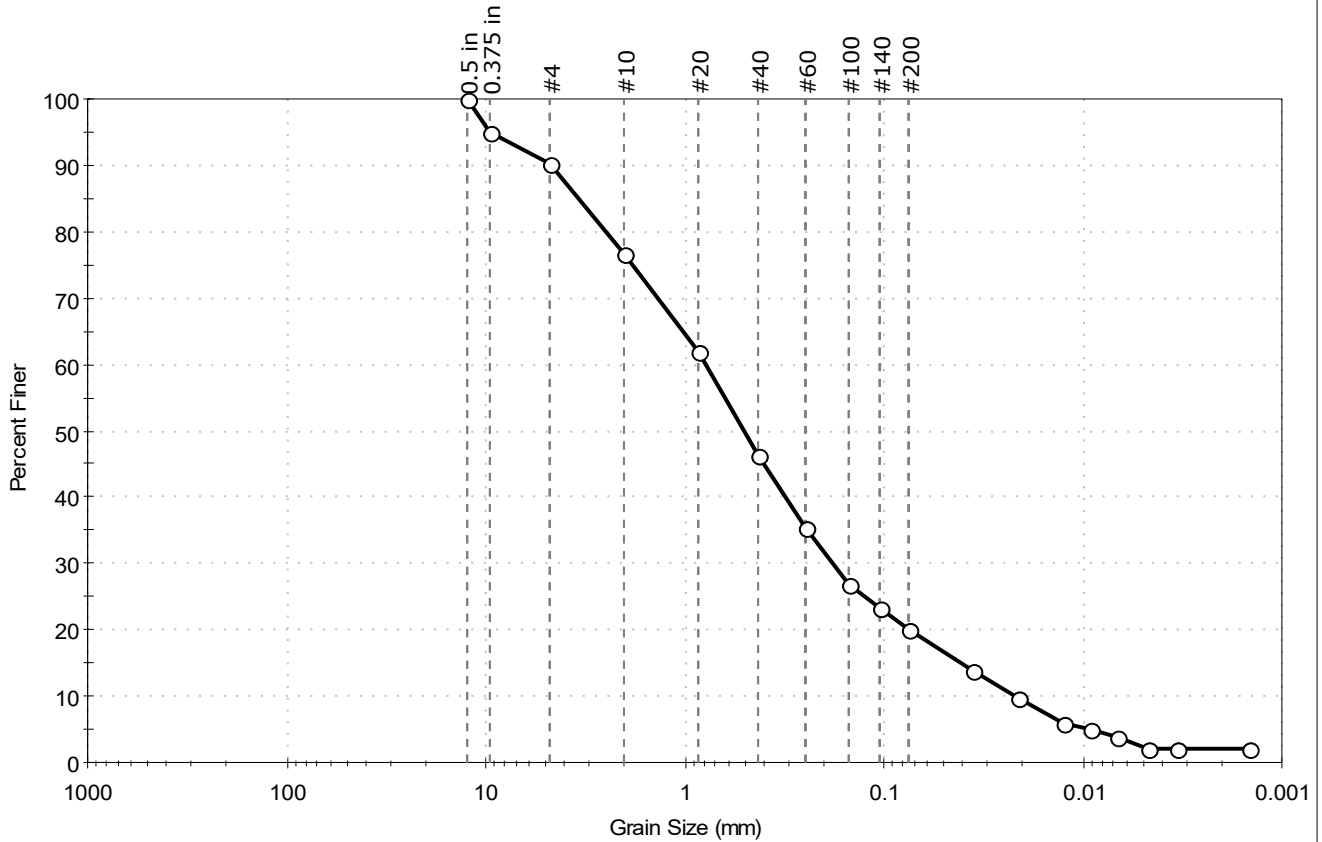
<u>Classification</u>	
<u>ASTM</u>	N/A
<u>AASHTO</u>	Silty Gravel and Sand (A-2-4 (0))

<u>Sample/Test Description</u>
Sand/Gravel Particle Shape : ROUNDED
Sand/Gravel Hardness : HARD
Dispersion Device : Apparatus A - Mech Mixer
Dispersion Period : 1 minute
Est. Specific Gravity : 2.65
Separation of Sample: #200 Sieve



Client:	AECOM		
Project:	MADCR Six Dams		
Location:	Ashburnham, Oxford, Pittsfield, Walpole, & Freetow		Project No: GTX-310217
Boring ID:	B19-02	Sample Type:	jar
Sample ID:	SS-3	Test Date:	07/09/19
Depth :	4-6	Checked By:	bfs
		Test Id:	512610
Test Comment:	---		
Visual Description:	Moist, dark brown silty sand		
Sample Comment:	---		

Particle Size Analysis - ASTM D6913/D7928



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	9.7	70.4	19.9

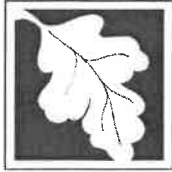
Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.5 in	12.50	100		
0.375 in	9.50	95		
#4	4.75	90		
#10	2.00	77		
#20	0.85	62		
#40	0.42	46		
#60	0.25	35		
#100	0.15	27		
#140	0.11	23		
#200	0.075	20		
Hydrometer	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0361	14		
---	0.0210	10		
---	0.0126	6		
---	0.0093	5		
---	0.0067	4		
---	0.0048	2		
---	0.0033	2		
---	0.0015	2		

<u>Coefficients</u>	
D ₈₅ = 3.3861 mm	D ₃₀ = 0.1803 mm
D ₆₀ = 0.7794 mm	D ₁₅ = 0.0415 mm
D ₅₀ = 0.4995 mm	D ₁₀ = 0.0213 mm
C _u = 36.592	C _c = 1.958

<u>Classification</u>	
<u>ASTM</u>	N/A
<u>AASHTO</u>	Stone Fragments, Gravel and Sand (A-1-b (0))

<u>Sample/Test Description</u>
Sand/Gravel Particle Shape : ROUNDED
Sand/Gravel Hardness : HARD
Dispersion Device : Apparatus A - Mech Mixer
Dispersion Period : 1 minute
Est. Specific Gravity : 2.65
Separation of Sample: #200 Sieve

PERMITS



Massachusetts Department of Environmental Protection
 Bureau of Resource Protection - Wetlands
WPA Form 5 – Order of Conditions
 Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Provided by MassDEP:
 255-874
 MassDEP File # _____
 eDEP Transaction # _____
 OXFORD
 City/Town

A. General Information (cont.)

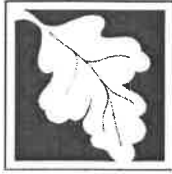
6. Property recorded at the Registry of Deeds for (attach additional information if more than one parcel):
 Worcester
 a. County Worcester b. Certificate Number (if registered land) 289
 3228
 c. Book 3228 d. Page 289
7. Dates: 10/3/2023 11/15/2023 11/28/2023
 a. Date Notice of Intent Filed b. Date Public Hearing Closed c. Date of Issuance
8. Final Approved Plans and Other Documents (attach additional plan or document references as needed):
 Lowes Pond Rehabilitation
 a. Plan Title Lowes Pond Rehabilitation
 AECOM Douglas Gove, Jr. Civil
 b. Prepared By AECOM c. Signed and Stamped by Douglas Gove, Jr. Civil
 11/1//2023
 d. Final Revision Date 11/1//2023 e. Scale 1" = 20'
 f. Additional Plan or Document Title _____ g. Date _____

B. Findings

1. Findings pursuant to the Massachusetts Wetlands Protection Act:
 Following the review of the above-referenced Notice of Intent and based on the information provided in this application and presented at the public hearing, this Commission finds that the areas in which work is proposed is significant to the following interests of the Wetlands Protection Act (the Act). Check all that apply:
- a. Public Water Supply b. Land Containing Shellfish c. Prevention of Pollution
 d. Private Water Supply e. Fisheries f. Protection of Wildlife Habitat
 g. Groundwater Supply h. Storm Damage Prevention i. Flood Control
2. This Commission hereby finds the project, as proposed, is: (check one of the following boxes)

Approved subject to:

- a. the following conditions which are necessary in accordance with the performance standards set forth in the wetlands regulations. This Commission orders that all work shall be performed in accordance with the Notice of Intent referenced above, the following General Conditions, and any other special conditions attached to this Order. To the extent that the following conditions modify or differ from the plans, specifications, or other proposals submitted with the Notice of Intent, these conditions shall control.



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B. Findings (cont.)

Denied because:

- b. the proposed work cannot be conditioned to meet the performance standards set forth in the wetland regulations. Therefore, work on this project may not go forward unless and until a new Notice of Intent is submitted which provides measures which are adequate to protect the interests of the Act, and a final Order of Conditions is issued. **A description of the performance standards which the proposed work cannot meet is attached to this Order.**
- c. the information submitted by the applicant is not sufficient to describe the site, the work, or the effect of the work on the interests identified in the Wetlands Protection Act. Therefore, work on this project may not go forward unless and until a revised Notice of Intent is submitted which provides sufficient information and includes measures which are adequate to protect the Act's interests, and a final Order of Conditions is issued. **A description of the specific information which is lacking and why it is necessary is attached to this Order as per 310 CMR 10.05(6)(c).**
- 3. Buffer Zone Impacts: Shortest distance between limit of project disturbance and the wetland resource area specified in 310 CMR 10.02(1)(a) _____ a. linear feet

Inland Resource Area Impacts: Check all that apply below. (For Approvals Only)

Resource Area	Proposed Alteration	Permitted Alteration	Proposed Replacement	Permitted Replacement
4. <input checked="" type="checkbox"/> Bank	150 a. linear feet	150 b. linear feet	150 c. linear feet	150 d. linear feet
5. <input type="checkbox"/> Bordering Vegetated Wetland	_____ a. square feet	_____ b. square feet	_____ c. square feet	_____ d. square feet
6. <input checked="" type="checkbox"/> Land Under Waterbodies and Waterways	13,900 + 15.6 Pond Acres 865 e. c/y dredged	13,900 + 15.6 Pond Acres 865 f. c/y dredged	13,900 + 15.6 Pond Acres	13,900 + 15.6 Pond Acres
7. <input checked="" type="checkbox"/> Bordering Land Subject to Flooding Cubic Feet Flood Storage	1,100 a. square feet 0 e. cubic feet	1,100 b. square feet 0 f. cubic feet	1,100 c. square feet g. cubic feet	1,100 d. square feet h. cubic feet
8. <input type="checkbox"/> Isolated Land Subject to Flooding Cubic Feet Flood Storage	_____ a. square feet _____ c. cubic feet	_____ b. square feet _____ d. cubic feet	_____ e. cubic feet	_____ f. cubic feet
9. <input checked="" type="checkbox"/> Riverfront Area	_____ a. total sq. feet 14,860 c. square feet 4,200 g. square feet	_____ b. total sq. feet 14,860 d. square feet 4,200 h. square feet	_____ 14,860 e. square feet 4,200 i. square feet	_____ 14,860 f. square feet 4,200 j. square feet



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B. Findings (cont.)

Coastal Resource Area Impacts: Check all that apply below. (For Approvals Only)

	Proposed Alteration	Permitted Alteration	Proposed Replacement	Permitted Replacement
10. <input type="checkbox"/> Designated Port Areas	Indicate size under Land Under the Ocean, below			
11. <input type="checkbox"/> Land Under the Ocean	_____	_____		
	a. square feet	b. square feet		
	_____	_____		
	c. c/y dredged	d. c/y dredged		
12. <input type="checkbox"/> Barrier Beaches	Indicate size under Coastal Beaches and/or Coastal Dunes below			
13. <input type="checkbox"/> Coastal Beaches	_____	_____	_____ cu yd	_____ cu yd
	a. square feet	b. square feet	c. nourishment	d. nourishment
14. <input type="checkbox"/> Coastal Dunes	_____	_____	_____ cu yd	_____ cu yd
	a. square feet	b. square feet	c. nourishment	d. nourishment
15. <input type="checkbox"/> Coastal Banks	_____	_____		
	a. linear feet	b. linear feet		
16. <input type="checkbox"/> Rocky Intertidal Shores	_____	_____		
	a. square feet	b. square feet		
17. <input type="checkbox"/> Salt Marshes	_____	_____	_____	_____
	a. square feet	b. square feet	c. square feet	d. square feet
18. <input type="checkbox"/> Land Under Salt Ponds	_____	_____		
	a. square feet	b. square feet		
	_____	_____		
	c. c/y dredged	d. c/y dredged		
19. <input type="checkbox"/> Land Containing Shellfish	_____	_____	_____	_____
	a. square feet	b. square feet	c. square feet	d. square feet
20. <input type="checkbox"/> Fish Runs	Indicate size under Coastal Banks, Inland Bank, Land Under the Ocean, and/or inland Land Under Waterbodies and Waterways, above			
	_____	_____		
	a. c/y dredged	b. c/y dredged		
21. <input type="checkbox"/> Land Subject to Coastal Storm Flowage	_____	_____		
	a. square feet	b. square feet		
22. <input type="checkbox"/> Riverfront Area	_____	_____		
	a. total sq. feet	b. total sq. feet		
Sq ft within 100 ft	_____	_____	_____	_____
	c. square feet	d. square feet	e. square feet	f. square feet
Sq ft between 100-200 ft	_____	_____	_____	_____
	g. square feet	h. square feet	i. square feet	j. square feet



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B. Findings (cont.)

* #23. If the project is for the purpose of restoring or enhancing a wetland resource area in addition to the square footage that has been entered in Section B.5.c (BVW) or B.17.c (Salt Marsh) above, please enter the additional amount here.

23. Restoration/Enhancement *:

a. square feet of BVW _____

b. square feet of salt marsh _____

24. Stream Crossing(s):

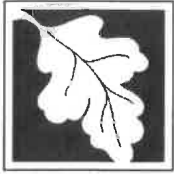
a. number of new stream crossings _____

b. number of replacement stream crossings _____

C. General Conditions Under Massachusetts Wetlands Protection Act

The following conditions are only applicable to Approved projects.

1. Failure to comply with all conditions stated herein, and with all related statutes and other regulatory measures, shall be deemed cause to revoke or modify this Order.
2. The Order does not grant any property rights or any exclusive privileges; it does not authorize any injury to private property or invasion of private rights.
3. This Order does not relieve the permittee or any other person of the necessity of complying with all other applicable federal, state, or local statutes, ordinances, bylaws, or regulations.
4. The work authorized hereunder shall be completed within three years from the date of this Order unless either of the following apply:
 - a. The work is a maintenance dredging project as provided for in the Act; or
 - b. The time for completion has been extended to a specified date more than three years, but less than five years, from the date of issuance. If this Order is intended to be valid for more than three years, the extension date and the special circumstances warranting the extended time period are set forth as a special condition in this Order.
 - c. If the work is for a Test Project, this Order of Conditions shall be valid for no more than one year.
5. This Order may be extended by the issuing authority for one or more periods of up to three years each upon application to the issuing authority at least 30 days prior to the expiration date of the Order. An Order of Conditions for a Test Project may be extended for one additional year only upon written application by the applicant, subject to the provisions of 310 CMR 10.05(11)(f).
6. If this Order constitutes an Amended Order of Conditions, this Amended Order of Conditions does not extend the issuance date of the original Final Order of Conditions and the Order will expire on 11/28/2026 unless extended in writing by the Department.
7. Any fill used in connection with this project shall be clean fill. Any fill shall contain no trash, refuse, rubbish, or debris, including but not limited to lumber, bricks, plaster, wire, lath, paper, cardboard, pipe, tires, ashes, refrigerators, motor vehicles, or parts of any of the foregoing.



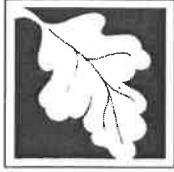
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C. General Conditions Under Massachusetts Wetlands Protection Act

8. This Order is not final until all administrative appeal periods from this Order have elapsed, or if such an appeal has been taken, until all proceedings before the Department have been completed.
9. No work shall be undertaken until the Order has become final and then has been recorded in the Registry of Deeds or the Land Court for the district in which the land is located, within the chain of title of the affected property. In the case of recorded land, the Final Order shall also be noted in the Registry's Grantor Index under the name of the owner of the land upon which the proposed work is to be done. In the case of the registered land, the Final Order shall also be noted on the Land Court Certificate of Title of the owner of the land upon which the proposed work is done. The recording information shall be submitted to the Conservation Commission on the form at the end of this Order, which form must be stamped by the Registry of Deeds, prior to the commencement of work.
10. A sign shall be displayed at the site not less than two square feet or more than three square feet in size bearing the words,

"Massachusetts Department of Environmental Protection" [or, "MassDEP"]
"File Number 255-874 "
11. Where the Department of Environmental Protection is requested to issue a Superseding Order, the Conservation Commission shall be a party to all agency proceedings and hearings before MassDEP.
12. Upon completion of the work described herein, the applicant shall submit a Request for Certificate of Compliance (WPA Form 8A) to the Conservation Commission.
13. The work shall conform to the plans and special conditions referenced in this order.
14. Any change to the plans identified in Condition #13 above shall require the applicant to inquire of the Conservation Commission in writing whether the change is significant enough to require the filing of a new Notice of Intent.
15. The Agent or members of the Conservation Commission and the Department of Environmental Protection shall have the right to enter and inspect the area subject to this Order at reasonable hours to evaluate compliance with the conditions stated in this Order, and may require the submittal of any data deemed necessary by the Conservation Commission or Department for that evaluation.
16. This Order of Conditions shall apply to any successor in interest or successor in control of the property subject to this Order and to any contractor or other person performing work conditioned by this Order.



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C. General Conditions Under Massachusetts Wetlands Protection Act (cont.)

17. Prior to the start of work, and if the project involves work adjacent to a Bordering Vegetated Wetland, the boundary of the wetland in the vicinity of the proposed work area shall be marked by wooden stakes or flagging. Once in place, the wetland boundary markers shall be maintained until a Certificate of Compliance has been issued by the Conservation Commission.
18. All sedimentation barriers shall be maintained in good repair until all disturbed areas have been fully stabilized with vegetation or other means. At no time shall sediments be deposited in a wetland or water body. During construction, the applicant or his/her designee shall inspect the erosion controls on a daily basis and shall remove accumulated sediments as needed. The applicant shall immediately control any erosion problems that occur at the site and shall also immediately notify the Conservation Commission, which reserves the right to require additional erosion and/or damage prevention controls it may deem necessary. Sedimentation barriers shall serve as the limit of work unless another limit of work line has been approved by this Order.
19. The work associated with this Order (the "Project")
- (1) is subject to the Massachusetts Stormwater Standards
 - (2) is NOT subject to the Massachusetts Stormwater Standards

If the work is subject to the Stormwater Standards, then the project is subject to the following conditions:

- a) All work, including site preparation, land disturbance, construction and redevelopment, shall be implemented in accordance with the construction period pollution prevention and erosion and sedimentation control plan and, if applicable, the Stormwater Pollution Prevention Plan required by the National Pollution Discharge Elimination System Construction General Permit as required by Stormwater Condition 8. Construction period erosion, sedimentation and pollution control measures and best management practices (BMPs) shall remain in place until the site is fully stabilized.
- b) No stormwater runoff may be discharged to the post-construction stormwater BMPs unless and until a Registered Professional Engineer provides a Certification that:
 - i.* all construction period BMPs have been removed or will be removed by a date certain specified in the Certification. For any construction period BMPs intended to be converted to post construction operation for stormwater attenuation, recharge, and/or treatment, the conversion is allowed by the MassDEP Stormwater Handbook BMP specifications and that the BMP has been properly cleaned or prepared for post construction operation, including removal of all construction period sediment trapped in inlet and outlet control structures;
 - ii.* as-built final construction BMP plans are included, signed and stamped by a Registered Professional Engineer, certifying the site is fully stabilized;
 - iii.* any illicit discharges to the stormwater management system have been removed, as per the requirements of Stormwater Standard 10;



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C. General Conditions Under Massachusetts Wetlands Protection Act (cont.)

- iv. all post-construction stormwater BMPs are installed in accordance with the plans (including all planting plans) approved by the issuing authority, and have been inspected to ensure that they are not damaged and that they are in proper working condition;
- v. any vegetation associated with post-construction BMPs is suitably established to withstand erosion.
- c) The landowner is responsible for BMP maintenance until the issuing authority is notified that another party has legally assumed responsibility for BMP maintenance. Prior to requesting a Certificate of Compliance, or Partial Certificate of Compliance, the responsible party (defined in General Condition 18(e)) shall execute and submit to the issuing authority an Operation and Maintenance Compliance Statement ("O&M Statement") for the Stormwater BMPs identifying the party responsible for implementing the stormwater BMP Operation and Maintenance Plan ("O&M Plan") and certifying the following:
- i.) the O&M Plan is complete and will be implemented upon receipt of the Certificate of Compliance, and
 - ii.) the future responsible parties shall be notified in writing of their ongoing legal responsibility to operate and maintain the stormwater management BMPs and implement the Stormwater Pollution Prevention Plan.
- d) Post-construction pollution prevention and source control shall be implemented in accordance with the long-term pollution prevention plan section of the approved Stormwater Report and, if applicable, the Stormwater Pollution Prevention Plan required by the National Pollution Discharge Elimination System Multi-Sector General Permit.
- e) Unless and until another party accepts responsibility, the landowner, or owner of any drainage easement, assumes responsibility for maintaining each BMP. To overcome this presumption, the landowner of the property must submit to the issuing authority a legally binding agreement of record, acceptable to the issuing authority, evidencing that another entity has accepted responsibility for maintaining the BMP, and that the proposed responsible party shall be treated as a permittee for purposes of implementing the requirements of Conditions 18(f) through 18(k) with respect to that BMP. Any failure of the proposed responsible party to implement the requirements of Conditions 18(f) through 18(k) with respect to that BMP shall be a violation of the Order of Conditions or Certificate of Compliance. In the case of stormwater BMPs that are serving more than one lot, the legally binding agreement shall also identify the lots that will be serviced by the stormwater BMPs. A plan and easement deed that grants the responsible party access to perform the required operation and maintenance must be submitted along with the legally binding agreement.
- f) The responsible party shall operate and maintain all stormwater BMPs in accordance with the design plans, the O&M Plan, and the requirements of the Massachusetts Stormwater Handbook.



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C. General Conditions Under Massachusetts Wetlands Protection Act (cont.)

- g) The responsible party shall:
1. Maintain an operation and maintenance log for the last three (3) consecutive calendar years of inspections, repairs, maintenance and/or replacement of the stormwater management system or any part thereof, and disposal (for disposal the log shall indicate the type of material and the disposal location);
 2. Make the maintenance log available to MassDEP and the Conservation Commission ("Commission") upon request; and
 3. Allow members and agents of the MassDEP and the Commission to enter and inspect the site to evaluate and ensure that the responsible party is in compliance with the requirements for each BMP established in the O&M Plan approved by the issuing authority.
- h) All sediment or other contaminants removed from stormwater BMPs shall be disposed of in accordance with all applicable federal, state, and local laws and regulations.
- i) Illicit discharges to the stormwater management system as defined in 310 CMR 10.04 are prohibited.
- j) The stormwater management system approved in the Order of Conditions shall not be changed without the prior written approval of the issuing authority.
- k) Areas designated as qualifying pervious areas for the purpose of the Low Impact Site Design Credit (as defined in the MassDEP Stormwater Handbook, Volume 3, Chapter 1, Low Impact Development Site Design Credits) shall not be altered without the prior written approval of the issuing authority.
- l) Access for maintenance, repair, and/or replacement of BMPs shall not be withheld. Any fencing constructed around stormwater BMPs shall include access gates and shall be at least six inches above grade to allow for wildlife passage.

Special Conditions (if you need more space for additional conditions, please attach a text document):

Conditions Continue on Pages 9A-9C.

20. For Test Projects subject to 310 CMR 10.05(11), the applicant shall also implement the monitoring plan and the restoration plan submitted with the Notice of Intent. If the conservation commission or Department determines that the Test Project threatens the public health, safety or the environment, the applicant shall implement the removal plan submitted with the Notice of Intent or modify the project as directed by the conservation commission or the Department.

General Conditions (continued)

21. The ORDER OF CONDITIONS AGREEMENT FORM must be filled out and signed by the Applicant and Owner, and submitted to the Conservation Office within 14 days of Issuance of the Order of Conditions. No work shall commence until the completed form is submitted.
22. In addition to the recording requirements of Condition # 9, this Order shall be recorded prior to the sale or transfer of the property. Upon sale or transfer of the property while this Order is still open, the applicant shall notify the Conservation Commission in writing of the new owner's name, address and phone number.
23. All requirements of this Order of Conditions shall continue in force until a Certificate of Compliance is issued and has been recorded at the Registry of Deeds or the Land Court for the district which it is located, within the chain of title of the affected property.
24. The Commission shall be informed in writing of all changes that may be made to the approved plans. All changes affecting jurisdictional resource areas or buffer zones shall be presented to the Commission and may require additional approvals should the Commission deem necessary.
25. The applicant and/or landowner shall notify the Commission in writing at least five (5) business days prior to commencing with any activity on the project site.
26. During the construction phase of this project, the on-site foreman, directing engineer or design construction manager, shall have a copy of this Order at the site and familiarize themselves with the conditions of this Order and adhere to its conditions.
27. A copy of this Order of Conditions shall be onsite at all times while construction activities regulated by this order are being performed.
28. The Commission reserves the right to impose additional conditions to protect the interests of the Wetland Protection Act and its Regulations 310 CMR 10.00 if any activity in conjunction with this project results in un-permitted alteration to the identified wetland resource area or any noticeable degradation of surface water quality discharging from the site.
29. Any damage caused as a direct result of this project to any wetland resource area shall be the responsibility of the applicant and/or the landowner to repair, restore or replace the wetland features, which have been altered. The Commission shall be notified immediately as to any wetland alteration, which has occurred on the project site. Any plans to abate the problem or restoration of the wetland shall be submitted to the Commission for their approval prior to any further work.
30. Floating oil absorbent booms shall be used in the water whenever there is any hydraulic equipment within 40 feet of any waterline, in the event of a hydraulic leak. The booms must be strung in a contiguous line and secured to the bank a minimum of 20 feet on either side of the proposed activity. The booms must be positioned in the water to capture a possible oil leak/spray up to 40 feet from the equipment. Oil absorbent pads shall also be kept on site whenever hydraulic equipment is on site. Used booms and pads shall be stored in a leak-proof container and disposed of properly.

31. The applicant shall ensure that no invasive plant species, as defined and listed as Invasive, Likely Invasive, or Potentially Invasive by the Massachusetts Invasive Plant Advisory Group, <https://www.massnrc.org/MIPAG/>, are introduced or spread around the site by construction activities including but not limited to improperly cleaned construction equipment and importation of infected materials such as fill, compost, nursery stock, seed, or hay bales. Corrective measures, if necessary, shall be made by the applicant for as long as necessary to eliminate the introduced invasive plant species and prevent re-establishment of same.

Erosion & Sediment Control

32. The erosion and sedimentation control (ESC) shall be installed and located on the property, in accordance with the approved design plan, sketch and/or details provided with the Notice of Intent filing.
33. The location of the ESC shall be established and delineated in the field by a licensed surveyor or professional engineer according to the approved plans for all engineered projects.
34. Once the ESC is installed, the applicant shall contact the Conservation Commission at 508-987-6044 for an inspection. No clearing of vegetation, cutting of trees, or disturbance of soil shall occur prior to the Commission's inspection and approval of the ESC.
35. Sedimentation shall be removed from the ESC once the height of the sediment reaches halfway up the control. Sediment shall also be removed prior to replacement/removal of the sediment control. All stockpile material, excavated material, vegetation debris, and other materials shall not be placed up against the ESC.
36. The location of the sediment controls on the site shall provide a defined limit of construction activities. No work shall be performed beyond the sediment control line.
37. All areas of construction shall be inspected at the close of each construction day by the Site Supervisor. Sediment and erosion control measures shall be inspected and maintained or reinforced as needed at this time and prior to any further construction activities.

Site Stabilization

38. Interim and permanent stabilization measures shall be instituted on all disturbed or exposed soil surfaces as soon as practicable but no more than 14 days after construction activity has ceased on that portion of the site. Surfaces shall be stabilized in accordance with the Massachusetts Department of Environmental Protection Erosion and Sediment Control Guidelines for Urban and Suburban Areas.
39. All final earth contours shall be permanently stabilized by the application of loam, seed and/or sod. Stabilized areas may include landscaped areas, which may include ornamental plantings with a minimum of four (4) inches of bark mulch to prevent erosion.

Material Storage

40. All soil, debris, fill and excavated materials shall be stockpiled outside of the 100-foot buffer zone to wetland resource areas wherever feasible.
41. Construction materials and equipment shall be stored in a manner and location that will limit compaction of soils and the concentration of the surface runoff.
42. All toxic substances used in construction or for equipment, i.e. oil, gasoline, fuels, lubricants, etc. shall be stored outside of the 100-foot buffer zone to wetland resource areas. The manner in which these items are stored shall prevent others from gaining access to such toxic substances or from having any possible spillage and eventual alteration to the wetland area.

Stormwater Management

43. This Order of Conditions shall serve as the Land Disturbance Administrative Approval in accordance with the Town of Oxford General By-Laws Chapter 66.
44. All underground drainage and stormwater conveyance structures must be inspected by a representative of the Town of Oxford prior to backfilling. The applicant must contact the Oxford DPW at 508-987-6006 to schedule such inspection.
45. An as-built plan showing the location of all approved structures and site improvements including final grades and the designer's certification, stating that the work has been completed in accordance with the approved plan and this Order, shall be submitted with the Request for Certificate of Compliance or a request for occupancy. Said certification shall be preferably from the same engineer as on the approved stamped plans on file. The certification shall bear the engineer's professional seal, signature and date and shall include a statement indicating that the stormwater management system required by the Oxford General By-Laws, as constructed, is built in accordance with the approved plan and this Order. Occupancy or use shall not be allowed until this condition is satisfied.

Post Construction

46. Upon completion of the project, all disturbed areas shall be permanently stabilized with rapidly growing cover with sufficient topsoil to assure long term stabilization. A Certificate of Compliance will not be issued for any project until a dense cover of grass at least four (4) inches in height can be shown over all areas which were disturbed.

Special Conditions

47. Additional turbidity controls and erosion control measures shall be implemented as construction period conditions dictate.



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D. Findings Under Municipal Wetlands Bylaw or Ordinance

1. Is a municipal wetlands bylaw or ordinance applicable? Yes No
2. The _____ hereby finds (check one that applies):
Conservation Commission
 - a. that the proposed work cannot be conditioned to meet the standards set forth in a municipal ordinance or bylaw, specifically:

1. Municipal Ordinance or Bylaw	2. Citation
---------------------------------	-------------

Therefore, work on this project may not go forward unless and until a revised Notice of Intent is submitted which provides measures which are adequate to meet these standards, and a final Order of Conditions is issued.
 - b. that the following additional conditions are necessary to comply with a municipal ordinance or bylaw:

1. Municipal Ordinance or Bylaw	2. Citation
---------------------------------	-------------
3. The Commission orders that all work shall be performed in accordance with the following conditions and with the Notice of Intent referenced above. To the extent that the following conditions modify or differ from the plans, specifications, or other proposals submitted with the Notice of Intent, the conditions shall control.
The special conditions relating to municipal ordinance or bylaw are as follows (if you need more space for additional conditions, attach a text document):



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E. Signatures

This Order is valid for three years, unless otherwise specified as a special condition pursuant to General Conditions #4, from the date of issuance.

11/28/2023
 1. Date of Issuance

Please indicate the number of members who will sign this form.

4
 2. Number of Signers

This Order must be signed by a majority of the Conservation Commission.

The Order must be mailed by certified mail (return receipt requested) or hand delivered to the applicant. A copy also must be mailed or hand delivered at the same time to the appropriate Department of Environmental Protection Regional Office, if not filing electronically, and the property owner, if different from applicant.

Paul Cunningham
 Signature

Paul Cunningham
 Printed Name

Albert Shahnarian
 Signature

Albert Shahnarian
 Printed Name

Tom O'Neill
 Signature

Tom O'Neill
 Printed Name

Arthur Firl
 Signature

Arthur Firl
 Printed Name

William Zoldak
 Signature

William Zoldak
 Printed Name

 Signature

Sheila P. Conroy
 Printed Name

 Signature

Wayne McFarland
 Printed Name

 Signature

 Printed Name

by hand delivery on _____
 Date

by certified mail, return receipt requested, on 11/28/2023
 Date



Massachusetts Department of Environmental Protection
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F. Appeals

The applicant, the owner, any person aggrieved by this Order, any owner of land abutting the land subject to this Order, or any ten residents of the city or town in which such land is located, are hereby notified of their right to request the appropriate MassDEP Regional Office to issue a Superseding Order of Conditions. The request must be made by certified mail or hand delivery to the Department, with the appropriate filing fee and a completed Request for Departmental Action Fee Transmittal Form, as provided in 310 CMR 10.03(7) within ten business days from the date of issuance of this Order. A copy of the request shall at the same time be sent by certified mail or hand delivery to the Conservation Commission and to the applicant, if he/she is not the appellant.

Any appellants seeking to appeal the Department's Superseding Order associated with this appeal will be required to demonstrate prior participation in the review of this project. Previous participation in the permit proceeding means the submission of written information to the Conservation Commission prior to the close of the public hearing, requesting a Superseding Order, or providing written information to the Department prior to issuance of a Superseding Order.

The request shall state clearly and concisely the objections to the Order which is being appealed and how the Order does not contribute to the protection of the interests identified in the Massachusetts Wetlands Protection Act (M.G.L. c. 131, § 40), and is inconsistent with the wetlands regulations (310 CMR 10.00). To the extent that the Order is based on a municipal ordinance or bylaw, and not on the Massachusetts Wetlands Protection Act or regulations, the Department has no appellate jurisdiction.



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G. Recording Information

Prior to commencement of work, this Order of Conditions must be recorded in the Registry of Deeds or the Land Court for the district in which the land is located, within the chain of title of the affected property. In the case of recorded land, the Final Order shall also be noted in the Registry's Grantor Index under the name of the owner of the land subject to the Order. In the case of registered land, this Order shall also be noted on the Land Court Certificate of Title of the owner of the land subject to the Order of Conditions. The recording information on this page shall be submitted to the Conservation Commission listed below.

Oxford Conservation Commission
 Conservation Commission

Detach on dotted line, have stamped by the Registry of Deeds and submit to the Conservation Commission.

To:

Conservation Commission

Please be advised that the Order of Conditions for the Project at:

Project Location

MassDEP File Number

Has been recorded at the Registry of Deeds of:

County

Book

Page

for:

Property Owner

and has been noted in the chain of title of the affected property in:

Book

Page

In accordance with the Order of Conditions issued on:

Date

If recorded land, the instrument number identifying this transaction is:

Instrument Number

If registered land, the document number identifying this transaction is:

Document Number

Signature of Applicant



DEPARTMENT OF THE ARMY
US ARMY CORPS OF ENGINEERS
NEW ENGLAND DISTRICT
696 VIRGINIA ROAD
CONCORD MA 01742-2751

March 5, 2024

Regulatory Division
File Number: NAE-2021-02497

William Salomaa
Massachusetts Department of Conservation & Recreation – Office of Dam Safety
10 Park Plaza Suite 6620
Boston, Massachusetts 02116
Sent by email: william.salomaa@mass.gov

Dear Mr. Salomaa,

The U.S. Army Corps of Engineers (USACE) has reviewed your application to permanently impact 1,200 square feet and temporarily impact 12,750 square feet of land under Ordinary High Water (OHW) Mark for the purposes of bringing the dam into compliance with Mass DCR's Office of Dam Safety regulations. Associated work will include the removal of 865 cubic yards of accumulated sediment from within an 8,000 square foot area, temporarily impacting 3,770 square feet for installation of the cofferdam and by-pass flow pump upstream of the spillway, and 980 square feet for dewatering within the spillway structure and cofferdam. The area to be excavated will be surrounded by a temporary cofferdam to be installed upstream of the existing spillway, and the area inside the cofferdam will be dewatered with a by-pass flow pumping system. The cofferdam will be located along the limit of work within the reservoir. The project is located in Lowe's Pond and Lowe's Brook at 3 Huguenot Road, Oxford, Massachusetts. The work is shown on the enclosed plans titled "Lowe's Pond Dam Rehabilitation," on 23 sheets, and dated "September, 2023."

Based on the information that you have provided, we verify that the activity is authorized under General Permit # 2 and 24 of the June 2, 2023, federal permit known as the Massachusetts General Permits (GPs). The GPs are available at <https://www.nae.usace.army.mil/Missions/Regulatory/State-General-Permits/Massachusetts-General-Permit>.

Please review the enclosed GPs carefully, in particular the general conditions beginning on page 35, and ensure that you and all personnel performing work authorized by the GPs are fully aware of and comply with its terms and conditions. A copy of the GPs and this verification letter shall be available at the work site as required by General Condition 17. You must perform this work in compliance with the following special condition:

- You must complete and return the enclosed Certificate of Compliance within one month following the completion of the authorized work.

This authorization expires on June 1, 2028. You must commence or have under contract to commence the work authorized herein by June 1, 2028, and complete the work by June 1, 2029. If not, you must contact this office to determine the need for further authorization and we recommend you contact us *before* the work authorized herein expires. Please contact us immediately if you change the plans or construction methods for work within our jurisdiction as we must approve any changes before you undertake them. Performing work within our jurisdiction that is not specifically authorized by this determination or failing to comply with the special condition(s) provided above or all the terms and conditions of the GPs may subject you to the enforcement provisions of our regulations.

This authorization does not obviate the need to obtain other federal, state, or local authorizations required by law. Applicants are responsible for applying for and obtaining any other approvals.

We continually strive to improve our customer service. To better serve you, we would appreciate your completing our Customer Service Survey located at <https://regulatory.ops.usace.army.mil/customer-service-survey>.

Please contact Abigail Thrall of my staff at abigail.e.thrall@usace.army.mil or (978) 778-6479 if you have any questions.

Sincerely,

Paul Maniccia

Paul Maniccia
Chief, Permits & Enforcement Section
Regulatory Division

cc:

Jennifer Doyle-Breen, AECOM; jennifer.doyle-breen@aecom.com

Ed Reiner, U.S. EPA, Region 1, Boston, MA, reiner.ed@epa.gov

Rachel Croy, U.S. EPA, Region 1, Boston, MA, croy.rachel@epa.gov

DEP CERO, Wetlands and Waterways, Worcester, MA; cero_noi@mass.gov

David Wong, MassDEP, david.w.wong@mass.gov

David Robinson, MA Board of Underwater Archaeological Resources (BUAR);
david.s.robinson@mass.gov

Oxford Conservation Commission, jlochner@town.oxford.ma.us



US Army Corps
of Engineers®
New England District

COMPLIANCE CERTIFICATION FORM

(Minimum Notice: Permittee must sign and return notification
within one month of the completion of work.)

Permit Number: _____

Project Manager: _____

Name of Permittee: _____

Permit Issuance Date: _____

Note: Choose one of the following. Choose the 2nd when mitigation required.

Please sign this certification and return it to our office upon completion of the activity.

Please sign this certification and return it to our office upon completion of the activity and any mitigation required by the permit. You must submit this after the mitigation is complete, but not after the mitigation monitoring, which requires separate submittals.

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*****
* E-MAIL TO: cenae-r-ma@usace.army.mil; or *
* * * * *
* MAIL TO: Massachusetts Section *
* Regulatory Division *
* U.S. Army Corps of Engineers, New England District *
* 696 Virginia Road *
* Concord, MA 01742-2751 *
*****

```

Please note that your permitted activity is subject to a compliance inspection by an U.S. Army Corps of Engineers representative. If you fail to comply with this permit you are subject to permit suspension, modification, or revocation.

I hereby certify that the work authorized by the above referenced permit was completed in accordance with the terms and conditions of the above referenced permit, and any required mitigation was completed in accordance with the permit conditions.

Signature of Permittee

Date

Printed Name

Date of Work Completion

() _____
Telephone Number

() _____
Telephone Number



Commonwealth of Massachusetts
Executive Office of Energy & Environmental Affairs

Department of Environmental Protection

100 Cambridge Street 9th Floor Boston, MA 02114 • 617-292-5500

Maura T. Healey
Governor

Kimberley Driscoll
Lieutenant Governor

Rebecca L. Tepper
Secretary

Bonnie Heiple
Commissioner

January 12, 2024

William Salomaa
Massachusetts Department of
Conservation and Recreation
Office of Dam Safety
Ten Park Plaza
Boston, MA 02116

WQC APPLICATION # 23-WW08-0018-APP
DEP File # 255-0874
EEA # 16571
NAE-2021-02497

RE: 401 WATER QUALITY CERTIFICATION
Application for: BRP WW 08
WATER QUALITY CERTIFICATION FOR DREDGING – MINOR PROJECT

AT: Lowes Pond Dam – Oxford
French River Basin

Dear Mr. Salomaa:

The Department of Environmental Protection (“MassDEP”) has reviewed your application for a 401 Water Quality Certification for Dredging (“401 WQC”), as referenced above and is basing its certification upon an evaluation of the information contained in the application which is relevant to water quality considerations. In accordance with the provisions of Section 401 of the Federal Clean Water Act (33 U.S.C. § 1251 et seq.), M.G.L. c. 21, §§ 26-53, and 314 CMR 9.00, MassDEP has determined there is reasonable assurance the project or activity, as conditioned herein, will be conducted in a manner which will not violate applicable water quality standards (314 CMR 4.00) and other appropriate requirements of state law.

The waters of Lowes Pond, which is a manmade impoundment along Lowes Brook, are unlisted in the Massachusetts Surface Water Quality Standards, and therefore, considered Class B. Such waters are intended “as habitat for fish, other aquatic life and wildlife, and for primary and secondary contact recreation.” Antidegradation provisions of these Standards require that “existing uses and the level of water quality necessary to protect the existing uses shall be maintained and protected.”

The above-referenced project involves the rehabilitation of Lowes Pond Dam as well as improvements to the recreational access to Lowes Pond. The project includes widening the existing spillway and adding operational and maintenance features; removing the remnant sluiceway and woody plants from the dam embankment; and dredging approximately 865 cubic yards of accumulated sediment immediately upstream of the dam. The sediment will be beneficially reused on site to the maximum extent possible with any excess being transported to an appropriate facility off site. It should be noted that the spillway crest elevation will remain the same as existing conditions. As a result, the pond level will not change post-construction.

Sediment Chemistry Results: One composite sample (comprised of two samples) was collected within the proposed dredge footprint for analysis. The results of the chemical analysis were compared to MassDEP's *Interim Policy for Sampling, Analysis, Handling and Tracking Requirements for Dredged Sediment Reuse and Disposal* (COMM-94-007). All of the results were either non-detect or below the Reportable Concentration ("RC") S-1 criteria of the Massachusetts Contingency Plan ("MCP").

Public Notice: The 401 WQC Application public notice was published in the *Worcester Telegram & Gazette* on September 30, 2023. No comments were received by MassDEP during the 21-day public comment period pursuant to 314 CMR 9.05(3)(e), which ended on October 21, 2023.

Section 61 Findings: Pursuant to M.G.L. Chapter 30, Sections 61 to 62H inclusive [the Massachusetts Environmental Policy Act ("MEPA")], the project, as referenced in 401 Water Quality Certification Application for Dredging, DEP Application # 23-WW08-0018-APP, was required to file an Expanded Environmental Notification Form ("EENF"). The Massachusetts Department of Conservation and Recreation (the "Proponent") filed the EENF for the construction of the project under EEA # 16571 and noticed the EENF in the Environmental Monitor (the "Monitor") on June 24, 2022. In the Certificate issued on August 1, 2022, the Secretary of Energy and Environmental Affairs (the "Secretary") determined that the project required "a mandatory Environmental Impact Report ("EIR")." The Proponent requested that the Secretary allow a Single EIR to be prepared in lieu of the usual two-stage Draft and Final EIR process in accordance with Section 11.06(8) of the MEPA regulations. The Secretary granted that request. Accordingly, the Proponent filed the Single EIR and noticed such in the Monitor on July 10, 2023. In the Certificate issued on August 16, 2023, the Secretary determined that the Single EIR "adequately and properly complies with MEPA and its implementing regulations" and that the Project "may proceed to permitting." MassDEP has reviewed the findings in both the EENF and Single EIR Certificates and confirms that based on the avoidance, minimization, and mitigation measures undertaken by the Proponent, in conjunction with the requirements set forth in this 401 WQC, all outstanding issues have been addressed satisfactorily.

Therefore, based on information currently in the record, MassDEP grants a 401 WQC for this project subject to the following conditions to maintain or attain water quality, to minimize any damage to the environment that may result from

the project, and to ensure compliance with appropriate provisions of state law. MassDEP certifies that there is reasonable assurance the project or activity, as conditioned herein, will be conducted in a manner which will not violate applicable water quality standards (314 CMR 4.00) and other appropriate requirements of state law.

1. The contractor shall take all steps necessary to ensure that the proposed activities will be conducted in a manner that will avoid violations of the antidegradation provisions of the Massachusetts Surface Water Quality Standards, 314 CMR 4.00, that protect all waters, including wetlands. Pursuant to 314 CMR 9.01(3), this condition is necessary to ensure that any discharge from the project complies with the Massachusetts Surface Water Quality Standards, as provided in 314 CMR 4.00, to protect the public health and restore and maintain the chemical, physical, and biological integrity of the water resources of the Commonwealth.
2. Prior to the start of work, or for any portion of the work thereafter, MassDEP shall be notified of any change(s) in the proposed project or plans that may affect waters or wetlands. MassDEP will determine whether the change(s) requires a revision to this 401 WQC. Pursuant to 314 CMR 9.07(1) and 314 CMR 9.09(2), this condition is necessary to protect the public health and restore and maintain the chemical, physical, and biological integrity of the water resources of the Commonwealth.
3. Dredging in accordance with this 401 WQC may begin following the 21-day appeal period and once all other permits have been received. Pursuant to 314 CMR 9.10, this condition is necessary to ensure that due process is provided to certain persons deemed to be aggrieved by the 401 WQC.
4. All work shall be performed in accordance with the following documents and plans [Pursuant to 314 CMR 9.05(1), this condition is necessary as these documents outline how the execution of the project will meet the criteria of 314 CMR 9.07 thereby protecting water quality and preventing degradation to wetlands and waters of the Commonwealth]:
 - Application for 401 WQC for Dredging, DEP Application # 23-WW08-0018-APP, dated January 27, 2023, as revised through December 13, 2023, with attachments.
 - Plan entitled “Massachusetts Department of Conservation and Recreation, Lowes Pond Dam Rehabilitation, Oxford, MA,” consisting of 23 sheets, various scales, dated September 2023, as revised through November 1, 2023, signed, and stamped by Douglas B. Gove, Jr., PE, Anthony Catalano, Jr., PE, and Lisa Susan Decker, RLA, and attached to this 401 WQC.
 - Document entitled “Dredging and Disposal Operation,” consisting of 2 pages, received by MassDEP on December 13, 2023.

5. MassDEP shall be notified, attention Derek Standish [617-875-3843 derek.standish@mass.gov], one week prior to the start of in-water work so that MassDEP staff may inspect the work for compliance with the terms and conditions of this 401 WQC. Pursuant to 314 CMR 9.05(4), this condition is necessary to ensure that construction practices are implemented in such a manner as to prevent degradation to wetlands and waters of the Commonwealth.
6. The term of this 401 WQC remains in effect for the same duration as the federal permit that requires it. Pursuant to 314 CMR 9.00, this condition is necessary to ensure that any dredging is conducted in a timely manner and complies with the Massachusetts Surface Water Quality Standards, as provided in 314 CMR 4.00, to protect the public health and restore and maintain the chemical, physical, and biological integrity of wetlands and waters of the Commonwealth.
7. During the project period, there shall be no discharge or spillage of fuel, oil, or other pollutants, including sediments, onto any part of the site. The applicant shall take all reasonable precautions to prevent the release of pollutants by ignorance, accident, or vandalism. Pursuant to 314 CMR 9.07(1), this condition is necessary to ensure that construction practices are implemented in such a manner as to prevent degradation to wetlands and waters of the Commonwealth.
8. No later than four weeks after issuance of this 401 WQC, the applicant shall submit a notification procedure outlining the reporting process to MassDEP for incidents relating to dredging activities that impact surrounding resource areas and habitats including, but not limited to, observed dead or distressed fish or other aquatic organisms, observed oily sheen on the surface of the water, a sediment spill, a turbidity plume beyond the deployed Best Management Practices (“BMPs”), and a barge or equipment accident/spill. If at any time during implementation of the project such an incident occurs, the applicant shall immediately notify MassDEP and all site related activities impacting the water shall cease until the source of the problem is identified and adequate mitigating measures are deployed to the satisfaction of MassDEP. Pursuant to 314 CMR 9.07(3), this condition is necessary to ensure that construction is conducted in a manner that minimizes short-term, long-term, and cumulative impacts on the aquatic ecosystem and provides protection to human health.
9. Future maintenance dredging is not authorized under this 401 WQC. Pursuant to 314 CMR 9.04(5), the project does not qualify for the routine maintenance exemption. This condition is necessary to ensure that the chemical, physical and biological integrity of wetlands and waters of the Commonwealth are protected.
10. Flow to the downstream channel (Lowes Brook) shall be maintained throughout construction of the project. Pursuant to 314 CMR 9.07(1), this condition is necessary to ensure that construction will be conducted in a manner that will not adversely affect wetlands and waters of the Commonwealth.

11. All equipment/machinery shall be stored above the High Water Mark (“HWM”) and outside any wetland resource areas when not in use. Pursuant to 314 CMR 9.07(1), this condition ensures that no hazardous materials from equipment are inadvertently discharged into the resource area in which construction is occurring thereby protecting water quality.
12. MassDEP shall be notified in writing of the name and location of the upland licensed facility accepting the dredged material for disposal or reuse as daily cover material. If the licensed facility is located out of state, documentation shall be provided to MassDEP that the dredged material disposal/reuse has been approved and will be accepted by the receiving state in accordance with 314 CMR 9.07(13)(b). The dredged material shall not be transported to the facility without the concurrence of MassDEP. Pursuant to 314 CMR 9.07(5) and 314 CMR 9.07(13), this condition is necessary to ensure that dredged material disposal will not adversely affect any wetlands or waters in the receiving area.
13. A Material Shipping Record (“MSR”) shall be used to track the dredged material to the licensed upland facility. A fully executed copy of the MSR shall be provided to MassDEP within 30 days of final shipment to the reuse location or facility. Pursuant to 314 CMR 9.07(5), this condition is necessary to maintain a record of the dredged material for reference and to ensure accountability in its transportation. This assists in the protection of health, safety, public welfare, and the environment from any potential hazards during transportation. Finally, it attests to the dredged material conforming with permitting and regulatory requirements for acceptance at the receiving location.
14. BMPs shall be implemented during transportation of the dredged material to the licensed receiving facility. At a minimum, when transported upon public roadways, all dredged material shall have no free liquid as determined by the Paint Filter Test or other suitably analogous methodology acceptable to MassDEP, and a tarpaulin or other means shall be used to cover the dredged material during transport. Pursuant to 314 CMR 9.07(5), this condition is necessary to protect off site water quality during transportation. These practices help to avoid fugitive dust and siltation into wetlands and waters of the Commonwealth.
15. Within 30 days of the completion of dredging, photographs of the affected areas depicting post-dredge conditions shall be taken and submitted to Derek Standish [derek.standish@mass.gov] at MassDEP. Pursuant to 314 CMR 9.07(1), this condition is necessary to ensure that construction practices are implemented in such a manner as to prevent degradation to wetlands and waters of the Commonwealth.

Failure to comply with this 401 WQC is grounds for enforcement, including civil and criminal penalties, under M.G.L. c. 21, § 42, 314 CMR 9.00, M.G.L. c. 21A § 16, 310 CMR 5.00, or other possible actions/penalties as authorized by the General Laws of the Commonwealth.

This 401 WQC does not relieve the applicant of the obligation to comply with other appropriate state or federal statutes or regulations. Any changes made to the project as described in the previously submitted 401 WQC Application or supplemental documents will require further notification to and, if an amendment is required, approval by MassDEP.

NOTICE OF APPEAL RIGHTS

Certain persons shall have a right to request an adjudicatory hearing concerning 401 WQCs by MassDEP when an application is required:

- a. the applicant or property owner;
- b. any person aggrieved by the decision who has submitted written comments during the public comment period;
- c. any ten persons of the Commonwealth pursuant to M.G.L. c. 30A where a group member has submitted written comments during the public comment period; or
- d. any governmental body or private organization with a mandate to protect the environment, which has submitted written comments during the public comment period.

Any person aggrieved, any ten persons of the Commonwealth, or a governmental body or private organization with a mandate to protect the environment may appeal without having submitted written comments during the public comment period only when the claim is based on new substantive issues arising from material changes to the scope or impact of the activity and not apparent at the time of public notice. To request an adjudicatory hearing pursuant to M.G.L. c. 30A, § 10, a Notice of Claim must be made in writing, provided that the request is made by certified mail or hand delivery to MassDEP, with the appropriate filing fee specified within 310 CMR 4.10 along with a DEP Fee Transmittal Form within 21 days from the date of issuance of this 401 WQC.

Department of Environmental Protection
Case Administrator
Office of Appeals and Dispute Resolution
100 Cambridge Street, Suite 900
Boston, MA 02114

A copy of the request shall at the same time be sent by certified mail or hand delivery to the issuing office of the Wetlands Program at:

Department of Environmental Protection
Wetlands Program
100 Cambridge Street, Suite 900
Boston, MA 02114

A Notice of Claim for Adjudicatory Hearing shall comply with MassDEP's Rules for Adjudicatory Proceedings, 310 CMR 1.01(6), and shall contain the following information pursuant to 314 CMR 9.10(3):

- a. the 401 WQC Application Number;
- b. the complete name of the applicant and address of the project;
- c. the complete name, address, and fax and telephone numbers of the party filing the request, and, if represented by counsel or other representative, the name, fax and telephone numbers, and address of the attorney;
- d. if claiming to be a party aggrieved, the specific facts that demonstrate that the party satisfies the definition of "aggrieved person" found at 314 CMR 9.02;
- e. a clear and concise statement that an adjudicatory hearing is being requested;
- f. a clear and concise statement of (1) the facts which are grounds for the proceedings, (2) the objections to this 401 WQC, including specifically the manner in which it is alleged to be inconsistent with the MassDEP's Water Quality Regulations, 314 CMR 9.00, and (3) the relief sought through the adjudicatory hearing, including specifically the changes desired in the final written 401 WQC; and
- g. a statement that a copy of the request has been sent by certified mail or hand delivery to the applicant, the owner (if different from the applicant), the conservation commission of the city or town where the activity will occur, the Department of Conservation and Recreation (when the certificate concerns projects in Areas of Critical Environmental Concern), the public or private water supplier where the project is located (when the certificate concerns projects in Outstanding Resource Waters), and any other entity with responsibility for the resource where the project is located.

The hearing request along with a DEP Fee Transmittal Form and a valid check or money order payable to the Commonwealth of Massachusetts in the amount of one hundred dollars (\$100) must be mailed to:

Commonwealth of Massachusetts
Department of Environmental Protection
Commonwealth Master Lockbox
PO Box 4062
Boston, MA 02211

The request will be dismissed if the filing fee is not paid, unless the appellant is exempt or granted a waiver. The filing fee is not required if the appellant is a city or town (or municipal agency), county, or district of the Commonwealth of Massachusetts, or a municipal housing authority. MassDEP may waive the adjudicatory hearing filing fee pursuant to 310 CMR 4.06(2) for a person who shows that paying the fee will create an undue financial hardship. A person seeking a waiver must file an affidavit setting forth the facts believed to support the claim of undue financial hardship together with the hearing request as provided above.

Should you have any questions relative to this 401 WQC, please contact Derek Standish at (617) 875-3843 [derek.standish@mass.gov].

Sincerely,

A handwritten signature in black ink, appearing to read "Lisa Rhodes", written in a cursive style.

Lisa Rhodes
Wetlands Program Chief

ecc: Oxford Conservation Commission, 325 Main Street, Oxford, MA 01540
Jillian Flanagan and Jennifer Doyle-Breen, AECOM, 250 Apollo Drive, Chelmsford, MA 01824
Judith Schmitz, DEP – CERO, 8 New Bond Street, Worcester, MA 01606
Christine M. Jacek and Paul M. Maniccia, Department of the Army, New England District, Corps of Engineers, 696 Virginia Road, Concord, MA 01742-2751
Edward Reiner and Rachel Croy, EPA, 5 Post Office Square, Suite 100, Boston, MA 02109

attachments: Communication for Non-English Speaking Parties document
Plans of Record



重要 महत्वपूर्ण σημαντικός
Important
կարևոր quan trọng مهم



Communication for Non-English-Speaking Parties

This document is important and should be translated immediately.

If you need this document translated, please contact MassDEP's Director of Environmental Justice at the telephone number listed below.

Español Spanish

Este documento es importante y debe ser traducido inmediatamente. Si necesita traducir este documento, póngase en contacto con el Director de Justicia Ambiental de MassDEP (*MassDEP's Director of Environmental Justice*) en el número de teléfono que figura más abajo.

Português Portuguese

Este documento é importante e deve ser traduzido imediatamente. Se você precisar traduzir este documento, entre em contato com o Diretor de Justiça Ambiental do MassDEP no número de telefone listado abaixo.

繁體中文 Chinese Traditional

本文檔很重要，需要即刻進行翻譯。
如需對本文檔進行翻譯，請透過如下列示電話號碼與 MassDEP 的環境司法總監聯絡。

简体中文 Chinese Simplified

这份文件非常重要，需要立即翻译。
如果您需要翻译这份文件，请通过下方电话与 MassDEP 环境司法主任联系。

Ayisyen Kreyòl Haitian Creole

Dokiman sa a enpòtan epi yo ta dwe tradui l imedyatman. Si w bezwen tradui dokiman sa a, tanpri kontakte Direktè. Jistis Anviwònmanal MassDEP a nan nimewo telefòn ki endike anba a.

Việt Vietnamese

Tài liệu này và quan trọng và phải được dịch ngay. Nếu quý vị cần bản dịch của tài liệu này, vui lòng liên hệ với Giám Đốc Phòng Công Lý Môi Trường của MassDEP theo số điện thoại được liệt kê bên dưới.

ប្រទេសកម្ពុជា Khmer/Cambodian

ឯកសារនេះមានសារៈសំខាន់
ហើយគួរត្រូវបានបកប្រែភ្លាមៗ។
ប្រសិនបើអ្នកត្រូវការអោយឯកសារនេះបកប្រែ
សូមទាក់ទងនាយកផ្នែកយុត្តិធម៌បរិស្ថានរបស់
MassDEPតាមរយៈលេខទូរស័ព្ទដែលបានរាយដូចខា
ងក្រោម។

Kriolu Kabuverdianu Cape Verdean

Es dokumentu sta important i tenki ser tradusidu imediatamenti. Se nho ta presisa ke es dokumentu sta tradisidu, por favor kontata O Diretor di Justisia di Environman di DEP ku es numero di telefoni menxionadu di baixo.

Contact Deneen Simpson 857-406-0738

**Massachusetts Department of Environmental Protection
100 Cambridge Street 9th Floor Boston, MA 02114**

TTY# MassRelay Service 1-800-439-2370 • <https://www.mass.gov/environmental-justice>
(Version revised 8.2.2023) 310 CMR 1.03(5)(a)

Русский Russian

Это чрезвычайно важный документ, и он должен быть немедленно переведен. Если вам нужен перевод этого документа, обратитесь к директору Департамента экологического правосудия MassDEP (MassDEP's Director of Environmental Justice) по телефону, указанному ниже.

العربية Arabic

هذه الوثيقة مهمة وتجب ترجمتها على الفور.

إذا كنت بحاجة إلى ترجمة هذه الوثيقة، فيرجى الاتصال بمدير العدالة البيئية في MassDEP على رقم الهاتف المذكور أدناه.

한국어 Korean

이 문서는 중대하므로 즉시 번역되어야 합니다. 본 문서 번역이 필요하신 경우, 매사추세츠 환경보호부의 "환경정의" 담당자 분께 문의하십시오. 전화번호는 아래와 같습니다.

հայերեն Armenian

Այս փաստաթուղթը կարևոր է, և պետք է անհապաղ թարգմանել այն:
Եթե Ձեզ անհրաժեշտ է թարգմանել այս փաստաթուղթը, դիմեք Մասաչուսեթսի շրջակա միջավայրի պահպանության նախարարության (MassDEP) Բնապահպանական հարցերով արդարադատության ղեկավարին (Director of Environmental Justice)՝ ստորև նշված հեռախոսահամարով

فارسی Farsi Persian

این نوشتار بسیار مهمی است و باید فوراً ترجمه شود. اگر نیاز به ترجمه این نوشتار دارید لطفاً با مدیر عدالت محیط زیستی MassDEP در شماره تلفن ذکر شده زیر تماس بگیرید.

Français French

Ce document est important et doit être traduit immédiatement. Si vous avez besoin d'une traduction de ce document, veuillez contacter le directeur de la justice environnementale du MassDEP au numéro de téléphone indiqué ci-dessous.

Deutsch German

Dieses Dokument ist wichtig und muss sofort übersetzt werden. Wenn Sie eine Übersetzung dieses Dokuments benötigen, wenden Sie sich bitte an MassDEP's Director of Environmental Justice (Direktor für Umweltgerechtigkeit in Massachusetts) unter der unten angegebenen Telefonnummer.

Ελληνική Greek

Το έγγραφο αυτό είναι πολύ σημαντικό και πρέπει να μεταφραστεί αμέσως. Αν χρειάζεστε μετάφραση του εγγράφου αυτού, παρακαλώ επικοινωνήστε με τον Διευθυντή του Τμήματος Περιβαλλοντικής Δικαιοσύνης της Μασαχουσέτης στον αριθμό τηλεφώνου που αναγράφεται παρακάτω

Italiano Italian

Questo documento è importante e deve essere tradotto immediatamente. Se hai bisogno di tradurre questo documento, contatta il Direttore della Giustizia Ambientale di MassDEP al numero di telefono sotto indicato.

Język Polski Polish

Ten dokument jest ważny i powinien zostać niezwłocznie przetłumaczony. Jeśli potrzebne jest tłumaczenie tego dokumentu, należy skontaktować się z dyrektorem ds. sprawiedliwości środowiskowej MassDEP pod numerem telefonu podanym poniżej.

हिन्दी Hindi

यह दस्तावेज महत्वपूर्ण है और इसका अनुवाद तुरंत किया जाना चाहिए। यदि आपको इस दस्तावेज का अनुवाद कराने की जरूरत है, तो कृपया नीचे दिए गए टेलीफोन नंबर पर MassDEP के पर्यावरणीय न्याय निदेशक से संपर्क करें।

Contact Deneen Simpson 857-406-0738

Massachusetts Department of Environmental Protection
100 Cambridge Street 9th Floor Boston, MA 02114

TTY# MassRelay Service 1-800-439-2370 • <https://www.mass.gov/environmental-justice>

(Version revised 8.2.2023) 310 CMR 1.03(5)(a)



The Commonwealth of Massachusetts
Executive Office of Energy and Environmental Affairs
100 Cambridge Street, 10th Floor
Boston, MA 02114

Maura T. Healey
GOVERNOR

Kimberley Driscoll
LIEUTENANT GOVERNOR

Rebecca L. Tepper
SECRETARY

Tel: (617) 626-1000
Fax: (617) 626-1081
<http://www.mass.gov/eea>

August 16, 2023

CERTIFICATE OF THE SECRETARY OF ENERGY AND ENVIRONMENTAL AFFAIRS
ON THE
SINGLE ENVIRONMENTAL IMPACT REPORT

PROJECT NAME : Lowes Pond Dam Rehabilitation
PROJECT MUNICIPALITY : Oxford
PROJECT WATERSHED : French Watershed
EEA NUMBER : 16571
PROJECT PROPONENT : Massachusetts Department of Conservation and
Recreation
DATE NOTICED IN MONITOR : July 10, 2023

Pursuant to the Massachusetts Environmental Policy Act (MEPA; M.G.L. c. 30, ss. 61-62L) and Section 11.08 of the MEPA regulations (301 CMR 11.00), I have reviewed the Single Environmental Impact Report (Single EIR) and hereby determine that it **adequately and properly complies** with MEPA and its implementing regulations.

Project Description

As described in the Single EIR, the project involves the rehabilitation of Lowes Pond Dam in the Town of Oxford (Town). The Massachusetts Department of Conservation and Recreation (DCR) is proposing the project as part of a pilot program to determine the most appropriate approach to assessing safety and implementing required remedial measures at abandoned DCR-jurisdictional dams in Massachusetts. Such dams (including Lowes Pond Dam) have no identifiable owner willing to evaluate and repair the infrastructure in compliance with dam safety regulations. Lowes Pond Dam currently exhibits multiple structural deficiencies and cannot safely pass the Spillway Design Flood (SDF), which is based on the 100-year storm. The proposed project involves restoring the dam to a condition that meets the design parameters of the Dam Safety Regulations (302 CMR 10.00) and will remove a safety hazard for the residents of Oxford.

In order to complete the proposed rehabilitation of Lowes Pond Dam, the construction area will be dewatered through the use of cofferdams. The existing 42-foot-wide spillway will be reconstructed and widened another 28 feet for a total spillway length of 70 feet; a new reinforced concrete training wall will be constructed adjacent and to the right of the new section of spillway. The existing section of concrete and stone masonry training wall along the left side of the existing spillway will be replaced and a new embankment will be built to the left of the spillway; areas within 20 feet of the training walls will be cleared to avoid adverse impacts to the embankment from roots and re-seeded with native herbaceous seed mix. A 24-inch diameter low-level outlet pipe with a gate valve will be installed on the western side of the spillway. This low-level outlet will allow the water elevation in the pond to be lowered in the event that repair or maintenance to the upstream spillway face is needed in the future. An aluminum walkway/platform is included above the spillway, extending from the western bank, to facilitate access to the low-level outlet. As described in the Single EIR, the design also incorporates stop logs, which could facilitate potentially lowering of the pond in the future for aquatic vegetation management.

A concrete stilling basin, consisting of a 20-foot-long flat concrete slab, will be constructed at the toe of the spillway for energy dissipation and erosion control. Approximately 865 cubic yards (cy) of accumulated sediment upstream of the dam will be dredged to below the elevation of the new low-level outlet. As described in the Single EIR, sediment has accumulated in the pond to within one foot of the existing spillway crest. A retaining wall will be constructed extending into the pond upstream of the low-level intake in order to minimize future sediment accumulation in the vicinity of the new low-level intake. Vegetation clearing is proposed along the western bank for staging and access for the construction of the new embankment section, and for use a park following project construction. For added public safety, the design provides aluminum guardrails along the training walls on both sides of the dam that would tie into the existing guardrails along Huguenot Road.

Two new parking lots will be constructed on either side of the dam, containing a combined total of five parking spaces. A new pedestrian bridge and connecting walkways will be constructed to connect the two sides of the waterway to provide a safe way for visitors to travel around the site. The parking areas and walkways will be Americans with Disabilities Act (ADA) compliant to encourage public access. A bio-infiltration rain garden adjacent to the east and west parking lots will be constructed to treat runoff from the parking areas. As noted above, the dam is currently abandoned and is located on private property. While DCR is proposing the project, it will not be the owner and/or operator of the site following project completion. The Town is currently moving forward with a Land Court Tax Lien Foreclosure process in the courts, which is anticipated to be completed by the end of 2023 and will result in the Town taking ownership of the dam. As stated in the Single EIR, once the Town completes these legal proceedings, DCR will advertise the project for construction.

Project Site

The 0.91-acre project site includes Lowes Pond Dam and the area immediately surrounding it, extending into the pond to the limit of proposed dredging. Lowes Pond Dam

(MA00669), located between I-395 and Huguenot Road, impounds Lowes Pond, which discharges to Lowe's Brook, a tributary of the French River. The dam is a combined earthen embankment, stone masonry, and concrete structure. There is a culvert immediately downstream of the dam that supports Huguenot Road. While there are no known design or construction drawings, the Lowes Pond Dam is thought to have been constructed around 1900 and is located on the site of a former mill structure that was demolished in the 1970s, although remnants of the former mill remain. The dam is classified as a Significant Hazard Potential dam in accordance with Massachusetts Dam Safety Regulations. Lowes Pond Dam has a maximum structural height of 15.6 feet and a maximum storage capacity of 188 acre-feet, as such it is categorized as an Intermediate sized structure. A visual, structural, and geotechnical condition assessment on May 20, 2019 found that, consistent with previous inspections, the condition of the dam was Unsafe. As defined by the Dam Safety Regulations, an Unsafe Condition Dam is a dam whose condition is such that a high risk of failure exists and the dam condition presents a high risk to public safety located downstream from the dam (301 CMR 10.03(2)). As noted above, the dam currently does not have adequate spillway capacity and cannot safely pass the SDF.

The principal spillway has a crest length of 40 feet and consists of a 6-foot-wide broad crested weir with a surveyed crest elevation (el.) of 474.8 feet (ft) NAVD88. The channel elevation at the toe of the spillway is at approximately el. 461.9 ft NAVD88, resulting in an estimated spillway height of 12.9 feet. Concrete and stone masonry training walls contain the flow within the spillway channel. A 6-foot-wide sluiceway inlet is located approximately 20 feet to the right of the principal spillway with an invert elevation of 472.8 ft NAVD88. The covered concrete and stone masonry sluiceway channel is approximately 70 feet in length and passes through the right embankment, which is approximately 90 feet in length traveling westward from the principal spillway. The minimum surveyed crest elevation along the right embankment is 477.8 ft NAVD88. The left embankment is approximately 40 feet in length traveling eastward from the principal spillway, with a minimum surveyed crest elevation of 477.5 ft NAVD88. Both embankments are covered with trees and dense vegetation; concrete and stone masonry walls line the upstream slopes.

Wetland resources on site are associated with the dam and impoundment and include Bank, Land Under Water (LUW), Riverfront Area, and Bordering Land Subject to Flooding (BLSF). The EENF states Lowes Pond is classified as an impaired water body with the stressor identified as noxious aquatic plants. Portions of the project site are mapped as a Regulatory Floodway and as Flood Zone AE (an area inundated during a 100-year storm), with a Base Flood Elevation (BFE) of elevation (el.) 469 ft NAVD88, extending up to 478.1 ft NAVD88 just north of the project site, as delineated on Federal Emergency Management Agency (FEMA) map 25027C0976E (effective date July 4, 2011). The project site does not contain *Estimated and Priority Habitat of Rare Species* as delineated by the Natural Heritage and Endangered Species Program (NHESP) in the 15th Edition of the Massachusetts Natural Heritage Atlas or an Area of Critical Environmental Concern (ACEC). The site does not contain any structures listed in the State Register of Historic Places or the Massachusetts Historical Commission's (MHC) Inventory of Historic and Archaeological Assets of the Commonwealth.

The project site is located within one Environmental Justice (EJ) population characterized by Income criteria and within one mile of an additional EJ population characterized by Minority

criteria. The site is located within five miles of seven additional EJ populations characterized by Income criteria (4) and Minority and Income criteria (3). The Single EIR indicates that the Designated Geographic Area (DGA) for the project is one mile.

Environmental Impacts and Mitigation

Potential environmental impacts associated with the project include the alteration of 0.92 acres of land, the creation of 0.06 acres of impervious surface (for a total of 0.14 acres on site), the construction of one new parking space (for a total of five on site), and the generation of two New average daily trips (adt), for a total of four adt from the project site. The project will alter 693,396 square feet (sf) (approximately 15.92 acres) of LUW; 325 linear feet (lf) of Bank; 19,330 sf of Riverfront Area (approximately 0.44 acres); and 1,950 sf of BLSF; as a result, the project is expected to result in a net loss of 250 sf of LUW and 25 lf of Bank, and a net gain of 850 sf of BLSF. The project will also dredge approximately 865 cy of sediment.

Measures to avoid, minimize, and mitigate project impacts include the partial removal of existing impervious surface on site, the restoration of temporarily altered wetland resource areas, construction of a bio-infiltration rain garden, use of erosion and sedimentation controls, use of best management practices (BMPs) during construction to minimize noise and dust impacts, and the creation of 850 sf of LUW, 125 lf of Bank, and 850 sf of BLSF through the removal of existing infrastructure within these resource areas.

Jurisdiction and Permitting

The project is undergoing MEPA review and is subject to a mandatory EIR pursuant to 301 CMR 11.03(3)(a)(1)(b) of the MEPA regulations because it requires an Agency Action and will involve the alteration of 10 or more acres of wetlands through the temporary dewatering of the pond. The project additionally exceeds the ENF threshold at 301 CMR 11.03(3)(b)(1)(f) because it will result in the alteration of one half or more acres of any other wetlands (LUW, Riverfront Area, and BLSF). The project requires the preparation of an EIR under 301 CMR 11.06(7)(b) of the MEPA regulations because it is located within one mile of one or more EJ populations. The project requires a Chapter 253 Dam Safety Permit from DCR and a 401 Water Quality Certification (WQC) and Chapter 91 (c.91) License and Permit from the Massachusetts Department of Environmental Protection (MassDEP).

The project requires an Order of Conditions from the Oxford Conservation Commission (or in the case of an appeal of either, a Superseding Order of Conditions from MassDEP). The project requires authorization from the U.S. Army Corps of Engineers (USACE) under the General Permits for Massachusetts in accordance with Section 404 of the Federal Clean Water Act. The project will also require consultation with the US Fish and Wildlife Service (USFWS).

The project was reviewed by MHC acting as the State Historic Preservation Officer (SHPO) pursuant to Section 106 of the National Historic Preservation Act of 1966, as amended (36 CFR 800).

Because the project will be undertaken by an Agency (DCR), MEPA jurisdiction is broad in scope and extends to all aspects of the project that may cause Damage to the Environment, as defined in the MEPA regulations.

Review of the Single EIR

The Single EIR included an updated project description, existing and proposed conditions plans, estimates of project-related impacts, an update on permitting, a description of public outreach conducted since the filing of the EENF, an update on coordination with Agencies since the filing of the EENF, and response to comments on the EENF. The Single EIR states that no changes to the project design have been made since the filing of the EENF. However, the impacts to wetland resource area as presented in the EENF were estimates; these impacts have since been refined resulting in slight adjustments to wetland impact estimates as presented in the Single EIR and identified above.

The Proponent provided additional information to the MEPA Office on August 9, 2023 regarding EJ populations within one mile of the project site, the potential for climate change to impact the project, and invasive species management. For purposes of clarity, all supplemental materials provided by the Proponent are included in references to the “Single EIR,” unless otherwise indicated.

Environmental Justice / Public Health

As noted above, the project site is located within one EJ population characterized by Income criteria and within one mile of an additional EJ population characterized by Minority criteria. The Single EIR notes that the project will eliminate an existing public safety hazard to downstream EJ communities, and create a publicly accessible recreational resource. As described in the Single EIR, the nearest downstream environmental justice population is a Minority and low-income population in 2010 census tract 7542, block group 3, located approximately 3 miles to the south of the project in the Town of Webster. Since the filing of the EENF, the Town has provided updates via live cable television and public meetings to the community. A list of community-based organizations (CBOs) and tribes/indigenous organizations (the “EJ Reference List”) provided by the MEPA Office was used to notify the listed entities of the filing of the Single EIR.

As noted in the EENF, the DPH EJ Tool did not indicate that any census tract or municipality in which the identified EJ populations are located as exhibiting “vulnerable health EJ criteria”; this term is defined in the DPH EJ Tool to include any one of four environmentally related health indicators that are measured to be 110% above statewide rates based on a five-year rolling average. The EENF also surveyed environmental indicators tracked through the U.S. EPA’s “EJ Screen” for census tract 7532, block group 3 (the EJ population in which the project site is partially located), which indicated that the EJ census block does not exhibit any environmental indicators at or above the 80th percentile of the statewide average. The Scope on the EENF directed the Proponent to provide data from the EPA’s EJ Screen for census tract 7531, block group 5, the second EJ population present within one mile of the project at the time the EENF was filed. The Single EIR states that based on the revised mapping published by EEA on November 12, 2022, this census block is no longer designated as an EJ population.

Wetlands and Waterways

The Single EIR clarified impacts to wetland resource areas and provided additional details regarding the restoration of temporarily impacted wetland resource areas, as required by the Scope. As described in the Single EIR, all existing vegetated wetland areas that are anticipated to be disturbed during construction (4,830 sf of Riverfront, 1,500 sf of 100-Foot Buffer, and 1,100 sf of BLSF) will be revegetated by seeding and planting of native species. Post-construction monitoring to confirm revegetation is anticipated to occur over two years. During this time, the Town will also monitor for invasive species and address as needed in coordination with the Oxford Conservation Commission, via either hand-pulling or herbicide application. The Town has committed to ongoing water quality testing at Lowes Pond following construction.

Site plans included in the Single EIR identified the location of the cofferdams proposed for water control during construction. The Single EIR indicates that the Proponent will use dewatering bags in conjunction with dewatering/bypass pumping equipment to provide both filtration and velocity reduction. Inflow to the pond will be pumped from a location immediately upstream of the cofferdam to by-pass the construction site and discharged back to the stream immediately upstream of the Huguenot Road bridge. I refer the Proponents to comments from MassDEP, which recommend that the Proponent consider additional turbidity control measures as construction period conditions dictate.

Climate Change Adaptation and Resiliency

As noted in the Certificate on the EENF, an H&H analysis was developed to simulate flood events for the 10-, 50-, and the 100-year storm events using National Oceanic and Atmospheric Administration (NOAA) Atlas 14 precipitation data. According to this analysis, the dam would be overtopped by approximately 0.9 feet during the 100-year storm under existing conditions, and would likely be overtopped by the 50-year storm as well. As noted above, the spillway will be widened as part of the project to pass the SDF (which is based on the 100-year storm). Based on the 60-year useful life of the dam and the self-assessed criticality of this asset, the output report from the MA Resilience Design Tool recommends a planning horizon of 2070 and a return period associated with a 50-year (2% chance) storm event when designing the dam to address extreme precipitation. As stated in the Single EIR, the modifications to the proposed spillway were designed based on the present-day 100-year flood using NOAA Atlas 14 precipitation data, which has a 24-hr precipitation depth of 7.94 inches. The 50-year storm in 2070 (as recommended by the MA Resilience Design Tool) corresponds to a 24-hr precipitation depth of 9.5 inches, 1.56 inches above the 100-year design storm that was used.

The Single EIR notes that, as the goal of the project is to bring the dam into compliance with current regulatory requirements, which do not mandate designing for future climate conditions. However, the Single EIR states that the project as proposed would not preclude additional dam rehabilitation to address future conditions. As noted above, the project will address an immediate public safety hazard, and will improve the dam's ability to adequately contain and pass larger storm events as compared to existing conditions. As stated in the Single EIR, the project is not anticipated to result in any change in water level or velocity upstream of

the spillway as a result of the widening of the spillway, and the project will not result in adverse changes to floodwater flow paths and/or velocities that could impact adjacent properties or the function of the floodplain. Given the limited goals of the project, the Single EIR indicates that spillway sizing is adequate to address existing hazards and does not foreclose future opportunities to add resiliency.

Mitigation and Section 61 Findings

The Single EIR provided draft Section 61 Findings for use by Agencies, which are summarized below. The Section 61 Findings should be provided to Agencies to assist in the permitting process and issuance of final Section 61 Findings.

Environmental Justice

- Elimination of the risk of dam failure and associated hazards
- Improvement of community aesthetics, including improvements to recreational access to Lowes Pond
- Implementation of best management practices (BMPs) during construction to mitigate noise and dust impacts

Wetlands and Waterways

- Use of erosion, sediment, and turbidity controls, including filtering discharge water
- Fueling operations will be conducted away from resource areas whenever possible
- Removal of invasive species and invasive species monitoring
- Restoration of temporarily disturbed wetland resource areas
- Post-constructing monitoring for a period of two years and ongoing water quality monitoring

Adaptation and Resiliency

- Renovation of dam with significant hazard potential
- Widening of the dam spillway such that it is able to pass the 100-year storm based on NOAA Atlas 14 precipitation data
- Installation of a hydrodynamic separator and bioretention rain garden that will receive rainwater from the parking areas

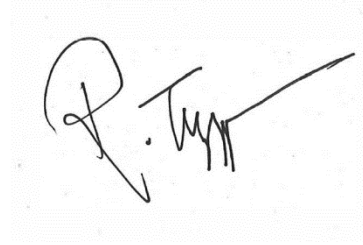
Construction Period

- Use of construction BMPs, including reducing idling times of vehicles, dampening exposed soil areas on dry and/or windy days, and requiring mufflers for construction equipment.
- Limiting construction to daylight hours
- On and off-road idling will be restricted to the maximum extent practicable

- Contractors will be encouraged to use construction equipment with engines manufactured to Tier 4 federal emission standards
- Consideration will be given to selecting project contractors that have installed retrofit emissions control devices or vehicles that use alternative fuels to reduce emissions of volatile organic compounds (VOCs), carbon monoxide (CO) and particulate matter (PM) from diesel-powered equipment to the maximum extent practicable
- Off-road vehicles will be encouraged to use ultra-low sulfur diesel fuel (ULSD)

Conclusion

Based on a review of the Single EIR and consultation with MassDEP, I find that the SEIR adequately and properly complies with MEPA and its implementing regulations. The project may proceed to permitting. Participating Agencies should forward copies of the final Section 61 Findings to the MEPA Office for publication in accordance with 301 CMR 11.12.



August 16, 2023
Date

Rebecca L. Tepper

Comments received:

08/09/2023 Massachusetts Department of Environmental Protection (MassDEP), Central Regional Office (CERO)

RLT/ELV/elv



Commonwealth of Massachusetts
Executive Office of Energy & Environmental Affairs

Department of Environmental Protection

Central Regional Office • 8 New Bond Street, Worcester MA 01606 • 508-792-7650

Maura T. Healey
Governor

Kimberley Driscoll
Lieutenant Governor

Rebecca L. Tepper
Secretary

Bonnie Heiple
Commissioner

August 9, 2023

Secretary Rebecca Tepper
Executive Office of Environmental Affairs
100 Cambridge Street, 9th Floor
Boston, MA 02114

Attention: MEPA Unit – Eva Vaughan

Re: Single Environmental Impact Report (SEIR)
Lowes Pond Dam Rehabilitation
Oxford
EEA #16571

Dear Secretary Tepper,

The Massachusetts Department of Environmental Protection's ("MassDEP") Central Regional Office has reviewed the SEIR for the Lowes Pond Dam Rehabilitation (the "Project") submitted by the Massachusetts Department of Conservation and Recreation Office of Dam Safety (ODS). ODS (the "Proponent") is proposing to rehabilitate the Lowes Pond Dam located north of Huguenot Road and west of Main Street. The Project includes reconstruction and widening of the spillway, reinforcement of the concrete training wall, installation of a 24-inch diameter outlet pipe, removal of sediment, and construction of a pedestrian bridge, parking areas and walkways.

The Project is under MEPA review because it meets or exceeds the following review thresholds:

- 301 CMR 11.03(3)(a)(1)(b) - Alteration of ten or more acres of any other wetlands;
- 301 CMR 11.03(3)(b)(1)(f) - alteration of ½ or more acres of any other wetlands.

The Project requires the following State Agency Permits:

- MassDEP Superseding Order of Conditions (if local Order of Conditions is appealed);
- MassDEP 401 Water Quality Certification;

This information is available in alternate format. Please contact Melixza Esenyie at 617-626-1282.

TTY# MassRelay Service 1-800-439-2370

MassDEP Website: www.mass.gov/dep

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- Massachusetts Historical Commission Project Notification Form (PNF) and National Historic Preservation Act Section 106 Compliance;
- Chapter 253 Dam Safety Permit;
- MassDEP Chapter 91 License.

MassDEP offers the following comments:

Wetlands

In response to comments made by MassDEP on the Expanded Environmental Notification Form, the SEIR contains information demonstrating that impact values provided for Land Under Waterbodies include the footprint of the proposed training wall along the western limit of the Project. The SEIR includes additional information relating to proposed mitigation plantings, including the location, number, and species to be implemented within restored resource areas and their Buffer Zones. The SEIR includes information which indicates that while the existing Bank which will be impacted by the Project is human-made and affords minimal wildlife habitat value under existing conditions, a wildlife habitat evaluation will be submitted as part of the Notice of Intent filed with the Oxford Conservation Commission and MassDEP. MassDEP is satisfied with these responses.

The SEIR indicates that the proposed cofferdam location will be determined in the field by the contractor and is anticipated to be placed parallel to the Limit of Work as shown on Project plans. The SEIR indicates that the Proponent will use dewatering bags in conjunction with dewatering/bypass pumping equipment to provide both filtration and velocity reduction. MassDEP recommends that the Proponent remain open to the consideration of additional turbidity control measures as construction period conditions dictate.

MassDEP appreciates the opportunity to comment on the Project. If you have any questions regarding these comments, please do not hesitate to contact JoAnne Kasper-Dunne, Central Regional Office MEPA Coordinator, at (508) 767-2716.

Very truly yours,



Mary Jude Pigsley
Regional Director

cc: Commissioner's Office, MassDEP



The Commonwealth of Massachusetts
Executive Office of Energy and Environmental Affairs
100 Cambridge Street, Suite 900
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August 1, 2022

CERTIFICATE OF THE SECRETARY OF ENERGY AND ENVIRONMENTAL AFFAIRS
ON THE
EXPANDED ENVIRONMENTAL NOTIFICATION FORM

PROJECT NAME : Lowes Pond Dam Rehabilitation
PROJECT MUNICIPALITY : Oxford
PROJECT WATERSHED : French Watershed
EEA NUMBER : 16571
PROJECT PROPONENT : Massachusetts Department of Conservation and
Recreation
DATE NOTICED IN MONITOR : June 24, 2022

Pursuant to the Massachusetts Environmental Policy Act (MEPA; M.G.L. c. 30, ss. 61-62L) and Section 11.06 of the MEPA Regulations (301 CMR 11.00), I have reviewed the Expanded Environmental Notification Form (EENF) and hereby determine that this project requires a mandatory Environmental Impact Report (EIR). In accordance with Sections 11.06(8) of the MEPA regulations, the Proponent requested that I allow a Single EIR (SEIR) in lieu of the usual two-stage Draft and Final EIR process. I hereby grant the request to file a SEIR, which the Proponent should submit in accordance with the Scope included in this Certificate.

Project Description

As described in the Expanded Environmental Notification Form (EENF), the project involves the rehabilitation of Lowes Pond Dam in the Town of Oxford (Town). The Massachusetts Department of Conservation and Recreation (DCR) is proposing the project as part of a pilot program to determine the most appropriate approach to assessing safety and implementing required remedial measures at abandoned DCR-jurisdictional dams in Massachusetts. Such dams (including Lowes Pond Dam) have no identifiable owner willing to evaluate and repair the infrastructure in compliance with dam safety regulations. Lowes Pond

Dam currently exhibits multiple structural deficiencies and cannot safely pass the Spillway Design Flood (SDF), which is based on the 100-year storm. As stated in the EENF, the proposed project involves restoring the dam to a condition that meets the design parameters of the Dam Safety Regulations (302 CMR 10.00) and will remove a safety hazard for the residents of Oxford.

In order to complete the proposed rehabilitation of Lowes Pond Dam, the construction area will be dewatered through the use of cofferdams. The existing 42-foot-wide spillway will be reconstructed and widened another 28 feet for a total spillway length of 70 feet; a new reinforced concrete training wall will be constructed adjacent and to the right of the new section of spillway. The existing section of concrete and stone masonry training wall along the left side of the existing spillway will be replaced and a new embankment will be built to the left of the spillway; areas within 20 feet of the training walls will be cleared to avoid adverse impacts to the embankment from roots and re-seeded with native herbaceous seed mix. A 24-inch diameter low-level outlet pipe with a gate valve will be installed on the western side of the spillway. This low-level outlet will allow the water elevation in the pond to be lowered in the event that repair or maintenance to the upstream spillway face is needed in the future. An aluminum walkway/platform is included above the spillway, extending from the western bank, to facilitate access to the low-level outlet. As described in the EENF, the design also incorporates stop logs, which could facilitate potentially lowering of the pond in the future for aquatic vegetation management.

A concrete stilling basin, consisting of a 20-foot-long flat concrete slab, will be constructed at the toe of the spillway for energy dissipation and erosion control. Approximately 865 cubic yards (cy) of accumulated sediment upstream of the dam will be dredged to below the elevation of the new low-level outlet. As described in the EENF, sediment has accumulated in the pond to within one foot of the existing spillway crest. A retaining wall will be constructed extending into the pond upstream of the low-level intake in order to minimize future sediment accumulation in the vicinity of the new low-level intake. Vegetation clearing is proposed along the western bank for staging and access for the construction of the new embankment section, and for use a park following project construction. For added public safety, the design provides aluminum guardrails along the training walls on both sides of the dam that would tie into the existing guardrails along Huguenot Road.

Two new parking lots will be constructed on either side of the dam, containing a combined total of five parking spaces. A new pedestrian bridge and connecting walkways will be constructed to connect the two sides of the waterway to provide a safe way for visitors to travel around the site. The parking areas and walkways will be Americans with Disabilities Act (ADA) compliant to encourage public access. A bio-infiltration rain garden adjacent to the east and west parking lots will be constructed to treat runoff from the parking areas. As noted above, the dam is currently abandoned and is located on private property. While the details of the arrangement are not finalized at this time, the EENF indicates that the Town will take ownership of the property if the dam is repaired, and if the pond can be maintained as a recreational resource. While DCR is proposing the project, it will not be the owner and/or operator of the site following project completion.

Project Site

The 0.91-acre project site includes Lowes Pond Dam and the area immediately surrounding it, extending into the pond to the limit of proposed dredging. Lowes Pond Dam (MA00669), located between I-395 and Huguenot Road, impounds Lowes Pond, which discharges to Lowe's Brook, a tributary of the French River. The dam is a combined earthen embankment, stone masonry, and concrete structure. There is a culvert immediately downstream of the dam that supports Huguenot Road. While there are no known design or construction drawings, the Lowes Pond Dam is thought to have been constructed around 1900 and is located on the site of a former mill structure that was demolished in the 1970s, although remnants of the former mill remain. The dam is classified as a Significant Hazard Potential dam in accordance with Massachusetts Dam Safety Regulations. Lowes Pond Dam has a maximum structural height of 15.6 feet and a maximum storage capacity of 188 acre-feet, as such it is categorized as an Intermediate sized structure. A visual, structural, and geotechnical condition assessment on May 20, 2019 found that, consistent with previous inspections, the condition of the dam was Unsafe. As defined by the Dam Safety Regulations, an Unsafe Condition Dam is a dam whose condition is such that a high risk of failure exists and the dam condition presents a high risk to public safety located downstream from the dam (301 CMR 10.03(2)). As noted above, the dam currently does not have adequate spillway capacity and cannot safely pass the SDF.

The principal spillway has a crest length of 40 feet and consists of a 6-foot-wide broad crested weir with a surveyed crest elevation (el.) of 474.8 feet (ft) NAVD88. The channel elevation at the toe of the spillway is at approximately el. 461.9 ft NAVD88, resulting in an estimated spillway height of 12.9 feet. Concrete and stone masonry training walls contain the flow within the spillway channel. A 6-foot-wide sluiceway inlet is located approximately 20 feet to the right of the principal spillway with an invert elevation of 472.8 ft NAVD88. The covered concrete and stone masonry sluiceway channel is approximately 70 feet in length and passes through the right embankment, which is approximately 90 feet in length traveling westward from the principal spillway. The minimum surveyed crest elevation along the right embankment is 477.8 ft NAVD88. The left embankment is approximately 40 feet in length traveling eastward from the principal spillway, with a minimum surveyed crest elevation of 477.5 ft NAVD88. Both embankments are covered with trees and dense vegetation; concrete and stone masonry walls line the upstream slopes.

Wetland resources on site are associated with the dam and impoundment and include Bank, Land Under Water (LUW), Riverfront Area, and Bordering Land Subject to Flooding (BLSF). The EENF states Lowes Pond is classified as an impaired water body with the stressor identified as noxious aquatic plants. Portions of the project site are mapped as a Regulatory Floodway and as Flood Zone AE (an area inundated during a 100-year storm), with a Base Flood Elevation (BFE) of elevation (el.) 469 ft NAVD88, extending up to 478.1 ft NAVD88 just north of the project site, as delineated on Federal Emergency Management Agency (FEMA) map 25027C0976E (effective date July 4, 2011). The project site does not contain *Estimated and Priority Habitat of Rare Species* as delineated by the Natural Heritage and Endangered Species Program (NHESP) in the 15th Edition of the Massachusetts Natural Heritage Atlas or an Area of Critical Environmental Concern (ACEC). The site does not contain any structures listed in the

State Register of Historic Places or the Massachusetts Historical Commission's (MHC) Inventory of Historic and Archaeological Assets of the Commonwealth.

The project site is located within one Environmental Justice (EJ) population characterized by Income criteria and within one mile of an additional EJ population characterized by Minority criteria. The site is located within five miles of seven additional EJ populations characterized by Income criteria (4) and Minority and Income criteria (3). As described below, the ENF included a review of potential impacts and benefits to EJ populations within one mile of the project site and described public involvement efforts undertaken to date.

Environmental Impacts and Mitigation

Potential environmental impacts associated with the project include the alteration of 0.92 acres of land, the creation of 0.06 acres of impervious surface (for a total of 0.14 acre on site), the construction of one new parking space (for a total of five on site), and the generation of two New average daily trips (adt), for a total of four adt from the project site. The project will alter 693,396 square feet (sf) (approximately 15.92 acres) of LUW; 340 linear feet (lf) of Bank; 19,330 sf of Riverfront Area (approximately 0.44 acres); and 1,950 sf of BLSF. The project will also dredge approximately 965 cy of sediment.

Measures to avoid, minimize, and mitigate project impacts include the partial removal of existing impervious surface on site, the restoration of temporarily altered wetland resource areas, construction of a bio-infiltration rain garden, use of erosion and sedimentation controls, use of best management practices (BMPs) during construction to minimize noise and dust impacts, and the creation of 850 sf of LUW, 130 lf of Bank, and 850 sf of BLSF through the removal of existing infrastructure within these resource areas.

Jurisdiction and Permitting

The project is undergoing MEPA review and is subject to a mandatory EIR pursuant to 301 CMR 11.03(3)(a)(1)(b) of the MEPA regulations because it requires an Agency Action and will involve the alteration of 10 or more acres of wetlands through the temporary dewatering of the pond. The project additionally exceeds the ENF threshold at 301 CMR 11.03(3)(b)(1)(f) because it will result in the alteration of one half or more acres of any other wetlands (LUW, Riverfront Area, and BLSF). The project requires the preparation of an EIR under 301 CMR 11.06(7)(b) of the MEPA regulations because it is located within one mile of one or more EJ populations. The project requires a Chapter 253 Dam Safety Permit from DCR and a 401 Water Quality Certification (WQC) and Chapter 91 (c.91) License and Permit from the Massachusetts Department of Environmental Protection (MassDEP).

The project requires an Order of Conditions from the Oxford Conservation Commission (or in the case of an appeal of either, a Superseding Order of Conditions from MassDEP). The project requires Pre-Construction Notification under the U.S. Army Corps of Engineers (USACE) General Permits for Massachusetts Engineers.

Because the project will be undertaken by an Agency (DCR), MEPA jurisdiction is broad in scope and extends to all aspects of the project that may cause Damage to the Environment, as defined in the MEPA regulations.

Request for Single EIR

The MEPA regulations indicate a Single EIR may be allowed provided I find that the EENF:

- a) describes and analyzes all aspects of the project and all feasible alternatives, regardless of any jurisdictional or other limitation that may apply to the Scope;
- b) provides a detailed baseline in relation to which potential environmental impacts and mitigation measures can be assessed; and,
- c) demonstrates that the planning and design of the project use all feasible means to avoid potential environmental impacts.

For any Project for which an EIR is required in accordance with 301 CMR 11.06(7)(b), I must also find that the EENF:

- d) describes and analyzes all aspects of the Project that may affect EJ Populations located in whole or in part within the Designated Geographic Area around the project; describes measures taken to provide meaningful opportunities for public involvement by EJ Populations prior to filing the EENF, including any changes made to the project to address concerns raised by or on behalf of EJ Populations; and provides a detailed baseline in relation to any existing unfair or inequitable Environmental Burden and related public health consequences impacting EJ Populations in accordance with 301 CMR 11.07(6)(n)(1)

Consistent with this request, the EENF was subject to an extended comment period under 301 CMR 11.05(7).

Review of the EENF

The EENF provided a description of existing and proposed conditions, preliminary project plans, a hydrologic and hydraulic (H&H) study summary, copies of correspondence with the U.S. Fish and Wildlife Service (USFWS) and MHC, and a sediment analysis. The EENF identified measures to avoid, minimize and mitigate environmental and public health impacts. Consistent with the MEPA Interim Protocol on Climate Change Adaptation and Resiliency, the EENF contained an output report from the MA Climate Resilience Design Standards Tool prepared by the Resilient Massachusetts Action Team (RMAT) (the “MA Resilience Design Tool”),¹ together with information on climate resilience strategies to be undertaken by the project. The EENF also included a description of measures taken to enhance public involvement by EJ populations and a baseline assessment of any existing unfair or inequitable Environmental Burden and related public health consequences impacting EJ Populations in accordance with 301

¹ https://resilientma.org/rmat_home/designstandards/

CMR 11.07(6)(n)(1). The Proponent provided supplemental information including the complete H&H study, a clarification of impacts to wetlands resources and of project goals/alternatives, and information on previous public meetings held on the project, which was distributed on July 11, 2022. For purposes of clarity, all supplemental materials are included in references to the “EENF” unless otherwise indicated.

Alternatives Analysis

The EENF included an alternatives analysis which described a No-Action Alternative, Full Dam Removal Alternative, Partial Dam Removal Alternative, and Permanent Lowering of the Spillway Alternative in addition to the Preferred Alternative. Alternatives were analyzed based on their environmental impacts and their ability to meet the project purpose, which is primarily to address the current threat to public safety posed by the dam by bringing the dam into compliance with the Dam Safety Regulations. As the project site is currently abandoned private property, the EENF indicates the Town must take ownership of the property prior to DCR being able to undertake the project. As such, the goals for the project were developed in conjunction with the Town, which has identified retaining the aesthetic and recreational value of the pond as a priority.

The No Action Alternative would leave the site in its existing state. This Alternative was dismissed as the dam is currently classified as an Unsafe Condition Dam and presents a potential hazard to public safety.

The Full Dam Removal Alternative would include the demolition of the existing dam to eliminate the impoundment and restore the hydraulic connectivity of the original waterway. As described in the EENF, full dam removal would result in the permanent loss of over a dozen acres of LUW and potentially the loss of Bordering Vegetated Wetland (BVW) located in the upstream reach of the current limits of Lowe’s Pond. The EENF states that the Town and residents prefer to retain the dam and existing impoundment elevation to maintain the aesthetic and recreational functions of Lowes Pond. As the Full Dam Removal Alternative would not meet the Town’s goals for the project, this Alternative was dismissed.

The Partial Dam Removal would involve modifying the existing dam such that it would no longer be jurisdictional under the Dam Safety Regulations as means of bringing the dam into compliance with these regulations (more specifically, by making the dam no longer subject to these regulations). A non-jurisdictional dam would be under 6 feet in height or have a storage capacity of less than 15 acre-feet. According to the EENF, it was not possible develop a cross section within the footprint of the existing dam that met either the height or storage criteria. As such, this Alternative was not considered viable.

The Permanent Lowering of the Dam Spillway Alternative would involve permanently lowering the principal spillway to pass the SDF. It was estimated that the crest level would need to be lowered by one foot to prevent overtopping of the dam during the SDF event. This Alternative also included the same structural elements included in the Preferred Alternative (addition of a new mass concrete section on the downstream side of the spillway to address stability deficiencies, removal of the failing sluiceway channel and surrounding embankment, and construction of a new earthen dam section with low level outlet in its place). This

Alternative would result in similar impacts to the Preferred Alternative, but could potentially result in long-term impacts to Lowes Pond and the large wetland complex located upstream. Permanent lowering of the Lowe's Pond elevation also raised concerns regarding recreational impacts to boating and fishing. The EENF states that, due to these potential impacts, it was decided that the best approach to minimize environmental impact and maintain the recreational value of Lowes Pond was to maintain the existing water surface elevation of the pond.

According to the EENF, the Preferred Alternative (described herein), which involves repairing the dam and widening the spillway (as opposed to permanently lowering it) in order to pass the SDF, was selected as it minimizes environmental impacts while addressing the threat to public safety and maintaining the recreational value of the pond.

Environmental Justice

Effective January 1, 2022, all new projects in "Designated Geographic Areas" ("DGA," as defined in 301 CMR 11.02, as amended) around EJ populations are subject to new requirements imposed by Chapter 8 of the Acts of 2021: An Act Creating a Next-Generation Roadmap for Massachusetts Climate Policy (the "Climate Roadmap Act") and amended MEPA regulations at 301 CMR 11.00.² Two related MEPA protocols – the MEPA Public Involvement Protocol for Environmental Justice Populations (the "MEPA EJ Public Involvement Protocol") and MEPA Interim Protocol for Analysis of project Impacts on Environmental Justice Populations (the "MEPA Interim Protocol for Analysis of EJ Impacts") – are also in effect for new projects filed on or after January 1, 2022.³ Under the new regulations and protocols, all projects located in a DGA around one or more EJ populations must take steps to enhance public involvement opportunities for EJ populations, and must submit analysis of impacts to such EJ populations in the form of an EIR.

The EENF indicates that the DGA for the project is one mile; as noted above, the project site is located within one EJ population characterized by Income criteria and within one mile of an additional EJ population characterized by Minority criteria. A public meeting on the project was held on September 29, 2021 that included Town of Oxford staff and other interested parties. The Proponent provided Advance Notification under Part II of the MEPA EJ Public Involvement Protocol through the distribution of an EJ Screening Form to a list of community-based organizations (CBOs) and tribes/indigenous organizations provided by the MEPA Office. An evening remote consultation session and daytime in-person site walk were held to promote public involvement during MEPA review of the EENF. The Proponent plans to maintain community engagement throughout the MEPA review process by holding community meetings, if requested, during weekend or evening hours, at accessible locations; and by establishing a local repository for project review documents, notices, and decisions.

According to the EENF, the data surveyed do not appear to indicate existing "unfair or inequitable" burdens impacting the identified EJ populations. Specifically, the EENF notes that

² MEPA regulations have been amended to implement Sections 55-60 of the Climate Roadmap Act, and took effect on December 24, 2021. More information is available at <https://www.mass.gov/service-details/information-about-upcoming-regulatory-updates>.

³ Available at <https://www.mass.gov/service-details/eea-policies-and-guidance>.

the DPH EJ Tool does not identify any census tract or municipality in which the identified EJ populations are located as exhibiting “vulnerable health EJ criteria”; this term is defined in the DPH EJ Tool to include any one of four environmentally related health indicators that are measured to be 110% above statewide rates based on a five-year rolling average.⁴ In addition, the EENF indicates that the following facilities and sources exist within the identified EJ populations within one mile of the project site, based on the mapping layers available in the DPH EJ Tool:

- MassDEP Groundwater Discharge Permits: 2
- Sites with Activity and Use Limitations (AULs): 3
- M.G.L. c. 21E sites: 1
- “Tier II” Toxics Release Inventory Site: 5
- Underground storage tanks: 1

Although not required by the MEPA Interim Protocol for Analysis of EJ Impacts, the EENF also surveyed environmental indicators tracked through the U.S. EPA’s “EJ Screen” for the census tract 7532, block group 3 (the EJ population the project site is located partially within), which shows the indicators measured at the following percentiles as compared to the MA statewide average:

- Particulate Matter (PM) 2.5: 30th percentile
- Ozone: 70th percentile
- 2017 Diesel Particulate Matter: 10th percentile
- 2017 Air Toxics Cancer Risk: 56th percentile
- Traffic Proximity: 63rd percentile
- Lead Paint: 46th percentile
- Superfund Proximity: 12th percentile
- RMP Facility Proximity: 24th percentile
- Hazardous Waste Proximity: 55th percentile
- Underground Storage Tanks: 50th percentile
- Wastewater Discharge: 29th percentile

The data indicate that the above EJ census block does not exhibit any environmental indicators at or above the 80th percentile of the statewide average. The EENF did not appear to provide any data on census tract 7531, block group 5, the other EJ population present within one mile of the project. The SEIR should include this information.

⁴ See <https://matracking.ehs.state.ma.us/Environmental-Data/ej-vulnerable-health/environmental-justice.html>. Four vulnerable health EJ criteria are tracked in the DPH EJ Viewer, of which two (heart attack hospitalization and childhood asthma) are tracked on a municipal level, and two (childhood blood lead, and low birth weight) are tracked on a census tract level.

The EENF included a screening of climate risks for the project site, using the MA Resilience Design Tool, as further described below. Based on the 60-year useful life of the dam, and the self-assessed criticality of this asset, the project was rated as “High” risk for extreme precipitation (urban flooding), extreme precipitation (riverine flooding), and extreme heat. As noted above, the dam currently cannot safely pass the SDF, and the EENF identifies EJ communities downstream of the dam.

The EENF describes project-related impacts to EJ populations within this DGA as primarily limited to construction period disruptions to public access for recreational purposes. The EENF states that short-term impacts to traffic on surrounding roads during construction are expected to be minimal but could temporarily disrupt local traffic, and that short-term impacts to air quality and noise levels in the project area could occur during construction but would not result in disproportionate adverse effects to EJ populations. As described in the EENF, BMPs will be employed to control emissions from construction vehicles in order to minimize air quality impacts, and work will only be completed during daylight hours to minimize noise impacts. The EENF describes project-related benefits to EJ populations as the elimination of an existing public safety hazard to downstream EJ communities, and the creation of a publicly accessible recreational resource.

Wetland and Waterways

The Oxford Conservation Commission will review the project for its consistency with the Wetlands Protections Act (WPA), the Wetland Regulations (310 CMR 10.00), and associated performance standards, including the Stormwater Management Standards (SMS). The Proponent has not submitted a Notice of Intent (NOI) to the Conservation Commission at the time of filing the EENF. The project will temporarily impact 14,500 sf of Riverfront Area, 175 lf of Bank, 1,100 sf of BLSF, and approximately 15.89 acres of LUW (15.6 acres of which is associated with temporary drawdown during construction). The project will result in the permanent alteration of 4,830 sf of Riverfront Area, 165 lf of Bank, 850 sf of BLSF, and 1,280 sf of LUW. The project will also create, through the removal of existing infrastructure, 850 sf of LUW, 130 lf of Bank, and 850 sf of BLSF, resulting in a net gain of 850 sf of BLSF and the net loss of 430 sf of LUW and 35 lf of Bank. As described in the EENF, temporarily impacted Bank, BLSF, and Riverfront Area will be revegetated following project construction. As noted in comments from MassDEP, it is unclear from the project narrative if the provided impact values for LUW include those resulting from the placement of the new training wall at the western dam face. This should be clarified in the SEIR in accordance with the Scope below.

The project proposes to drawdown Lowe’s Pond by 3.8 feet to el. 471 NAVD88 during the construction period of June through December. Comments from MassDEP recommend that pond drawdown be implemented gradually and for the minimum amount of time required to complete the project to minimize adverse impacts to aquatic species, and that timber construction mats, or comparable approved mats be implemented within areas of LUW which will be accessed by machine following drawdown and dewatering. The EENF states that, to implement the rehabilitation of the dam and spillway, the construction area will be dewatered behind a cofferdam installed in Lowes Pond. Inflow to the pond will be pumped from a location immediately upstream of the cofferdam to by-pass the construction site and discharged back to the stream immediately upstream of the Huguenot Road bridge. As described in the EENF, the

rehabilitation project may result in temporary, minor increases in turbidity during the construction phase, but indicates measures to control turbidity will be provided. As noted in comments from MassDEP, the location of the cofferdam(s) was not shown in plans included in the EENF; this should be provided in the SEIR.

As the project is located within a jurisdictional waterway, a c.91 License and Permit will be required. Comments from MassDEP Waterways Regulation Program (MassDEP-WRP) state that the proposed project appears to be water-dependent. The project will involve the dredging of approximately 865 cy of sediment and will in turn require a 401 WQC. The EENF states that excavated sediment would be reused on site to the maximum extent possible. As described in the EENF, dredged sediments from the upstream area could be suitable for unrestricted reuse or disposal and reuse at a lined landfill in Massachusetts, but sediment from below the dam may not be suitable for reuse based on the presence of arsenic and lead detected in the soil analysis. As noted in comments from MassDEP, samples should be collected from any sediment destined for off-site relocation for analysis of potential contaminants to ensure compliance with 310 CMR 40.0032(3), DEP's Similar Soils Provision Guidance (WSC-13-500) and DEP's Interim Policy Comm-94-007: Dredged Sediment Reuse or Disposal for the receiving location.

Climate Change

Governor Baker's Executive Order 569: Establishing an Integrated Climate Change Strategy for the Commonwealth was issued on September 16, 2016. The Order recognizes the serious threat presented by climate change and direct Executive Branch agencies to develop and implement an integrated strategy that leverages state resources to combat climate change and prepare for its impacts. The urgent need to address climate change was again recognized by Governor Baker and the Massachusetts Legislature with the recent passage of St. 2021, c. 8, An Act Creating a Next Generation Roadmap for Massachusetts Climate Policy, which sets a goal of Net Zero emissions by 2050. I note that the MEPA statute directs all Agencies to consider reasonably foreseeable climate change impacts, including additional greenhouse gas emissions, and effects, such as predicted sea level rise, when issuing permits, licenses and other administrative approvals and decisions. M.G.L. c. 30, § 61.

Adaptation and Resiliency

Effective October 1, 2021, all MEPA projects are required to submit an output report from the MA Resilience Design Tool to assess the climate risks of the project. As noted above, based on the 60-year useful life of the dam and the self-assessed criticality of this asset, the project was rated as "High" risk for extreme precipitation (urban flooding), extreme precipitation (riverine flooding), and extreme heat for all four project assets. According to the EENF, the Tool recommends a planning horizon of 2070 and a return period associated with a 50-year (2% chance) storm event when designing the dam to address extreme precipitation. This is correlated to a "Medium" criticality assessment for the dam, which appears to be understated in light of the dam's flood control function and the presence of residential areas downstream of the dam. For "High" criticality assets, the MA Resilience Design Tool recommends planning for a 100-year storm event as of 2070.

An H&H analysis was developed to simulate flood events for the 10-, 50-, and the 100-year storm events using National Oceanic and Atmospheric Administration (NOAA) Atlas 14 precipitation data. According to this analysis, the dam would be overtopped by approximately 0.9 feet during the 100-year storm under existing conditions, and would likely be overtopped by the 50-year storm as well. Based on the H&H modeling, the Lowes Pond Dam spillway needs to pass a discharge of 947 cubic feet per second (cfs) without overtopping the dam at el. 477.5 ft NAVD88. As noted above, the spillway will be widened as part of the project to pass the SDF (which is based on the 100-year storm).

The EENF states that the project is not anticipated to result in any change in water level or velocity upstream of the spillway as a result of the widening of the spillway, and that the project will not result in adverse changes to floodwater flow paths and/or velocities that could impact adjacent properties or the function of the floodplain (as noted above, the project is within Flood Zone AE). Specifically, the EENF states the project will not result in any increase in flood levels in Lowes Pond during the occurrence of the 1% annual chance event, as the spillway crest level will be maintained at its existing elevation (474.8 ft NAVD88). The EENF additionally notes that the bridge on Huguenot Road (and culvert within) has adequate capacity to pass the 1% annual chance flood without overtopping the road, and indicates that the project will not affect these existing conditions. The SEIR should discuss whether these conclusions would differ if future climate conditions were considered.

Greenhouse Gas (GHG) Emissions

This project is subject to review under the May 2010 MEPA Greenhouse Gas Emission (GHG) Policy and Protocol (Policy) because it exceeds thresholds for a mandatory EIR. The GHG Policy includes a de minimis exemption for projects that are expected to produce minimal GHG emissions. The EENF indicates that GHG emissions associated with the project will be limited to the construction period and are de minimis. The Proponent therefore was not required to submit a GHG analysis in conjunction with the EENF.

Construction Period

Project construction is anticipated to commence in May 2023 and conclude in December 2023. As described in the EENF, materials generated during demolition and construction, such as boulders, concrete, and brick, will be reused on site as feasible. On-site boulders will be incorporated into the landscaping throughout the site. Salvaged concrete and brick may be reused as subbase material under foundations of elements not supported on rock. BMPs would be employed to reduce the impacts to air quality during construction, which may include reducing idling times of construction vehicles.

All construction and demolition activities should be managed in accordance with applicable MassDEP's regulations regarding Air Pollution Control (310 CMR 7.01, 7.09-7.10), and Solid Waste Facilities (310 CMR 16.00 and 310 CMR 19.00, including the waste ban provision at 310 CMR 19.017). The project should include measures to reduce construction period impacts (e.g., noise, dust, odor, solid waste management) and emissions of air pollutants from equipment, including anti-idling measures in accordance with the Air Quality regulations (310 CMR 7.11). I encourage the Proponent to require that its contractors use construction

equipment with engines manufactured to Tier 4 federal emission standards, or select project contractors that have installed retrofit emissions control devices or vehicles that use alternative fuels to reduce emissions of volatile organic compounds (VOCs), carbon monoxide (CO) and particulate matter (PM) from diesel-powered equipment. Off-road vehicles are required to use ultra-low sulfur diesel fuel (ULSD). If oil and/or hazardous materials are found during construction, the Proponent should notify MassDEP in accordance with the Massachusetts Contingency Plan (310 CMR 40.00). All construction activities should be undertaken in compliance with the conditions of all State and local permits.

Conclusion

The EENF includes an alternatives analysis and an assessment of environmental impacts and mitigation sufficient to justify the request for a Single EIR. Based on review of the EENF and consultation with Agencies, I hereby allow the Proponent to submit a Single EIR in lieu of a Draft and Final EIR.

SCOPE

General

EEA 1 → The SEIR should follow Section 11.07 of the MEPA regulations for outline and content and provide the information and analyses required in this Scope. It should clearly demonstrate that the Proponent has sought to avoid, minimize and mitigate Damage to the Environment to the maximum extent practicable.

Project Description and Permitting

EEA 2 → The SEIR should identify any changes to the project since the filing of the EENF. It

EEA 3 → should identify and describe State, federal and local permitting and review requirements associated with the project and provide an update on the status of each of these pending actions.

EEA 4 → The SEIR should include a description and analysis of applicable statutory and regulatory standards and requirements, and a discussion of the project’s consistency with those standards.

EEA 5 → The SEIR should include updated site plans (legible and at a reasonable scale) for existing and post-development conditions; as noted below, this should include the location of cofferdams and other dewatering equipment. Conceptual plans should clearly identify: all major project components (existing and proposed buildings, access roads, etc.); wetland resource areas; impervious areas; ownership of parcels including easements; pedestrian and bicycle accommodations; stormwater and utility infrastructure. Conceptual plans should be provided for onsite work as well as any proposed off-site work for transportation or utility improvements that will benefit the project. The SEIR should provide an update on any coordination with the Town, and further details regarding the future ownership/operation of the area (i.e., what areas are being considered for Town ownership/public use, the mechanism of taking and status of these efforts, etc.).

EEA 6 →

Environmental Justice

EEA 7 → The EENF provided data from the EPA’s EJ Screen for census tract 7532, block group 3, but did not appear to provide any data on census tract 7531, block group 5, the second EJ population present within one mile of the project. The SEIR should include this information. Should any environmental indicators shown in EJ Screen for census tract 7531, census block 5 be in the 80th percentile or higher of statewide average, the SEIR should discuss whether the project is anticipated to materially exacerbate any such conditions. The SEIR should provide an update on any public outreach conducted since the filing of the EENF, and should describe a plan to maintain the same level of community engagement through subsequent permitting. Any changes made to the project design in response to this coordination should be identified. The SEIR should clarify what EJ communities are present downstream of the dam.

EEA 8

EEA 9

Wetlands and Waterways

EEA 10 → The SEIR should verify that all impact and replacement values are accurate and encompass all work within each respective resource area. The SEIR should include additional details regarding the restoration of temporarily impacted wetland resource areas, including the quantity of each resource proposed to be revegetated, and whether any post-construction monitoring and/or invasive species management is proposed. If a wildlife habitat analysis has been conducted as part of the NOI process prior to the filing of the SEIR, the results of this analysis should be included in the SEIR. The location of the cofferdams should be denoted on site plans, and a more detailed discussion of any in-stream measures proposed to prevent the downstream migration of sediments should be provided. The SEIR should also provide more details regarding potential turbidity controls, to the extent these have been evaluated and/or incorporated into the project design. If no turbidity controls are proposed, the SEIR should provide an explanation as to why these measures were dismissed.

EEA 11

EEA 12

Climate Change Adaptation and Resiliency

EEA 13 → The SEIR should clarify whether climate change impacts (i.e., increased volume and frequency of storms) were considered when modeling storm flows/flooding following project construction. The SEIR should clarify whether the project will meet the recommendations of the MA Resilience Design Tool, and specifically, the recommendation of a planning horizon of 2070 and a return period associated with a 50-year or 100-year storm event (as of 2070) when designing the dam, including sizing of the spillway. The SEIR should discuss whether the additional analyses and conclusions related to off-site flood impacts, flood levels in Lowes Pond, and the potential for overtopping of Huguenot Road and the culvert within would differ if future climate conditions and precipitation levels were to be considered. If the dam design or other components are not anticipated to meet 2070 50-year or 100-year storm conditions, the SEIR should discuss whether the project design would foreclose future opportunities for further retrofits, and whether the project has considered adaptive management strategies that would allow for future improvements over time.

Mitigation and Section 61 Findings

The SEIR should include a separate chapter summarizing all proposed mitigation measures including construction-period measures. This chapter should also include a comprehensive list of all commitments made by the Proponent to avoid, minimize and mitigate the impacts of the project, and should include a separate section outlining mitigation commitments relative to EJ populations. The SEIR should contain clear commitments to implement these mitigation measures, estimate the individual costs of each proposed measure, identify the parties responsible for implementation, and contain a schedule for implementation. The list of commitments should be provided in a tabular format organized by subject matter (traffic, water/wastewater, GHG, EJ, etc.) and identify the Agency Action or Permit associated with each category of impact. Draft Section 61 Findings should be separately included for each Agency Action to be taken on the project. The SEIR should clearly indicate which mitigation measures will be constructed or implemented based upon project phasing, either tying mitigation commitments to overall project square footage/phase or environmental impact thresholds, to ensure that adequate measures are in place to mitigate impacts associated with each development phase.

EEA 15

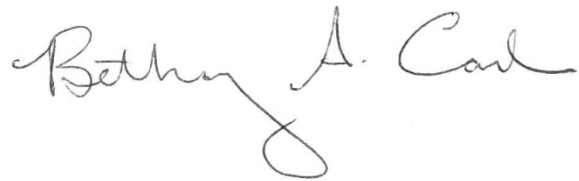
EEA 16

Responses to Comments

The SEIR should contain a copy of this Certificate and a copy of each comment letter received. In order to ensure that the issues raised by commenters are addressed, the SEIR should include direct responses to comments to the extent that they are within MEPA jurisdiction. This directive is not intended, and shall not be construed, to enlarge the scope of the SEIR beyond what has been expressly identified in this certificate.

Circulation

In accordance with 301 CMR 11.16(3)(b), the Proponent should circulate the SEIR to each Person or Agency who commented on the EENF, each Agency from which the project will seek Permits, Land Transfers or Financial Assistance, and to any other Agency or Person identified in this Scope. Pursuant to 301 CMR 11.16(5), the Proponent may circulate copies of the SEIR to commenters in a digital format (e.g., CD-ROM, USB drive) or post to an online website. A copy of the SEIR should be made available for review in the Oxford Public Library.



August 1, 2022
Date

Bethany A. Card

Comments received:

07/25/2022 Massachusetts Department of Environmental Protection (MassDEP)

EEA# 16571

EENF Certificate

August 1, 2022

07/25/2022 Massachusetts Department of Environmental Protection (MassDEP) Waterways
Regulation Program (MassDEP-WRP)

BAC/ELM/elm



Department of Environmental Protection

One Winter Street Boston, MA 02108 • 617-292-5500

Charles D. Baker
Governor

Karyn E. Polito
Lieutenant Governor

Bethany A. Card
Secretary

Martin Suuberg
Commissioner

Memorandum

To: Eva Murray, Environmental Analyst, MEPA

From: Alice Doyle, Waterways Regulation Program, MassDEP/Boston


Cc: Chrissy Hopps, Assistant Director, Waterways Regulation Program

Re: Comments from the Chapter 91 Waterways Regulation Program
Lowe's Pond Dam Rehabilitation Project, Oxford
EEA #16571 - EENF

Date: July 25, 2022

The Department of Environmental Protection Waterways Regulation Program (the "Department") has reviewed the referenced Expanded Environmental Notification Form (EENF) EEA #16571 submitted by AECOM Environmental Consultants on behalf of the Massachusetts Department of Conservation and Recreation Office of Dam Safety for the proposed rehabilitation of Lowe's Pond Dam and improved recreational access, at Huguenot Road in Oxford, Worcester County (the "project site"). The project includes dredging and the installation of structures within/over the waters of Lowe's Pond and Lowe's Brook.

Chapter 91 Jurisdiction

The Department has determined that the proposed project is located within a jurisdictional waterway pursuant to 310 CMR 9.04(1)(e), and the work will require a Chapter 91 license and permit. 

Water Dependency

The Department has determined that the proposed project appears to be water-dependent and will conduct a full review and determination of water-dependency upon receipt of a Chapter 91 application.

Regulatory Review

The Department looks forward to receipt of an application that meets the minimum filing requirements as prescribed at 310 CMR 9.11(3). If you have any questions regarding the Department's comments, please contact Alice Doyle at alice.doyle@mass.gov.



Commonwealth of Massachusetts
Executive Office of Energy & Environmental Affairs

Department of Environmental Protection

Central Regional Office • 8 New Bond Street, Worcester MA 01606 • 508-792-7650

Charles D. Baker
Governor

Karyn E. Polito
Lieutenant Governor

Bethany A. Card
Secretary

Martin Suuberg
Commissioner

July 25, 2022

Secretary Bethany A. Card
Executive Office of Environmental Affairs
100 Cambridge Street, 9th Floor
Boston, MA 02114

Attention: MEPA Unit – Eva Murray

Re: Expanded Environmental Notification Form (EENF)
Lowes Pond Dam Rehabilitation
Oxford
EEA #16571

Dear Secretary Card,

The Massachusetts Department of Environmental Protection's ("MassDEP") Central Regional Office has reviewed the EENF for the Lowes Pond Dam Rehabilitation (the "Project") submitted by the Massachusetts Department of Conservation and Recreation Office of Dam Safety (ODS). ODS (the "Proponent") is proposing to rehabilitate the Lowes Pond Dam located north of Huguenot Road and west of Main Street. The Project includes reconstruction and widening of the spillway, reinforcement of the concrete training wall, installation of a 24-inch diameter outlet pipe, removal of sediment, and construction of a pedestrian bridge, parking areas and walkways.

The Project is under MEPA review because it meets or exceeds the following review thresholds:

- 301 CMR 11.03(3)(a)(1)(b) - Alteration of ten or more acres of any other wetlands;
- 301 CMR 11.03(3)(b)(1)(f) - alteration of ½ or more acres of any other wetlands.

The Project requires the following State Agency Permits:

- MassDEP Superseding Order of Conditions (if a local Order of Conditions is appealed);
- MassDEP 401 Water Quality Certification;

This information is available in alternate format. Contact Glynis Bugg at 617-348-4040
TTY# MassRelay Service 1-800-439-2370
MassDEP Website: www.mass.gov/dep

Printed on Recycled Paper.

- Massachusetts Historical Commission Project Notification Form (PNF) and National Historic Preservation Act Section 106 Compliance;
- Chapter 253 Dam Safety Permit;
- MassDEP Chapter 91 License.

The Proponent is requesting permission to prepare a Single Environmental Impact Report (SEIR). MassDEP offers the following comments:

Bureau of Waste Site Cleanup (BWSC)

The Project includes the removal of sediment upstream of the dam. There are no reported releases of oil or hazardous materials at or near the Project site. The Proponent collected eight sediment samples taken upstream and downstream within the Project area for analysis of metals, extractable petroleum hydrocarbons (EPH), polycyclic aromatic hydrocarbons (PAHs), volatile organic compounds (VOCs), pesticides, total organic carbon (TOC), total solids, and grain size distribution. A review of the upstream (above the dam) analytical data indicated metals concentrations in the upstream sediment samples were below Method 1, S-1 Soil Standards with exception of one sample where arsenic was measured at 20.4 milligrams per kilogram (mg/kg) slightly exceeding the Method 1, S-1 soil Standard of 20 mg/kg. VOCs, PAHs, EPH and PCBs were not detected above Method 1, S-1 Soil Standards. The downstream (below the dam) analytical data indicated three PAHs exceeding Method 1 S-1 Soil Standards. Arsenic detected as high as 54.8 mg/Kg and lead measured at a maximum concentration of 849 mg/kg in downstream sediment samples are above Method 1, S-1 Soil Standards of 20 mg/kg and 200 mg/Kg, respectively. A trichloroethene (TCE) concentration in one downstream sample was measured at 0.44 mg/Kg exceeding the Method 1, S-1 standard of 0.3 mg/Kg. EPH and PCBs were not detected above Method 1, S-1 Soil Standards in any of the downstream sediment samples.

The Proponent intends to dredge and manage approximately 865 cubic yards of sediment. For any sediment destined for off-site relocation, samples should be collected for analysis of potential contaminants to ensure compliance with 310 CMR 40.0032(3), DEP's Similar Soils Provision Guidance (WSC-13-500) and DEP's Interim Policy Comm-94-007: Dredged Sediment Reuse or Disposal for the receiving location. Care should be taken in the relocation/reuse of any downstream sediment because it may not be suitable for unrestricted reuse in upland areas due to the detections in some samples of arsenic, lead and TCE. If oil and/or hazardous materials are identified during the implementation of this Project, notification to MassDEP may be required pursuant to M.G.L. c. 21E and the MCP. A Licensed Site Professional (LSP) should be retained to determine if submittals to MassDEP are required to conduct the work or if notification is required. The Proponent may contact the BWSC in the Central Region for guidance if questions arise regarding contaminated material.

Wetlands

The Project will result in the permanent alteration of wetland resource areas including alteration of 4,830 square feet (sf) of Riverfront Area (RA), 165 linear feet (lf) of Bank of which 130 lf will be replaced, 1,280 sf of Land Under Waterbodies (LUW), of which 850 sf will be replaced, and the creation of 850 sf of new Bordering Land Subject to Flooding (BLSF). Additional temporary impacts to LUW will occur in relation to temporary lake drawdown

activities required by the Project totaling 15.6 acres, as well as 8,000 sf of dredging to remove accumulated sediments from the dam face. These activities will not result in the loss of LUW once pond levels are restored following draw down. Total Buffer Zone (BZ) alteration to Bank will total 1,500 sf.

The Project as described requires the filing of a Notice of Intent (NOI) with the Oxford Conservation Commission and MassDEP. As indicated in the EENF, the Proponent has not yet submitted an NOI. Upon receipt of NOI materials, MassDEP may provide additional commentary relating to the Project and its compliance with the Massachusetts Wetland Protection Act, the Wetlands Regulations at 310 CMR 10.00 et.al., and the Massachusetts Stormwater Standards. The Project may require a Superseding Order of Conditions or a Final Order of Conditions from MassDEP if the local decision to issue an Order of Conditions is appealed.

Alterations of RA totaling 4,830 sf will be associated with construction of the proposed gravel parking areas, removal of existing mill structures, installation of the stilling basin and reconfiguration of the banks and retaining walls beneath the dam. An additional 14,500 sf of RA impact will result from the removal of vegetation from the dam embankments and surrounding area which is required to establish access and staging areas within the Limit of Work (LOW). The area of vegetation removal is temporary as areas outside of the dam embankments will be revegetated and undergo invasive species removal, but the dam embankments will need to be kept free of larger woody vegetation for continued dam operation.

Bank alterations totaling 165 lf will be associated with proposed repair activities. Approximately 130 lf of Bank resource is proposed to be restored in kind resulting in a net loss of 35 lf. The proposed Bank alterations are in excess of those presumed to have no impact on the capacity of a Bank resource to provide important wildlife habitat functions. Therefore, the NOI and SEIR should include a wildlife habitat analysis as outlined in 310 CMR 10.60.

Permanent alteration of LUW totaling 1,280 sf will be associated with both up and downstream rip rap armoring/retaining wall placement, expansion of the existing spill way, stilling basin placement and any grading associated with these activities. Removal of the existing sluiceway will result in the creation of an additional 850 sf of LUW, resulting in a net loss of 430 sf. Temporary impacts to LUW, totaling 9,462 sf, will be associated with the dredging as well as with check dam and cofferdam placement during the construction period. An additional 15.6 acres of LUW will be indirectly impacted by temporary pond drawdown activities. The proposed drawdown of Lowe's Pond will be 3.8 feet to elevation 471. Total proposed impact to LUW is in excess of those established in 310 CMR 10.56(4)4, which presumed to have no adverse impact on the capacity of a LUW resource to provide important wildlife habitat. Accordingly, the NOI and EIR should include a wildlife habitat analysis as outlined in 310 CMR 10.60. MassDEP recommends that Pond drawdown be implemented gradually and for the minimum amount of time required to complete the Project to minimize adverse impacts to aquatic species, and that timber construction mats, or comparable approved mats be implemented within areas of LUW which will be accessed by machine following drawdown and dewatering.

It is unclear from the Project narrative if the provided impact values for LUW include those resulting from the placement of the new training wall at the western dam face. The Proponent has noted that the net LUW loss value provided in the EENF as 200 sf is inconsistent with the impact and replacement values provided elsewhere in the document. The Proponent should verify that all impact and replacement values provided in the NOI and EIR are accurate and encompass all work within each respective resource area.

The Project appears to meet the provisions of 310 CMR 10.57(4), as work proposed within BLSF will not result in the change over existing grades and proposed work to remove the existing sluiceway and mill structure will result in the net gain of 850 sf of BLSF.

The Proponent has indicated that given the current condition of the dam and the existing uses of the pond that the proposed repair efforts represent the preferred alternative, with other available alternatives including: no action; partial dam removal, which would leave the dam still jurisdictional and require extensive work on existing mill and dam structures on par with the preferred rehabilitation; and full dam removal, which would diminish the current community use of Lowes Pond. The Proponent states that as proposed most of the Project meets the exemptions established under 310 CMR 10.53(3)(i) as the Project constitutes the maintenance/replacement of an existing dam structure and does not represent the significant increase in size over existing conditions. Portions of the Project which fall outside of this scope, including the proposed pedestrian walking paths, bridge, and parking areas, appear to meet the performance standards established in 310 CMR 10.58(4), because there appear to be no practicable and substantially equivalent economic alternatives to the Project with fewer adverse effects and that the work, including proposed mitigation, will have no significant adverse impact on the riverfront area.

Stormwater

Most of the proposed dam rehabilitation work is exempt from the Massachusetts Stormwater Management Standards (the “Standards”) because it will occur within the existing limits of dam structures and therefore does not represent a substantial enlargement over existing conditions. However, segments of the Project falling outside the scope of dam maintenance and improvement must comply with the Standards.

Construction period stormwater management discussed in the EENF include implementation of sedimentation barriers at the limit of work and silt sacks within existing in-road catch basins.

MassDEP notes that the location of the proposed cofferdams and any associated dewatering settling basins noted in the Project narrative have not been included on Project plans. The NOI should include revised Project plans that include this information for review. Additionally, MassDEP recommends the consideration of in-stream sedimentation protections to prevent the downstream migration of sediments that may bypass barriers proposed at the LOW.

Proposed long term stormwater management features include the installation of hydrodynamic separators and bioretention areas designed to collect and treat runoff from the proposed parking areas. The Proponent should submit a signed and stamped Stormwater Checklist and accompanying stormwater report with the NOI which demonstrate compliance with the Standards.

Additional Permits

The Project will involve the dredge of greater than 100 cubic yards of material and will therefore require a 401 Water Quality Certification. As indicated in the EENF, the Project may require a Ch. 91 license from the Waterways Section of MassDEP.

MassDEP appreciates the opportunity to comment on the Project. If you have any questions regarding these comments, please do not hesitate to contact JoAnne Kasper-Dunne, Central Regional Office MEPA Coordinator, at (508) 767-2716.

Very truly yours,

A handwritten signature in cursive script, appearing to read "Mary Jude Pigsley".

Mary Jude Pigsley
Regional Director

cc: Commissioner's Office, MassDEP

MASSACHUSETTS DEPARTMENT OF CONSERVATION AND RECREATION

LOWES POND DAM REHABILITATION OXFORD, MA

DCR PROJECT NO. FOR CONSTRUCTION P24-3541-C1A
AUGUST 2024



PROJECT

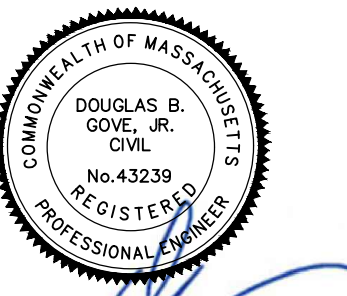
MASS DCR
ABANDONED DAMS
LOWES POND DAM
CONTRACT NO.
P19-3264-D4A

CLIENT

Massachusetts Department
of Conservation and
Recreation
10 Park Plaza, Suite 6620
Boston, MA 02116
617.626.1250 tel 617.626.1351 fax
www.mass.gov/orgs/departement-of-conservation-recreation

CONSULTANT

AECOM TECHNICAL SERVICES, INC.
250 APOLLO DRIVE
CHELMSFORD, MA 01824
PHONE: (978) 905-2100
www.aecom.com



REGISTRATION

ISSUE/REVISION

I/R	DATE	DESCRIPTION

PROJECT NUMBER

60604936

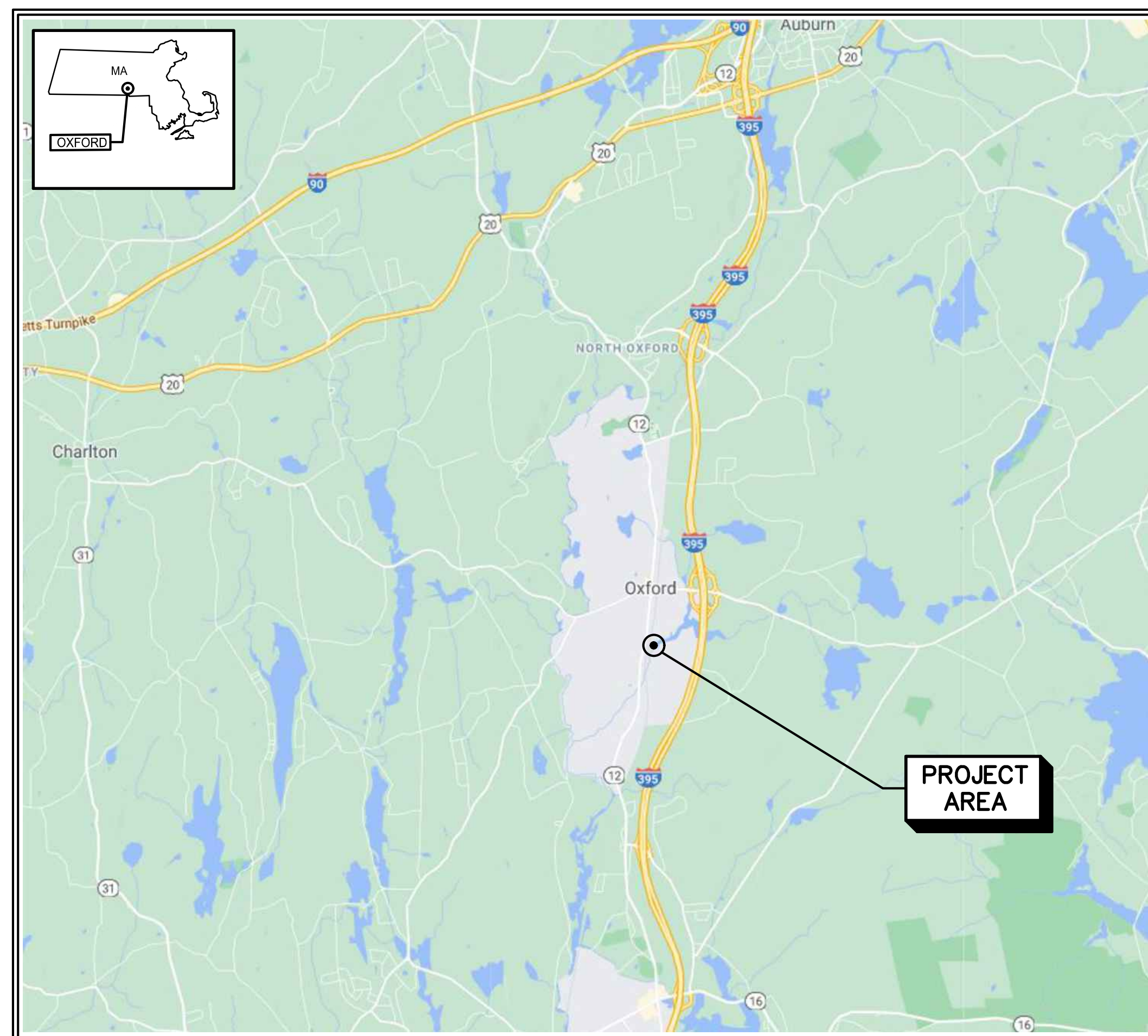
Designed By:	J.P. MINOIS
Drawn By:	M. THIBODEAU
Dept Check:	C. BENZIGER
Proj Check:	D. GOVE
Date:	AUGUST 2024
Scale:	AS NOTED

DISCIPLINE

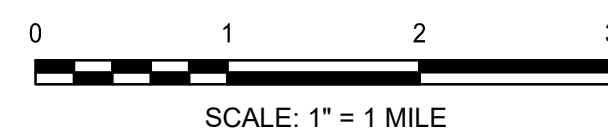
GENERAL
SHEET TITLE

LOWES POND
COVER SHEET, LOC. PLAN
AND INDEX OF DRAWINGS
SHEET NUMBER

00 G-001



LOCATION PLAN
APPROXIMATE SCALE: 1" = 1 Mile



INDEX OF DRAWINGS

DRAWING NO.	DRAWING TITLE
GENERAL	
00 G-001	COVER SHEET, LOCATION PLAN AND INDEX OF DRAWINGS
CIVIL	
00 C-001	LEGEND, ABBREVIATIONS AND GENERAL NOTES
10 C-101	EXISTING CONDITIONS AND EROSION PROTECTION PLAN
10 C-102	PROJECT HYDROLOGY AND HYDRAULIC DATA
10 C-103	SITE DEMOLITION PLAN I
10 C-104	SITE DEMOLITION PLAN II
10 C-105	SITE LAYOUT PLAN I
10 C-106	SITE LAYOUT PLAN II
10 C-107	SITE GRADING PLAN I
10 C-108	SITE GRADING PLAN II
10 C-109	LANDSCAPE PLAN I
10 C-110	LANDSCAPE PLAN II
99 C-501	DETAILS I
99 C-502	DETAILS II
99 C-503	DETAILS III
99 C-504	DETAILS IV
99 C-505	DETAILS V
99 C-506	DETAILS VI
99 C-507	DETAILS VII
99 C-508	DETAILS VIII
99 C-509	DETAILS IX
99 C-510	DETAILS X
STRUCTURAL	
00 S-001	STRUCTURAL NOTES AND STANDARD DETAILS
10 S-301	SECTIONS I
10 S-302	SECTIONS II
10 S-303	SECTIONS III
10 S-304	SECTIONS IV
99 S-501	STRUCTURAL STANDARD DETAILS I
PROCESS	
00 D-001	PROCESS SCHEDULES AND ABBREVIATIONS
10 D-101	PLAN AND SECTION

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 PLOT DATE: Thursday, August 29, 2024 2:28:44 PM

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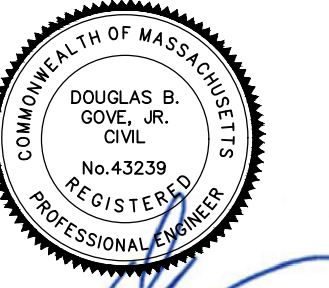
MASS DCR
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PROJECT NUMBER

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Designed By:	J.P. MINOIS
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Proj Check:	D. GOVE
Date:	AUGUST 2024
Scale:	AS NOTED

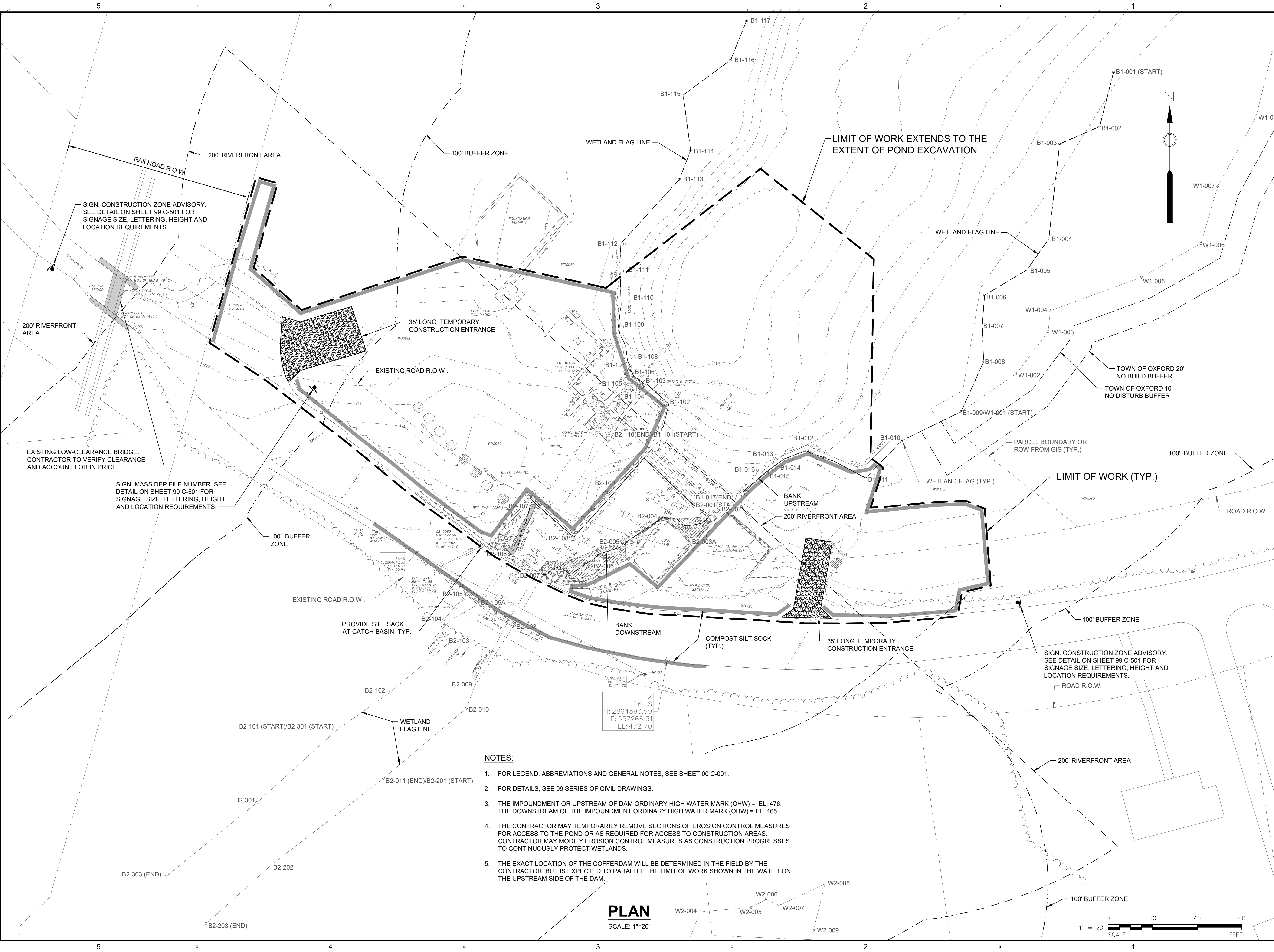
DISCIPLINE

CIVIL

SHEET TITLE

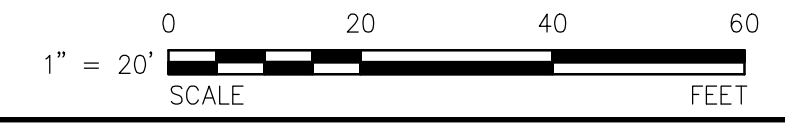
LOWES POND
 EXISTING CONDITIONS AND
 EROSION PROTECTION PLAN
 SHEET NUMBER

10 C-101

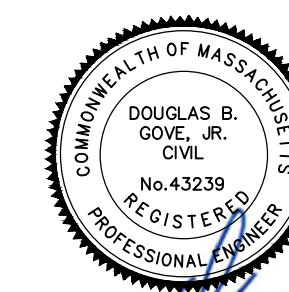


- NOTES:**
- FOR LEGEND, ABBREVIATIONS AND GENERAL NOTES, SEE SHEET 00 C-001.
 - FOR DETAILS, SEE 99 SERIES OF CIVIL DRAWINGS.
 - THE IMPOUNDMENT OR UPSTREAM OF DAM ORDINARY HIGH WATER MARK (OHW) = EL. 476. THE DOWNSTREAM OF THE IMPOUNDMENT ORDINARY HIGH WATER MARK (OHW) = EL. 465.
 - THE CONTRACTOR MAY TEMPORARILY REMOVE SECTIONS OF EROSION CONTROL MEASURES FOR ACCESS TO THE POND OR AS REQUIRED FOR ACCESS TO CONSTRUCTION AREAS. CONTRACTOR MAY MODIFY EROSION CONTROL MEASURES AS CONSTRUCTION PROGRESSES TO CONTINUOUSLY PROTECT WETLANDS.
 - THE EXACT LOCATION OF THE COFFERDAM WILL BE DETERMINED IN THE FIELD BY THE CONTRACTOR, BUT IS EXPECTED TO PARALLEL THE LIMIT OF WORK SHOWN IN THE WATER ON THE UPSTREAM SIDE OF THE DAM.

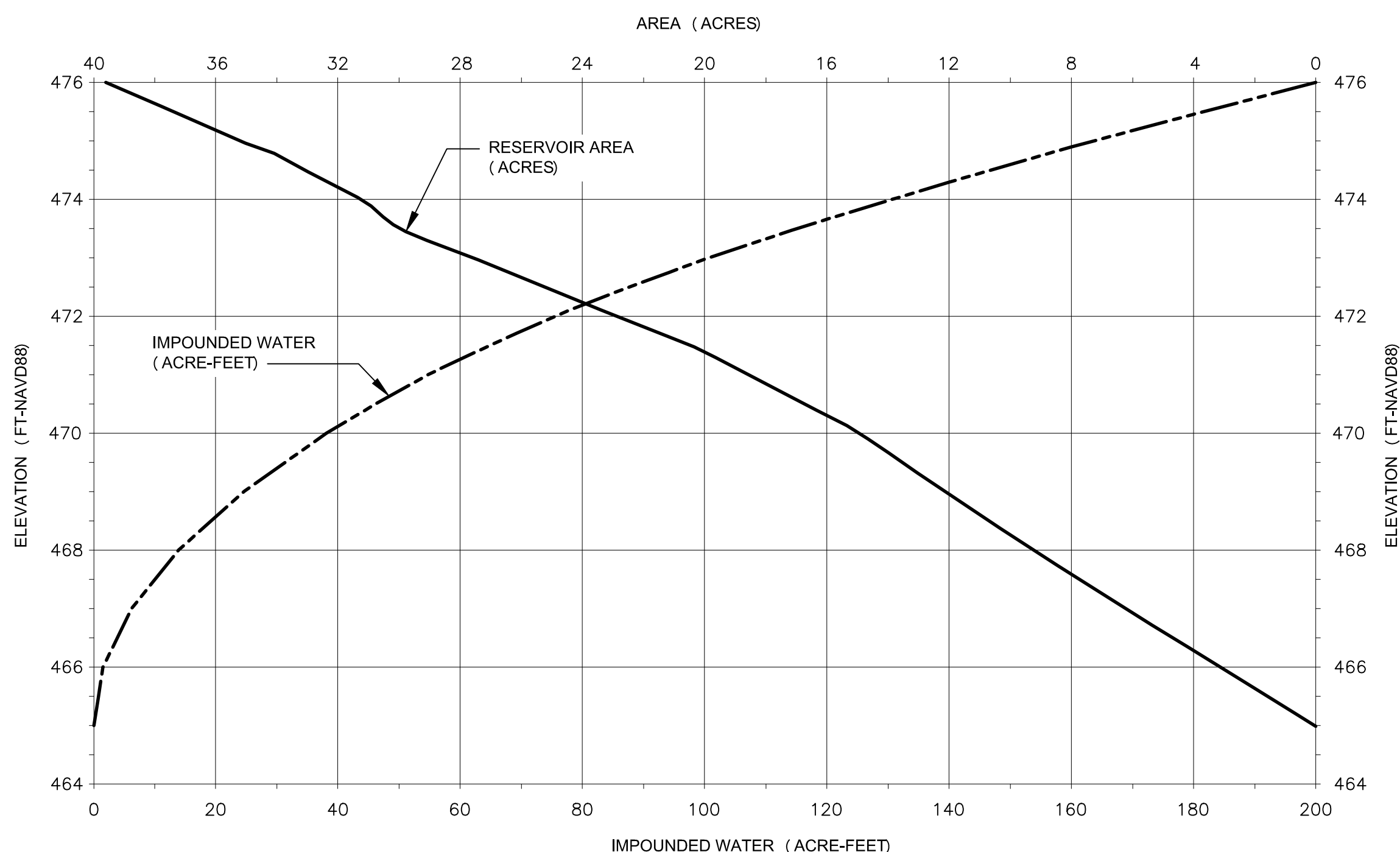
PLAN
 SCALE: 1"=20'



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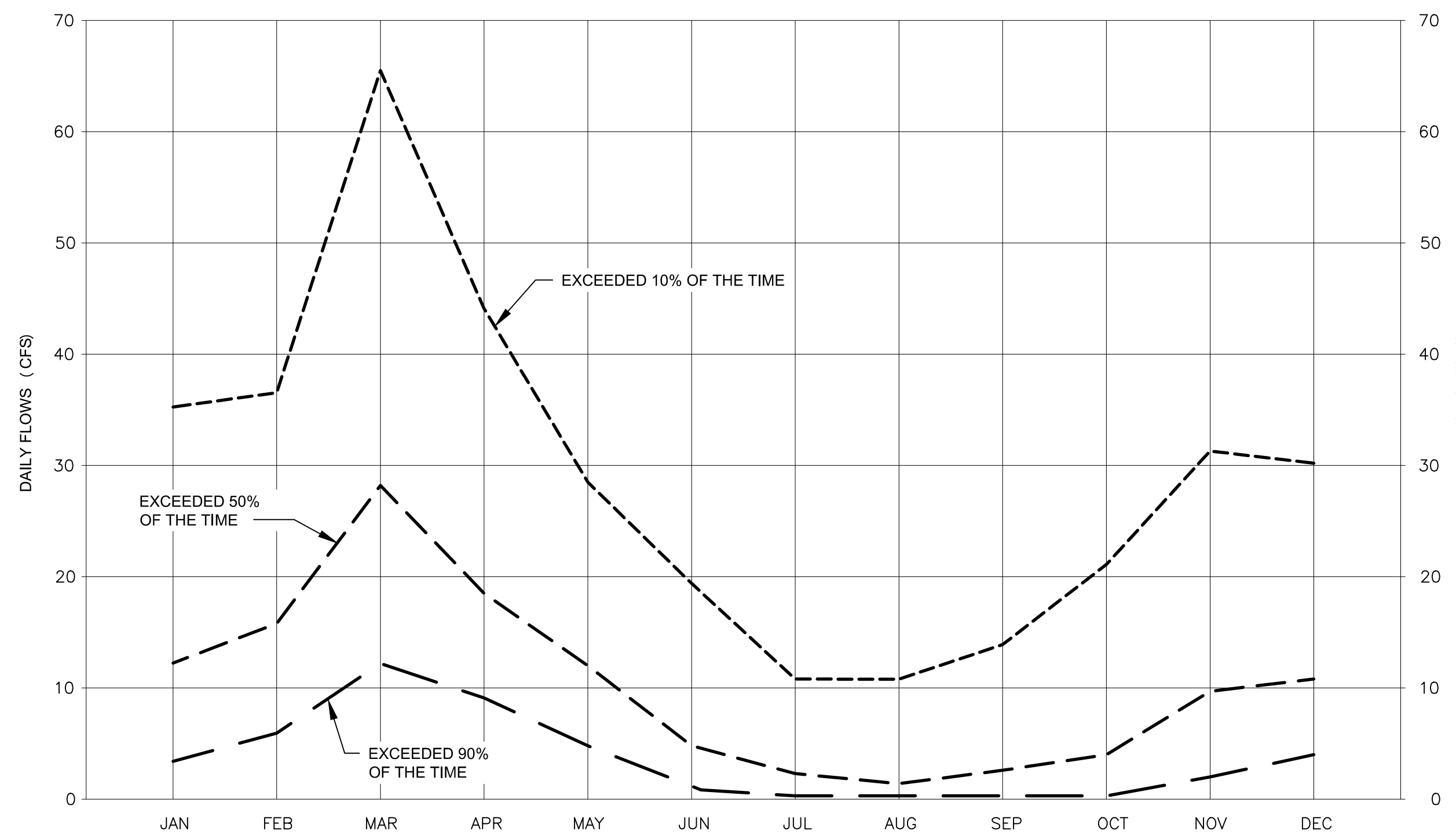


REGISTRATION



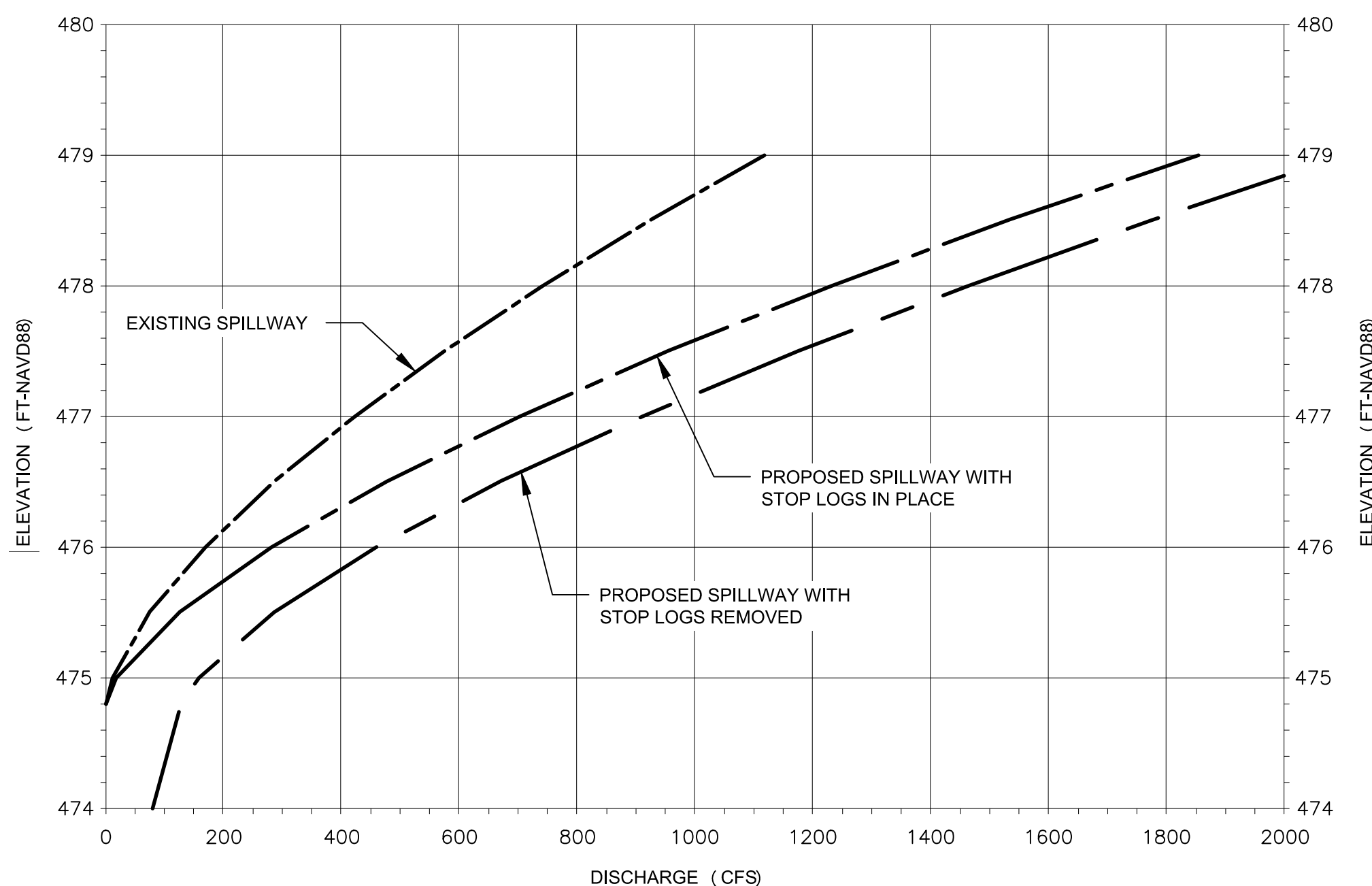
NOTE:
 THE AREA - CAPACITY CURVES ARE BASED ON THE BATHYMETRIC SURVEY OF JULY 2019 PRESENTED IN THE PHASE II REPORT (APRIL 2020).

LOWES POND AREA - CAPACITY CURVES



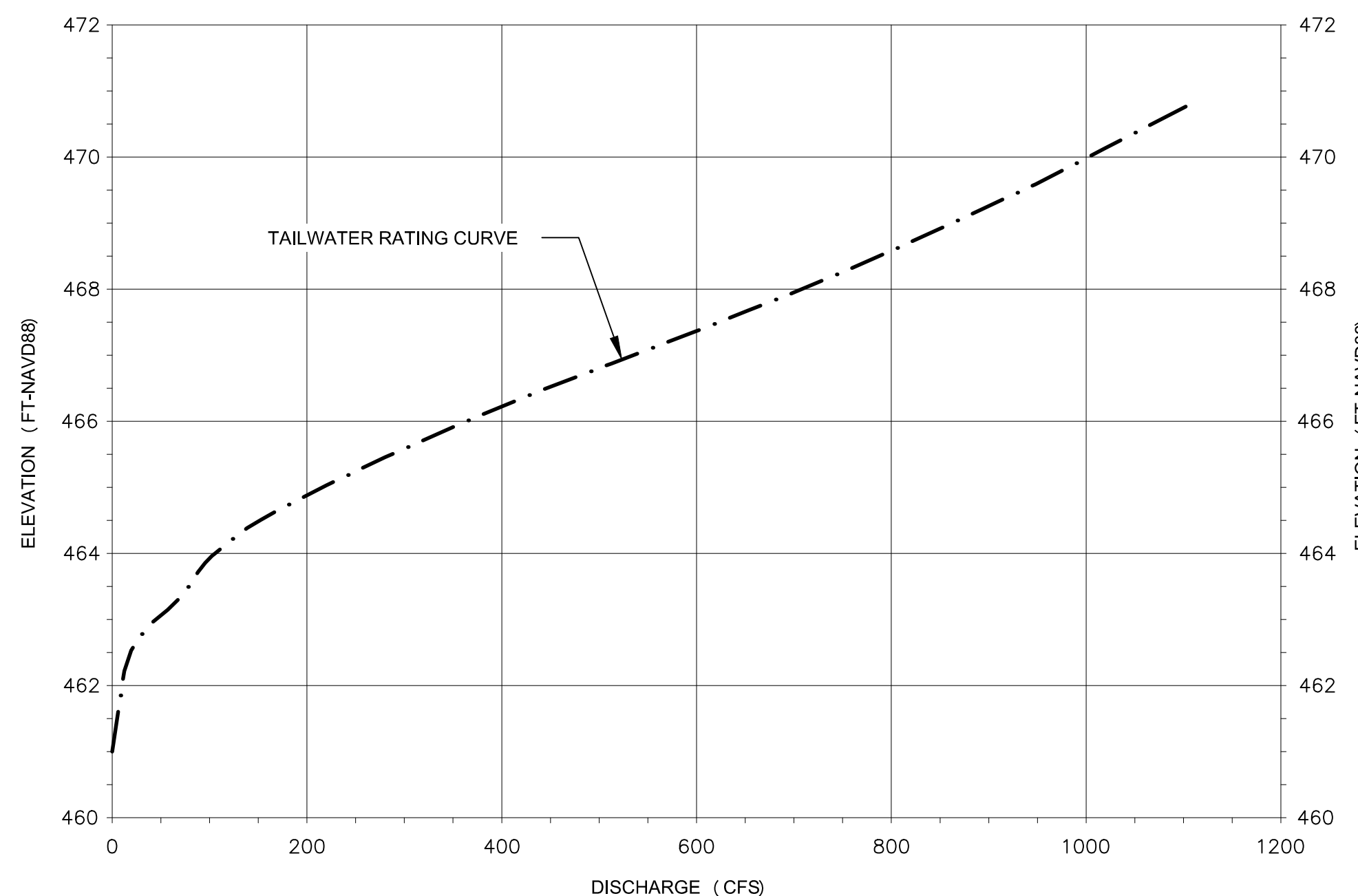
NOTE:
 THE AVERAGE DAILY FLOW STATISTICS WERE ESTIMATED BASED ON THE FLOW RECORDS AT THE USGS GAGING STATION NO. 01124500 ON LITTLE RIVER NEAR OXFORD AND ADJUSTED FOR DRAINAGE AREA.

AVERAGE DAILY FLOWS



NOTE:
 THE SPILLWAY DISCHARGE RATING CURVES WERE DEVELOPED FOR THE PURPOSE OF THE LOWES POND DAM REHABILITATION DESIGN, AND ARE BASED ON A SPILLWAY CREST ELEVATION AT 474.8 FT-NAVD88, AND A STOP LOG INVERT ELEVATION AT 471.8 FT-NAVD88.

SPILLWAY DISCHARGE RATING CURVES



NOTE:
 THE TAILWATER RATING CURVE WAS DEVELOPED FOR THE PURPOSE OF PHASE 2 REPORT (APRIL 2020) AND IS DERIVED FROM THE FEMA FLOOD PROFILE FOR LOWES BROOK PRESENTED IN FEMA FLOOD INSURANCE STUDY FOR WORCESTER COUNTY, MA DATED JULY 16, 2014.

TAILWATER RATING CURVE UPSTREAM OF HUGUENOT ROAD

FLOOD DISCHARGE PROBABILITIES

	PEAK DISCHARGE (CFS)	RUNOFF VOLUME (AC-FT)
2-YEAR FLOOD	107	128
10-YEAR FLOOD	374	490
50-YEAR FLOOD	753	1030
100-YEAR FLOOD	947	1307

NOTE:
 THE FLOOD DISCHARGE PROBABILITIES WERE DEVELOPED DURING THE HYDROLOGY AND HYDRAULICS STUDY COMPLETED FOR THE PHASE II REPORT (APRIL 2020).

ISSUE/REVISION

I/R	DATE	DESCRIPTION

PROJECT NUMBER

60604936

Designed By:	J.P. MINOIS
Drawn By:	M. THIBODEAU
Dept Check:	C. BENZIGER
Proj Check:	D. GOVE
Date:	AUGUST 2024
Scale:	AS NOTED

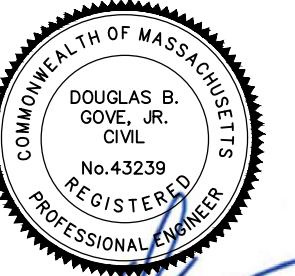
DISCIPLINE

CIVIL
SHEET TITLE

LOWES POND
PROJECT HYDROLOGY AND
HYDRAULIC DATA
SHEET NUMBER

10 C-102

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I/R	DATE	DESCRIPTION

60604936

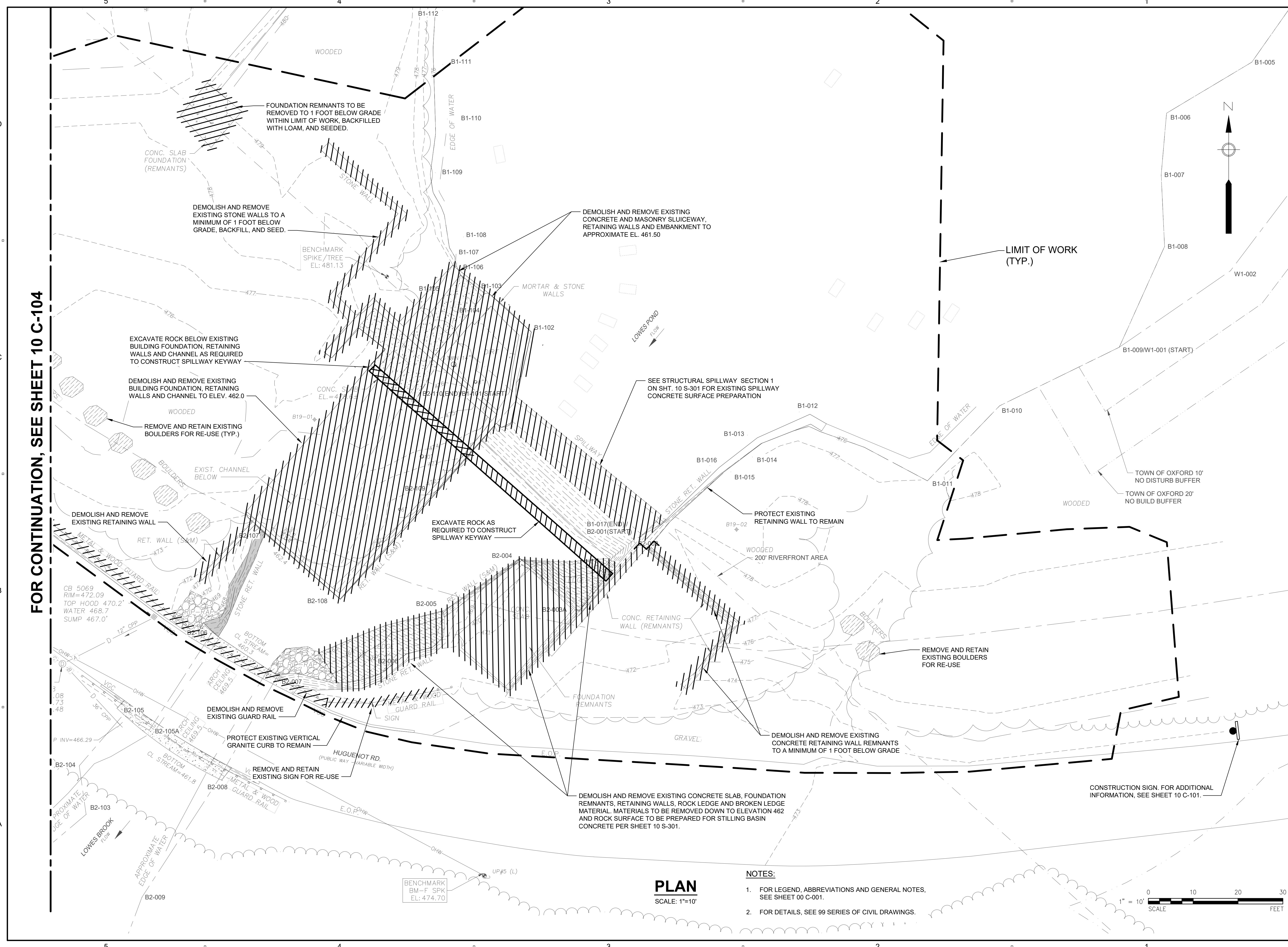
Designed By:	J.P. MINOIS
Drawn By:	M. THIBODEAU
Dept Check:	C. BENZIGER
Proj Check:	D. GOVE
Date:	AUGUST 2024
Scale:	AS NOTED

CIVIL

LOWES POND
SITE DEMOLITION PLAN I

10 C-103

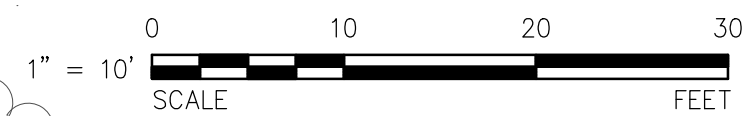
FOR CONTINUATION, SEE SHEET 10 C-104



PLAN
 SCALE: 1"=10'

NOTES:

- FOR LEGEND, ABBREVIATIONS AND GENERAL NOTES, SEE SHEET 00 C-001.
- FOR DETAILS, SEE 99 SERIES OF CIVIL DRAWINGS.



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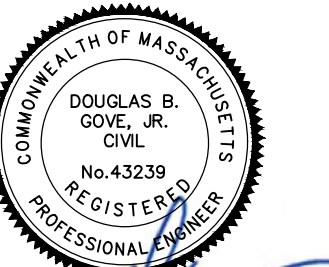
MASS DCR
 ABANDONED DAMS
 LOWES POND DAM
 CONTRACT NO.
 P19-3264-D4A

CLIENT

Massachusetts Department
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 10 Park Plaza, Suite 6620
 Boston, MA 02116
 617.626.1250 tel 617.626.1351 fax
 www.mass.gov/orgs/departement-of-conservation-recreation

CONSULTANT

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 250 APOLLO DRIVE
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 PHONE: (978) 905-2100
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REGISTRATION

ISSUE/REVISION

I/R	DATE	DESCRIPTION

PROJECT NUMBER

60604936

Designed By: **J.P. MINOIS**

Drawn By: **M. THIBODEAU**

Dept Check: **C. BENZIGER**

Proj Check: **D. GOVE**

Date: **AUGUST 2024**

Scale: **AS NOTED**

DISCIPLINE

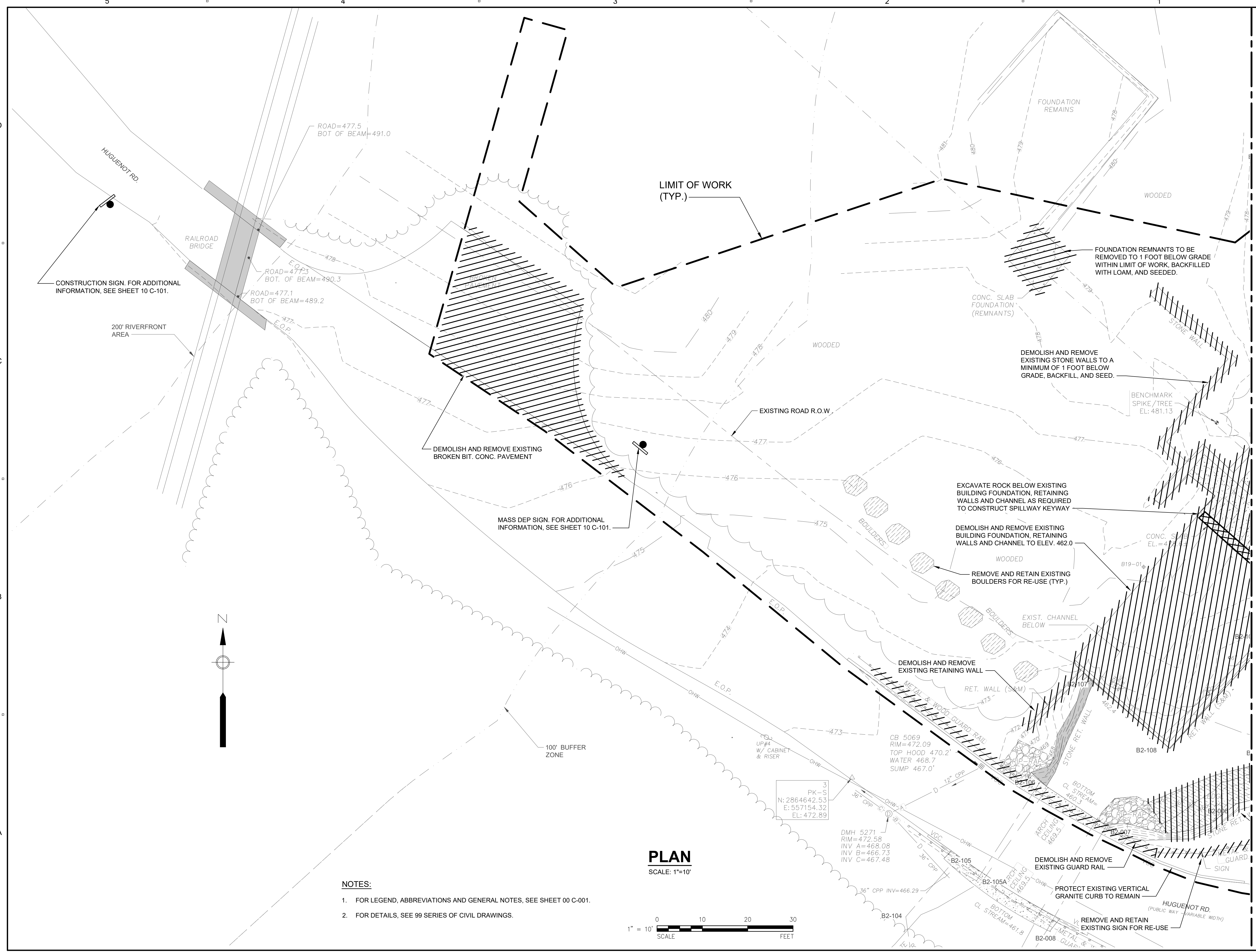
CIVIL

SHEET TITLE

LOWES POND
 SITE DEMOLITION PLAN II

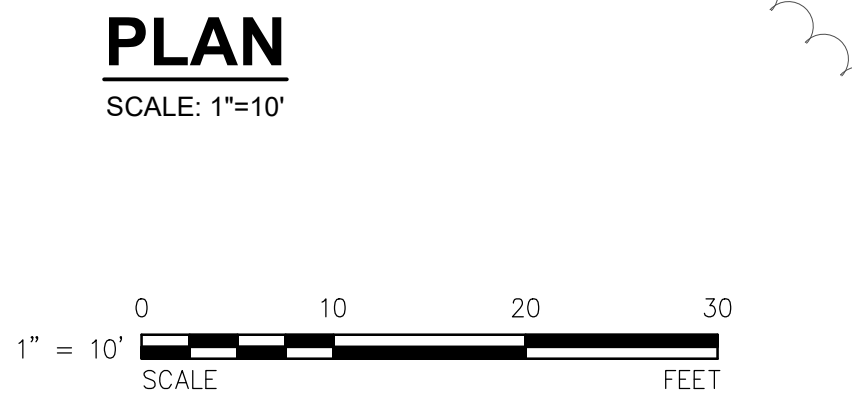
SHEET NUMBER

10 C-104



FOR CONTINUATION, SEE SHEET 10 C-103

- NOTES:**
- FOR LEGEND, ABBREVIATIONS AND GENERAL NOTES, SEE SHEET 00 C-001.
 - FOR DETAILS, SEE 99 SERIES OF CIVIL DRAWINGS.



PATH: \\AECOM\PROJECTS\2024\MASSDCR SIX ABANDONED DAMS\SHEETS\CIVIL\LOWES POND\10 C-104.DWG
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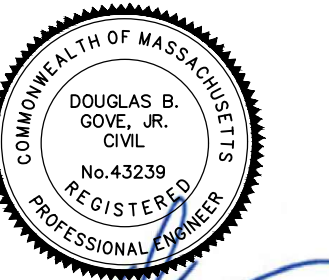
MASS DCR
 ABANDONED DAMS
 LOWES POND DAM
 CONTRACT NO.
 P19-3264-D4A

CLIENT

Massachusetts Department
 of Conservation and
 Recreation
 10 Park Plaza, Suite 6620
 Boston, MA 02116
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 www.mass.gov/orgs/departement-of-conservation-recreation

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REGISTRATION

ISSUE/REVISION

I/R	DATE	DESCRIPTION

PROJECT NUMBER

60604936

Designed By: **J.P. MINOIS**

Drawn By: **M. THIBODEAU**

Dept Check: **C. BENZIGER**

Proj Check: **D. GOVE**

Date: **AUGUST 2024**

Scale: **AS NOTED**

DISCIPLINE

CIVIL

SHEET TITLE

LOWES POND
 SITE LAYOUT PLAN I

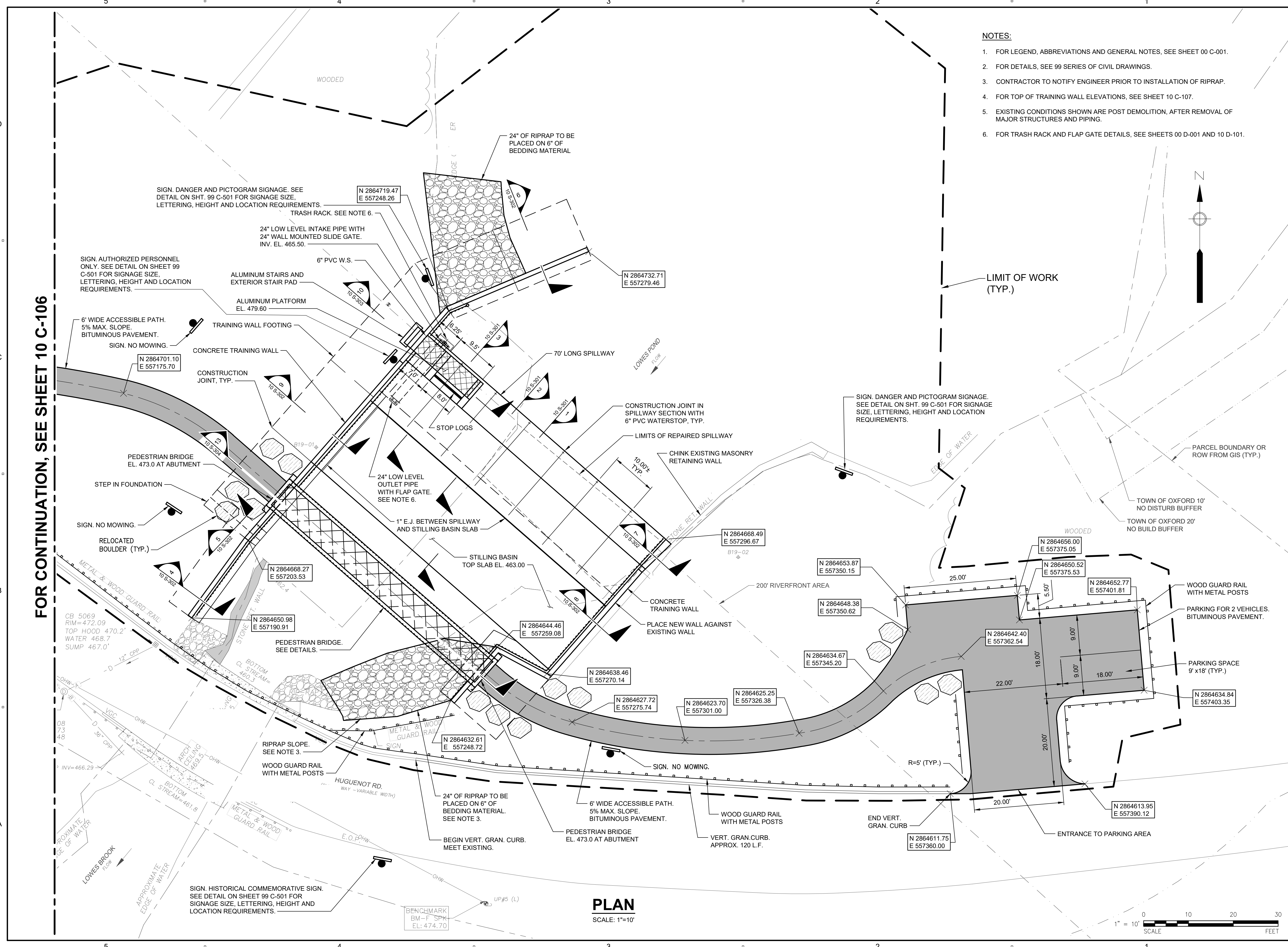
SHEET NUMBER

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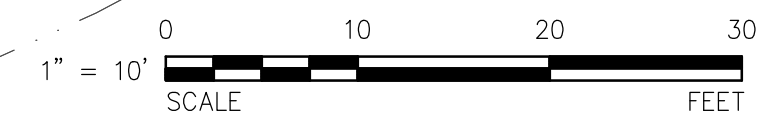
NOTES:

- FOR LEGEND, ABBREVIATIONS AND GENERAL NOTES, SEE SHEET 00 C-001.
- FOR DETAILS, SEE 99 SERIES OF CIVIL DRAWINGS.
- CONTRACTOR TO NOTIFY ENGINEER PRIOR TO INSTALLATION OF RIPRAP.
- FOR TOP OF TRAINING WALL ELEVATIONS, SEE SHEET 10 C-107.
- EXISTING CONDITIONS SHOWN ARE POST DEMOLITION, AFTER REMOVAL OF MAJOR STRUCTURES AND PIPING.
- FOR TRASH RACK AND FLAP GATE DETAILS, SEE SHEETS 00 D-001 AND 10 D-101.

FOR CONTINUATION, SEE SHEET 10 C-106



PLAN
 SCALE: 1"=10'



PATH: \\AECOM\PROJECTS\MASSDCR\616\ABANDONED DAMS\SHEETS\CIVIL\10 C-105.DWG
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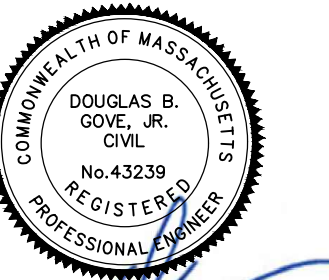
MASS DCR
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 LOWES POND DAM
 CONTRACT NO.
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Dept Check: **C. BENZIGER**

Proj Check: **D. GOVE**

Date: **AUGUST 2024**

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DISCIPLINE

CIVIL

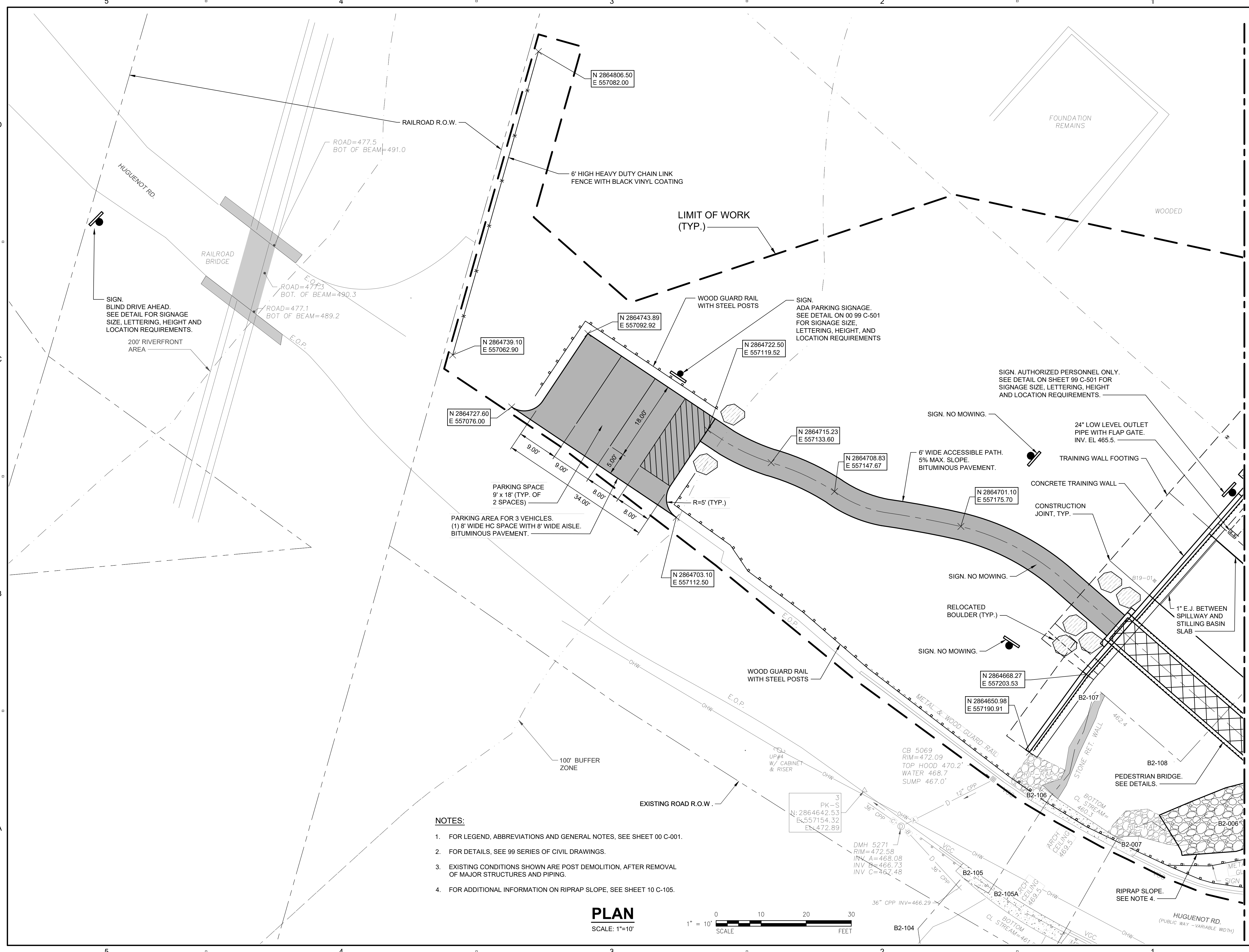
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LOWES POND
 SITE LAYOUT PLAN II

SHEET NUMBER

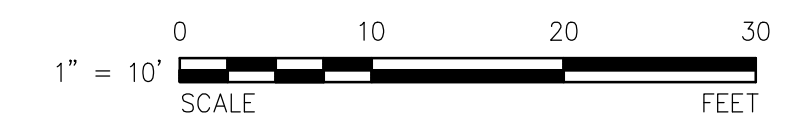
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FOR CONTINUATION, SEE SHEET 10 C-105

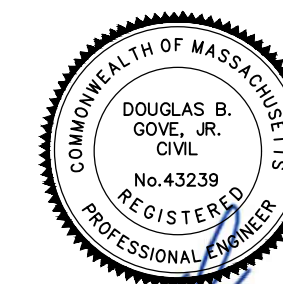


- NOTES:**
- FOR LEGEND, ABBREVIATIONS AND GENERAL NOTES, SEE SHEET 00 C-001.
 - FOR DETAILS, SEE 99 SERIES OF CIVIL DRAWINGS.
 - EXISTING CONDITIONS SHOWN ARE POST DEMOLITION, AFTER REMOVAL OF MAJOR STRUCTURES AND PIPING.
 - FOR ADDITIONAL INFORMATION ON RIPRAP SLOPE, SEE SHEET 10 C-105.

PLAN
 SCALE: 1"=10'



PATH: \\AECOM\PROJECTS\MASSDCR\616694936\MASSDCR_SIX ABANDONED DAMS\SHEETS\CIVIL\10 C-106.DWG
 LAST UPDATE: Wednesday, August 28, 2024 1:06:29 PM
 PLOT DATE: Thursday, August 29, 2024 2:41:06 PM



I/R	DATE	DESCRIPTION

60604936

Designed By: **J.P. MINOIS**
 Drawn By: **M. THIBODEAU**
 Dept Check: **C. BENZIGER**
 Proj Check: **D. GOVE**
 Date: **AUGUST 2024**
 Scale: **AS NOTED**

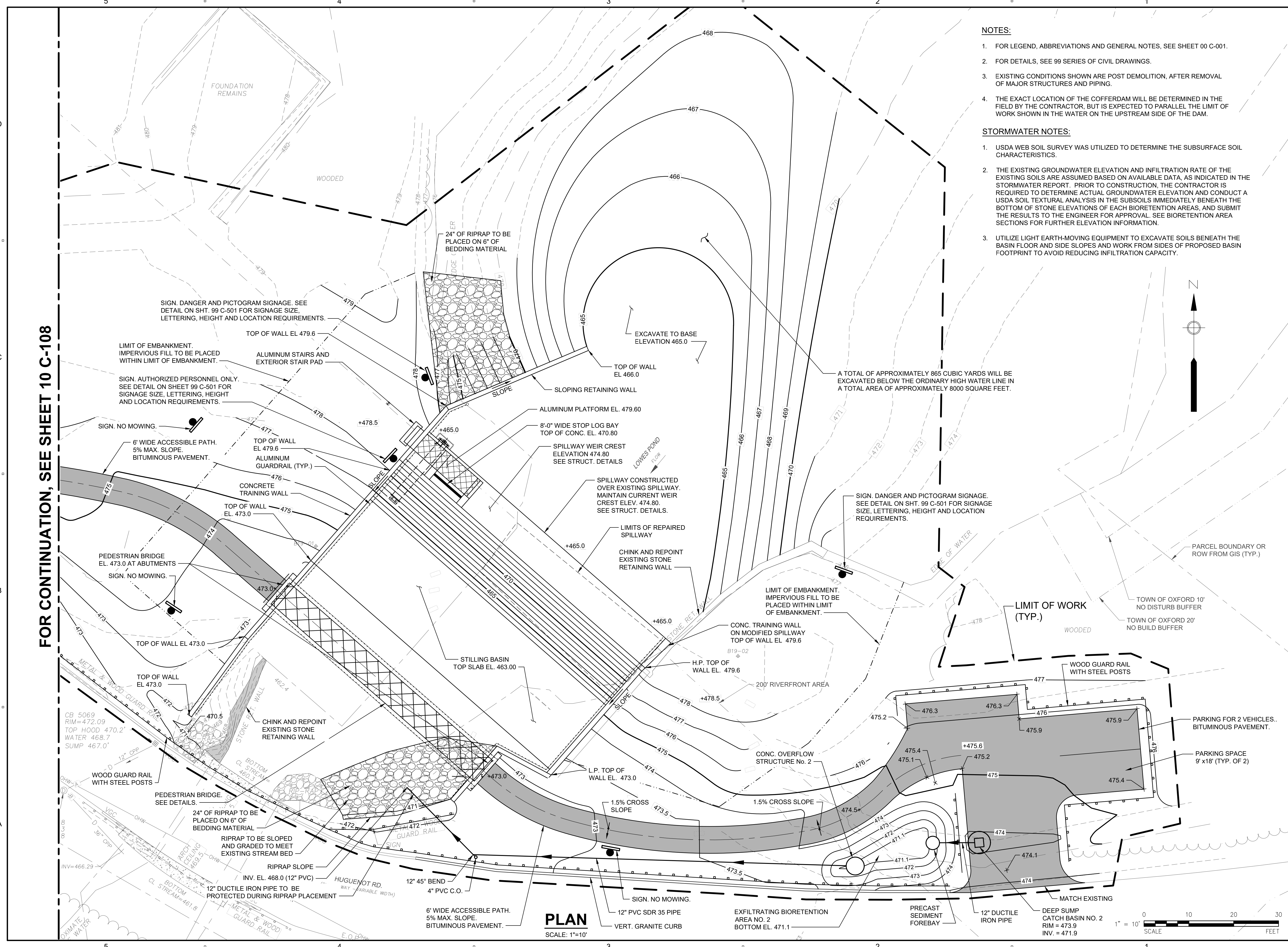
NOTES:

- FOR LEGEND, ABBREVIATIONS AND GENERAL NOTES, SEE SHEET 00 C-001.
- FOR DETAILS, SEE 99 SERIES OF CIVIL DRAWINGS.
- EXISTING CONDITIONS SHOWN ARE POST DEMOLITION, AFTER REMOVAL OF MAJOR STRUCTURES AND PIPING.
- THE EXACT LOCATION OF THE COFFERDAM WILL BE DETERMINED IN THE FIELD BY THE CONTRACTOR, BUT IS EXPECTED TO PARALLEL THE LIMIT OF WORK SHOWN IN THE WATER ON THE UPSTREAM SIDE OF THE DAM.

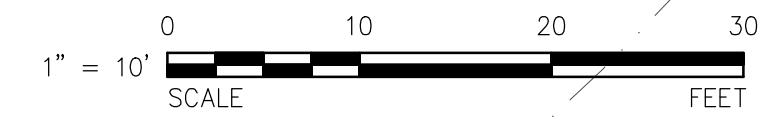
STORMWATER NOTES:

- USDA WEB SOIL SURVEY WAS UTILIZED TO DETERMINE THE SUBSURFACE SOIL CHARACTERISTICS.
- THE EXISTING GROUNDWATER ELEVATION AND INFILTRATION RATE OF THE EXISTING SOILS ARE ASSUMED BASED ON AVAILABLE DATA, AS INDICATED IN THE STORMWATER REPORT. PRIOR TO CONSTRUCTION, THE CONTRACTOR IS REQUIRED TO DETERMINE ACTUAL GROUNDWATER ELEVATION AND CONDUCT A USDA SOIL TEXTURAL ANALYSIS IN THE SUBSOILS IMMEDIATELY BENEATH THE BOTTOM OF STONE ELEVATIONS OF EACH BIORETENTION AREAS, AND SUBMIT THE RESULTS TO THE ENGINEER FOR APPROVAL. SEE BIORETENTION AREA SECTIONS FOR FURTHER ELEVATION INFORMATION.
- UTILIZE LIGHT EARTH-MOVING EQUIPMENT TO EXCAVATE SOILS BENEATH THE BASIN FLOOR AND SIDE SLOPES AND WORK FROM SIDES OF PROPOSED BASIN FOOTPRINT TO AVOID REDUCING INFILTRATION CAPACITY.

FOR CONTINUATION, SEE SHEET 10 C-108



PLAN
 SCALE: 1"=10'



PATH: \\AECOM\PROJECTS\MASSDCR\60604936\10 C-107.DWG
 LAST UPDATE: Wednesday, August 28, 2024 3:46:44 PM
 PLOT DATE: Thursday, August 29, 2024 2:44:46 PM

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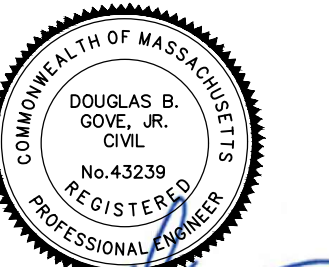
MASS DCR
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 CONTRACT NO.
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REGISTRATION

ISSUE/REVISION

I/R	DATE	DESCRIPTION

PROJECT NUMBER

60604936

Designed By: **J.P. MINOIS**

Drawn By: **M. THIBODEAU**

Dept Check: **C. BENZIGER**

Proj Check: **D. GOVE**

Date: **AUGUST 2024**

Scale: **AS NOTED**

DISCIPLINE

CIVIL

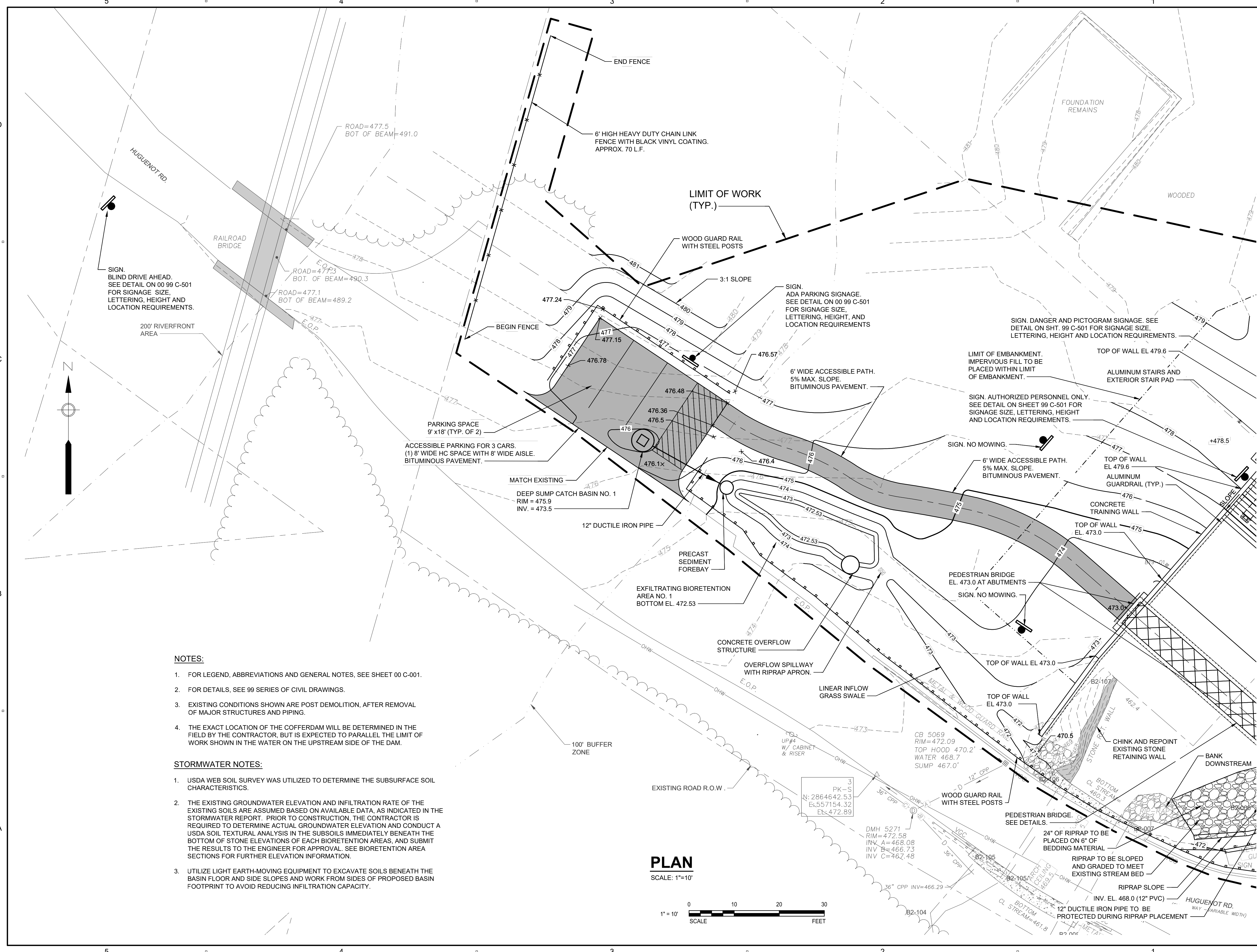
SHEET TITLE

LOWES POND
 SITE GRADING PLAN II

SHEET NUMBER

10 C-108

FOR CONTINUATION, SEE SHEET 10 C-107



NOTES:

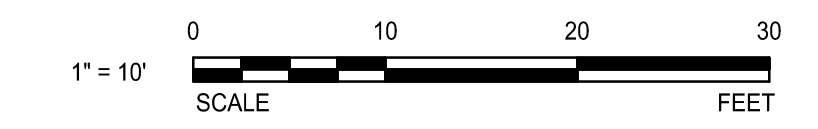
- FOR LEGEND, ABBREVIATIONS AND GENERAL NOTES, SEE SHEET 00 C-001.
- FOR DETAILS, SEE 99 SERIES OF CIVIL DRAWINGS.
- EXISTING CONDITIONS SHOWN ARE POST DEMOLITION, AFTER REMOVAL OF MAJOR STRUCTURES AND PIPING.
- THE EXACT LOCATION OF THE COFFERDAM WILL BE DETERMINED IN THE FIELD BY THE CONTRACTOR, BUT IS EXPECTED TO PARALLEL THE LIMIT OF WORK SHOWN IN THE WATER ON THE UPSTREAM SIDE OF THE DAM.

STORMWATER NOTES:

- USDA WEB SOIL SURVEY WAS UTILIZED TO DETERMINE THE SUBSURFACE SOIL CHARACTERISTICS.
- THE EXISTING GROUNDWATER ELEVATION AND INFILTRATION RATE OF THE EXISTING SOILS ARE ASSUMED BASED ON AVAILABLE DATA, AS INDICATED IN THE STORMWATER REPORT. PRIOR TO CONSTRUCTION, THE CONTRACTOR IS REQUIRED TO DETERMINE ACTUAL GROUNDWATER ELEVATION AND CONDUCT A USDA SOIL TEXTURAL ANALYSIS IN THE SUBSOILS IMMEDIATELY BENEATH THE BOTTOM OF STONE ELEVATIONS OF EACH BIORETENTION AREAS, AND SUBMIT THE RESULTS TO THE ENGINEER FOR APPROVAL. SEE BIORETENTION AREA SECTIONS FOR FURTHER ELEVATION INFORMATION.
- UTILIZE LIGHT EARTH-MOVING EQUIPMENT TO EXCAVATE SOILS BENEATH THE BASIN FLOOR AND SIDE SLOPES AND WORK FROM SIDES OF PROPOSED BASIN FOOTPRINT TO AVOID REDUCING INFILTRATION CAPACITY.

PLAN

SCALE: 1"=10'



PATH: \\AECOM\PROJECTS\19\MASSDCR_SIX ABANDONED DAMS\SHEETS\CIVIL\LOWES POND\10 C-108.DWG
 LAST UPDATE: Wednesday, August 28, 2024 1:39:00 PM
 PLOT DATE: Thursday, August 29, 2024 2:45:12 PM

PROJECT

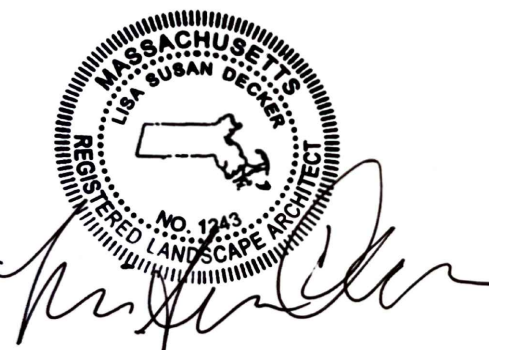
MASS DCR
 ABANDONED DAMS
 LOWES POND DAM
 CONTRACT NO.
 P19-3264-D4A

CLIENT

Massachusetts Department
 of Conservation and
 Recreation
 10 Park Plaza, Suite 6620
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CONSULTANT

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 www.aecom.com



REGISTRATION

ISSUE/REVISION

I/R	DATE	DESCRIPTION

PROJECT NUMBER

60604936

Designed By:	L. DECKER
Drawn By:	M. THIBODEAU
Dept Check:	C. BENZIGER
Proj Check:	D. GOVE
Date:	AUGUST 2024
Scale:	AS NOTED

DISCIPLINE

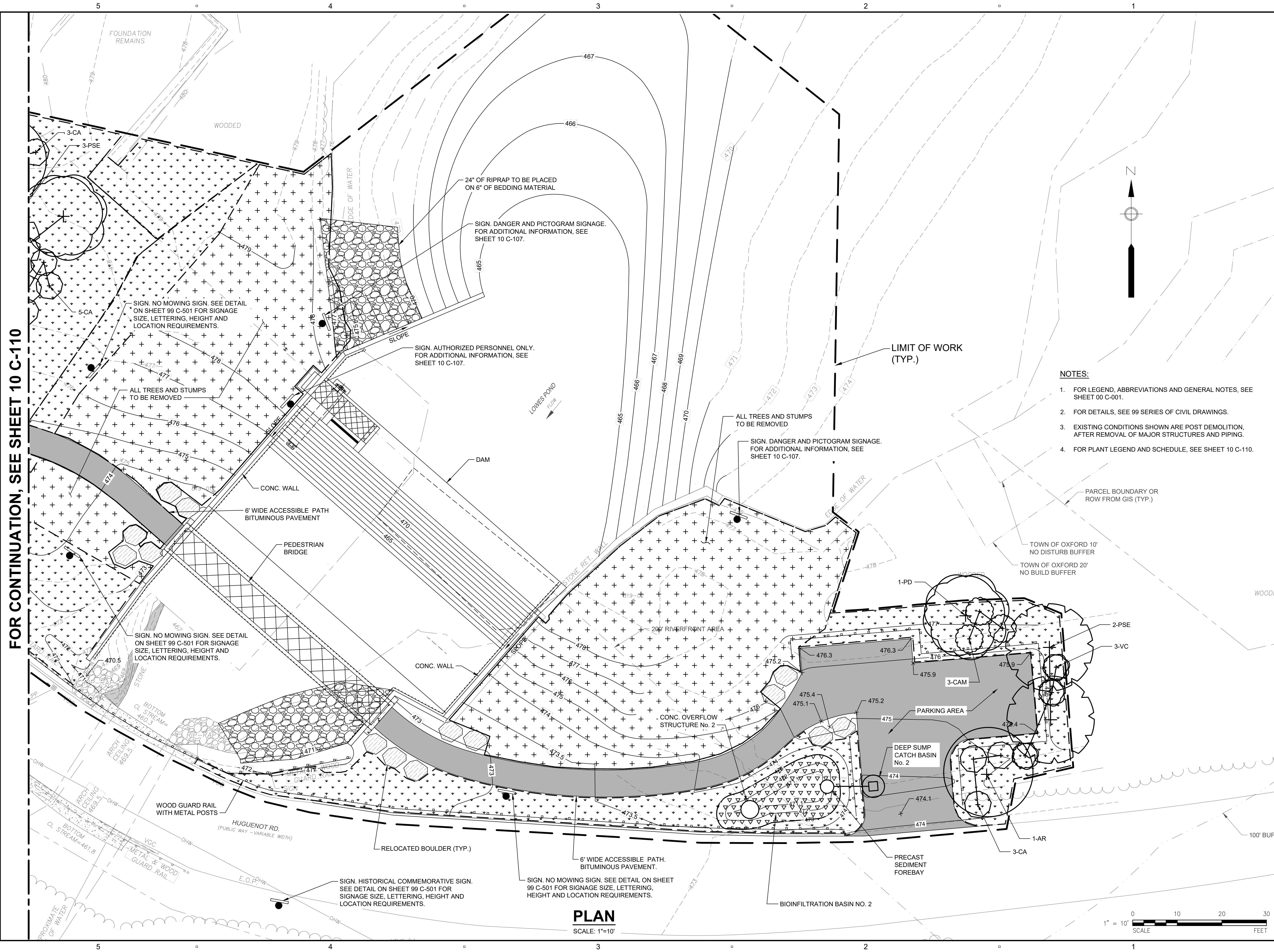
CIVIL

SHEET TITLE

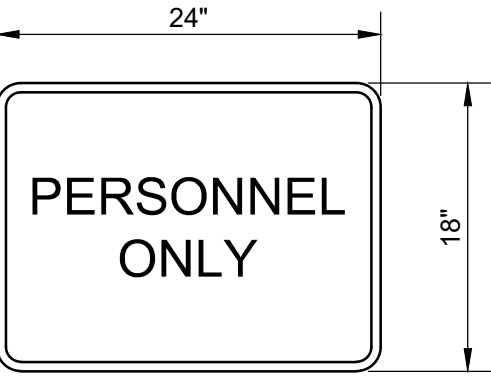
LOWES POND
 LANDSCAPE PLAN I

SHEET NUMBER

10 C-109

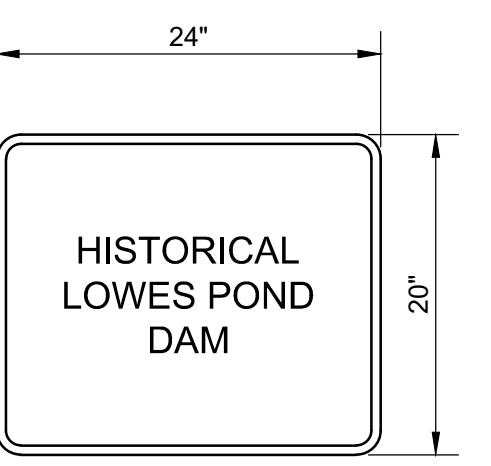


PATH: I:\PROJECTS\10 C-109\10 C-109.DWG
 LAST UPDATE: Wednesday, August 28, 2024 11:11:10 PM
 PLOT DATE: Thursday, August 29, 2024 2:50:51 PM



PERSONNEL ONLY SIGN NOTES:

1. SIGN MOUNTING HEIGHT SHALL BE 5'-0" MIN. FROM GRADE TO BOTTOM OF SIGN.
2. SIGN TO BE INSTALLED ADJACENT TO THE ENTRANCE OF THE VALVE OPERATOR PLATFORM.
3. SIGN MATERIAL - 63 MILS THICK ENGINEERING GRADE REFLECTIVE ALUMINUM

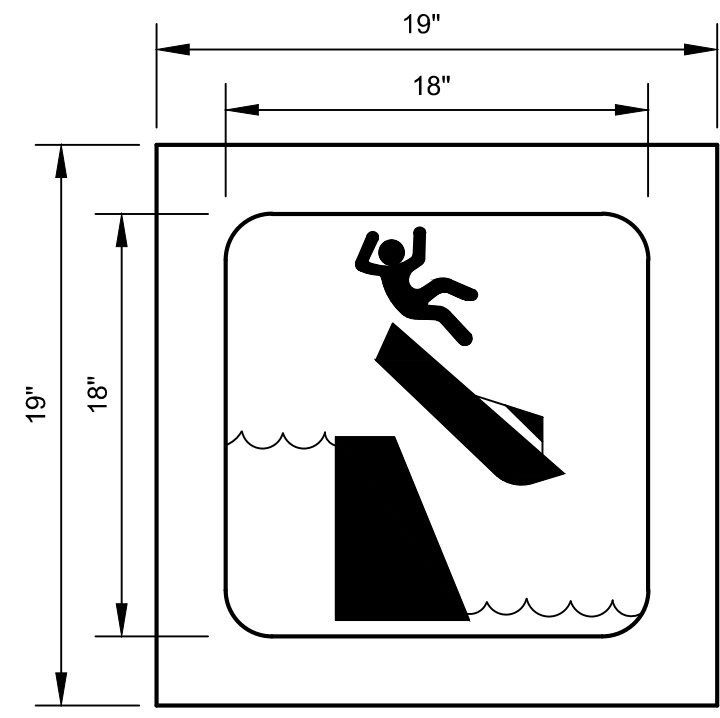


HISTORICAL SIGN NOTES:

1. SIGN MOUNTING HEIGHT SHALL BE 5'-0" MIN. FROM GRADE TO BOTTOM OF SIGN.
2. SIGN TO BE INSTALLED APPROXIMATELY 130' FROM WESTERN END OF EAST SIDE PARKING AREA.
3. SIGN MATERIAL - 63 MILS THICK ENGINEERING GRADE REFLECTIVE ALUMINUM

MISCELLANEOUS SIGNS AT DAM

NOT TO SCALE

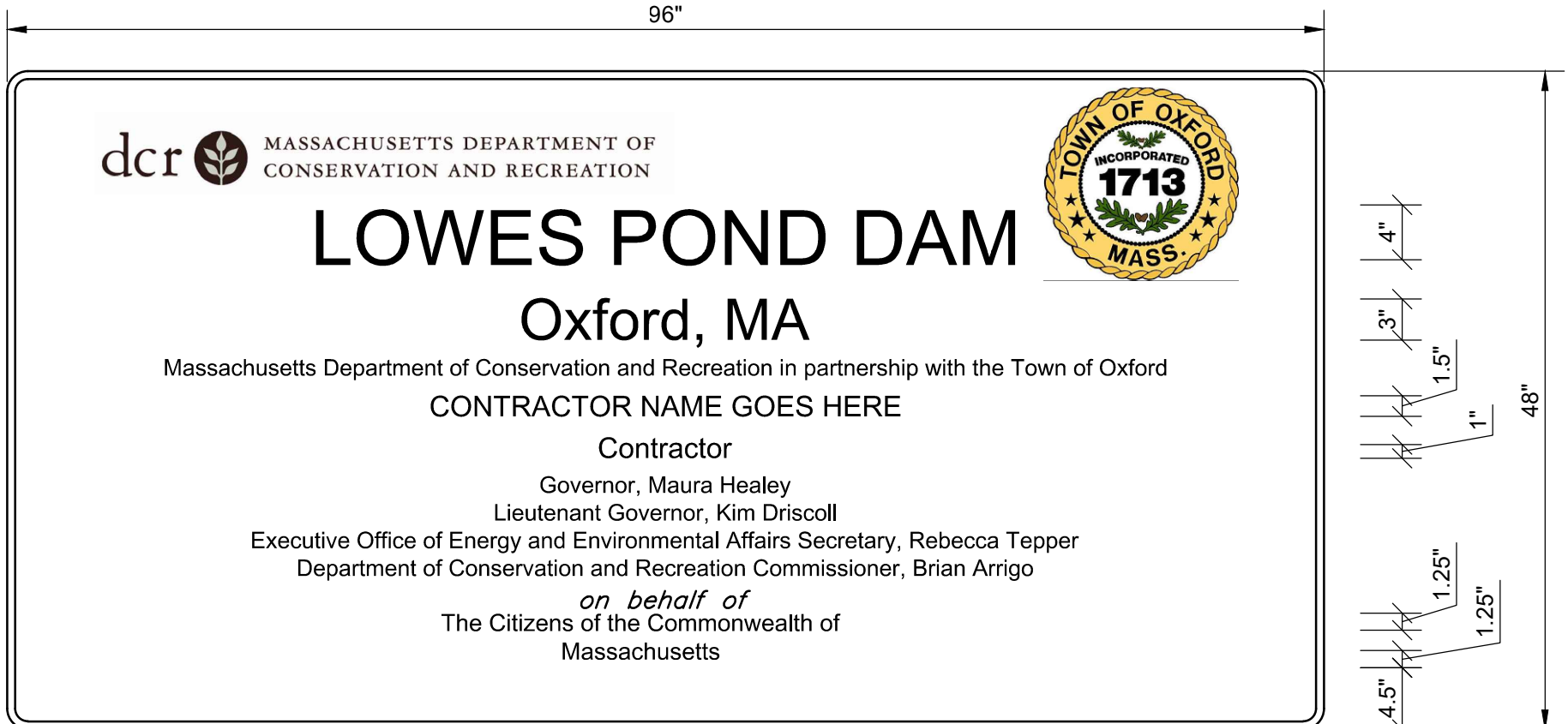


NOTES:

1. SIGN MOUNTING HEIGHT SHALL BE A MINIMUM OF 4'-0" AND MAXIMUM OF 5'-0" FROM GRADE TO BOTTOM OF SIGN.
2. DANGER SHALL BE IN HELVETICA BOLD FONT. ALL OTHER LETTERING SHALL BE IN HELVETICA FONT.
3. SIGN MATERIAL SHALL BE HIGH DENSITY OVERLAY (HDO) PLYWOOD, MARINE QUALITY 3/4" THICKNESS.
4. SIGNS (2 TOTAL) SHALL BE MOUNTED ON EAST AND WEST SIDES OF DAM AS SHOWN ON SHEET 00 C-107.

WARNING SIGN AT DAM

NOT TO SCALE

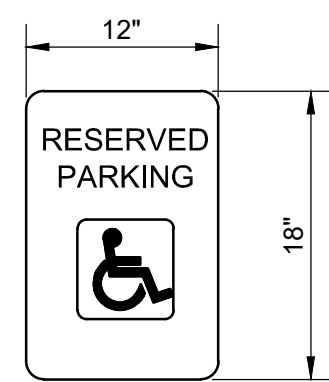
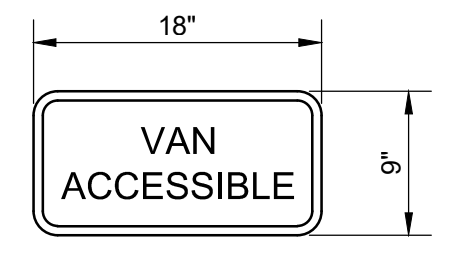


PROJECT SIGN NOTES:

- SIGN SIZE 4'x8'. SIGN SUBSTRATE 3/4" MDO PLYWOOD OR 0.080 INCH ALUMINUM MOUNTED ON 4"x6" WOOD POSTS OR 2"x12" METAL U-CHANNELS. U-CHANNELS MUST BE GALVANIZED OR PAINTED BLACK. A TWO PART POST SYSTEM WITH AN 8' U-CHANNEL BOLTED TO A 4' U-CHANNEL IN THE GROUND MAY BE USED. USE STAINLESS HEX HEAD BOLTS TO ATTACH SIGN TO POSTS. INSTALL POSTS A MINIMUM 4' BELOW GRADE. BOTTOM OF SIGN 4' ABOVE GRADE.
- DATA CONTAINED: PROJECT NAME, PROJECT LOCATION, DCR LOGO, CONTRACTOR AND CREDITS ON TWO LINES.
- DCR LOGO: CONTACT THE DCR SIGN SHOP TO OBTAIN A PRE CUT VINYL DCR LOGO. 617-727-5742.
- INCLUDE GC NAME ONLY. (USE OTHER SAMPLE CONSTRUCTION SIGN FOR DESIGNER AND CONTRACTOR NAMES).
- FOR PROJECT NAMES REQUIRING THREE LINES, THE TEXT SIZE MAYBE REDUCED TO 3.75" HIGH.
- SITING: TO BE DETERMINED BY DCR PROJECT MANAGER.
- COLORS: SIGN BOARD COLOR SAGE PMS 5655U. ALL TEXT IS BLACK. LOGO COLOR IS DARK MAROON PMS 504U.
- ALL TYPE IS FRUITGER 65 BOLD AND FRUITGER 55 ROMAN. LOGO IS GARAMOND.

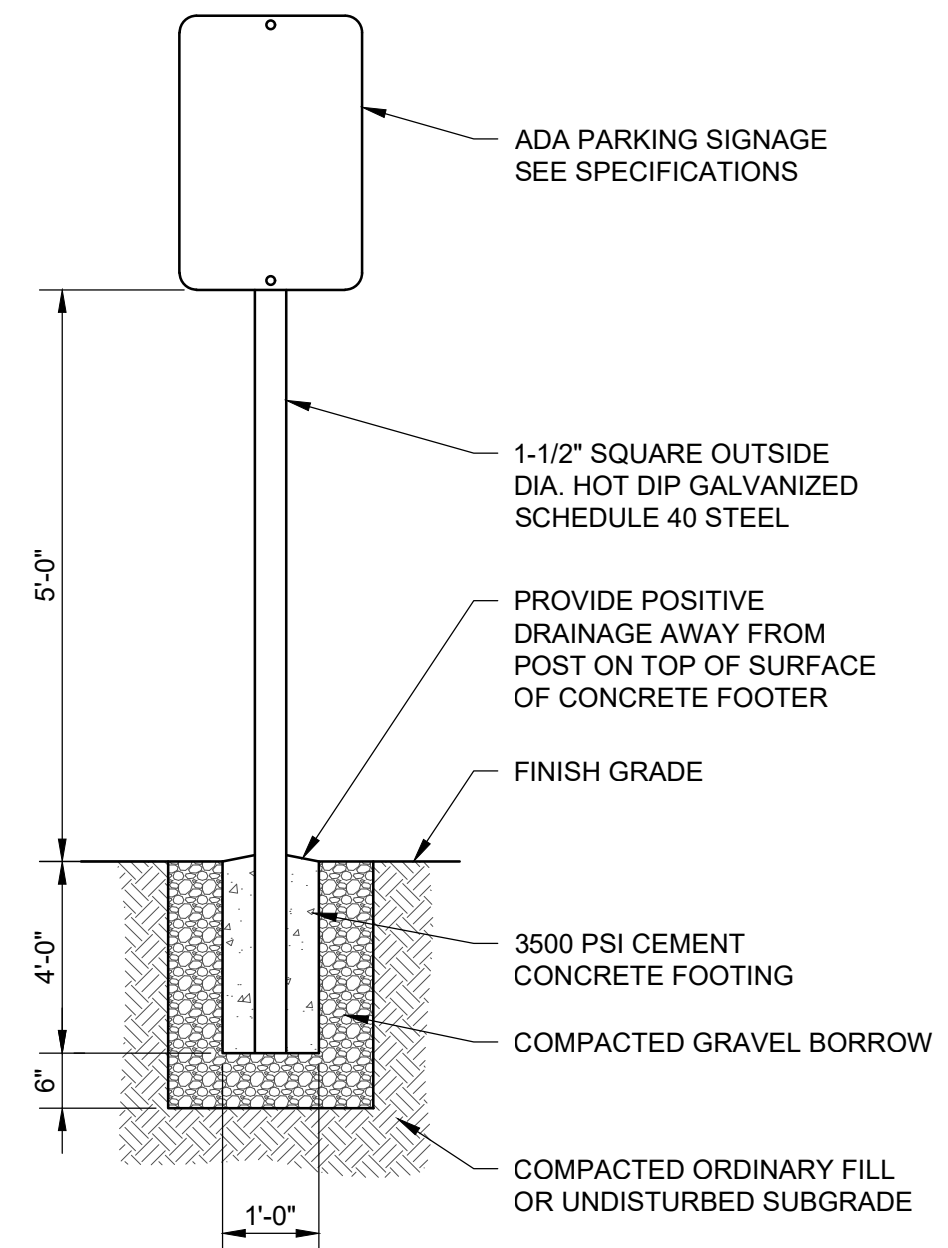
PROJECT SIGN

NOT TO SCALE



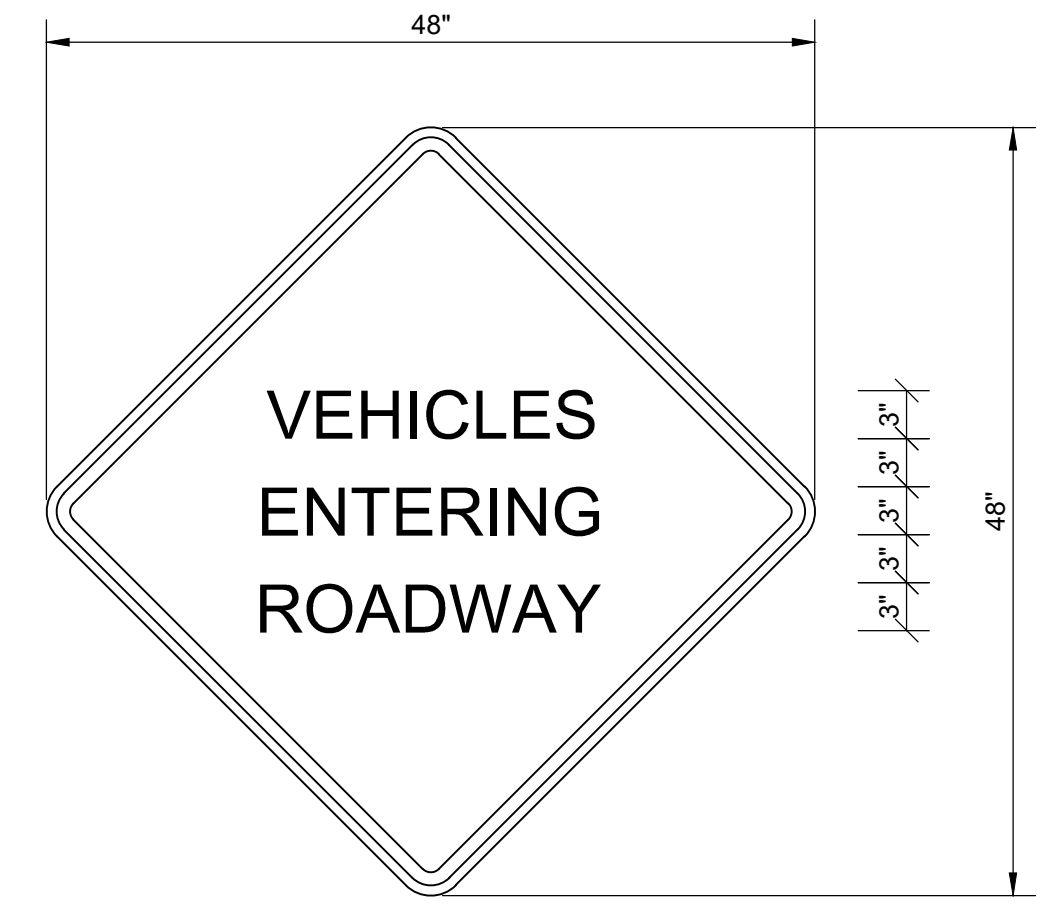
ADA PARKING SIGNAGE

NOT TO SCALE



NOTES:

1. SIGN MOUNTING HEIGHT SHALL BE 5'-0" MIN. FROM GRADE TO BOTTOM OF SIGN.
2. SIGN MATERIAL - 63 MILS THICK ENGINEERING GRADE REFLECTIVE ALUMINUM

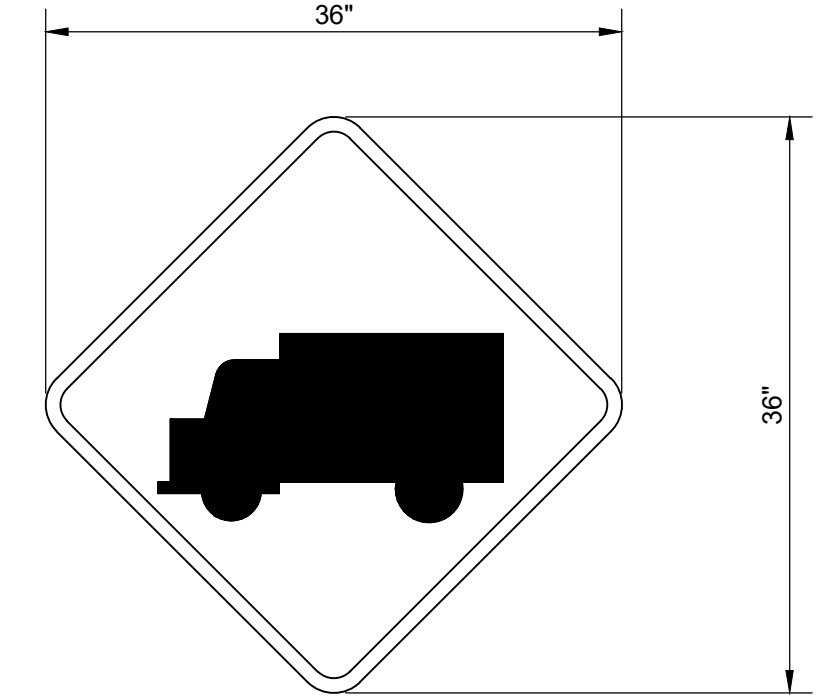


NOTES:

1. SIGN MOUNTING HEIGHT SHALL BE 7'-0" MIN. FROM GRADE TO BOTTOM OF SIGN.
2. SIGN TO BE INSTALLED APPROX. 200' FROM BEGINNING OF WEST SIDE PARKING AREA.
3. SIGN MATERIAL - 80 MILS HIGH INTENSITY PRISMATIC ALUMINUM.

VEHICLES ENTERING ROADWAY SIGN

NOT TO SCALE



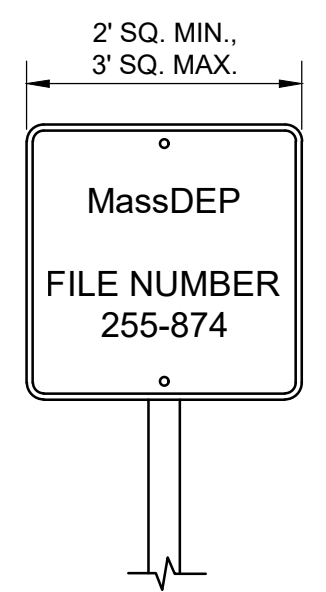
NOTES:

1. SIGN MOUNTING HEIGHT SHALL BE 7'-0" MIN. FROM GRADE TO BOTTOM OF SIGN.
2. SIGN MATERIAL - 80 MILS HIGH INTENSITY PRISMATIC ALUMINUM.

SIGN TYPE: WARNING
2.3" RADIUS, 0.9" BORDER, BLACK ON YELLOW

W11-10 SIGN

NOT TO SCALE

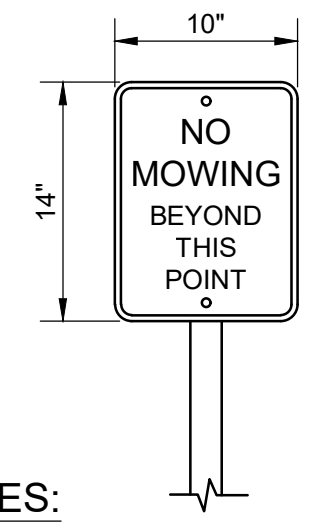


NOTES:

1. SIGN SIZE - 2' SQUARE MIN., 3' SQUARE MAX.
2. SIGN MOUNTING HEIGHT SHALL BE 3'-0" MIN. FROM GRADE TO BOTTOM OF SIGN
3. SIGN COLOR - WHITE WITH BLACK LETTERING
4. SIGN MATERIAL - 63 MILS THICK ENGINEERING GRADE REFLECTIVE ALUMINUM

MASS DEP FILE NUMBER SIGN

NOT TO SCALE

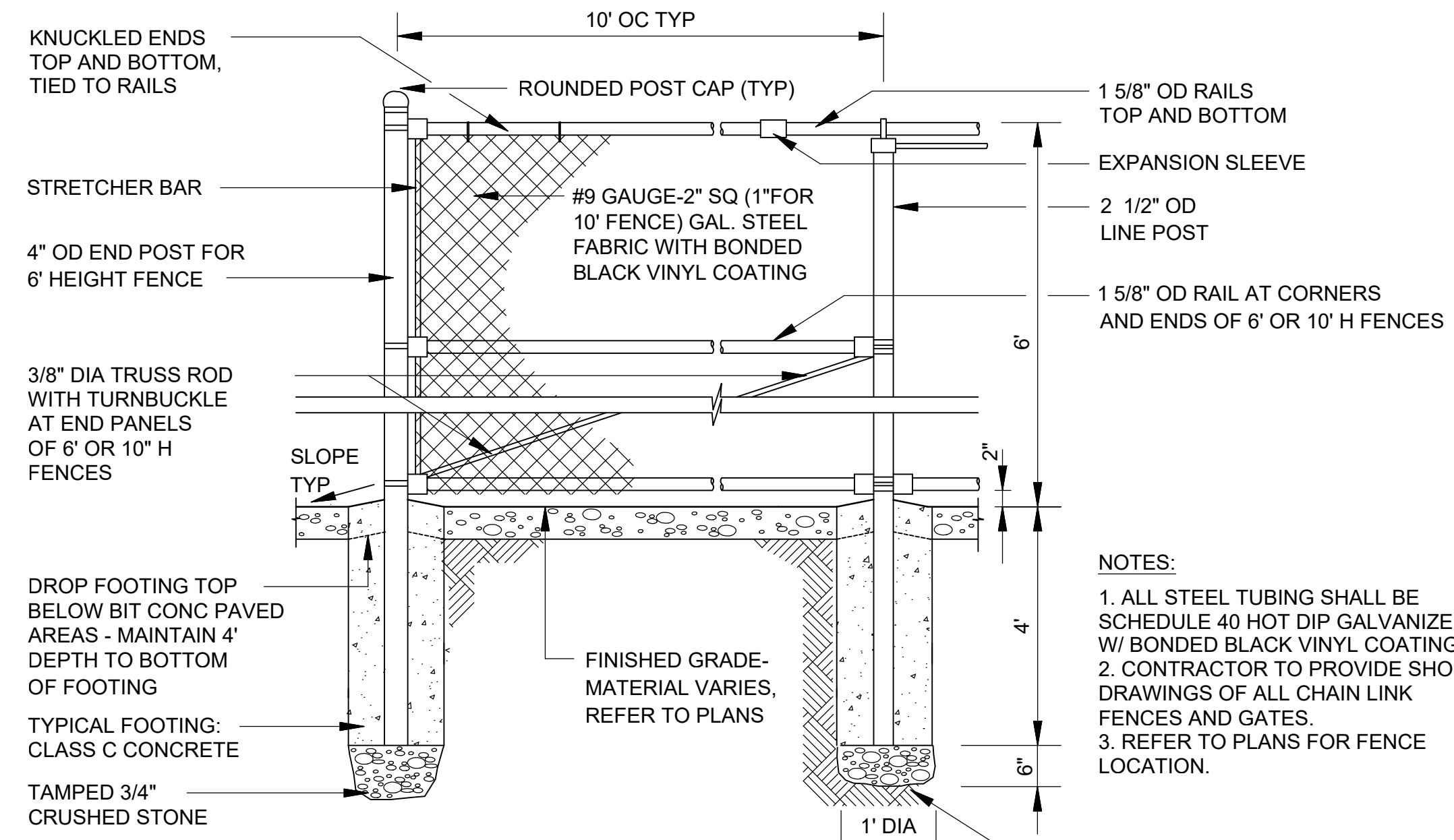


NOTES:

1. SIGN SIZE - 10"x14" WITH 0.5" BORDER
2. SIGN MOUNTING HEIGHT SHALL BE 3'-0" MIN. FROM GRADE TO BOTTOM OF SIGN
3. SIGN COLOR - GREEN AND BLACK ON WHITE
4. SIGN MATERIAL - 63 MILS THICK ENGINEERING GRADE REFLECTIVE ALUMINUM
5. 3M ENGINEER GRADE REFLECTIVE

NO MOWING SIGN

NOT TO SCALE



CHAIN LINK FENCE 6'

NOT TO SCALE

NOTES:

1. ALL STEEL TUBING SHALL BE SCHEDULE 40 HOT DIP GALVANIZED W/ BONDED BLACK VINYL COATING.
2. CONTRACTOR TO PROVIDE SHOP DRAWINGS OF ALL CHAIN LINK FENCES AND GATES.
3. REFER TO PLANS FOR FENCE LOCATION.



PROJECT

MASS DCR
ABANDONED DAMS
LOWES POND DAM
CONTRACT NO.
P19-3264-D4A

CLIENT

Massachusetts Department
of Conservation and
Recreation

10 Park Plaza, Suite 6620
Boston, MA 02116
617.626.1250 tel 617.626.1351 fax
www.mass.gov/orgs/departement-of-conservation-recreation

CONSULTANT

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www.aecom.com



REGISTRATION

ISSUE/REVISION

I/R	DATE	DESCRIPTION

PROJECT NUMBER

60604936

Designed By:	J.P. MINOIS
Drawn By:	M. THIBODEAU
Dept Check:	C. BENZIGER
Proj Check:	D. GOVE
Date:	AUGUST 2024
Scale:	AS NOTED

DISCIPLINE

CIVIL

SHEET TITLE

LOWES POND
DETAILS I

SHEET NUMBER

99 C-501

PATH: \\S:\projects\2024\08\MASSDCR_SIX_ABANDONED_DAMS\SHEETS\CIVIL\LOWES_POND\99_C-501.DWG
 LAST UPDATE: Thursday, August 29, 2024 2:14:45 PM
 PLOT DATE: Thursday, August 29, 2024 2:18:28 PM

PROJECT

MASS DCR
 ABANDONED DAMS
 LOWES POND DAM
 CONTRACT NO.
 P19-3264-D4A

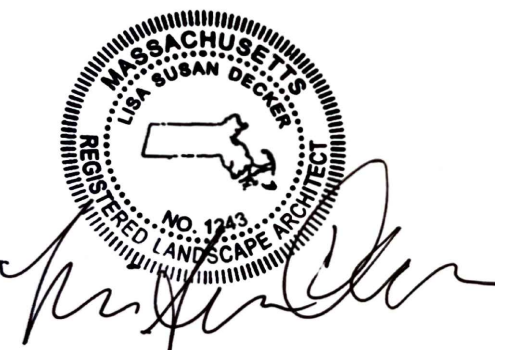
CLIENT

Massachusetts Department
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 Boston, MA 02116
 617.626.1250 tel 617.626.1351 fax
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REGISTRATION

ISSUE/REVISION

I/R	DATE	DESCRIPTION

PROJECT NUMBER

60604936

Designed By:	L. DECKER
Drawn By:	M. THIBODEAU
Dept Check:	C. BENZIGER
Proj Check:	D. GOVE
Date:	AUGUST 2024
Scale:	AS NOTED

DISCIPLINE

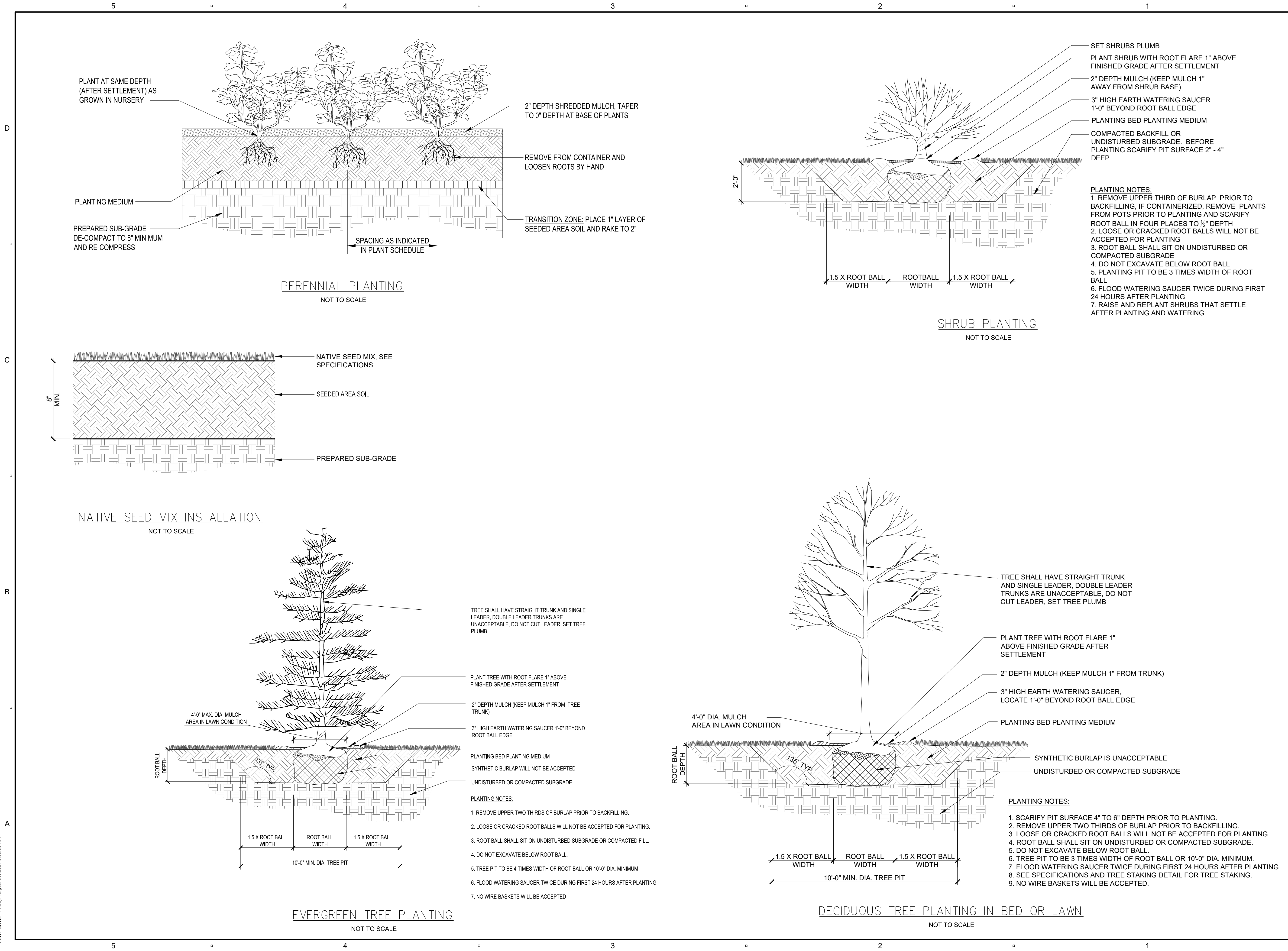
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SHEET TITLE

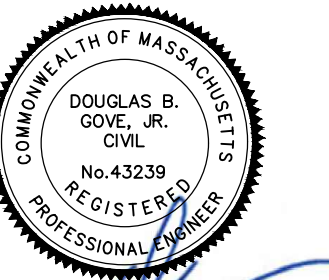
**LOWES POND
 DETAILS II**

SHEET NUMBER

99 C-502



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 LAST UPDATE: Thursday, August 29, 2024 2:25:52 PM
 PLOT DATE: Friday, August 30, 2024 8:08:58 AM



REGISTRATION

ISSUE/REVISION

I/R	DATE	DESCRIPTION

PROJECT NUMBER

60604936

Designed By:	S. HE
Drawn By:	S. NAPOLITANO
Dept Check:	C. BENZIGER
Proj Check:	D. GOVE
Date:	AUGUST 2024
Scale:	AS NOTED

DISCIPLINE

CIVIL

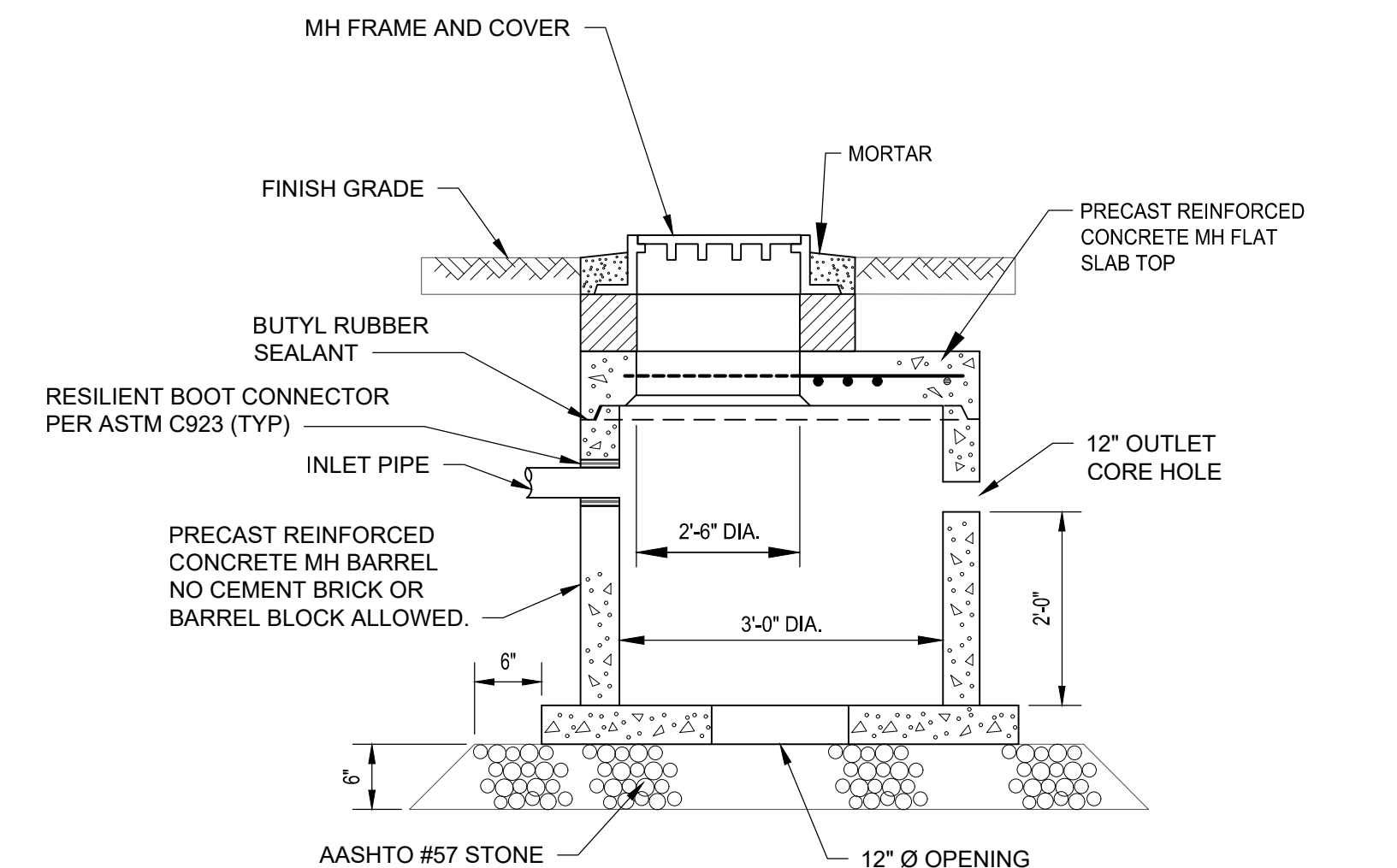
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LOWES POND

DETAILS III

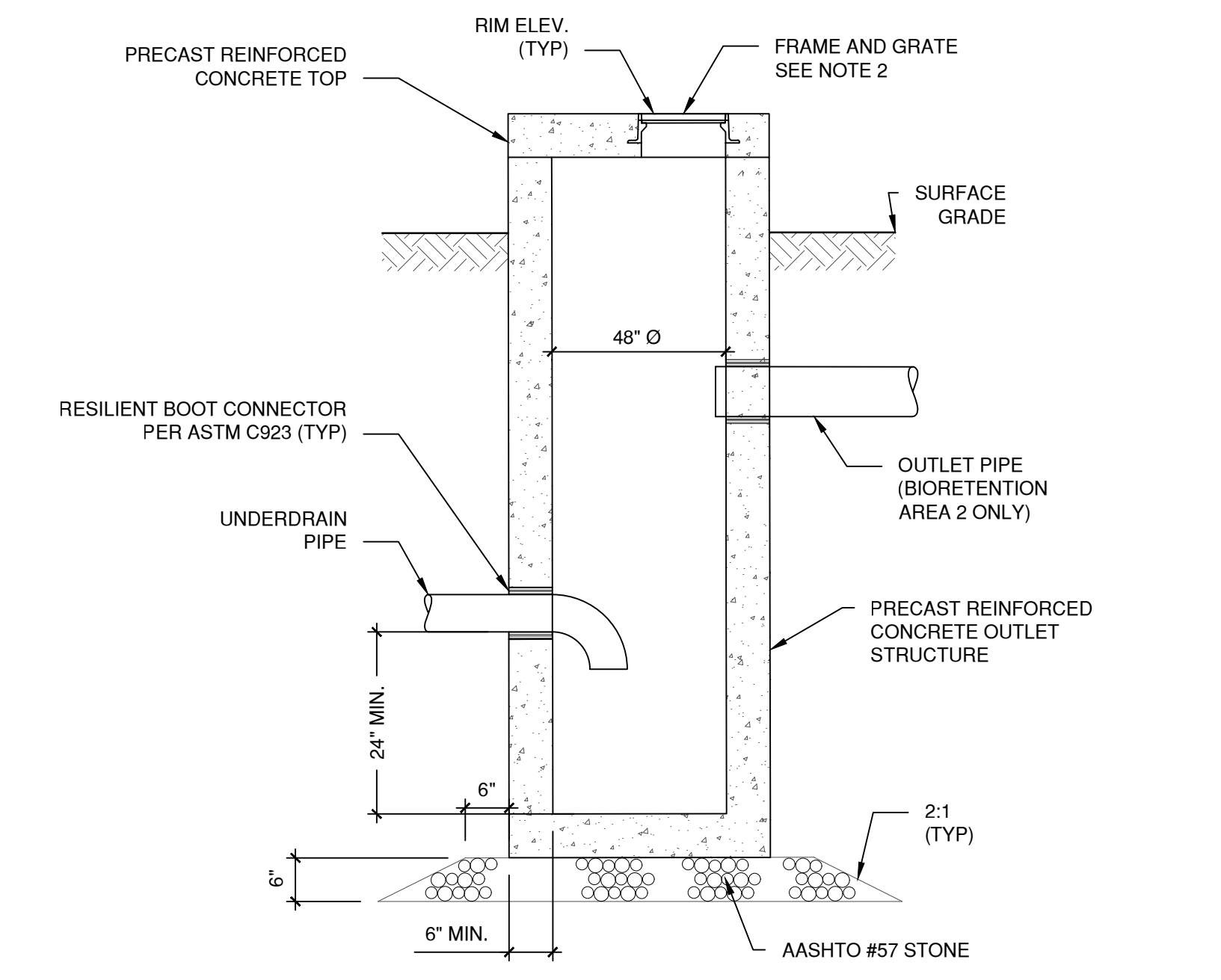
SHEET NUMBER

99 C-503



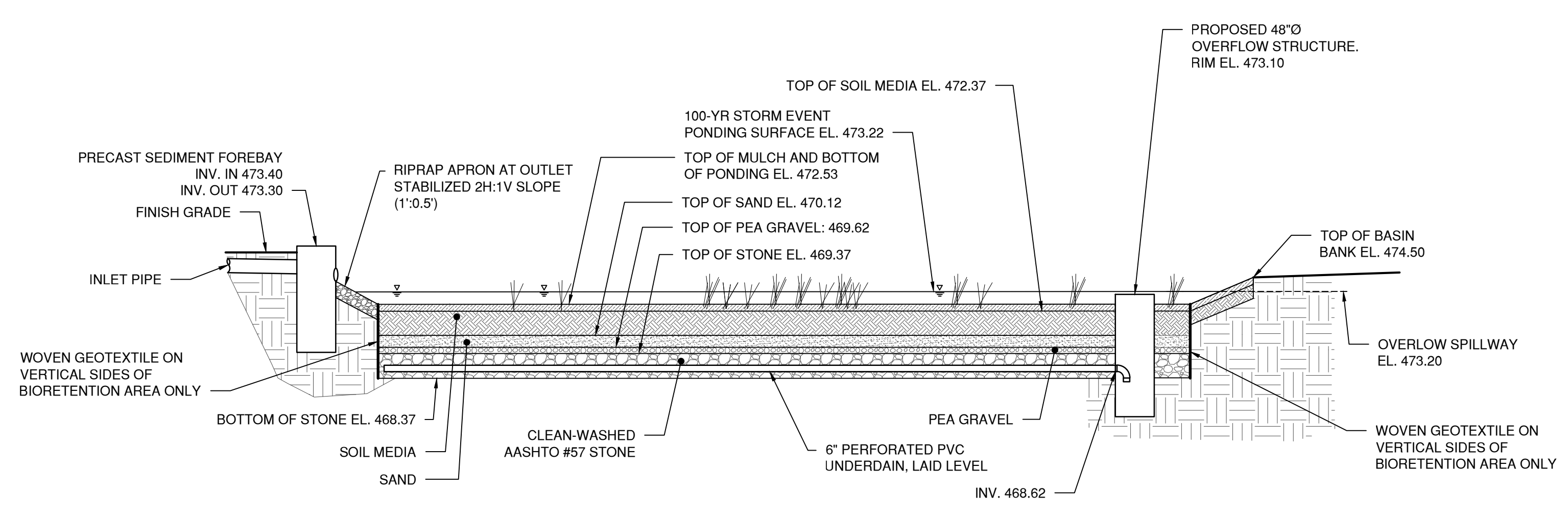
NOTE:
 1. PRECAST SEDIMENT FOREBAY, INCLUDING SLAB TOP AND MH FRAME AND COVER, TO BE DESIGNED FOR AASHTO H-20 LOADING.

SECTION
PRECAST SEDIMENT FOREBAY
 NOT TO SCALE

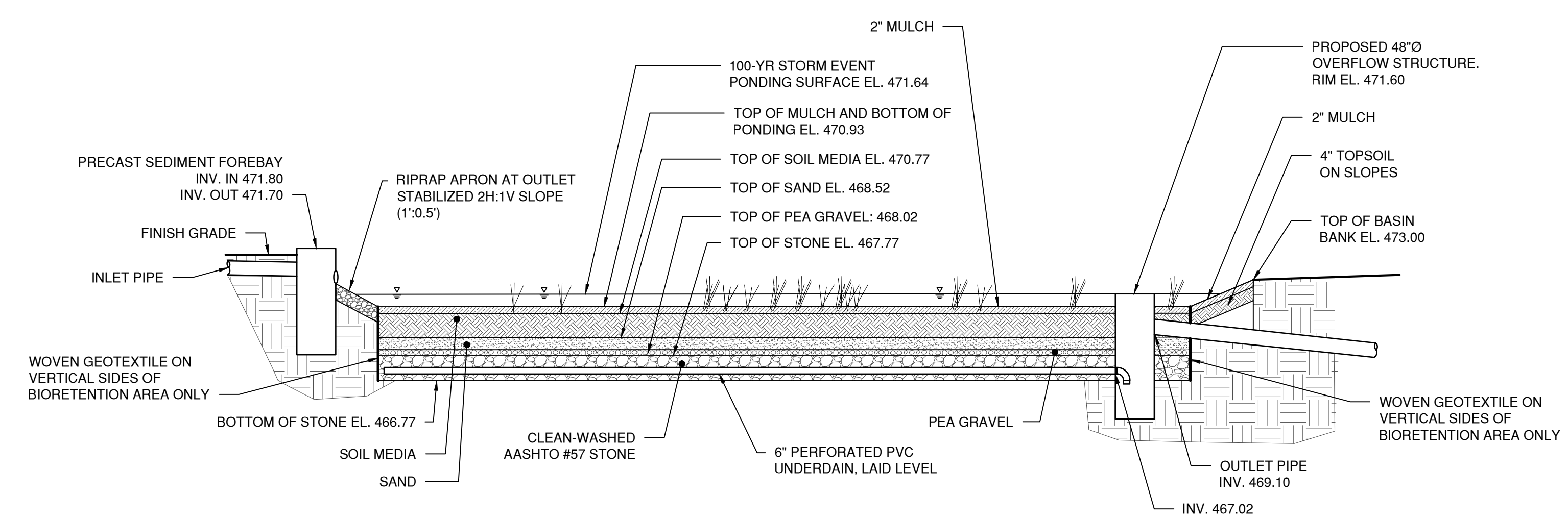


NOTES:
 1. PIPE SIZES, MATERIALS, INVERT ELEVATIONS AND ORIENTATION AS INDICATED ON PLANS AND DETAILS.
 2. H20 LOADING IS NOT REQUIRED. ALL JOINTS, ADJUSTMENTS, AND PIPE CONNECTIONS MUST BE WATERTIGHT.

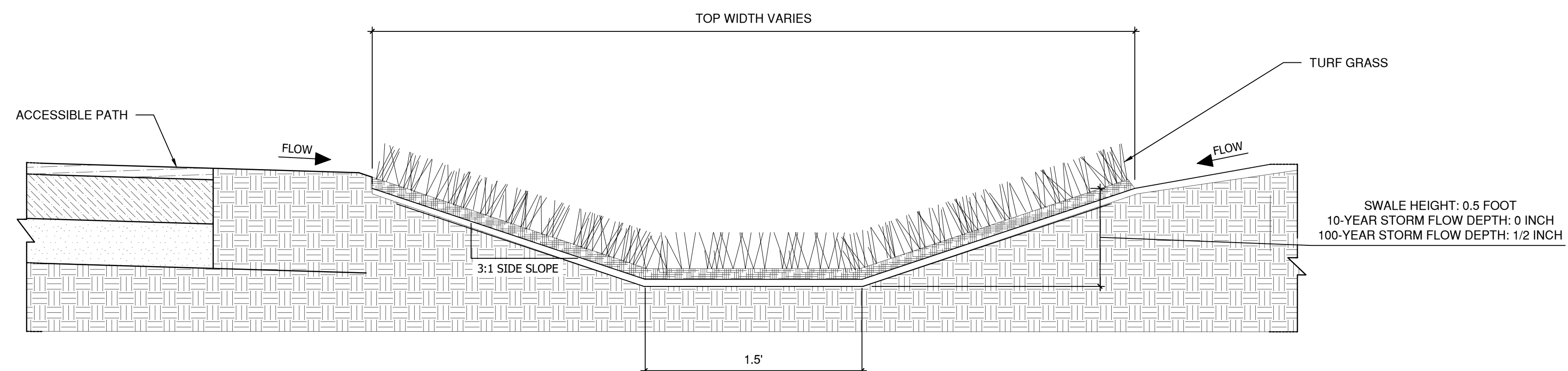
CONCRETE OVERFLOW STRUCTURE
 NOT TO SCALE



SCHEMATIC - EXFILTRATING BIORETENTION AREA NO. 1
 NOT TO SCALE



SCHEMATIC - EXFILTRATING BIORETENTION AREA NO. 2
 NOT TO SCALE



LINEAR INFLOW GRASS SWALE
 NOT TO SCALE

PATHFILENAME: C:\USERS\THIBODIAE\AECOM\DIRECTOR\60604936-MASSDCR SIX ABANDONED DAMS\SHEETS\CIVIL\LOWES POND\99 C-503.DWG
 LAST UPDATE: Thursday, August 29, 2024 2:16:26 PM
 PLOT DATE: Thursday, August 29, 2024 2:23:14 PM

PROJECT

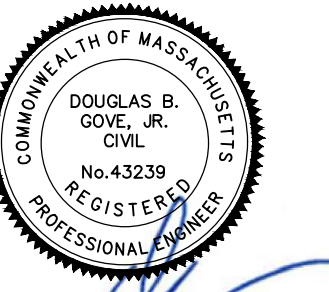
MASS DCR
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CLIENT

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REGISTRATION

ISSUE/REVISION

I/R	DATE	DESCRIPTION

PROJECT NUMBER

60604936

Designed By:	S. HE
Drawn By:	S. NAPOLITANO
Dept Check:	C. BENZIGER
Proj Check:	D. GOVE
Date:	AUGUST 2024
Scale:	AS NOTED

DISCIPLINE

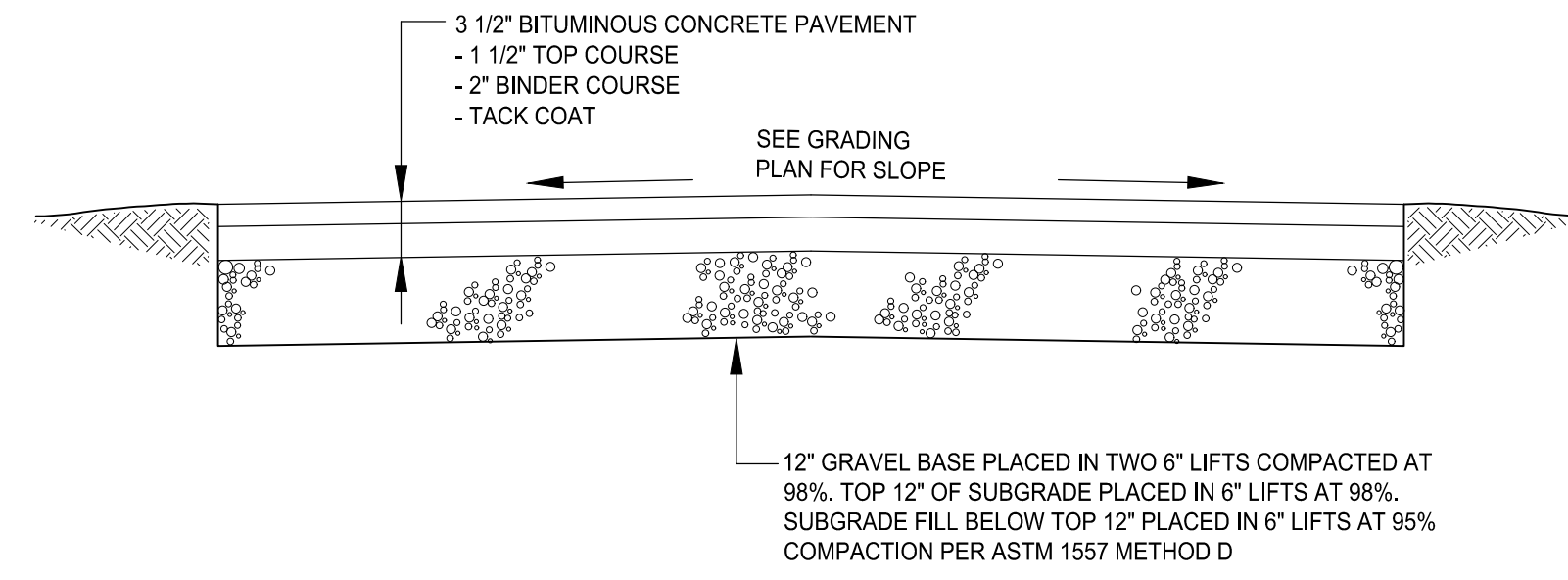
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SHEET TITLE

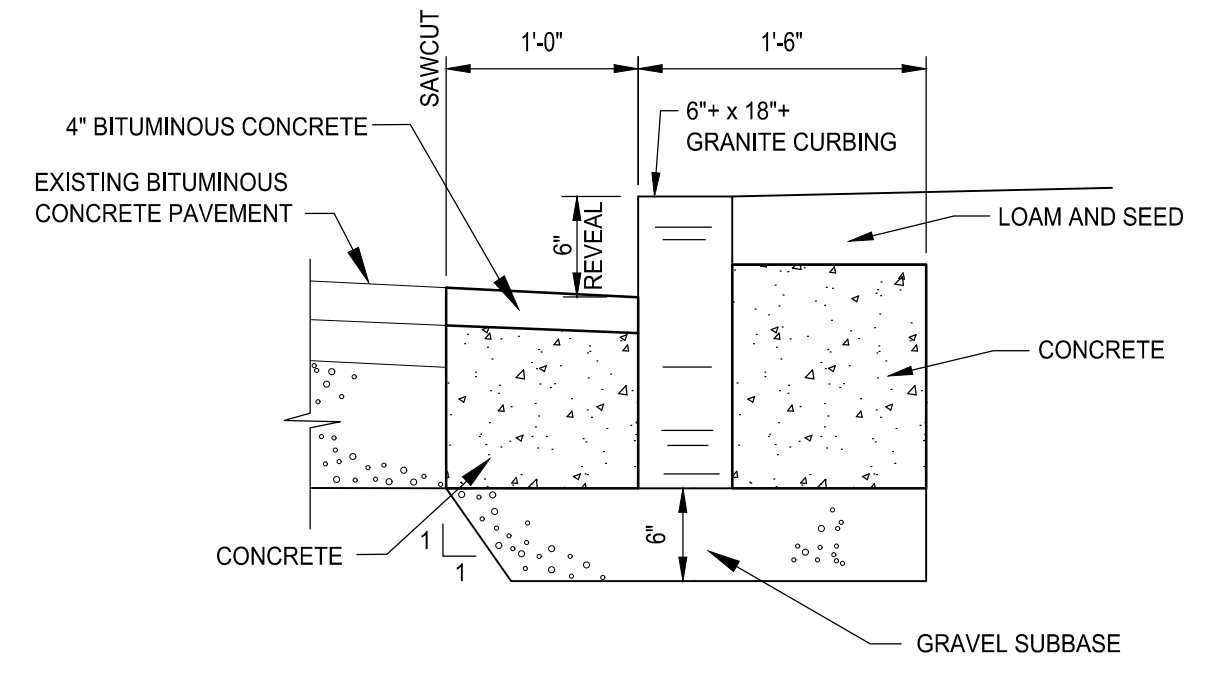
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DETAILS IV

SHEET NUMBER

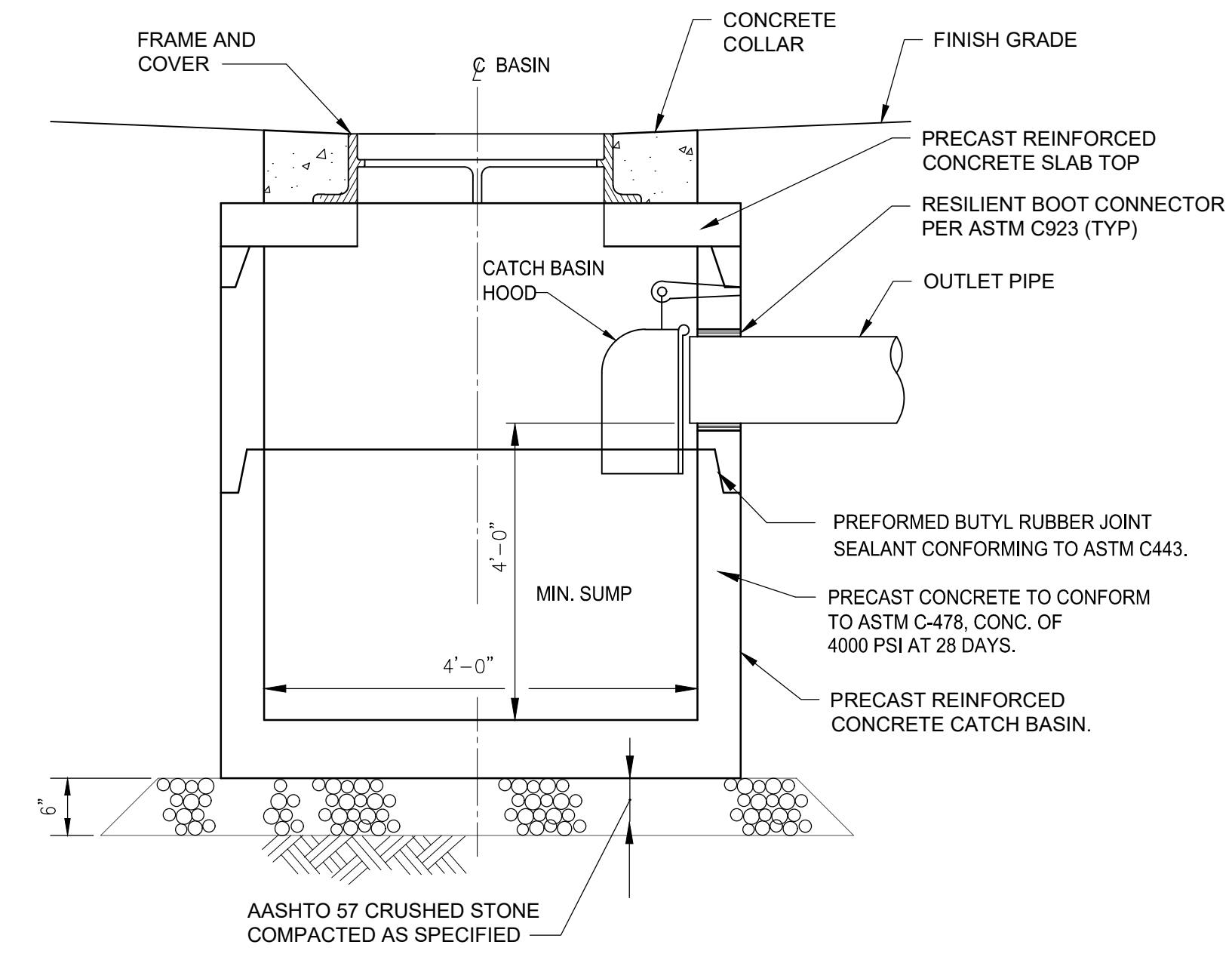
99 C-504



PAVEMENT SECTION
N.T.S.

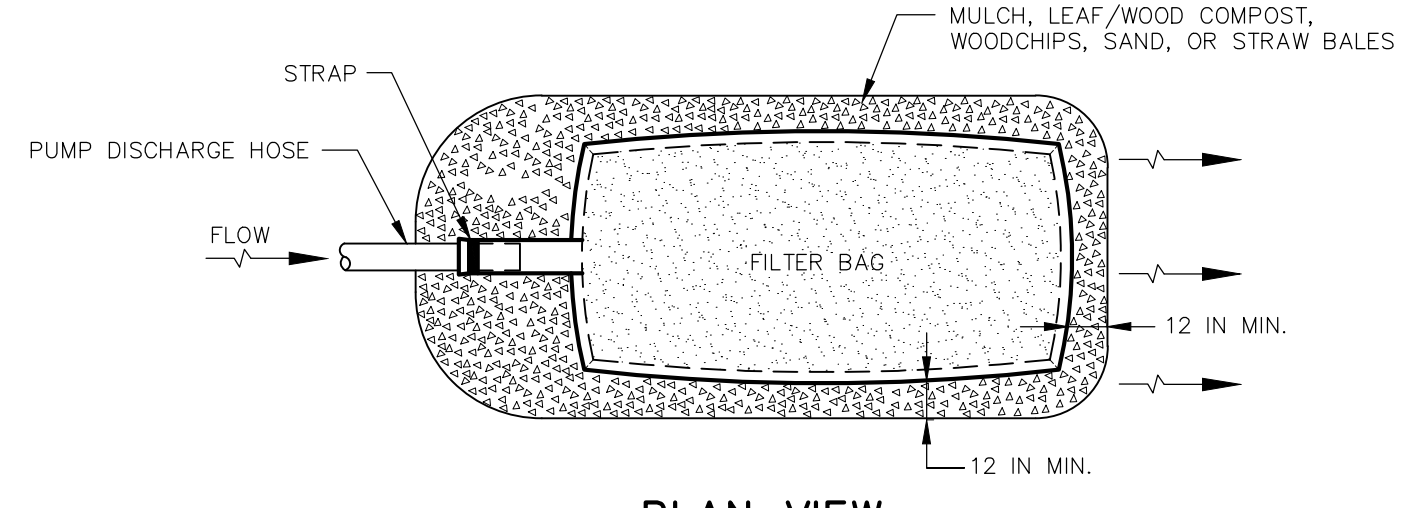


GRANITE CURB SETTING
NOT TO SCALE

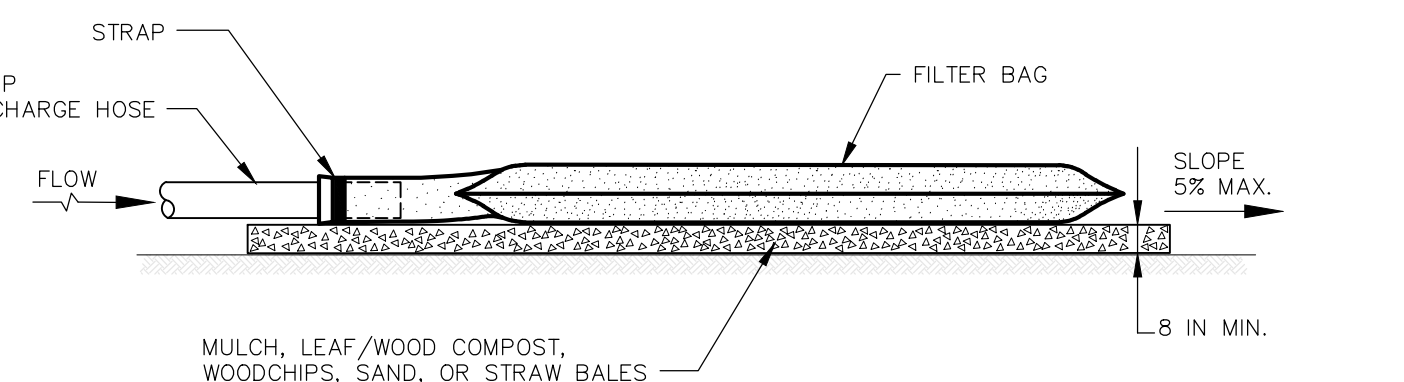


NOTE:
1. PRECAST CONCRETE DEEP SUMP CATCH BASIN, INCLUDING SLAB TOP AND SHALLOW FRAME & GRATE, MUST BE DESIGNED FOR AASHTO H-20 LOADING

DEEP SUMP CATCH BASIN
NOT TO SCALE



PLAN VIEW



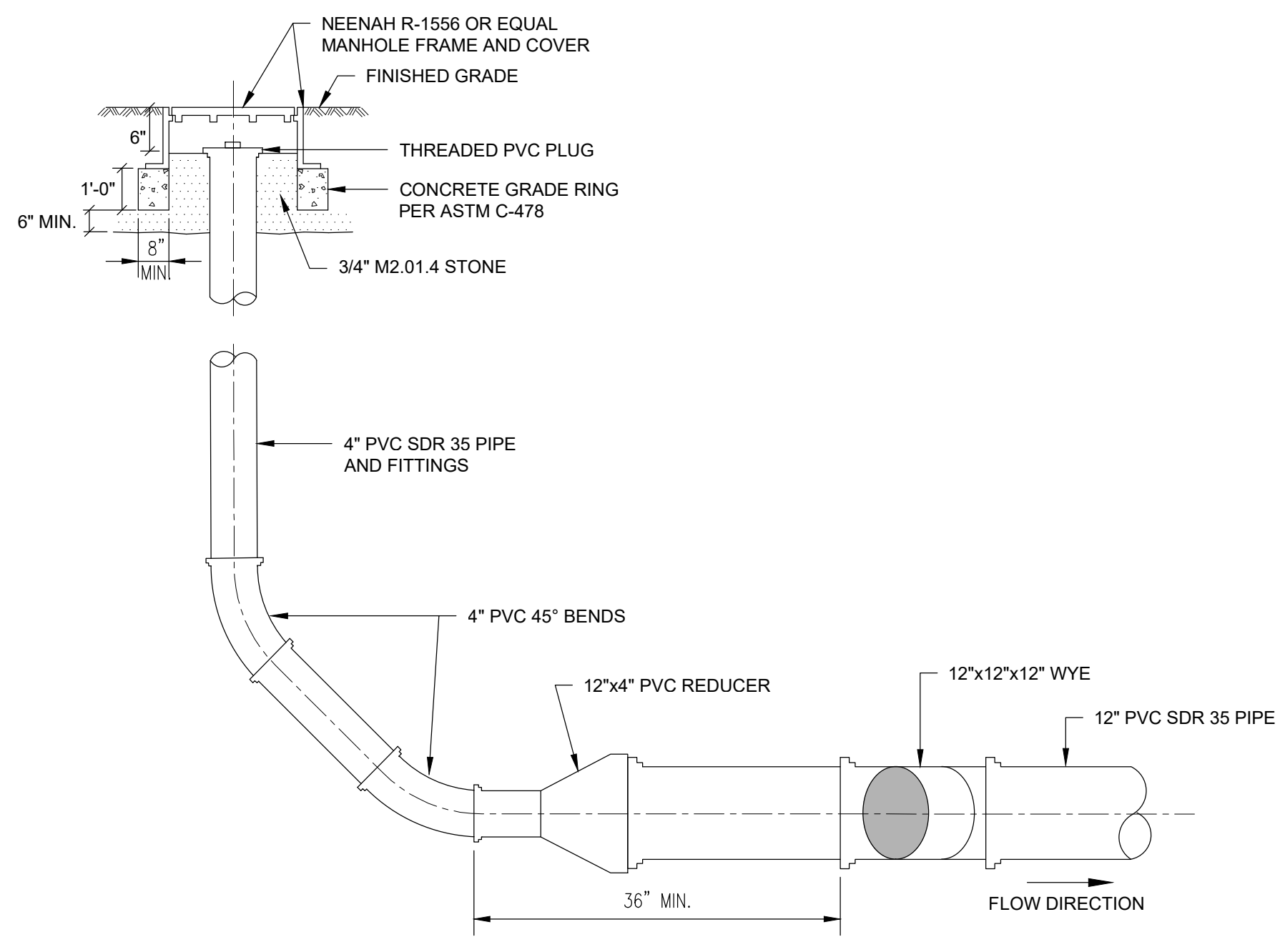
ELEVATION

CONSTRUCTION SPECIFICATIONS

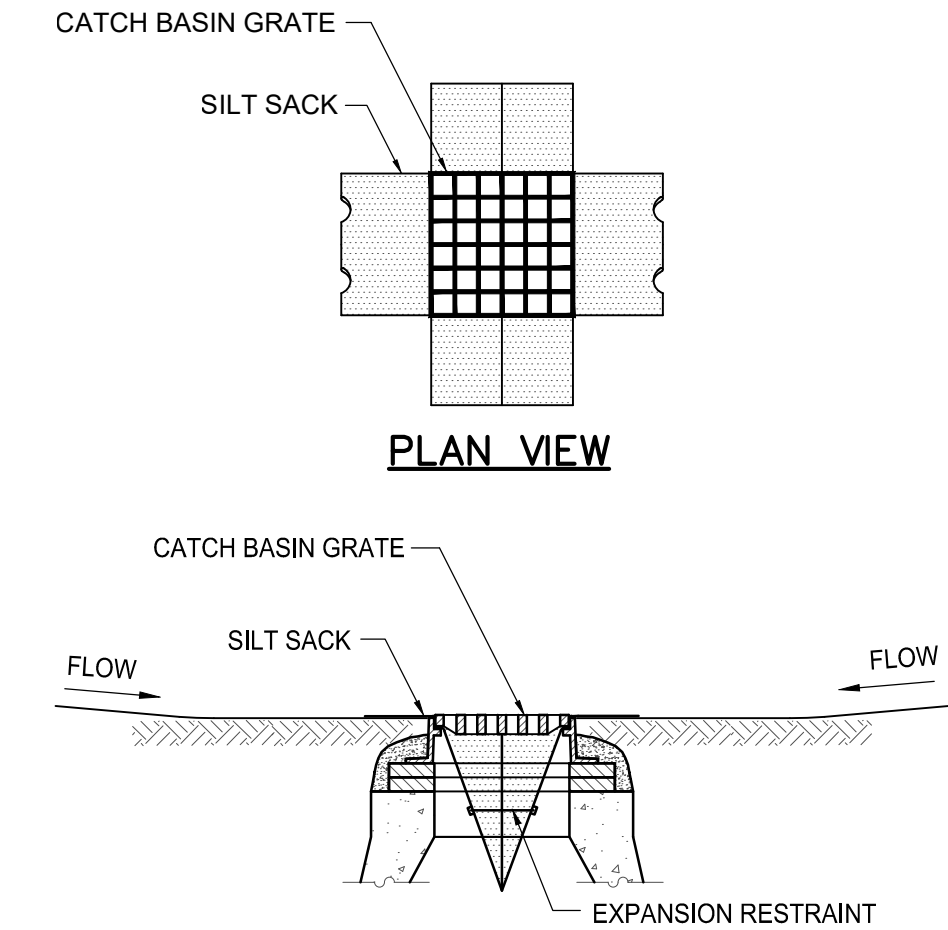
- TIGHTLY SEAL SLEEVE AROUND THE PUMP DISCHARGE HOSE WITH A STRAP OR SIMILAR DEVICE.
- PLACE FILTER BAG ON SUITABLE BASE (E.G., MULCH, LEAF/WOOD COMPOST, WOODCHIPS, SAND, OR STRAW BALES) LOCATED ON A LEVEL OR 5% MAXIMUM SLOPING SURFACE. DISCHARGE TO A STABILIZED AREA. EXTEND BASE A MINIMUM OF 12 INCHES FROM EDGES OF BAG.
- CONTROL PUMPING RATE TO PREVENT EXCESSIVE PRESSURE WITHIN THE FILTER BAG IN ACCORDANCE WITH THE MANUFACTURER RECOMMENDATIONS. AS THE BAG FILLS WITH SEDIMENT, REDUCE PUMPING RATE.
- REMOVE AND PROPERLY DISPOSE OF FILTER BAG UPON COMPLETION OF PUMPING OPERATIONS OR AFTER BAG HAS REACHED CAPACITY, WHICHEVER OCCURS FIRST. SPREAD THE DEWATERED SEDIMENT FROM THE BAG IN AN APPROVED UPLAND AREA AND STABILIZE WITH SEED AND MULCH BY THE END OF THE WORK DAY. RESTORE THE SURFACE AREA BENEATH THE BAG TO ORIGINAL CONDITION UPON REMOVAL OF THE DEVICE.
- USE NONWOVEN GEOTEXTILE WITH DOUBLE STITCHED SEAMS USING HIGH STRENGTH THREAD. SIZE SLEEVE TO ACCOMMODATE A MAXIMUM 4 INCH DIAMETER PUMP DISCHARGE HOSE. THE BAG MUST BE MANUFACTURED FROM A NONWOVEN GEOTEXTILE THAT MEETS OR EXCEEDS MINIMUM AVERAGE ROLL VALUES (MARV) FOR THE FOLLOWING:

GRAB TENSILE	250 LB	ASTM D-4632
PUNCTURE	150 LB	ASTM D-4833
FLOW RATE	70 GAL./MIN./FT ²	ASTM D-4491
PERMITTIVITY (SEC ⁻¹)	1.2 SEC ⁻¹	ASTM D-4491
UV RESISTANCE	70% STRENGTH @ 500 HOURS	ASTM D-4355
APPARENT OPENING SIZE (AOS)	0.15-0.18 MM	ASTM D-4751
SEAM STRENGTH	90%	ASTM D-4632
- REPLACE FILTER BAG IF BAG CLOGS OR HAS RIPS, TEARS, OR PUNCTURES. DURING OPERATION KEEP CONNECTION BETWEEN PUMP HOSE AND FILTER BAG WATER TIGHT. REPLACE BEDDING IF IT BECOMES DISPLACED.

SEDIMENTATION FILTER BAG
NOT TO SCALE



CLEANOUT
NOT TO SCALE



SECTION VIEW

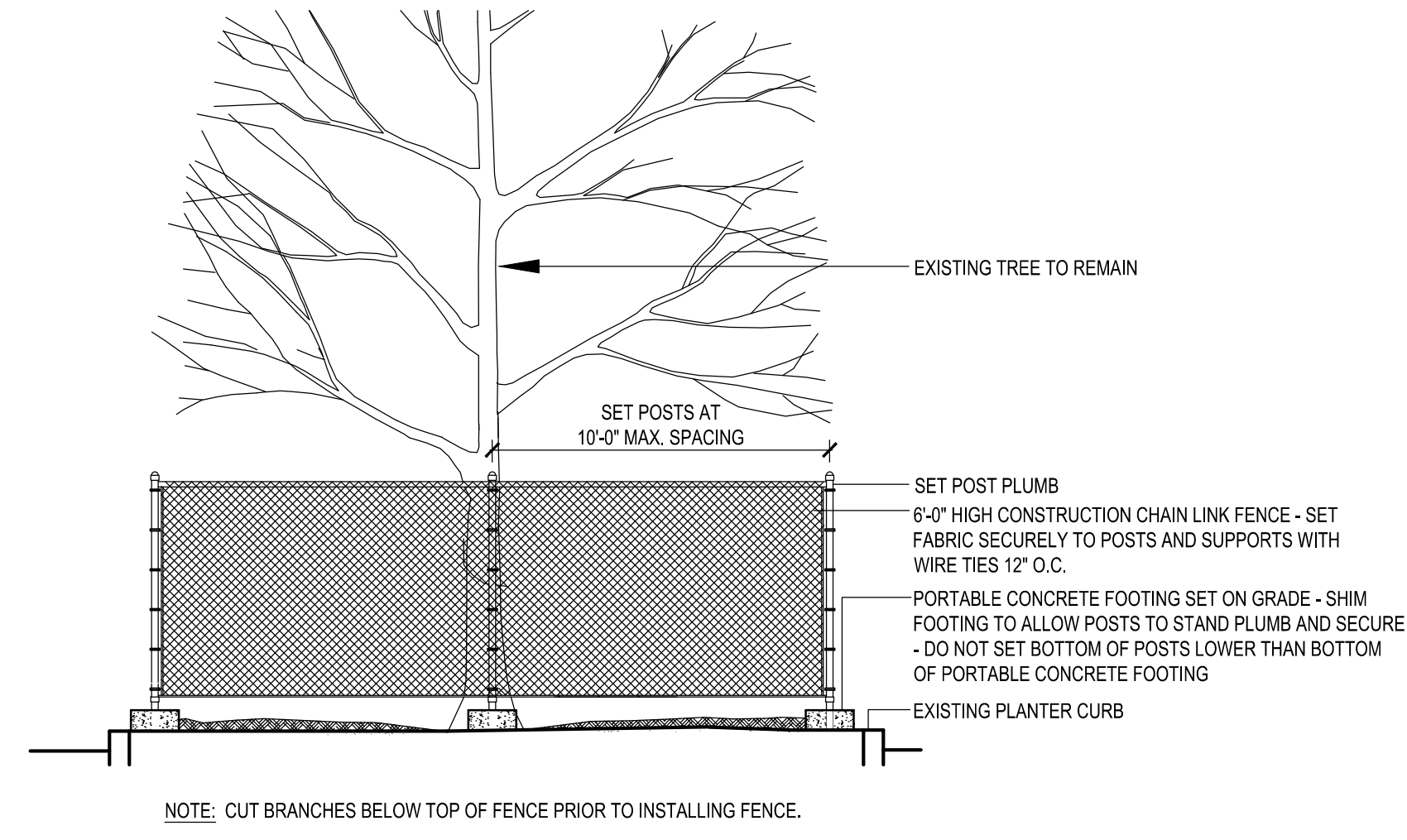
- NOTES:**
- INSTALL SILT SACK IN ALL CATCH BASINS BEFORE COMMENCING WORK OR IN PAVED AREAS AFTER BINDER COURSE IS PLACED AND STRAW BALES HAVE BEEN REMOVED. GRATE TO BE PLACED OVER SILT SACK.
 - SILT SACK SHALL BE INSPECTED PERIODICALLY AND AFTER ALL STORM EVENTS AND CLEANING OR REPLACEMENT SHALL BE PERFORMED PROMPTLY AS NEEDED.

SILT SACK SEDIMENT TRAP
NOT TO SCALE

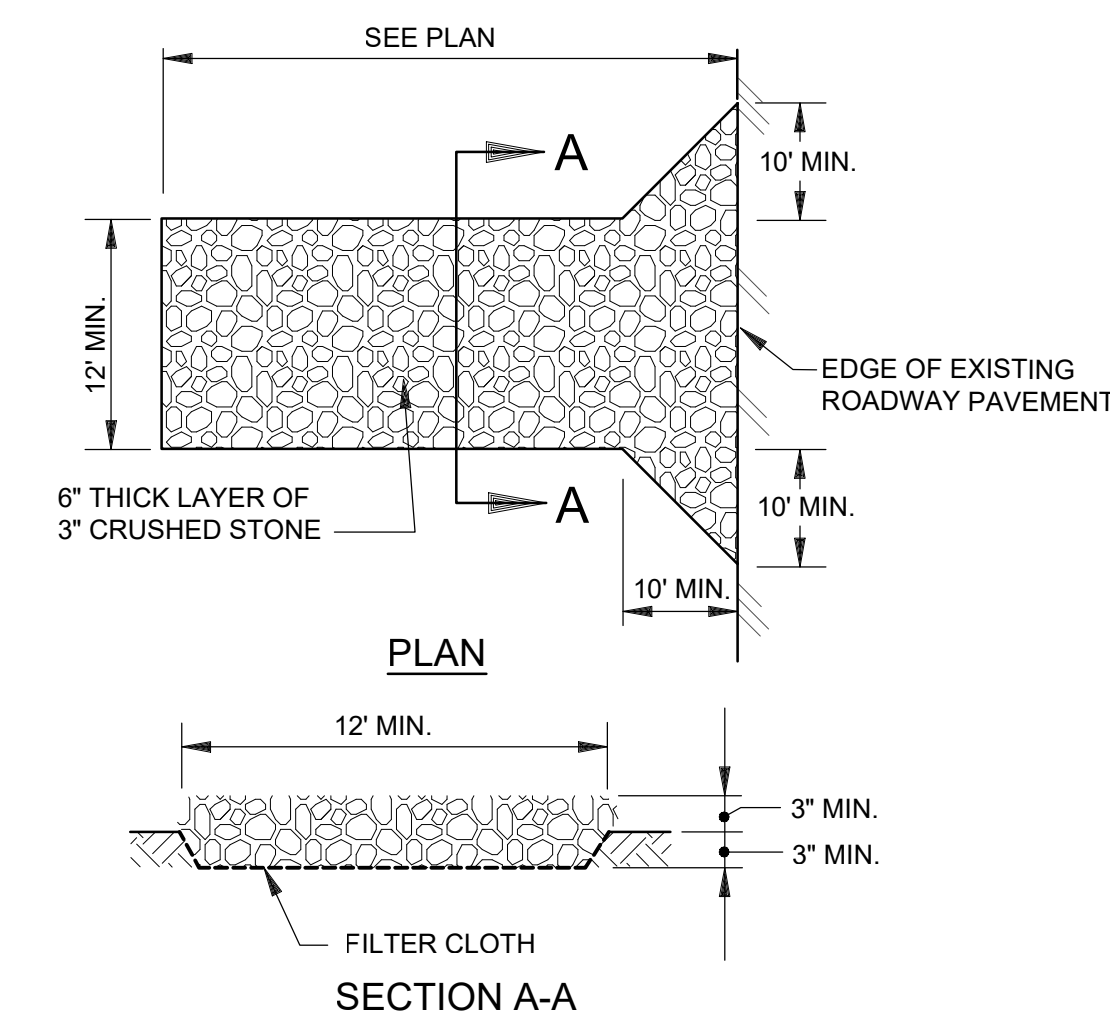
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 LAST UPDATE: Friday, August 30, 2024 12:13:51 PM
 PLOT DATE: Friday, August 30, 2024 12:20:20 PM

EROSION PROTECTION NOTES

1. SEDIMENT CONTROL MEASURES SHALL BE ADJUSTED TO MEET FIELD CONDITIONS AT THE TIME OF AND DURING ALL PHASES OF CONSTRUCTION AND BE CONSTRUCTED PRIOR TO AND IMMEDIATELY AFTER ANY GRADING OR DISTURBANCE OF EXISTING SURFACE MATERIAL ON THE SITE.
2. WEEKLY INSPECTION AND MAINTENANCE OF ALL SEDIMENT CONTROL STRUCTURES SHALL BE PROVIDED TO ENSURE THAT THE INTENDED PURPOSE IS ACCOMPLISHED. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ENSURING THAT NO SEDIMENT LEAVES THE LIMIT OF WORK. SEDIMENT CONTROL MEASURES SHALL BE IN WORKING CONDITION AT THE END OF EACH DAY.
3. THE CONTRACTOR SHALL PREVENT MUD/MATERIAL FROM BEING TRACKED ONTO HUGUENOT ROAD OR ONTO ANY AREAS OUTSIDE THE LIMIT OF WORK. IF DETECTED, DEBRIS MUST BE CLEANED UP IMMEDIATELY AND THE CAUSE MUST BE DETERMINED AND RECTIFIED.
4. ALL CONSTRUCTION INGRESS AND EGRESS POINTS SHALL BE PROTECTED WITH A STABILIZED CONSTRUCTION ENTRANCE/EXIT WITH WASH DOWN FACILITIES TO PREVENT TRACKING OF SEDIMENT ONTO THE ROAD.
5. ALL SEDIMENT MUST BE PREVENTED FROM ENTERING ANY STORMWATER COLLECTION SYSTEM, EXCEPT THOSE SYSTEMS SPECIFICALLY DESIGNED AS CONSTRUCTION-PERIOD SEDIMENT REMOVAL DEVICES.
6. CONTRACTOR SHALL PROVIDE COMPOST SILT SOCKS, AS NECESSARY, TO PREVENT SEDIMENT RUNOFF FROM ALL IMPACTED AREAS ASSOCIATED WITH CONSTRUCTION ACTIVITIES. THE SILT FENCE SHALL BE INSPECTED DAILY. THE CONTRACTOR SHALL REMOVE ACCUMULATED SEDIMENT AND REPAIR THE SILT FENCE AS DETERMINED DURING THE INSPECTION TO ORIGINAL CONDITION WITHIN THREE (3) DAYS OF INSPECTION.
7. ONLY DISTURB, CLEAR, OR GRADE AREAS NECESSARY FOR CONSTRUCTION. FLAG OR OTHERWISE DELINEATE AREAS NOT TO BE DISTURBED. EXCLUDE VEHICLES AND CONSTRUCTION EQUIPMENT FROM AREAS NOT NECESSARY FOR CONSTRUCTION.
8. THE CONTRACTOR IS RESPONSIBLE FOR REMOVAL AND DISPOSAL OF ALL EROSION AND SEDIMENT CONTROLS AT THE COMPLETION OF CONSTRUCTION AND WHEN THE CONTRIBUTING DRAINAGE AREA HAS BEEN PERMANENTLY STABILIZED. REMOVE TEMPORARY EROSION CONTROL MEASURES WITHIN 30 DAYS AFTER THE TRIBUTARY AREA HAS BEEN PERMANENTLY STABILIZED. REMOVE ANY ACCUMULATED SEDIMENTS AND STABILIZE ALL DISTURBED AREAS.
9. CONTRACTOR SHALL PROTECT AND MAINTAIN EXISTING DRAINAGE INLETS, DITCHES, SWALES, CULVERTS, AND DETENTION PONDS WITHIN THE LIMITS OF CONSTRUCTION AS WELL AS ANY OTHER AREAS IMPACTED BY CONSTRUCTION OPERATIONS. IF A DRAINAGE DITCH OR SWALE IS TO BE RELOCATED, THE RELOCATED DITCH SHALL BE IN PLACE PRIOR TO DISTURBANCE OF THE EXISTING DITCH.
10. PROVIDE AND STABILIZE STORMWATER TREATMENT AREAS, DITCHES AND SWALES AS EARLY AS PRACTICAL DURING CONSTRUCTION BUT PRIOR TO DISTURBING THE TRIBUTARY AREA AND PRIOR TO DIRECTING RUNOFF TO THE TREATMENT AREAS, DITCHES AND SWALES.
11. STABILIZE ACCESS DRIVES AND PARKING AREAS WITHIN 72 HOURS OF ACHIEVING FINISH GRADE.
12. INSPECT DISTURBED AREAS, STORAGE AREAS, AND EROSION CONTROL MEASURES WEEKLY UNLESS OTHERWISE INDICATED AND AFTER EVERY STORM EVENT OF 1/4 INCH OF RAINFALL OR MORE. ALL INSPECTIONS SHALL BE PERFORMED BY PERSONS FAMILIAR WITH EROSION AND SEDIMENT CONTROL PRACTICES.
13. AFTER ANY SIGNIFICANT RAINFALL (1/4 INCH OR GREATER), SEDIMENT CONTROL STRUCTURES SHALL BE INSPECTED FOR INTEGRITY. ANY DAMAGED DEVICES SHALL BE CORRECTED IMMEDIATELY.
14. DOCUMENT EACH INSPECTION IN A REPORT AND LOG, INCLUDING THE FOLLOWING: DATE, NAME (S) AND TITLE OF THE PERSONNEL MAKING THE INSPECTION, WEATHER AND DESCRIPTION OF ANY DISCHARGE OCCURRING AT THE TIME OF INSPECTION, LOCATION OF ANY DISCHARGE OF SEDIMENT OR POLLUTANTS, BEST MANAGEMENT PRACTICES THAT NEED TO BE MAINTAINED, BEST MANAGEMENT PRACTICES THAT FAILED OR OTHERWISE PROVED INADEQUATE, LOCATION WHERE ADDITIONAL BEST MANAGEMENT PRACTICES ARE NEEDED, AND CORRECTIVE ACTION REQUIRED. ALSO NOTE WHAT ACTION WAS TAKEN TO CORRECT DEFICIENCIES OR ENHANCE CONTROLS, INCLUDING THE DATE THE CORRECTIVE ACTION WAS TAKEN. PERFORM CORRECTIVE ACTION OF EROSION CONTROL MEASURES IMMEDIATELY.
15. ANY SEDIMENT TRACKED ONTO PAVED AREAS SHALL BE SWEEPED UP AND REMOVED AT THE END OF EACH WORKING DAY AND THE CAUSE OF THE INCIDENT DETERMINED AND CORRECTED.
16. STABILIZED PORTIONS OF A SITE SHALL BE INSPECTED AT LEAST ONCE PER MONTH.
17. MAINTAIN EROSION CONTROL MEASURES FOR THE DURATION OF THE PROJECT AND UNTIL PERMANENT STABILIZATION OF THE ENTIRE SITE IS ESTABLISHED.
18. PROTECT STABILIZED AREAS FROM EROSION AND IMMEDIATELY REPAIR AND RE-VEGETATE ERODED AREAS.



TREE PROTECTION FENCING
NOT TO SCALE



TEMPORARY CONSTRUCTION ENTRANCE
NOT TO SCALE

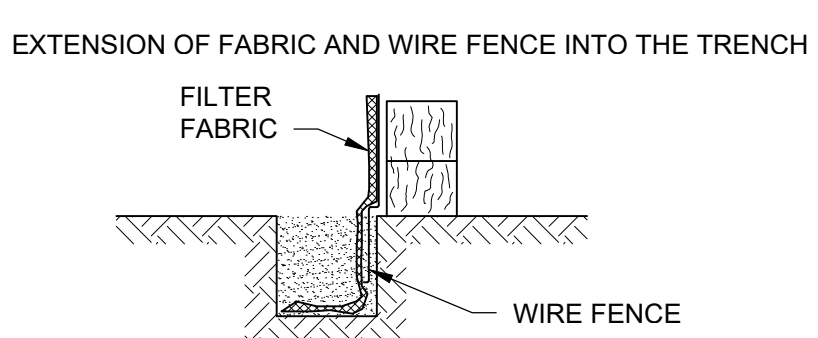
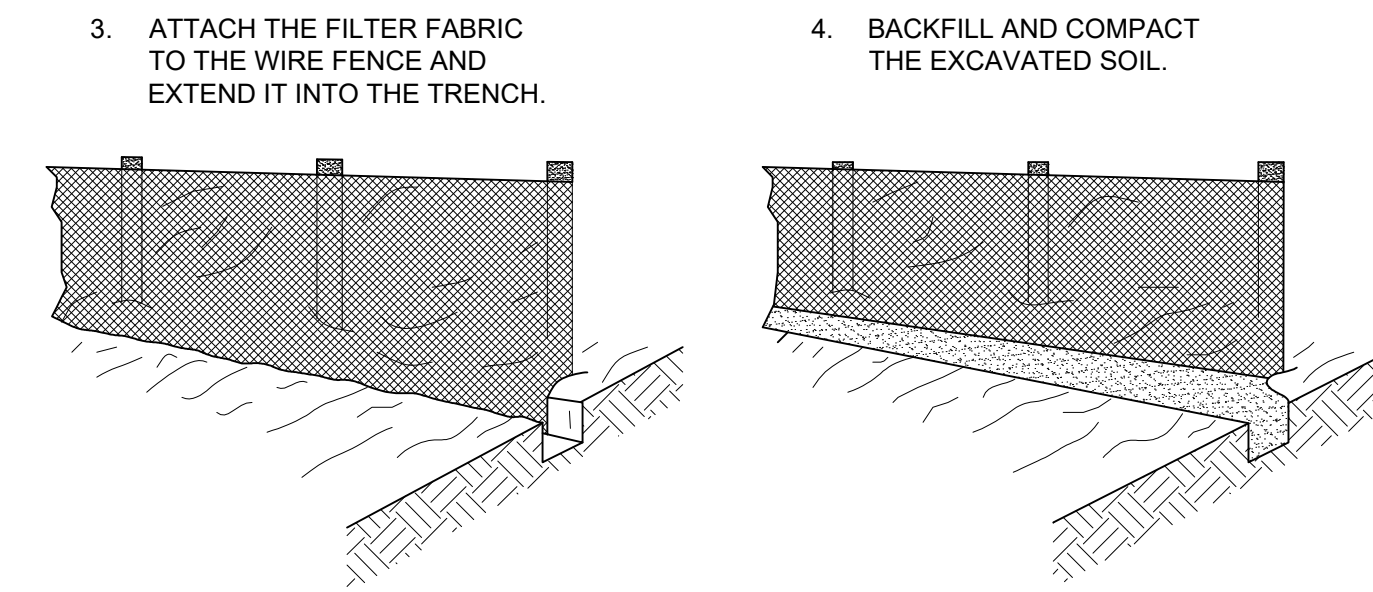
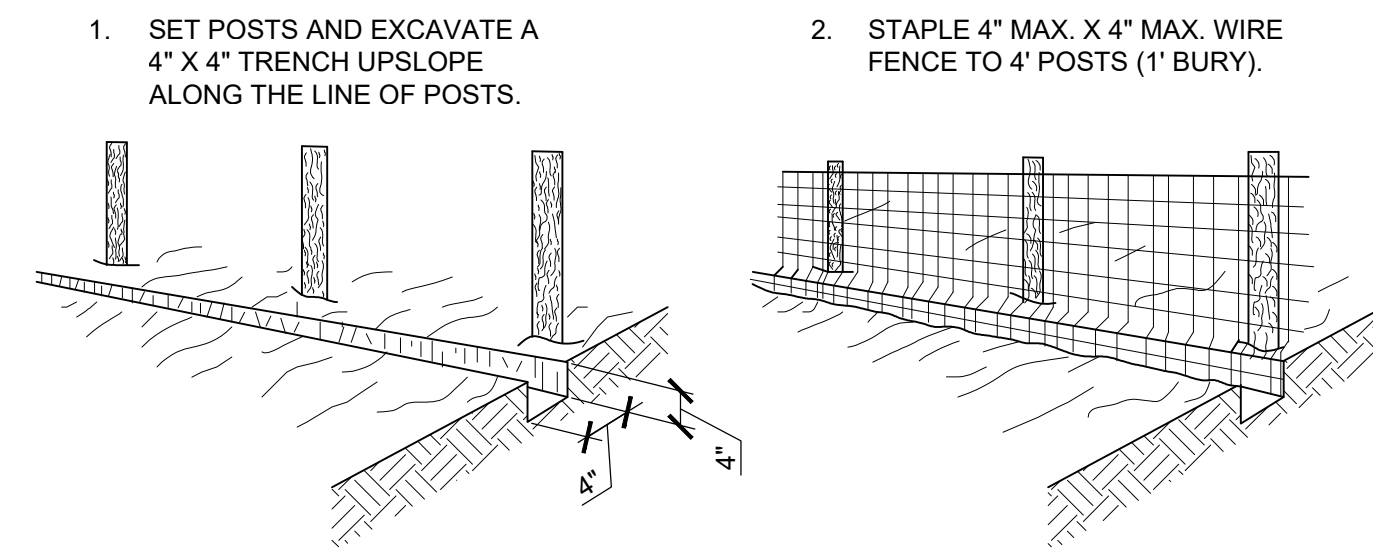
TRENCH WIDTH W_s OR W_u		
NOMINAL PIPE DIAMETER D	DEPTH OF PIPE INVERT BELOW GROUND SURFACE	
	0 TO 12'	12' TO 20'
24" AND SMALLER	5'-0"	7'-0"
OVER 24"	D + 3'-0"	D + 5'-0"

GENERAL NOTES FOR PIPE TRENCHES

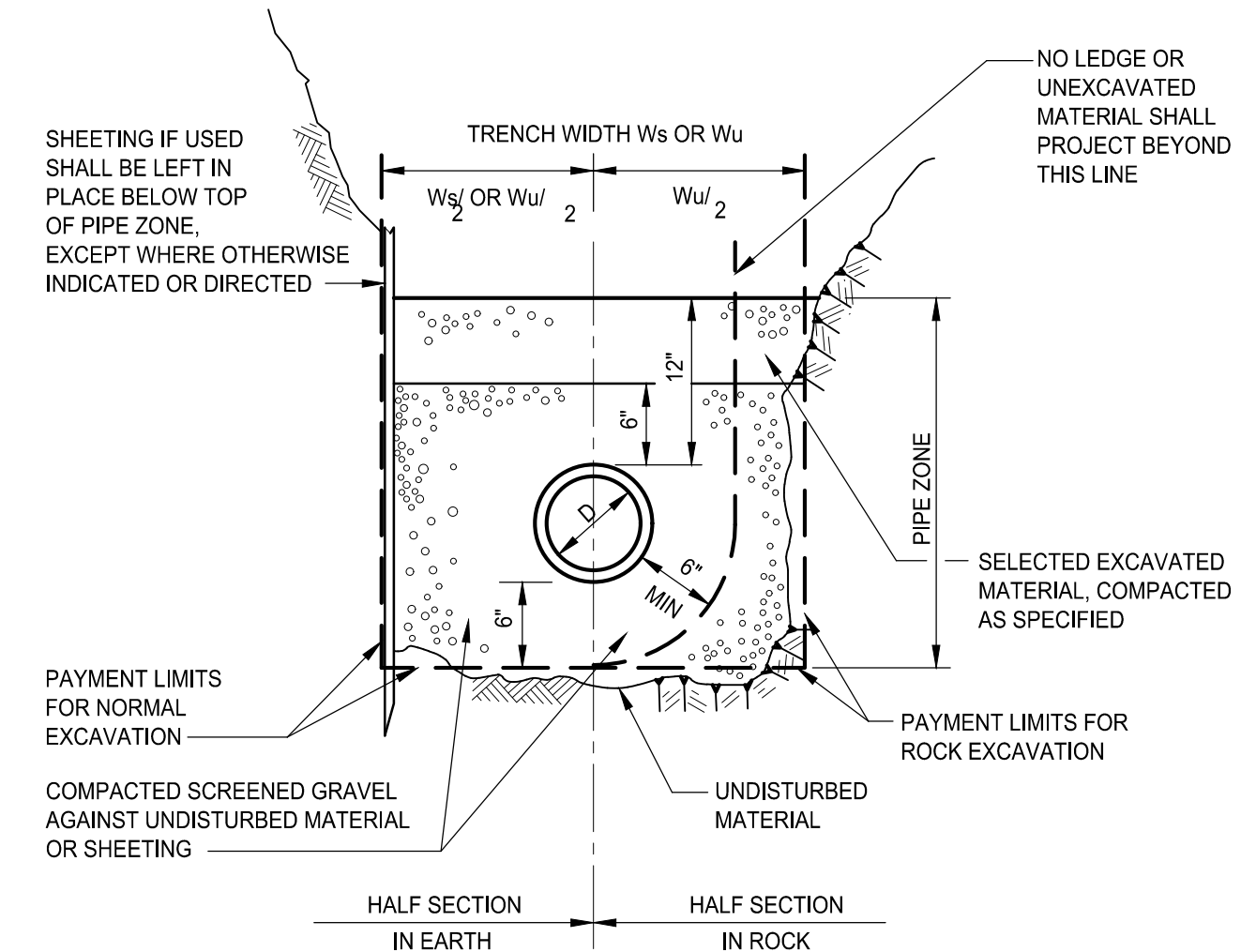
1. PIPE TRENCHES MAY BE EXCAVATED WIDER THAN TRENCH WIDTH W_s (SHEETED) OR W_u (UNSHEETED) ABOVE THE TOP OF PIPE ZONE.
2. TRENCHES SHALL NOT BE EXCAVATED BEYOND THE TRENCH WIDTH W_u BELOW THE TOP OF PIPE ZONE.
3. SHEETING MUST BE USED IF EXCAVATION AND BACKFILL, BELOW NORMAL DEPTH, IS REQUIRED. SHEETING SHALL BE LEFT IN PLACE BELOW A LINE 1'-0" ABOVE THE TOP OF PIPE.
4. ALL ROCK WITHIN 3'-0" HORIZONTALLY OF THE ENDS OF BUILDING CONNECTIONS, BRANCHES OR STUBS AND DOWN TO A HORIZONTAL PLANE 6" BELOW THE BOTTOMS OF SUCH CONNECTIONS, BRANCHES OR STUBS, SHALL BE EXCAVATED.

GENERAL NOTES FOR PIPE TRENCHES

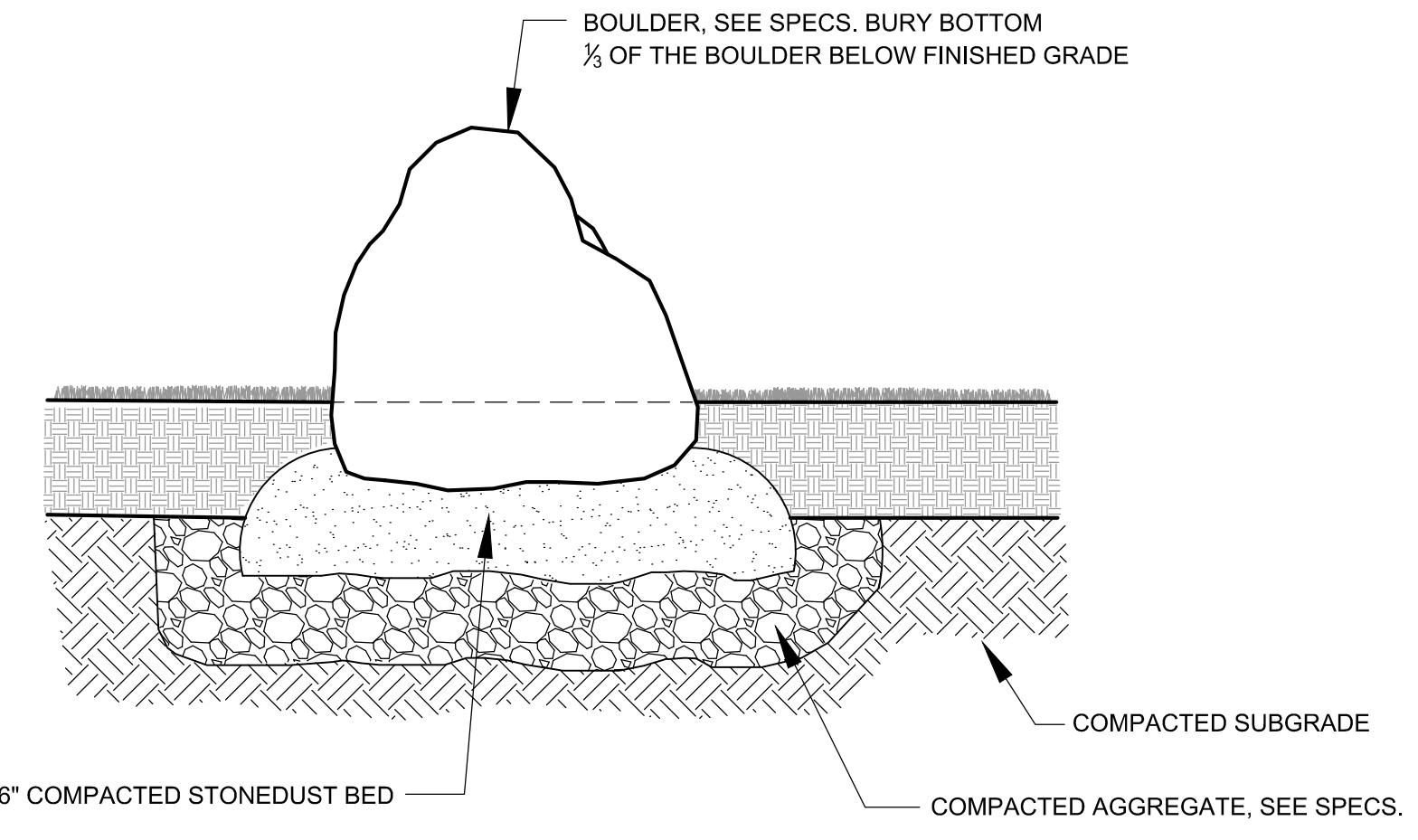
NOT TO SCALE
2-1.1.11 (REV. 10-23-95)



SILT FENCE
NOT TO SCALE

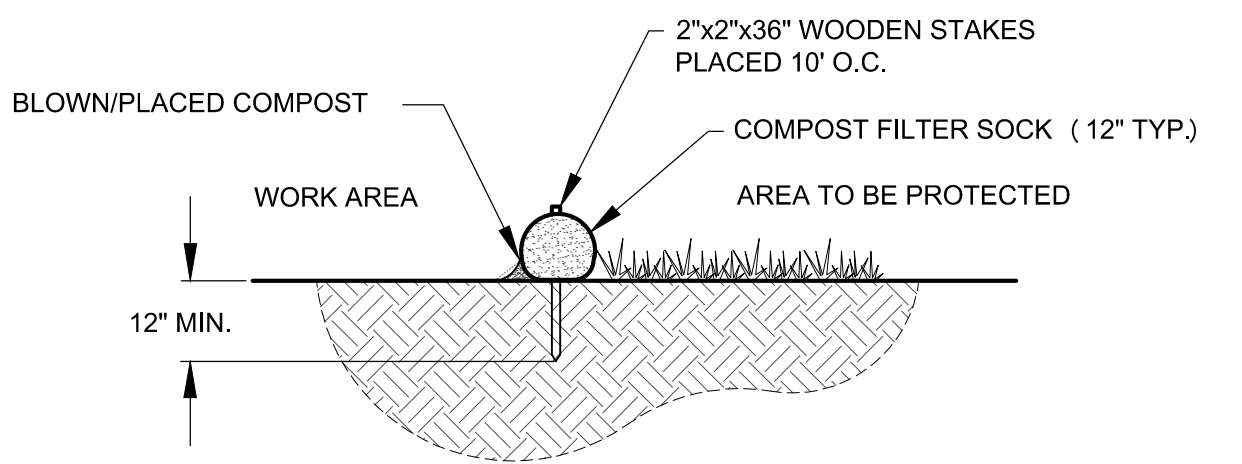
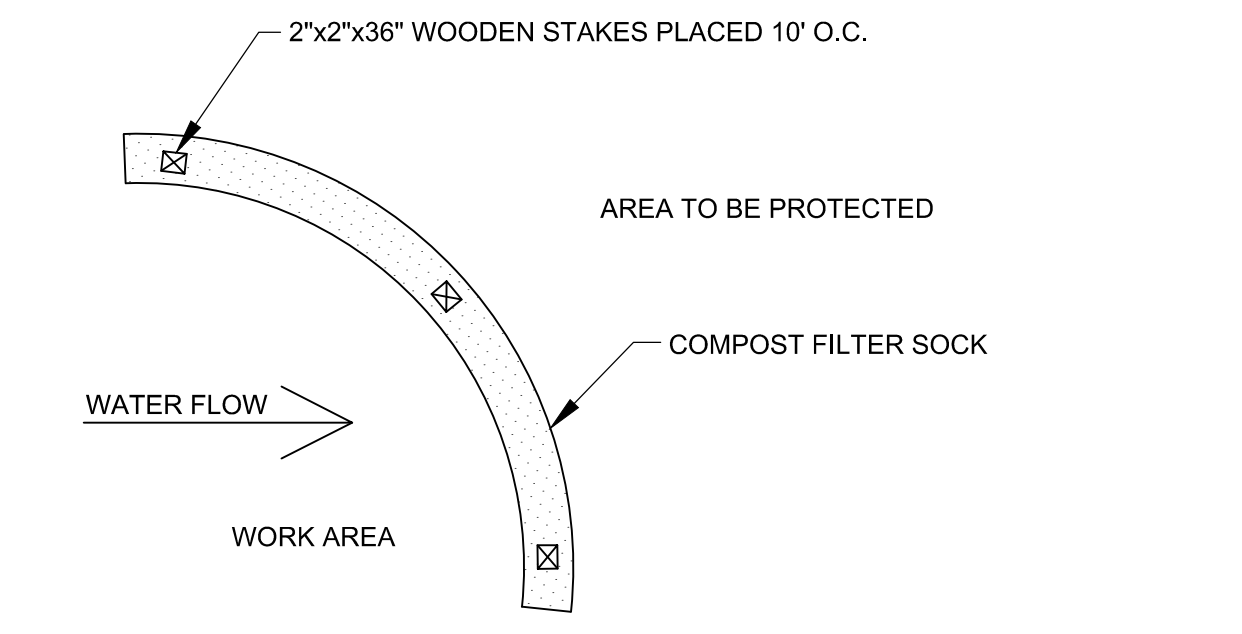


TRENCH SECTION FOR DI OR PVC PIPE 18 INCH DIAMETER AND SMALLER
NOT TO SCALE
2-1.1.1 (REV. 03-15-95)



NOTE: DETAIL APPLIES TO THE RELOCATION OF EXISTING SITE BOULDERS.

BOULDER SETTING
NOT TO SCALE



- NOTES:
1. SEE SPECIFICATION FOR COMPOST FILTER SOCK AND COMPOST FILL MATERIAL REQUIREMENTS.

COMPOST SILT SOCK
NOT TO SCALE



PROJECT
MASS DCR
ABANDONED DAMS
LOWES POND DAM
CONTRACT NO.
P19-3264-D4A

CLIENT
Massachusetts Department of Conservation and Recreation
10 Park Plaza, Suite 6620
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www.mass.gov/orgs/departement-of-conservation-recreation

CONSULTANT
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250 APOLLO DRIVE
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PHONE: (978) 905-2100
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REGISTRATION

ISSUE/REVISION

I/R	DATE	DESCRIPTION

PROJECT NUMBER

60604936

Designed By:	S. HE
Drawn By:	S. NAPOLITANO
Dept Check:	C. BENZIGER
Proj Check:	D. GOVE
Date:	AUGUST 2024
Scale:	AS NOTED

DISCIPLINE

CIVIL

SHEET TITLE

LOWES POND DETAILS V

SHEET NUMBER

99 C-505

PATH: \\C:\Users\THIBODIAE\OneDrive\Documents\AECOM\DIRECTOR\RYAN\60604936 - MASS DCR SIX ABANDONED DAMS\SHEETS\SILT FENCES POND\99 C-505.DWG
 LAST UPDATE: Thursday, August 29, 2024 2:15:24 PM
 PLOT DATE: Thursday, August 29, 2024 2:24:18 PM

PROJECT

MASS DCR
ABANDONED DAMS
LOWES POND DAM
CONTRACT NO.
P19-3264-D4A

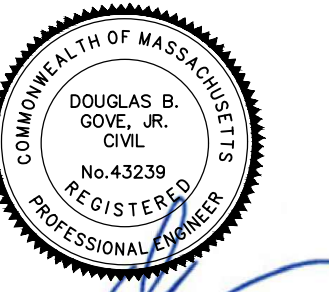
CLIENT

Massachusetts Department
of Conservation and
Recreation

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REGISTRATION

ISSUE/REVISION

I/R	DATE	DESCRIPTION

PROJECT NUMBER

60604936

Designed By:	B. REYES
Drawn By:	S. NAPOLITANO
Dept Check:	C. DUNLAP
Proj Check:	D. GOVE
Date:	AUGUST 2024
Scale:	AS NOTED

DISCIPLINE

CIVIL
SHEET TITLE

LOWES POND
DETAILS VI

SHEET NUMBER

99 C-506

GUARD RAIL GENERAL NOTES:

1. ALL DIMENSIONS OF STANDARD GUARDRAIL COMPONENTS, INCLUDING PANELS, POSTS, OFFSET BLOCKS, BOLTS, NUTS, WASHERS AND HOLES, ARE BASED UPON ENGLISH UNIT CONVERSIONS OF THE AASHTO-ARTBA-AGC JOINT COMMITTEE TASK FORCE 13 REPORT: *A GUIDE TO STANDARDIZING HIGHWAY BARRIER HARDWARE* (<http://www.aashtotf13.org/Barrier-Hardware.php>).
2. ALL GUARDRAIL MATERIALS SHALL CONFORM TO M8.07.0 UNLESS OTHERWISE INDICATED.
3. APPROVAL BY THE ENGINEER IS REQUIRED WHERE A DIFFERING GUARDRAIL CONFIGURATION IS REQUIRED FOR CONSTRUCTABILITY BEYOND THE OPTIONS SHOWN IN THESE STANDARDS OR THE PLANS.
4. THE BEGIN OR END STATION LABELS SHOWN IN THESE STANDARDS CORRESPOND TO THE STATION AND OFFSET CALLOUTS SPECIFIED IN THE PLANS.
5. USE 12'-6" NOMINAL LENGTH PANELS UNLESS OTHERWISE INDICATED IN THESE STANDARDS OR THE PLANS.
6. ALL LAP SPLICES SHALL BE MIDSPAN UNLESS OTHERWISE SHOWN.
7. LAP SPLICES SHALL BE CONSTRUCTED WITH THE SPLICE RIDGE ORIENTED DOWNSTREAM OF THE FINAL DIRECTION OF TRAFFIC IN THE NEAREST TRAVEL LANE. REORIENTING LAP SPLICES FOR TEMPORARY TRAFFIC CONTROL IS NOT REQUIRED.
8. STANDARD POSTS SHALL BE STEEL OR TIMBER, UNLESS OTHERWISE INDICATED IN THE PLANS, FABRICATED TO THE DIMENSIONS SHOWN ON 400.1.4. POSTS OF A SINGLE MATERIAL TYPE SHALL BE USED THROUGHOUT AN ENTIRE RUN OF GUARDRAIL; EXCEPTIONS ARE ALLOWED ONLY WHEN SPECIFIC MATERIAL TYPES ARE REQUIRED FOR TRANSITIONS, END TREATMENTS, AND/OR ANCHORAGES.
9. DEEP POST SHALL ONLY BE USED WHERE INDICATED IN THESE STANDARDS OR THE PLANS.
10. OFFSET BLOCKS, WHERE REQUIRED, SHALL BE TIMBER AND FABRICATED TO THE NOMINAL DIMENSIONS SHOWN ON 400.1.4. PLASTIC OR COMPOSITE OFFSET BLOCKS OF THE SAME NOMINAL DIMENSIONS THAT ARE LISTED ON THE QUALIFIED CONSTRUCTION MATERIALS LIST MAY BE SUBSTITUTED. OFFSET BLOCKS OF A SINGLE MATERIAL TYPE SHALL BE USED THROUGHOUT AN ENTIRE RUN OF GUARDRAIL; EXCEPTIONS ARE ALLOWED ONLY WHEN SPECIFIC MATERIAL TYPES ARE REQUIRED FOR TRANSITIONS, END TREATMENTS, AND/OR ANCHORAGES.
11. PAVEMENT MILLING MULCH, WHERE CALLED FOR IN THE STANDARDS, SHALL CONFORM TO SECTION 739.
12. GUARDRAIL DELINEATORS, CONFORMING TO SECTION 601, SHALL BE INSTALLED AT 25' INTERVALS WITHIN 100' OF AN END TREATMENT OR TRAILING ANCHORAGE AND AT 100' INTERVALS IN ALL OTHER AREAS UNLESS OTHERWISE SHOWN IN THE PLANS.
13. MINIMUM OFFSET DISTANCE FROM FACE OF W-BEAM PANEL TO A FIXED (NON-BREAKAWAY) OBJECT SHALL BE 48" FOR TL-2 AND 60" FOR TL-3.

PROJECT

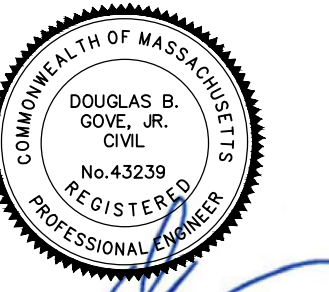
MASS DCR
ABANDONED DAMS
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CONSULTANT

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REGISTRATION

ISSUE/REVISION

I/R	DATE	DESCRIPTION

PROJECT NUMBER

60604936

Designed By:	B. REYES
Drawn By:	S. NAPOLITANO
Dept Check:	C. DUNLAP
Proj Check:	D. GOVE
Date:	AUGUST 2024
Scale:	AS NOTED

DISCIPLINE

CIVIL

SHEET TITLE

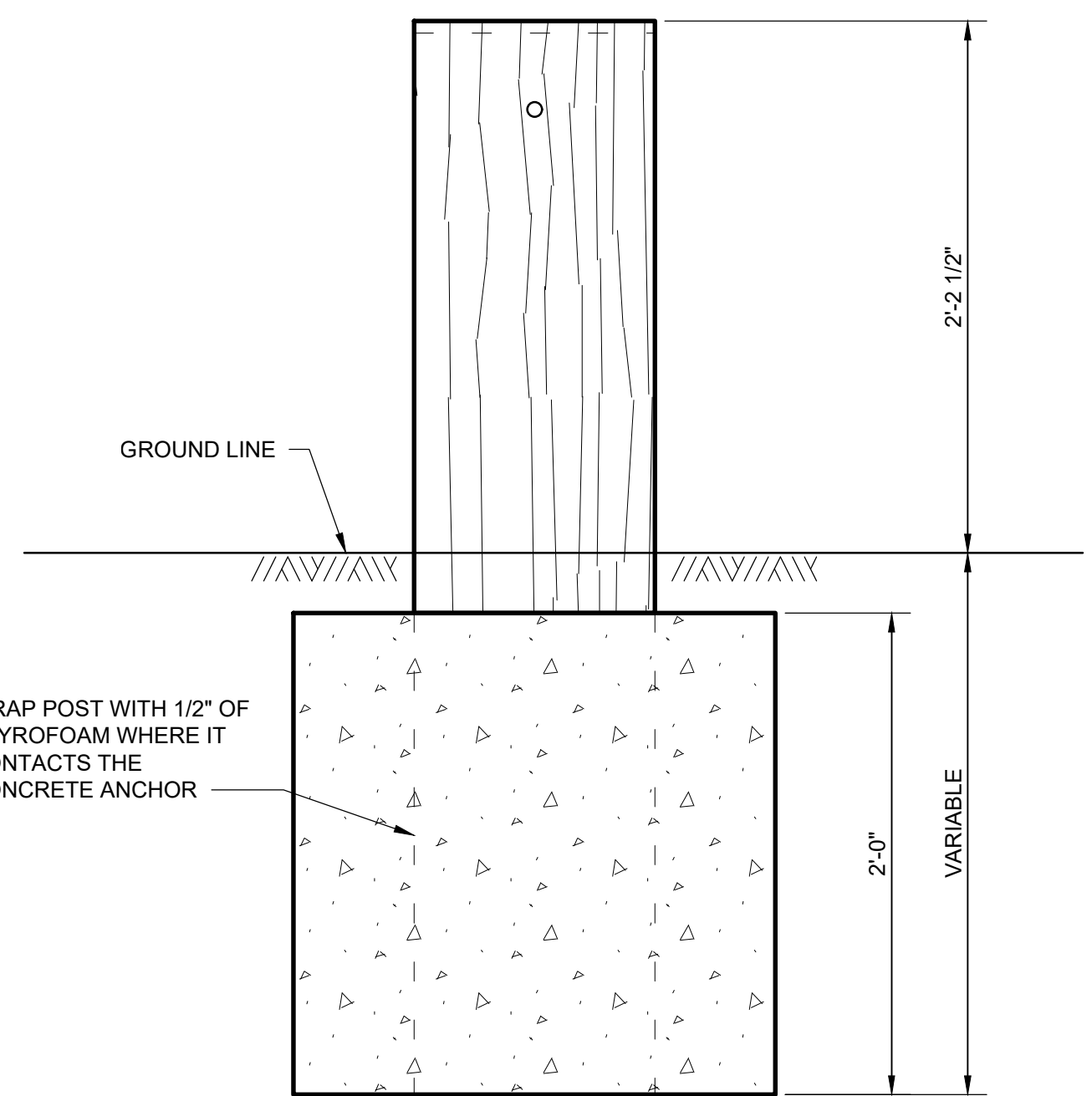
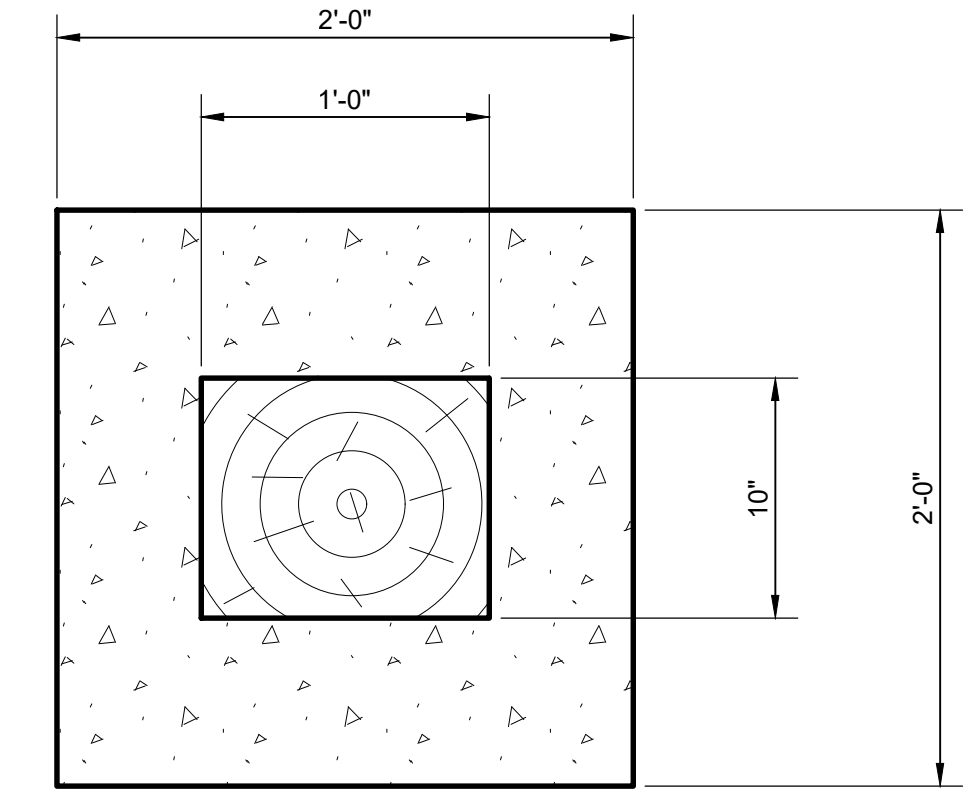
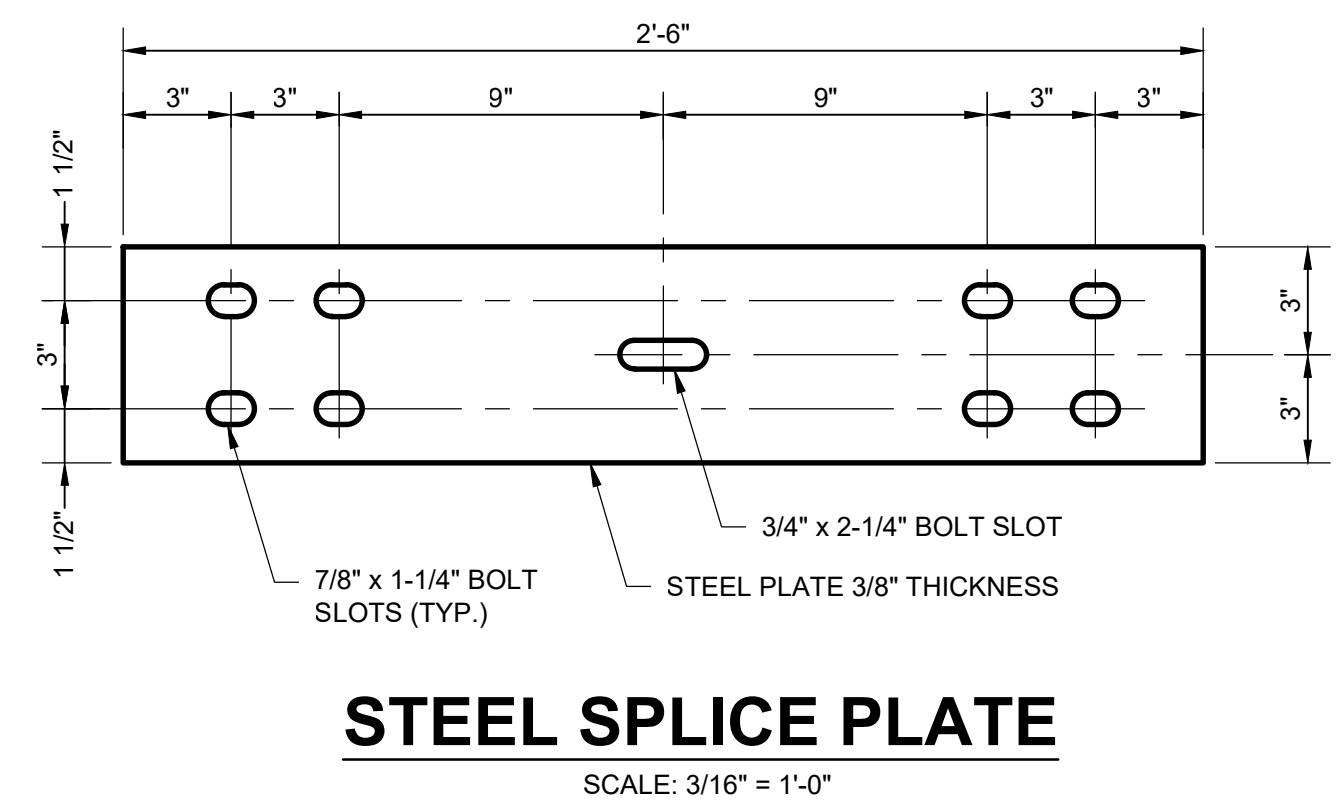
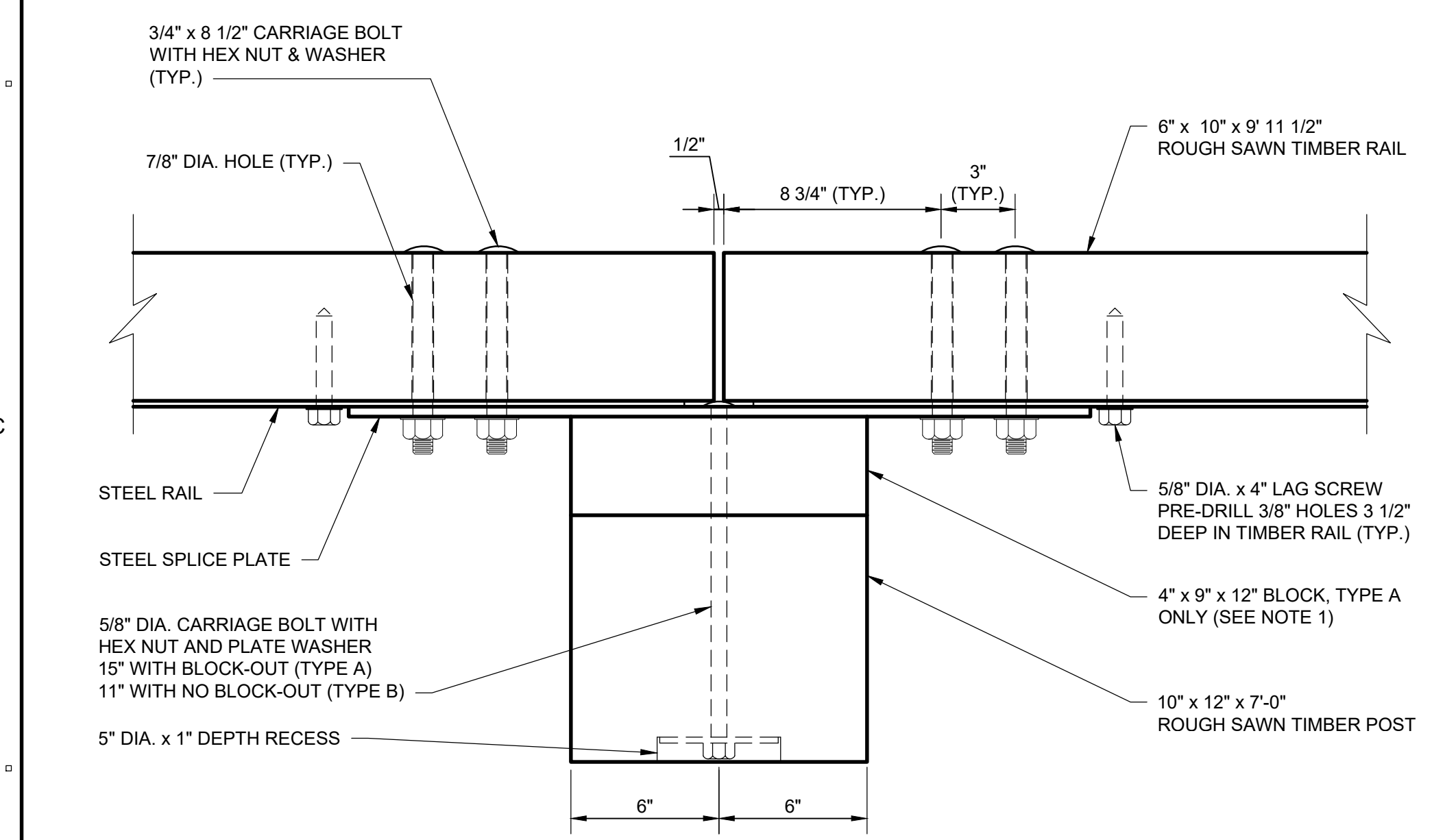
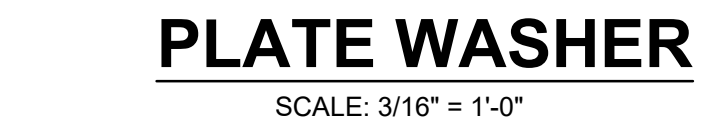
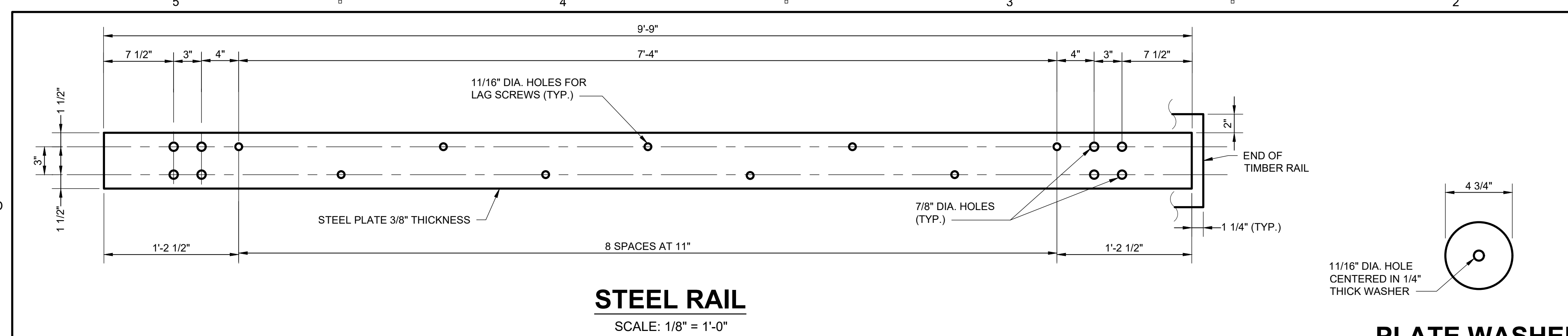
LOWES POND
DETAILS VII

SHEET NUMBER

99 C-507

NOTES:

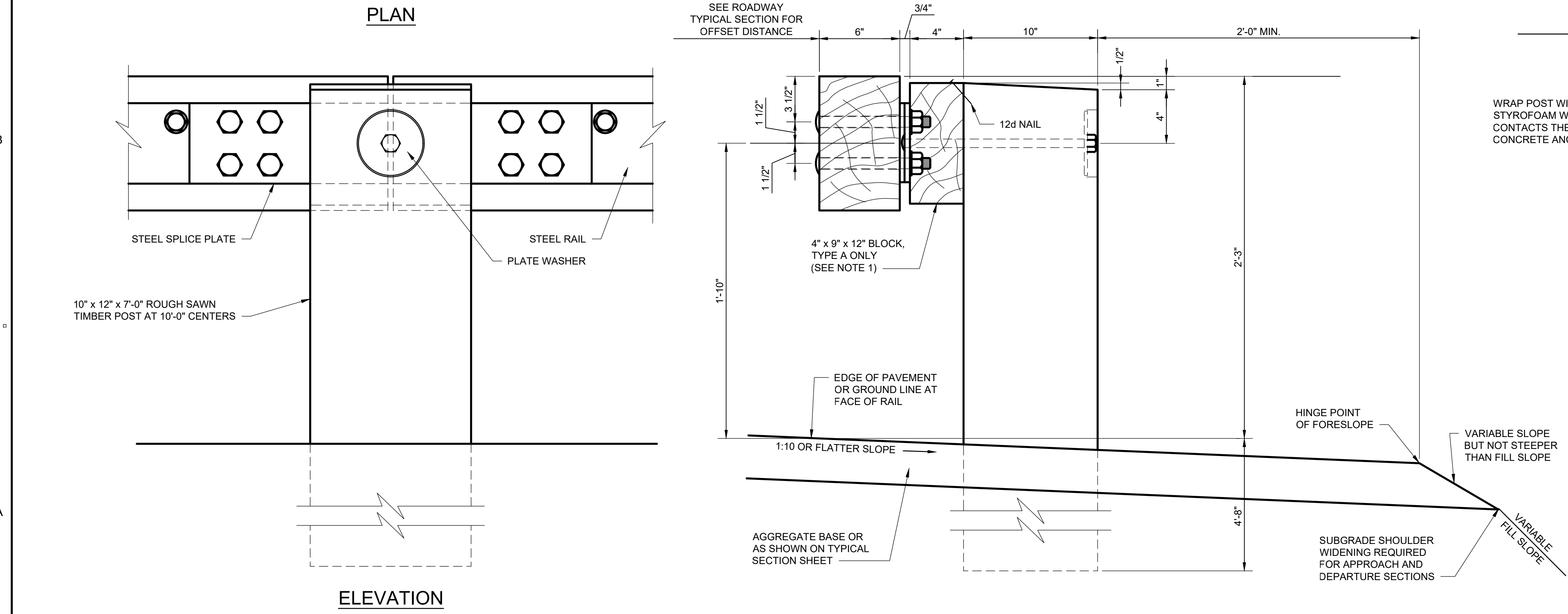
- USE THE TYPE A, BLOCKED-OUT, SYSTEM OR THE TYPE B, NON-BLOCKED-OUT, SYSTEM AS SPECIFIED IN THE PLAN.
- USE WEATHERING STEEL FOR ALL STRUCTURAL STEEL AND FASTENER HARDWARE AS SPECIFIED.
- PLACE A TERMINAL SECTION (SEE FHA STANDARDS 617-61 AND 617-62) ON BOTH APPROACH AND TRAILING ENDS OF BARRIER INSTALLATIONS.



24" DIA. ROUND ANCHOR IS AN ACCEPTABLE ALTERNATIVE.
REDUCED SIZE ACCEPTABLE IN SOLID ROCK.

**CONCRETE ANCHOR FOR
SHORT GUARDRAIL POST**

SCALE: 1/8" = 1'-0"

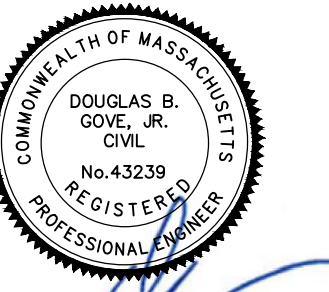


POST CONNECTION

SCALE: 3/16" = 1'-0"

**STEEL-BACKED TIMBER GUARDRAIL
TYPE A & TYPE B**

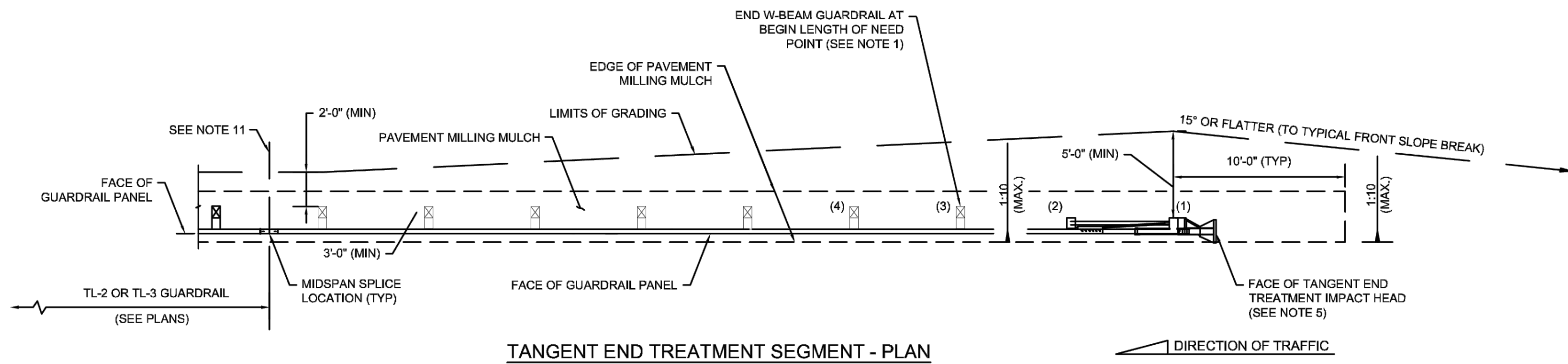
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 PLOT DATE: Thursday, August 29, 2024 4:08:12 PM



I/R	DATE	DESCRIPTION

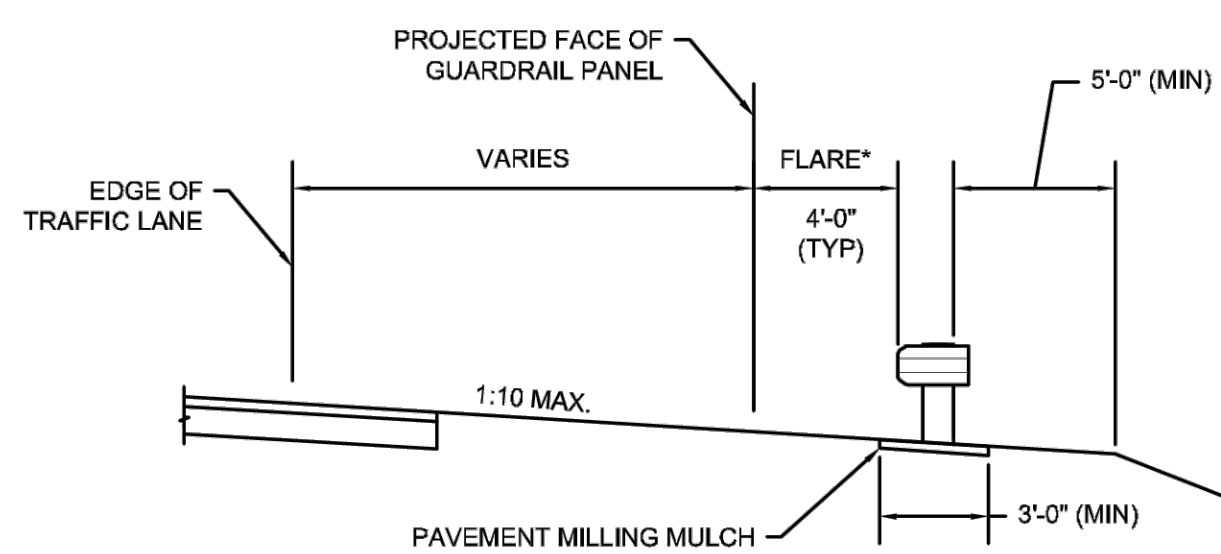
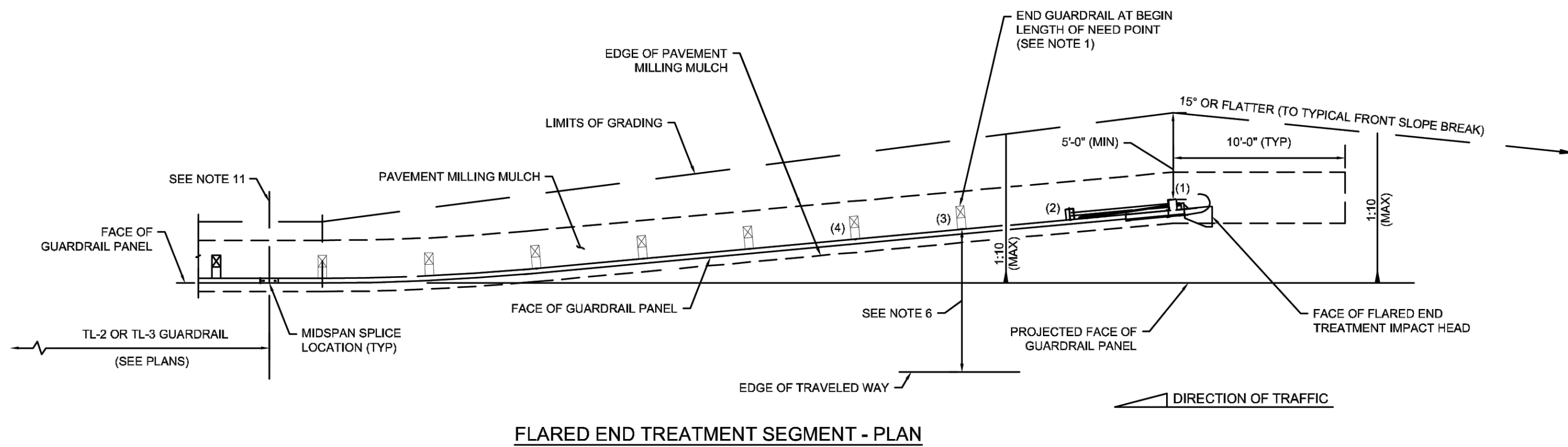
60604936

Designed By:	B. REYES
Drawn By:	S. NAPOLITANO
Dept Check:	C. DUNLAP
Proj Check:	D. GOVE
Date:	AUGUST 2024
Scale:	AS NOTED



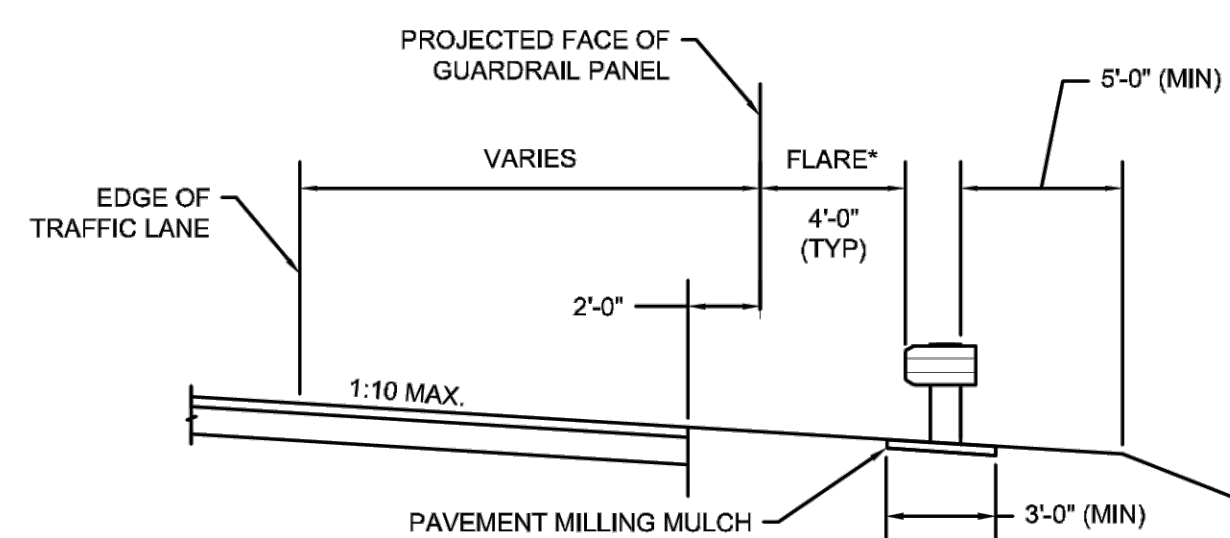
NOTES:

- INSTALL GUARDRAIL AT STATION AND OFFSET SHOWN IN THE PLANS. THE END OF THE GUARDRAIL SHOWN IN THE PLANS CORRESPONDS WITH THE BEGIN LENGTH OF NEED POINT FOR THE END TREATMENT (SHOWN AT POST 3 IN THESE STANDARDS, BUT MAY VARY BY MANUFACTURER).
- PROPRIETARY END TREATMENTS MAY VARY IN SIZE AND SHAPE FROM WHAT IS DEPICTED IN THESE STANDARDS. HOWEVER, THE MAXIMUM SLOPES AND MINIMUM OFFSETS DIMENSIONED FROM THE POSTS SHOWN HEREIN SHALL STILL APPLY.
- END TREATMENT TEST LEVEL AND TYPE (TANGENT OR FLARED) SHALL BE SPECIFIED IN THE PLANS.
- CONSTRUCT TANGENT AND FLARED END TREATMENTS IN ACCORDANCE WITH THE MANUFACTURER'S UNIQUE DRAWING DETAILS, PROCEDURES, AND SPECIFICATIONS.
- AT THE DISCRETION OF THE ENGINEER, THE FACE OF THE TANGENT END TREATMENT IMPACT HEAD MAY BE OFFSET UP TO 2'-0" FROM THE PROJECTED FACE OF GUARDRAIL TO MINIMIZE NUISANCE HITS. THE OFFSET SHALL OCCUR OVER THE ENTIRE LENGTH OF THE END TREATMENT UNLESS OTHERWISE SPECIFIED BY THE MANUFACTURER.
- LATERAL OFFSET OF FLARED END TREATMENT SHALL BE DETERMINED BY THE DESIGN ENGINEER FOLLOWING THE METHODOLOGY FOUND IN THE *ROADSIDE DESIGN GUIDE* AND SHOULD FALL WITHIN THE ALLOWABLE TOLERANCES SPECIFIED BY THE MANUFACTURER. LATERAL OFFSET SHALL BE MEASURED FROM THE EDGE OF TRAVELED WAY TO THE FACE OF THE GUARDRAIL AT POST #3.
- END TREATMENTS SHALL NOT TERMINATE CURVED W-BEAM SEGMENTS.
- END TREATMENT IMPACT HEAD DELINEATION SHALL CONFORM TO 601.63.
- INSTALL GRADING AS SHOWN HEREIN UNDER SEPARATE PAY ITEMS.
- SEE 400.2.2 FOR APPROACH TERMINAL GEOMETRY FOR GUARDRAIL INSTALLED ADJACENT TO CURB AND DOUBLE FACED GUARDRAIL.
- MAINTAIN 2'-0" (MIN) OFFSET TO FRONT SLOPE BREAK DOWNSTREAM OF MIDSPAN SPLICE LOCATION AT ALL TIMES. IF, DOWNSTREAM OF THE SPLICE, GRADING CONSTRAINTS INHIBIT THIS MINIMUM OFFSET THEN USE DEEP STEEL POSTS AND TRANSITION TO A SLOPE BREAK CONDITION DESIGN PER THE DETAIL IN 400.1.5 UNTIL THE 2'-0" OFFSET CAN BE MET.



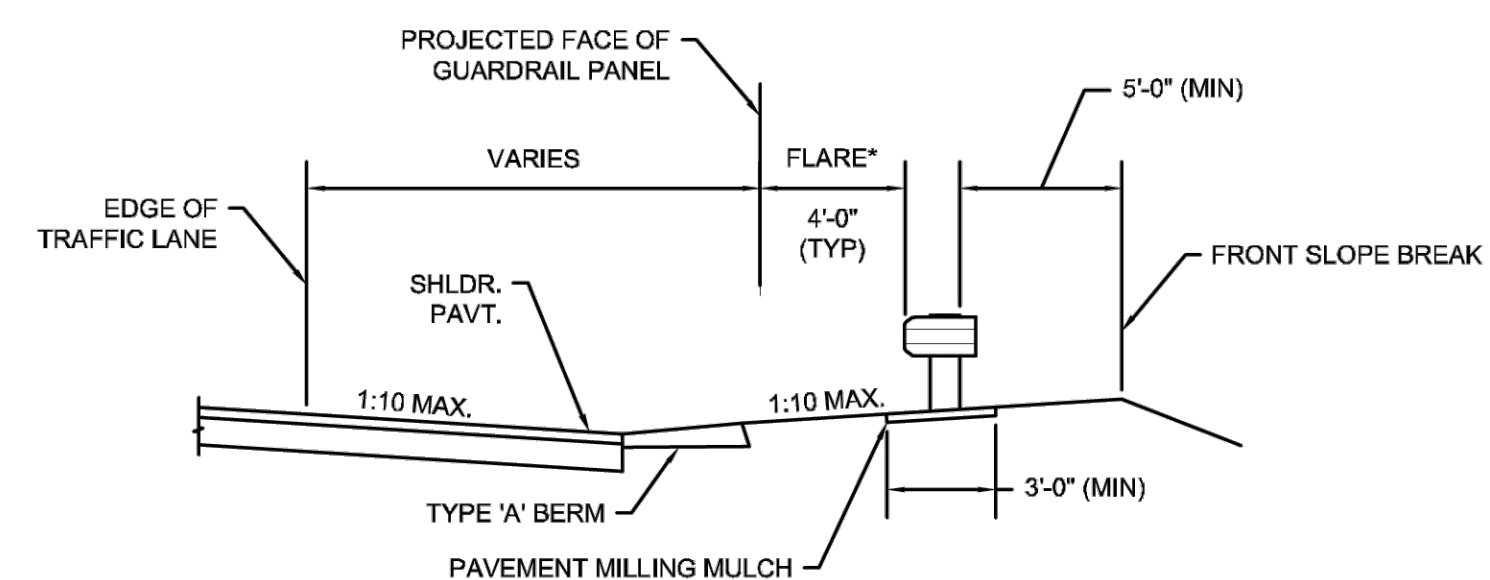
*FLARE IF CALLED FOR IN PLANS, OTHERWISE ALIGN WITH PROJECTED FACE OF GUARDRAIL (SEE NOTES 3 & 5)

**SECTION AT POST (1)
 WITH UNPAVED SHOULDER**



*FLARE IF CALLED FOR IN PLANS, OTHERWISE ALIGN WITH PROJECTED FACE OF GUARDRAIL (SEE NOTES 3 & 5)

**SECTION AT POST (1)
 WITH FULLY PAVED SHOULDER**



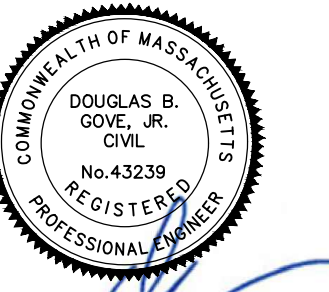
*FLARE IF CALLED FOR IN PLANS, OTHERWISE ALIGN WITH PROJECTED FACE OF GUARDRAIL (SEE NOTES 3 & 5)

**SECTION AT POST (1)
 WITH TYPE 'A' BERM**

APPROACH GEOMETRY : SINGLE FACED

SCALE: NTS

PATH: \\AECOM\PROJECTS\19\MASSDCR SIX ABANDONED DAMS\SHEETS\CIVIL\LOWES POND\99 C-508.DWG
 LAST UPDATE: Thursday, August 29, 2024 2:15:06 PM
 PLOT DATE: Thursday, August 29, 2024 4:58:38 PM



I/R	DATE	DESCRIPTION

60604936

Designed By: **B. REYES**

Drawn By: **S. NAPOLITANO**

Dept Check: **C. DUNLAP**

Proj Check: **D. GOVE**

Date: **AUGUST 2024**

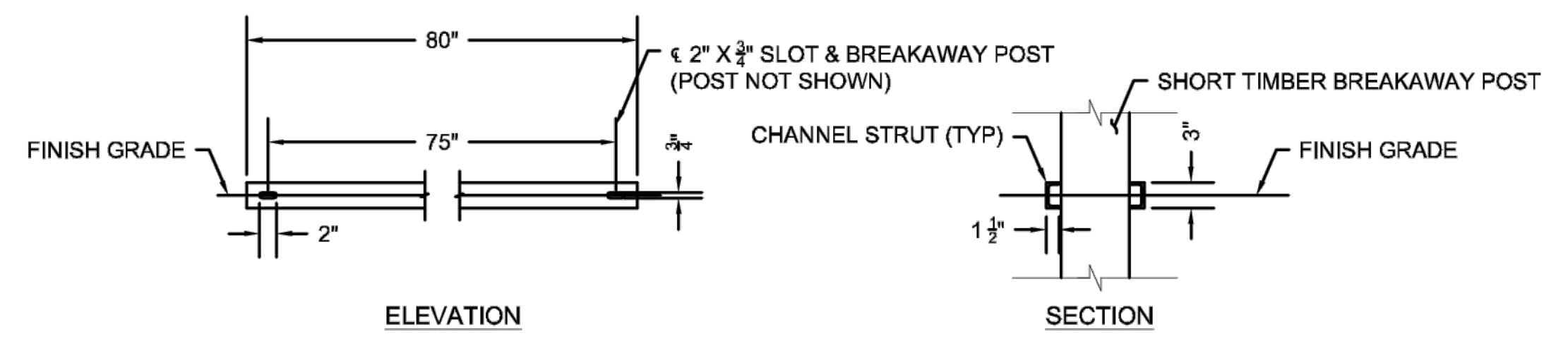
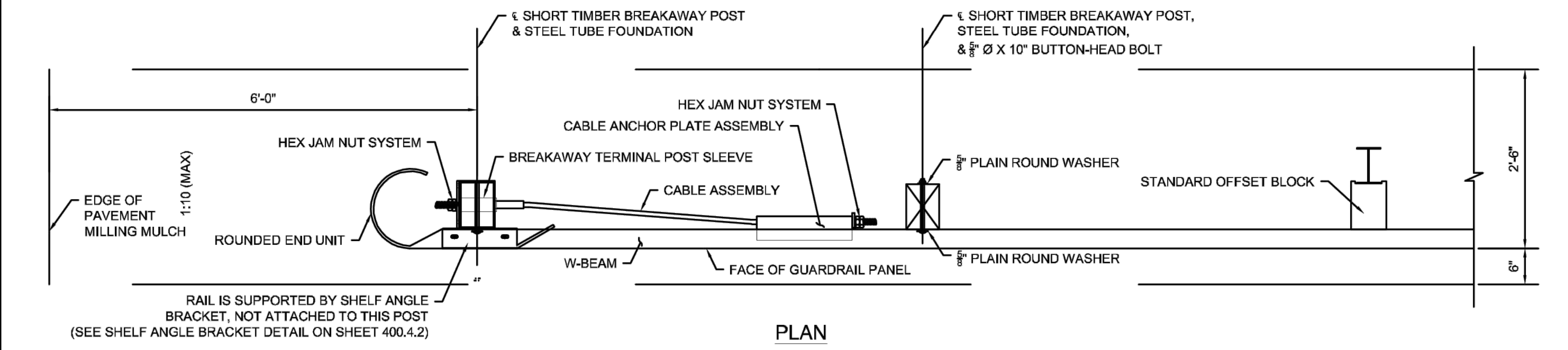
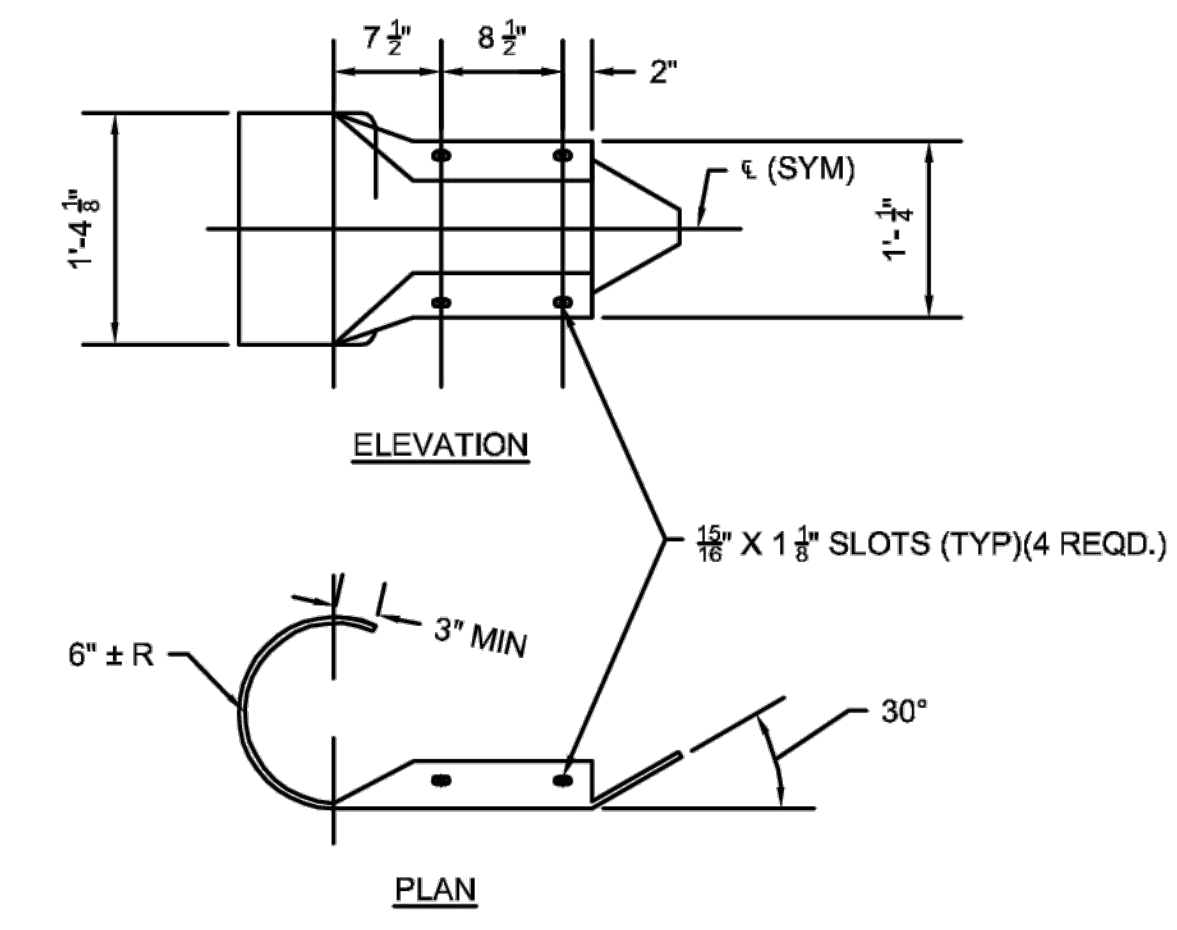
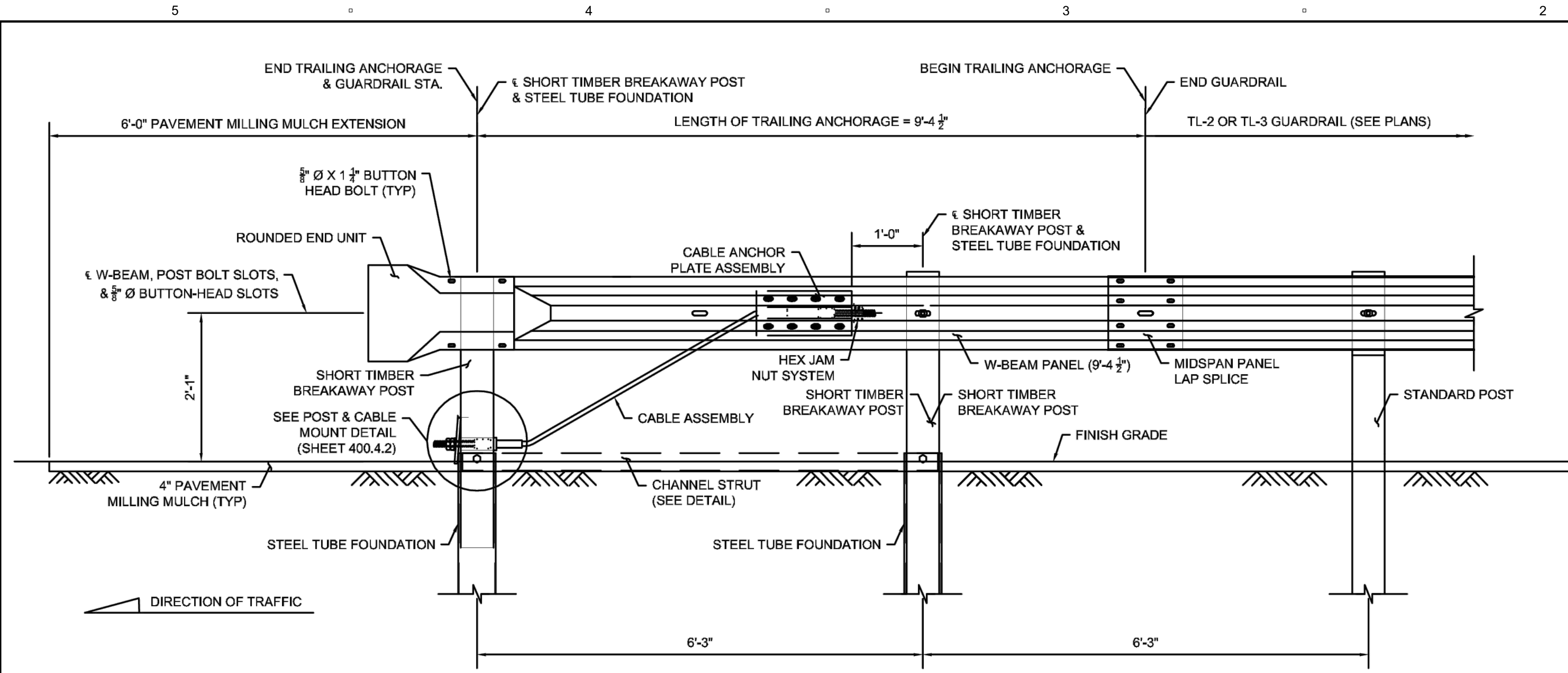
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CIVIL

LOWES POND

DETAILS IX

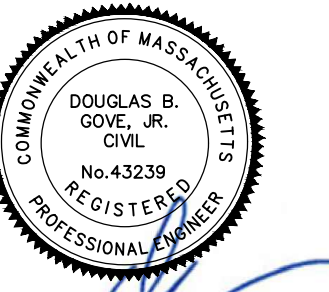
99 C-509



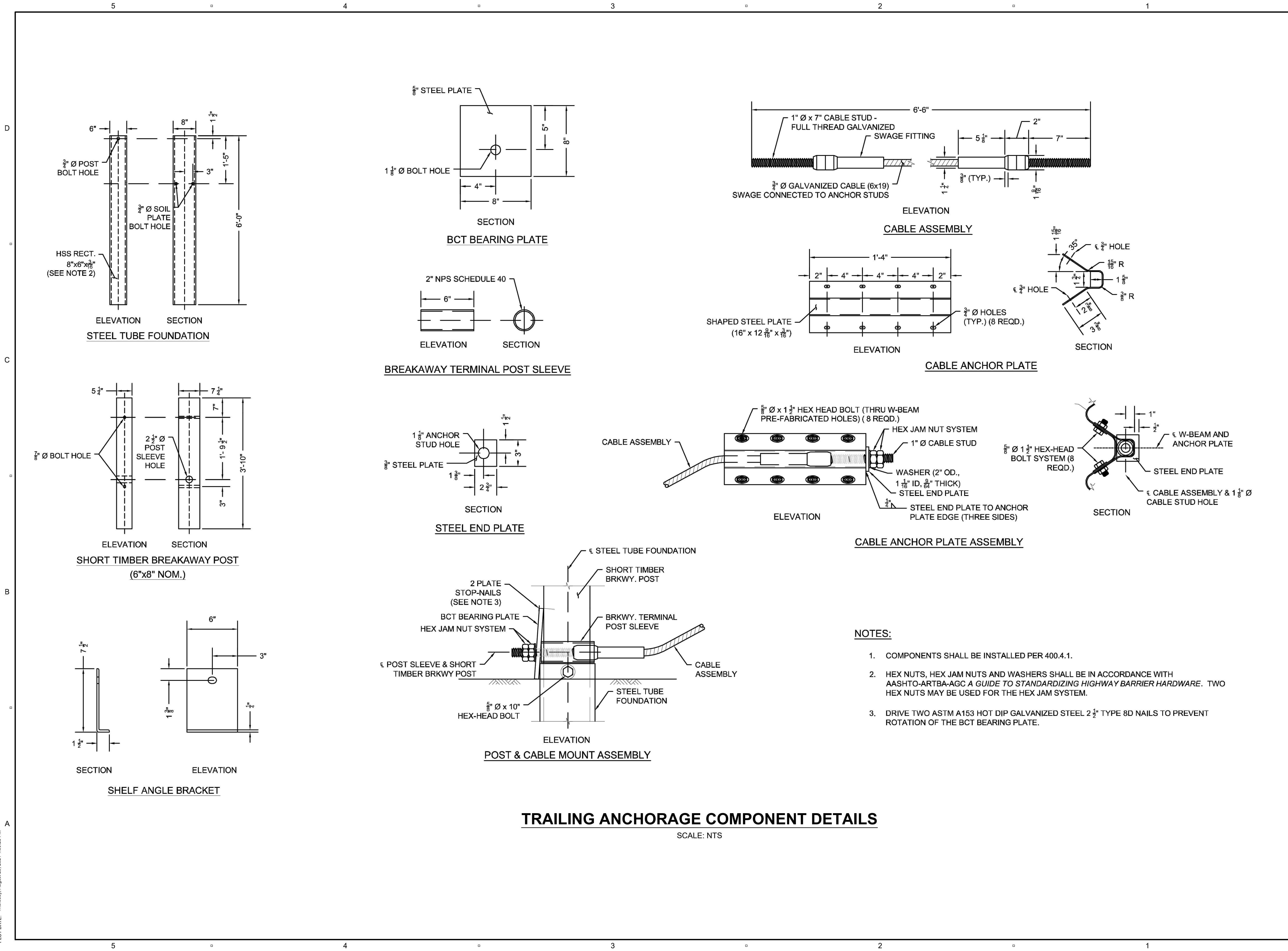
- NOTES:**
- FOR ADDITIONAL DETAILS, SEE 400.4.2.
 - LAP THE ROUNDED END UNIT OVER THE FACE OF THE W-BEAM PANEL.
 - INSTALL STEEL TUBE FOUNDATIONS BY ONE OF THE FOLLOWING METHODS:
 - A. EXCAVATE, INSTALL TUBE, BACKFILL, AND SUITABLY COMPACT MATERIALS; OR
 - B. DRIVE THE TUBE USING A DUMMY TIMBER POST TO PREVENT DAMAGE TO THE SHORT BREAKAWAY POST.

TRAILING ANCHORAGE
 SCALE: NTS

PATH: \\AECOM\PROJECTS\MASSDCR\616 ABANDONED DAMS\SHEETS\CIVIL\LOWES POND\99 C-509.DWG
 LAST UPDATE: Thursday, August 29, 2024 2:15:12 PM
 PLOT DATE: Thursday, August 29, 2024 4:08:55 PM



NO.	DATE	DESCRIPTION



TRAILING ANCHORAGE COMPONENT DETAILS

SCALE: NTS

NOTES:

- COMPONENTS SHALL BE INSTALLED PER 400.4.1.
- HEX NUTS, HEX JAM NUTS AND WASHERS SHALL BE IN ACCORDANCE WITH AASHTO-ARTBA-AGC A GUIDE TO STANDARDIZING HIGHWAY BARRIER HARDWARE. TWO HEX NUTS MAY BE USED FOR THE HEX JAM SYSTEM.
- DRIVE TWO ASTM A153 HOT DIP GALVANIZED STEEL 2 1/2" TYPE 8D NAILS TO PREVENT ROTATION OF THE BCT BEARING PLATE.

PROJECT

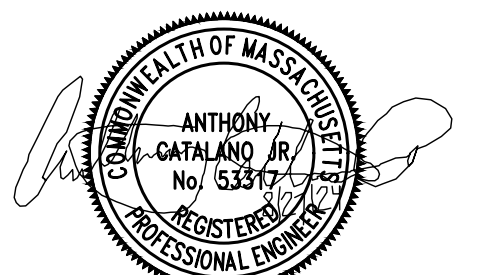
MASS DCR
 ABANDONED DAMS
 LOWES POND DAM
 CONTRACT NO.
 P19-3264-D4A

CLIENT

Massachusetts Department
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 10 Park Plaza, Suite 6620
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CONSULTANT

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REGISTRATION

ISSUE/REVISION

I/R	DATE	DESCRIPTION

PROJECT NUMBER

60604936

Designed By: J. PRIVITERA

Drawn By: A. CATALANO

Dept Check: M. MALENFANT

Proj Check: D. GOVE

Date: AUGUST 2024

Scale: AS NOTED

DISCIPLINE

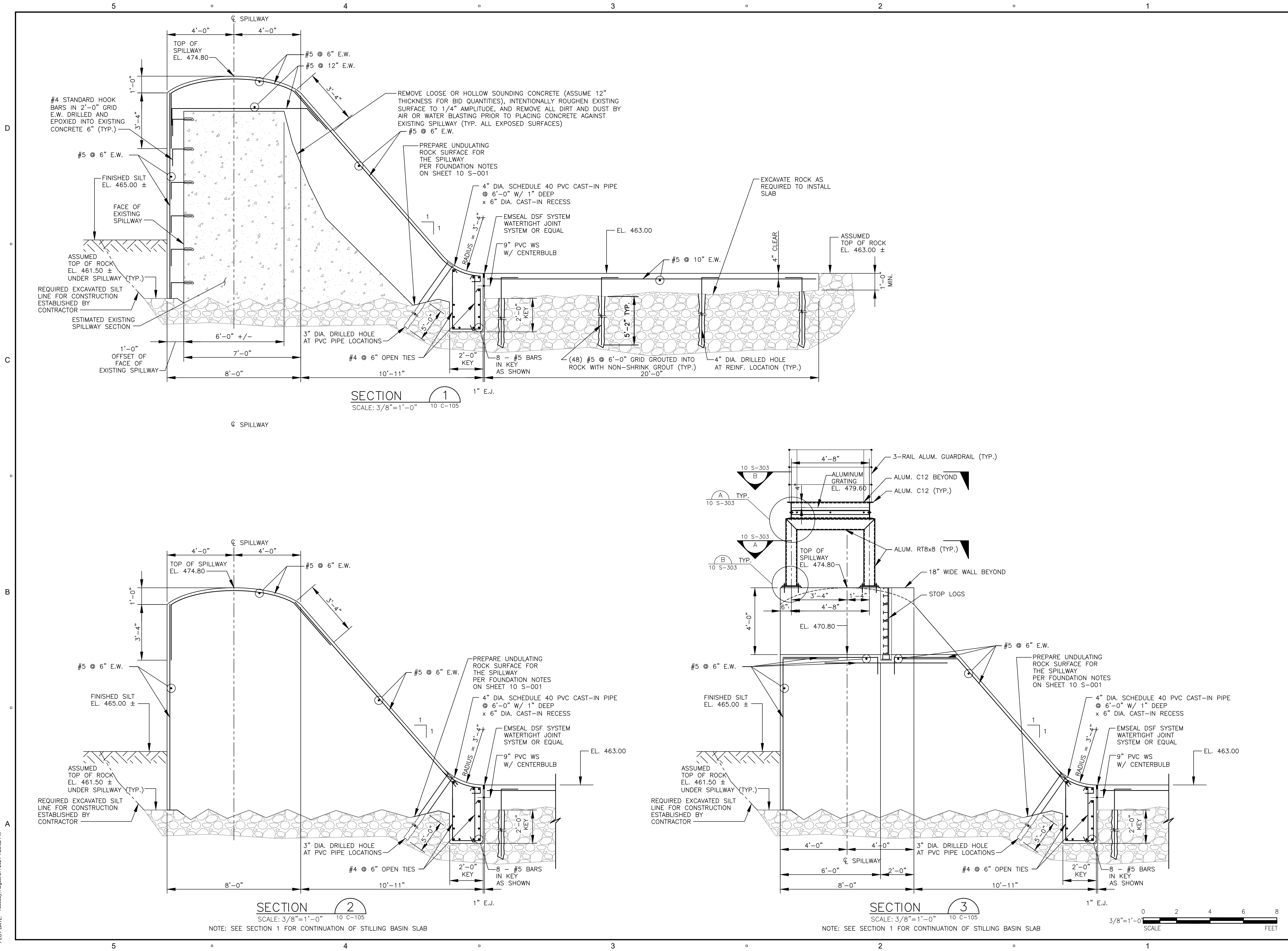
STRUCTURAL

SHEET TITLE

SECTIONS I

SHEET NUMBER

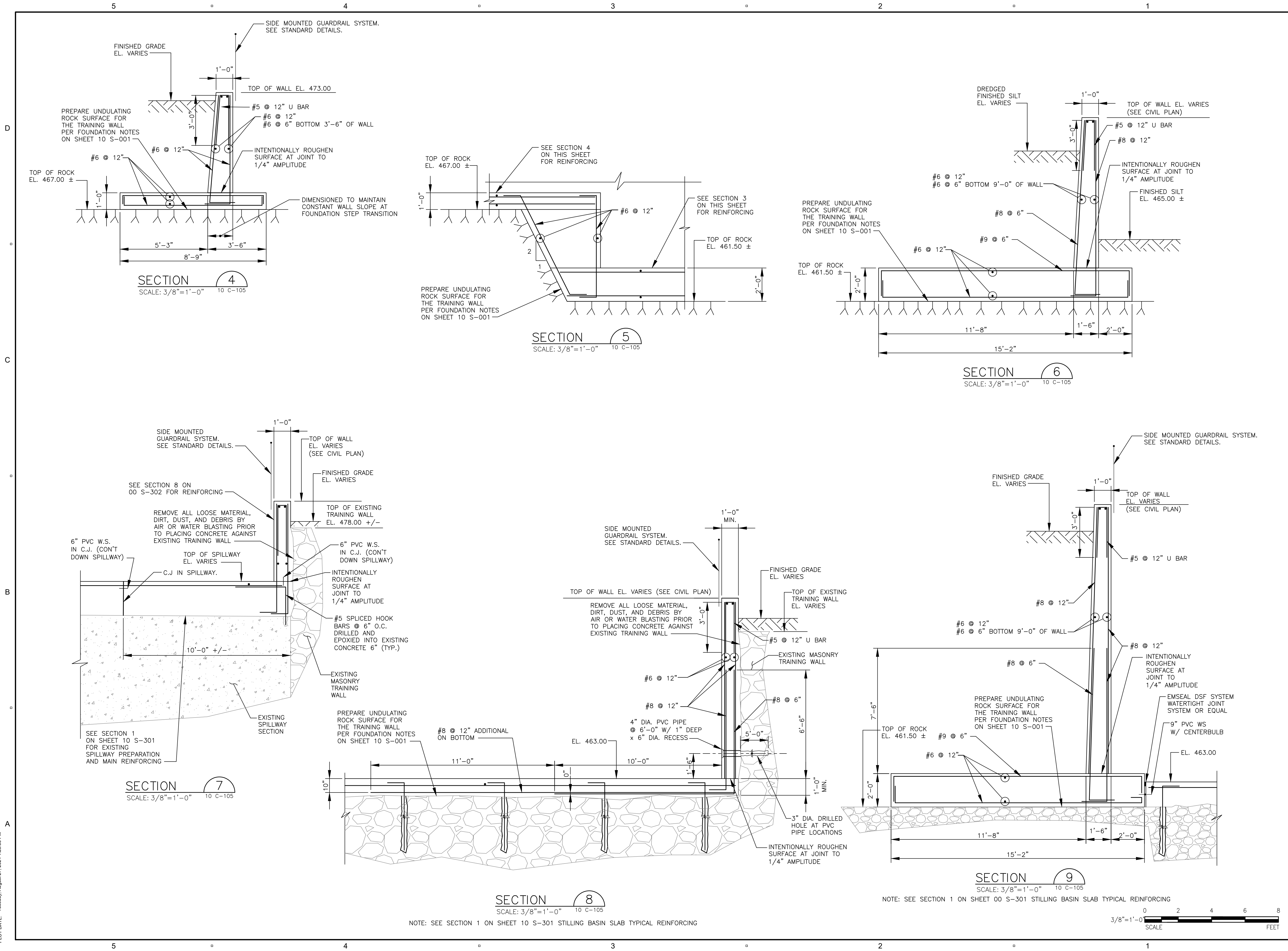
10 S-301



LAST UPDATE: Tuesday, August 27, 2024 12:25:18 PM
 PLOT DATE: Tuesday, August 27, 2024 1:26:02 PM



I/R	DATE	DESCRIPTION



LAST UPDATE: Tuesday, August 27, 2024 12:25:48 PM
 PLOT DATE: Tuesday, August 27, 2024 1:28:53 PM



REGISTRATION

ISSUE/REVISION

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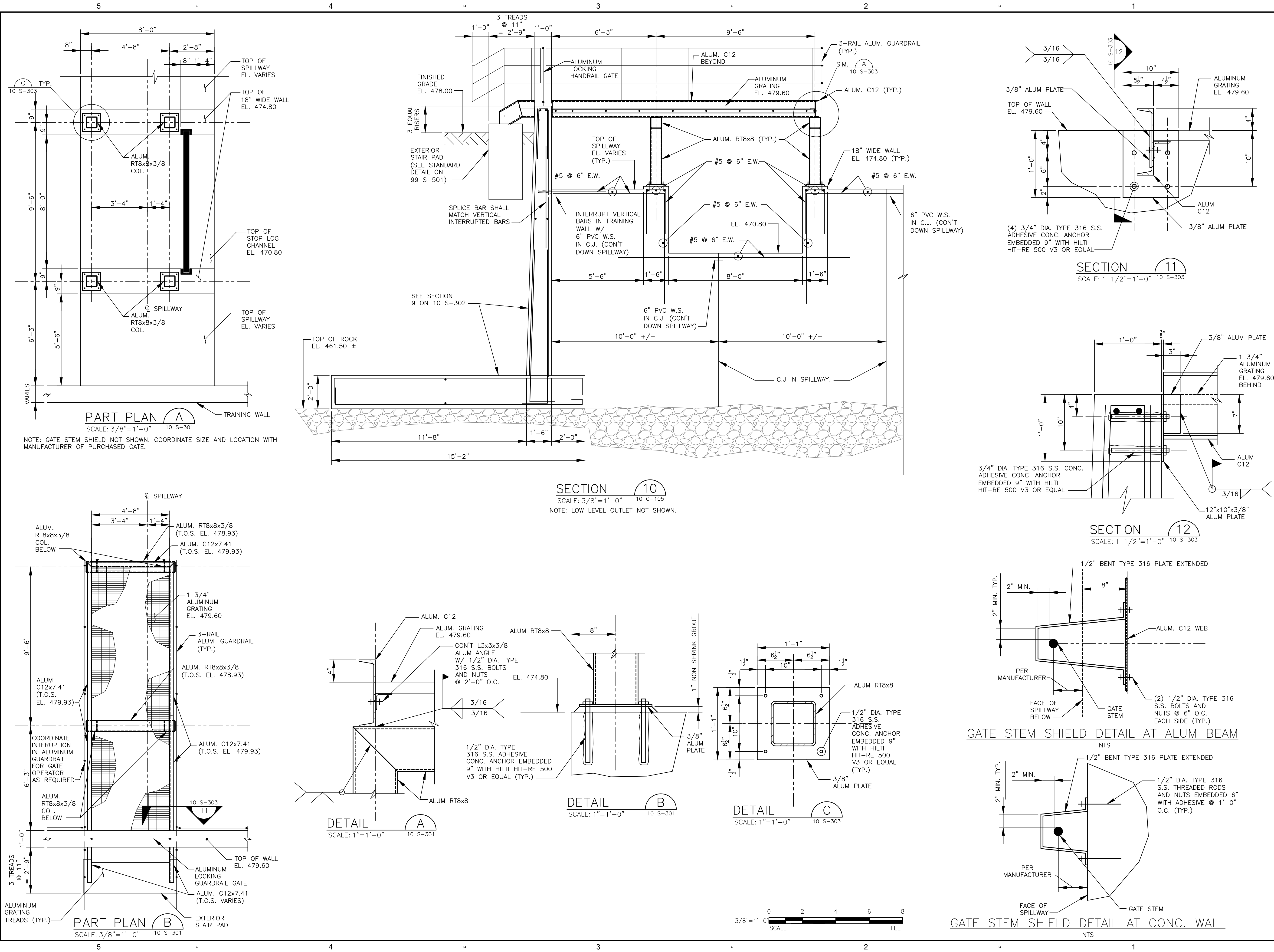
STRUCTURAL

SHEET TITLE

SECTIONS III

SHEET NUMBER

10 S-303



LAST UPDATE: Tuesday, August 27, 2024 12:22:20 PM
 PLOT DATE: Tuesday, August 27, 2024 1:31:03 PM

PROJECT

MASS DCR
 ABANDONED DAMS
 LOWES POND DAM
 CONTRACT NO.
 P19-3264-D4A

CLIENT

Massachusetts Department
 of Conservation and
 Recreation

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DISCIPLINE

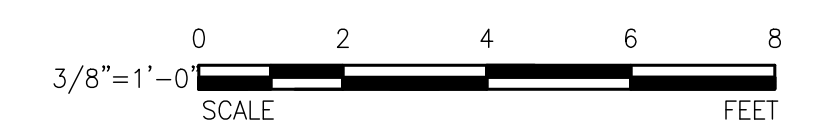
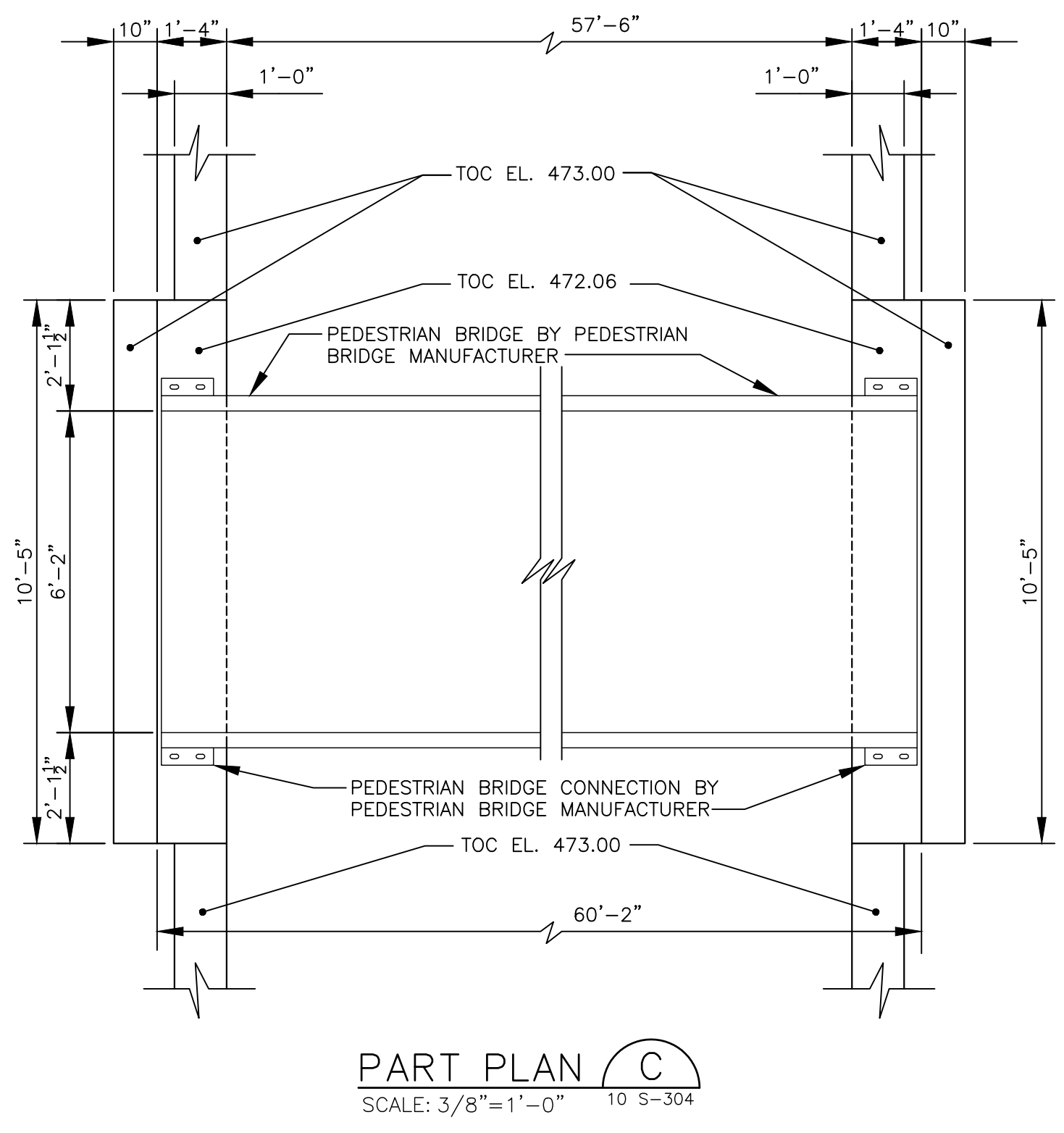
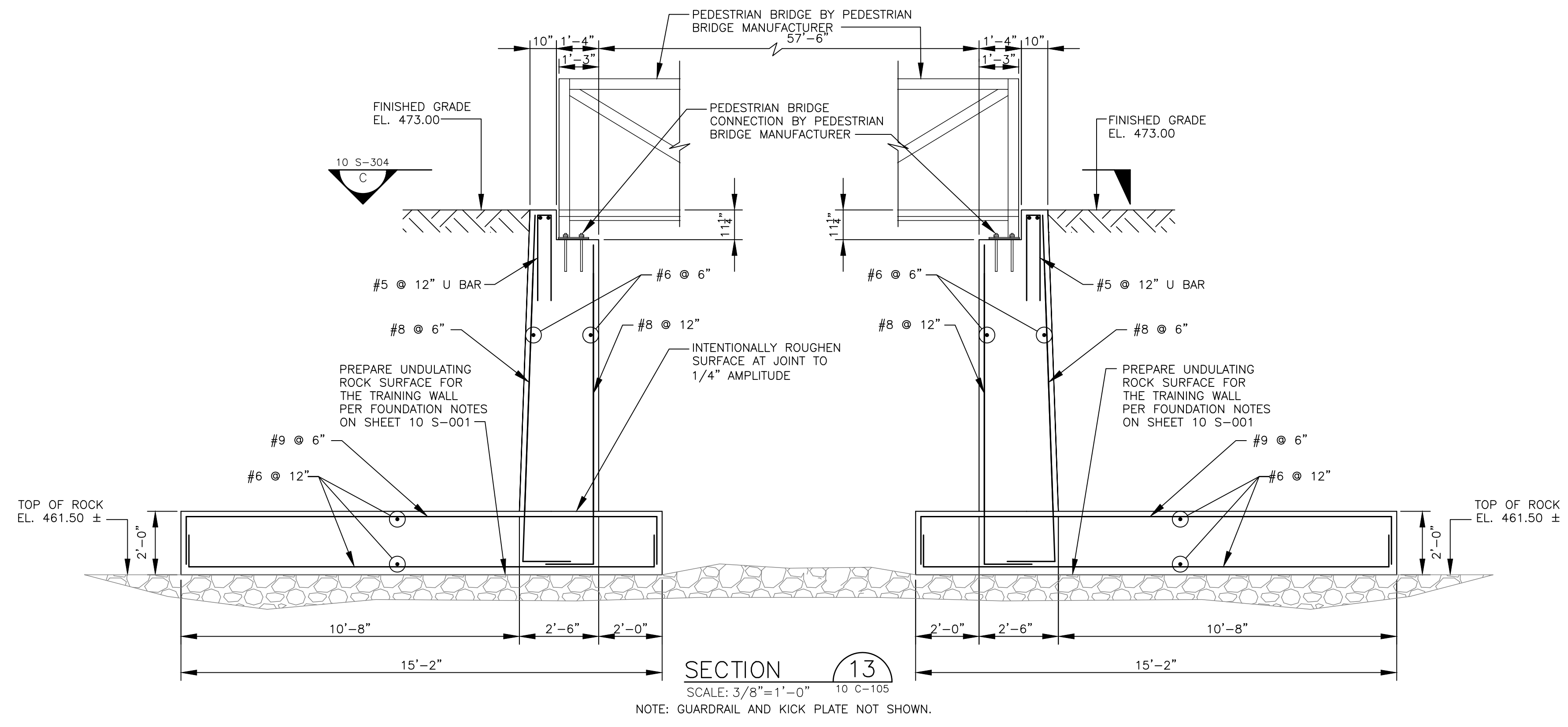
STRUCTURAL

SHEET TITLE

SECTIONS IV

SHEET NUMBER

10 S-304



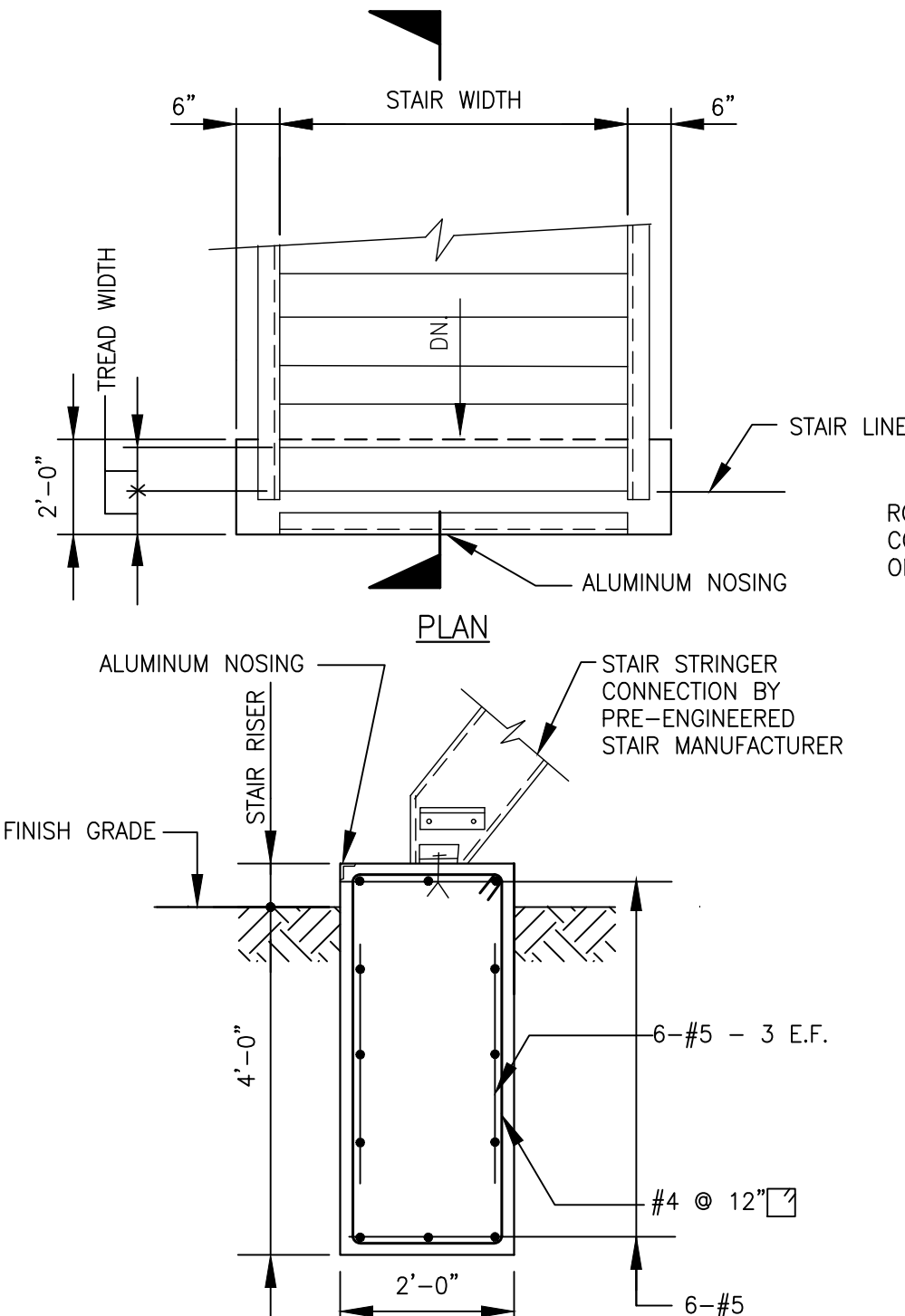
LAST UPDATE: Tuesday, August 27, 2024 12:19:24 PM
 PLOT DATE: Tuesday, August 27, 2024 1:33:07 PM

MEMBER	EXPOSURE CONDITIONS				
	AIR	WEATHER	AIR OVER LIQUID	EARTH OR STONE	LIQUIDS
FOOTINGS AND FOUNDATION MATS	2"	2"	-	2" * 3" •	2"
WALLS	2"	2"	2"	2"	2"

* TOP FACE AND SIDES
• BOTTOM FACE

CONCRETE COVER FOR CAST-IN-PLACE CONCRETE OVER REINFORCEMENT

NTS



EXTERIOR STAIR PAD

NTS

BAR SIZE	REINFORCING BAR DEVELOPMENT PER ACI 318			
	BASIC TENSION DEVELOPMENT	TOP BAR DEVELOPMENT	COMPRESSION DEVELOPMENT	STANDARD HOOK DEVELOPMENT
# 3 (10)	1'-2"	1'-6"	1'-0"	7"
# 4 (13)	1'-7"	2'-1"	1'-3"	9"
# 5 (16)	2'-0"	2'-7"	1'-7"	1'-0"
# 6 (19)	2'-4"	3'-1"	1'-11"	1'-2"
# 7 (22)	3'-5"	4'-6"	2'-2"	1'-5"
# 8 (25)	3'-11"	5'-2"	2'-6"	1'-7"
# 9 (29)	4'-5"	5'-10"	2'-10"	1'-9"

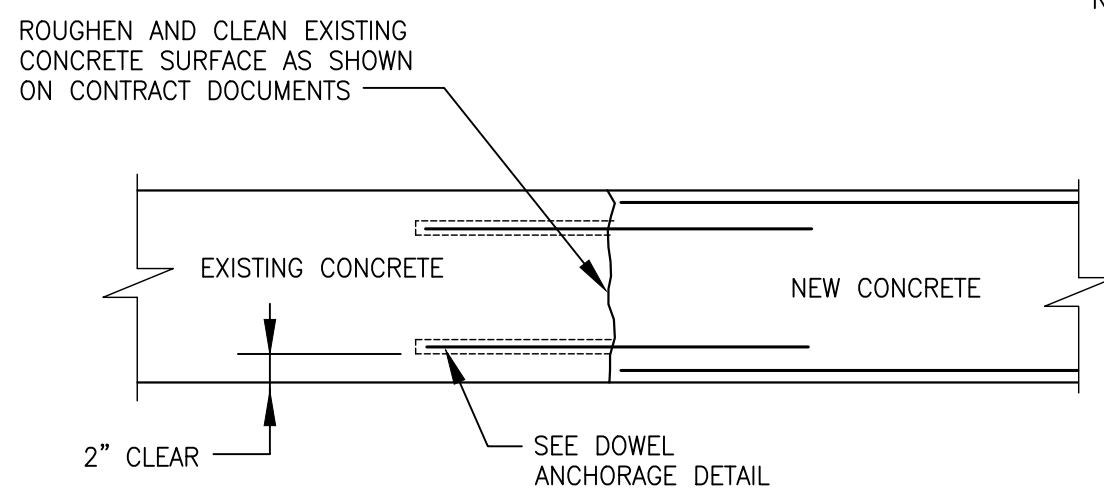
TABULATED VALUES ARE FOR UNCOATED BARS AND NORMAL WEIGHT CONCRETE.

TOP BARS ARE HORIZONTAL REINFORCEMENT PLACED SUCH THAT MORE THAN 12" OF CONCRETE IS PLACED BELOW THE BAR.

TABULATED VALUES ARE FOR BARS WHICH HAVE AT LEAST 1 1/2" OF CLEAR CONCRETE COVER AND ARE SPACED AT LEAST 3" ON CENTER. SPLICE LENGTHS FOR BARS NOT CONFORMING TO EITHER OF THESE CONDITIONS SHALL BE INCREASED 50%.

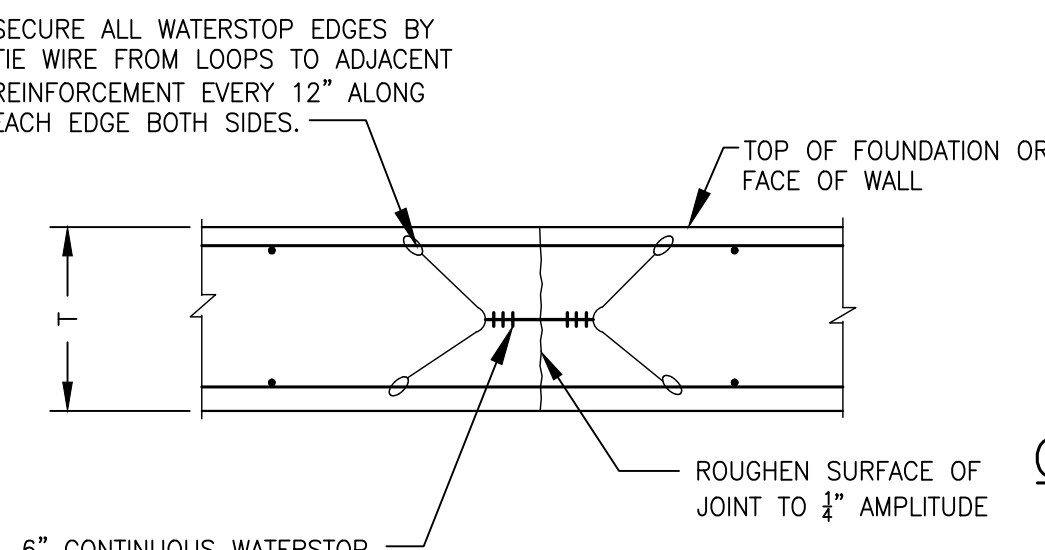
REINFORCING BAR DEVELOPMENT

NTS



BONDING NEW CONCRETE TO EXISTING CONCRETE

NTS



CONSTRUCTION JOINT WITH WATERSTOP

NTS

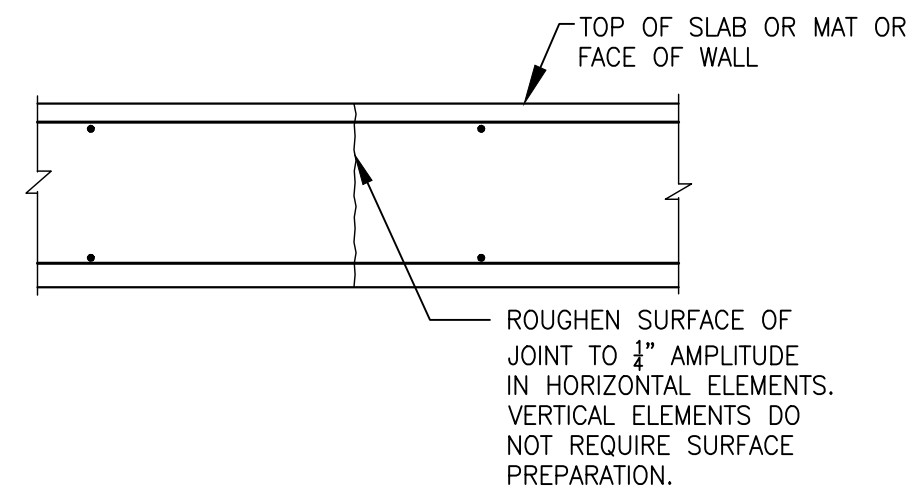
BAR SIZE (METRIC)	REINFORCING BAR SPLICES PER ACI 318		
	CLASS "B" SPLICE TOP BARS	CLASS "B" SPLICE OTHER BARS	COMPRESSION SPLICE
# 3 (10)	2'-0"	1'-6"	1'-0"
# 4 (13)	2'-8"	2'-1"	1'-3"
# 5 (16)	3'-4"	2'-7"	1'-7"
# 6 (19)	4'-0"	3'-1"	1'-11"
# 7 (22)	5'-10"	4'-6"	2'-2"
# 8 (25)	6'-8"	5'-2"	2'-6"
# 9 (29)	7'-7"	5'-10"	2'-10"

TABULATED VALUES ARE FOR NORMAL WEIGHT CONCRETE AND UNCOATED BARS THAT HAVE AT LEAST 1 1/2" OF CLEAR CONCRETE COVER AND ARE SPACED AT LEAST 3" ON CENTER.

TOP BARS ARE HORIZONTAL REINFORCEMENT PLACED SUCH THAT MORE THAN 12" OF CONCRETE IS PLACED BELOW THE BAR.

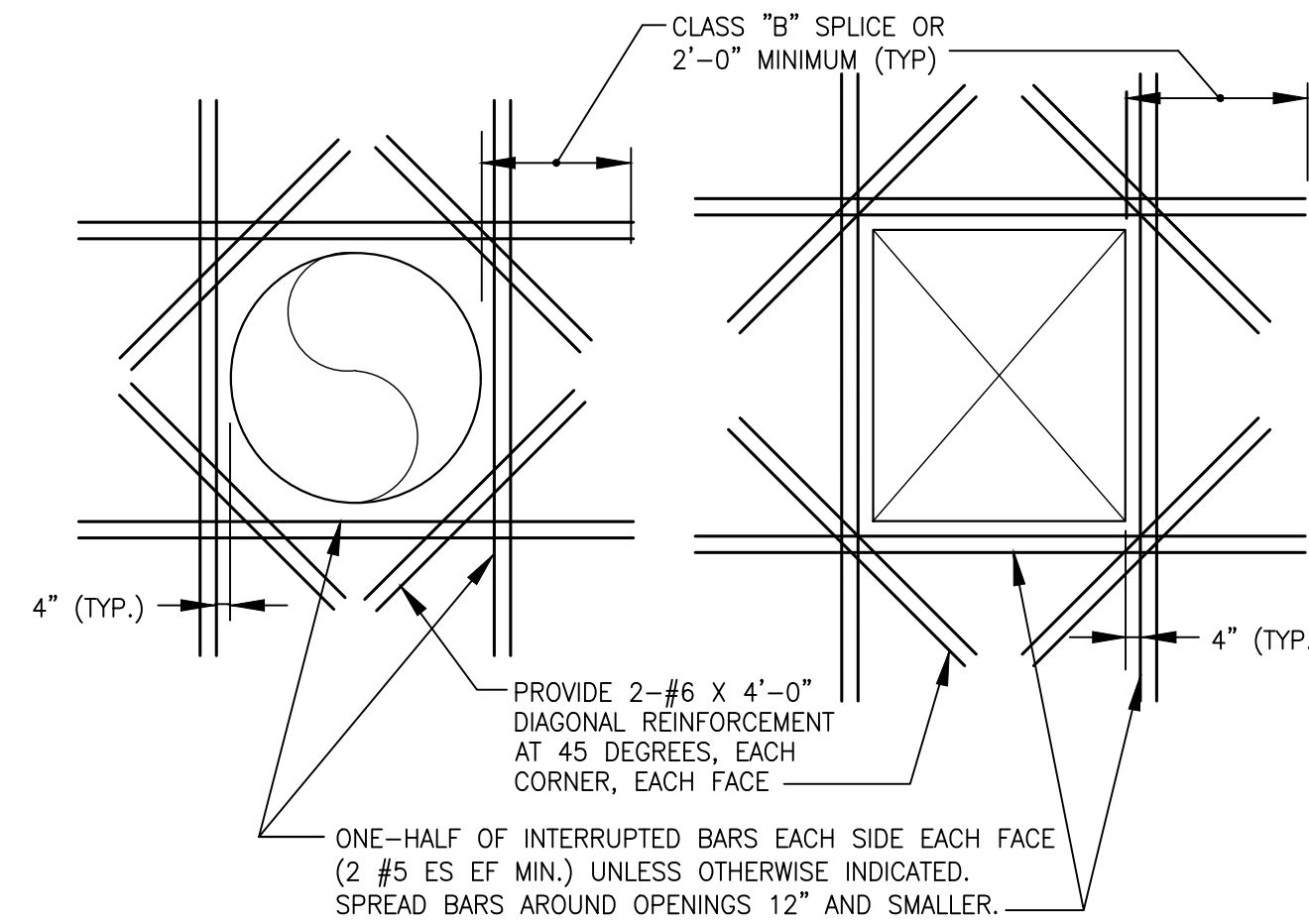
REINFORCING BAR SPLICES

NTS



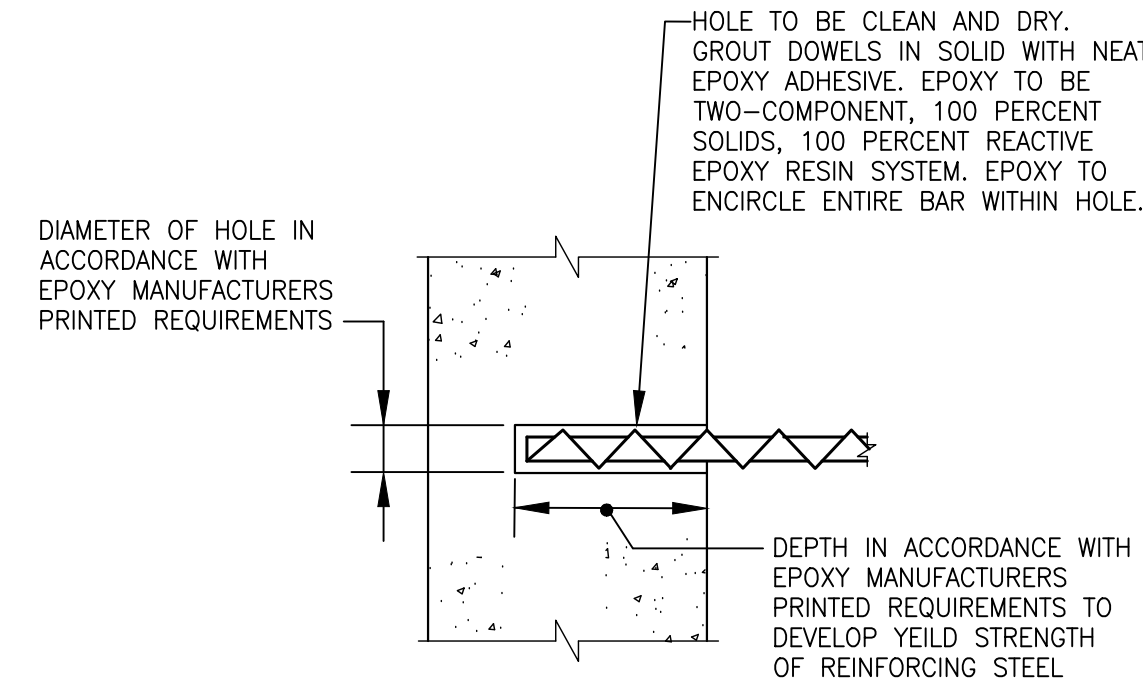
CONSTRUCTION JOINT WITHOUT WATERSTOP

NTS (REV. 4-19-13)



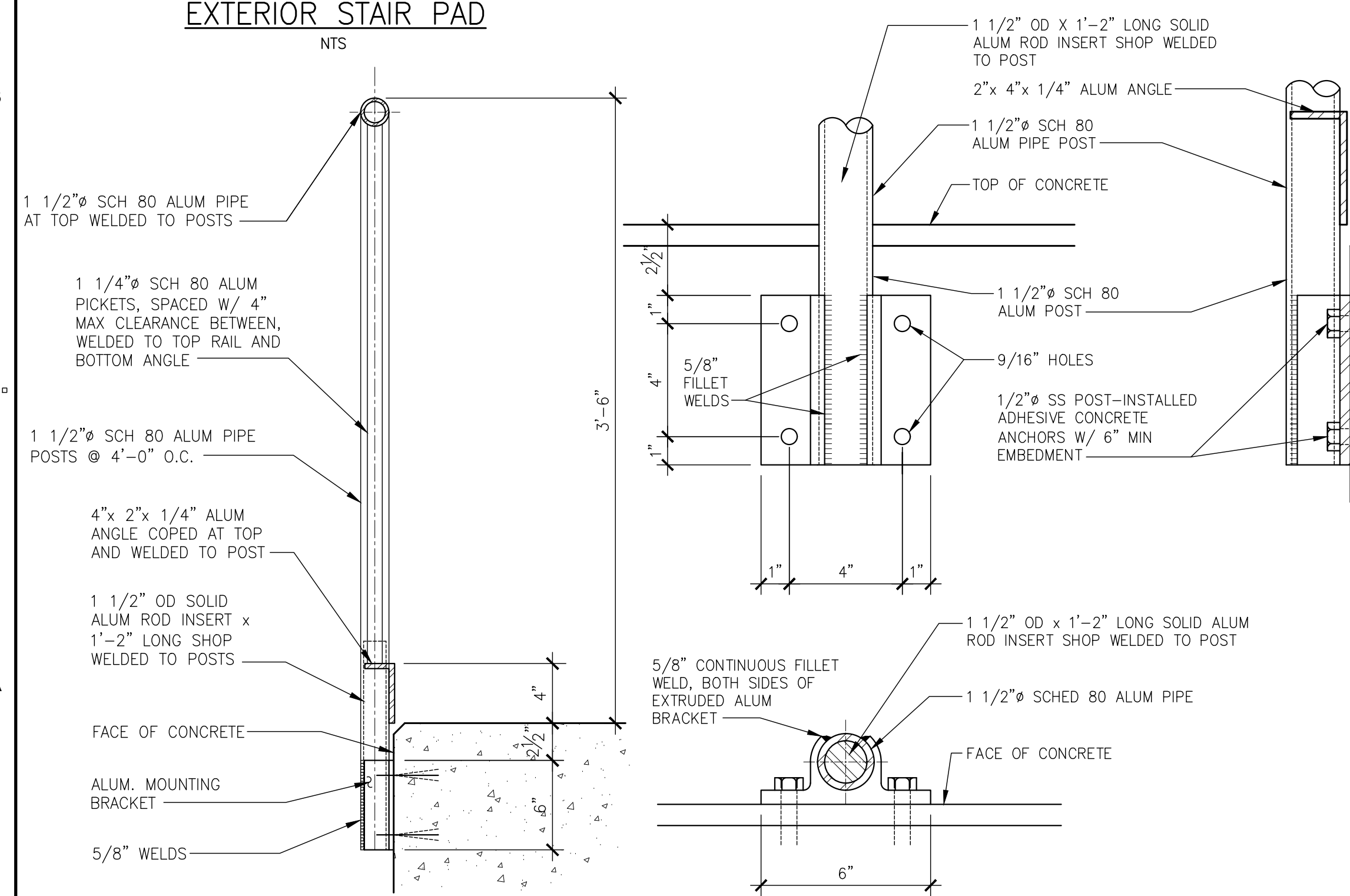
ADDITIONAL REINFORCEMENT FOR ROUND AND RECTANGULAR OPENINGS

NTS



DOWEL ANCHORAGE INTO EXISTING CONCRETE

NTS



SIDE MOUNTED ALUMINUM GUARDRAIL

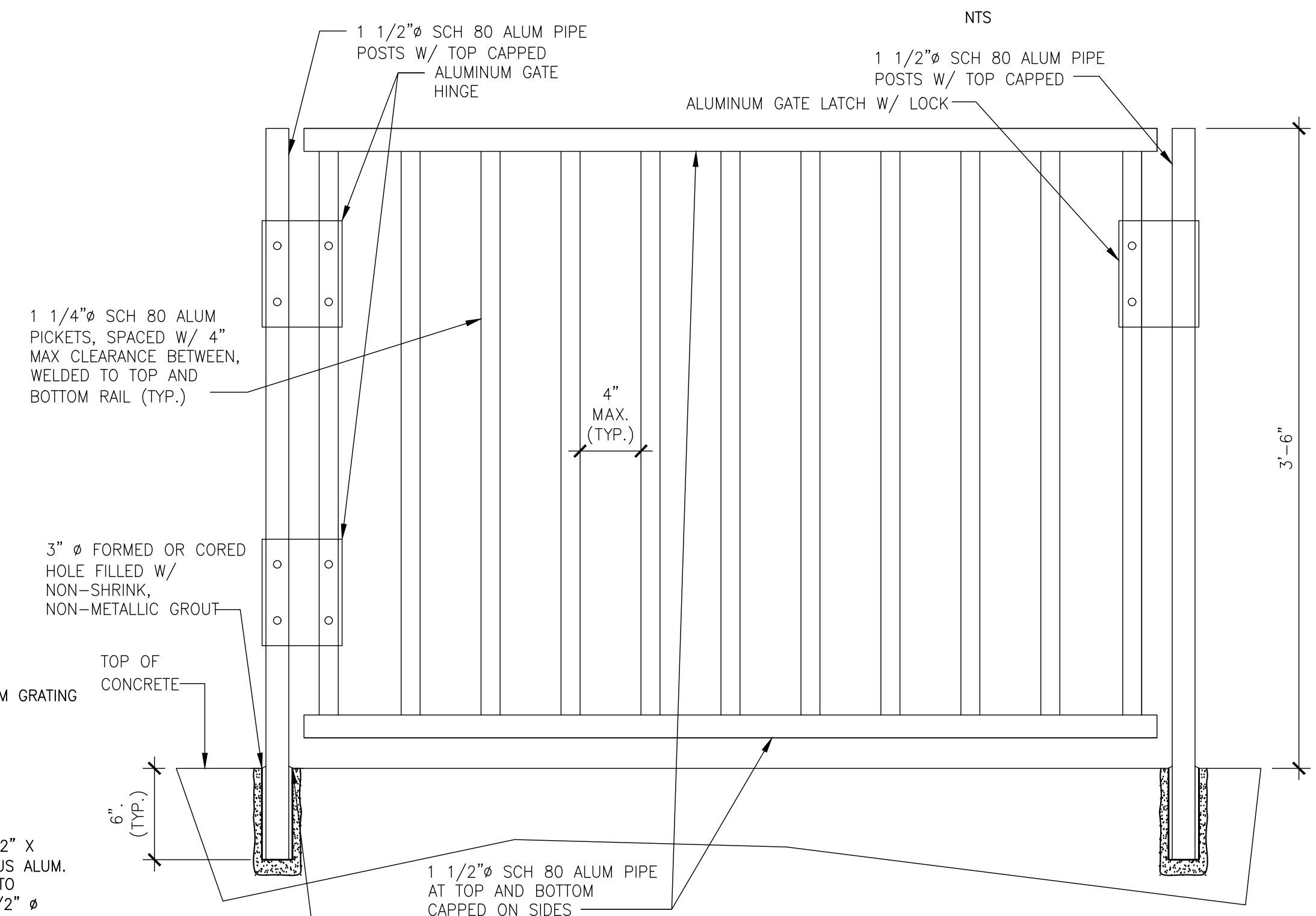
SCALE: 1 1/2" = 1'-0"

ALUMINUM GUARDRAIL MOUNTING BRACKET

SCALE: 3" = 1'-0"

3 RAIL ALUMINUM GUARDRAIL AT GRATING PLATFORM

NTS



ALUMINUM LOCKING GUARDRAIL GATE

NTS



PROJECT

MASS DCR
ABANDONED DAMS
LOWES POND DAM
CONTRACT NO.
P19-3264-D4A

CLIENT

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REGISTRATION

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PROJECT NUMBER

60604936

Designed By: J. PRIVITERA

Drawn By: A. CATALANO

Dept Check: M. MALENFANT

Proj Check: D. GOVE

Date: AUGUST 2024

Scale: AS NOTED

DISCIPLINE

STRUCTURAL

SHEET TITLE

STRUCTURAL STANDARD DETAILS I

SHEET NUMBER

99 S-501

LAST UPDATE: Tuesday, August 27, 2024 12:17:04 PM
PLOT DATE: Tuesday, August 27, 2024 1:34:51 PM

PROCESS PIPING SCHEDULE

LEGEND	SYSTEM DESIGN CONDITIONS					PIPING					INSULATION		VALVING			TEST REQUIREMENTS				SPEC SECTION	REMARKS
	SYSTEM	TEMP (DEG F)		PRESSURE (PSI)		MATERIAL	DIAMETER RANGE	SCH/ CLASS	LINING/ COATING	JOINT TYPE	TYPE	THICKNESS (IN)	BLOCK	CHECK	THROTTLING	PRESSURE (PSI)	MEDIUM	TEST DURATION (MIN)	LEAKAGE ALLOWANCE		
		OPER	MAX	WORK	MAX																
RW	RAW WATER	40	70	4	6	DUCTILE IRON	ALL	CLASS 52	CEMENT / SEE SPEC	RESTRAINED MECHANICAL JOINT	---	---	---	---	---	---	---	---	02615	---	

SLIDE GATE SCHEDULE

TAG NO	NUMBER OF UNITS	LOCATION	GATE SIZE (CLEAR OPENING) W(IN) x H(IN)	GATE TYPE	CONFIGURATION	HEAD TYPE	GATE DESIGN HEAD (FT)	INSTALLATION TYPE	THIMBLE TYPE	CLOSURE TYPE	OPERATOR TYPE	MOTOR DATA			SPEC SECTION	REMARKS
												HP	RPM (MAX)	ENCL TYPE		
10-RW-SG-1	1	LOWES POND DAM	24 x 24	FABRICATED	FOUR SIDED	SEATING	13	WALL MOUNTED	N/A	FLUSH BOTTOM	REMOVABLE CRANK WITH SHAFT EXTENSION TO CLEAR RAILING	---	---	---	15103	DESIGN HEAD: MAX WATER SURFACE TO GATE INVERT.

STOP LOG SCHEDULE

TAG NO	NUMBER OF UNITS	LOCATION	STOP LOG SIZE (CLEAR OPENING) W(IN) x H(IN)	SECTION HEIGHT(IN)	HEAD TYPE	DESIGN HEAD (FT) (MAX WATER TO BOT LOG INV)	INSTALLATION TYPE	CLOSURE TYPE	NUMBER OF LOGS	SPEC SECTION	REMARKS
10-RW-SL-1	1	LOWES POND DAM	96 x 108	6	SEATING	8	EMBEDDED	FLUSH BOTTOM	8	15112	GROOVES EMBEDDED 4 FT

FLAP GATE SCHEDULE

TAG NO	NUMBER OF UNITS	LOCATION	FLAP GATE OPENING SIZE (IN)	INSTALLATION TYPE	SERVICE	DESIGN HEAD (FT)	SPEC SECTION	REMARKS
10-RW-FG-1	1	LOWES POND DAM	24	PIPE FLANGE	GRAVITY FLOW	11.25	15150	---

PROCESS EQUIPMENT ABBREVIATIONS

FG FLAP GATE
SG SLIDE GATE
SL STOP LOG

PROCESS GENERAL ABBREVIATIONS

ACFM	ACTUAL CUBIC FEET PER MINUTE	FE	(FIXED x FIXED) FLOW ELEMENT	NO	NORMALLY OPEN	STR	STRUCTURAL
AFF	ABOVE FINISHED FLOOR	FF	FLAT FACE	NO	NUMBER	TEFC	TOTALLY ENCLOSED FAN COOLED
ANCH	ANCHOR	FHMB	FLAT HEAD MACHINE BOLT	NOM	NOMINAL	TEMP	TEMPERATURE
ANSI	AMERICAN NATIONAL STANDARDS INSTITUTE	FIN FL	FINISHED FLOOR	NPSH	NET POSITIVE SUCTION HEAD	TENV	TOTALLY ENCLOSED NON VENTILATED
APPROX	APPROXIMATE	FIN GR	FINISHED GRADE	NPSHR	NET POSITIVE HEAD REQUIRED	THK	THICK
ARCH	ARCHITECTURAL	FIT	FLOW INDICATING TRANSMITTER	NPSH3	NPSH RESULTING IN 3% DROP IN HEAD	TOC	TOP OF CONCRETE
ARV	AIR RELEASE VALVE	FLEX	FLEXIBLE	NPT	NATIONAL PIPE THREAD	TOD	TOP OF DUCT
AVV	AIR VACUUM VALVE	FLG	FLANGE	NRS	NON-RISING STEM	TOS	TOP OF STEEL
BOD	BOTTOM OF DUCT	FCV	FLOW CONTROL VALVE	NTS	NOT TO SCALE	TSH	TEMPERATURE SWITCH HIGH
CFM	CUBIC FEET PER MINUTE	FOB	FLAT ON BOTTOM	OC	ON CENTER	TYP	TYPICAL
CFS	CUBIC FEET PER SECOND	FOS	FLAT ON SIDE	OD	OUTSIDE DIAMETER	VD	VOLUME DAMPER
CHEM	CHEMICAL	FOT	FLAT ON TOP	ODP	OPEN DRIP PROOF	W/	WITH
CI	CAST IRON	FPD	FLOWER POT DISCHARGE	OPER	OPERATING	WxH	WIDTH x HEIGHT
CL	CENTERLINE	FT/MIN	FEET PER MINUTE	P	PRESSURE GAUGE	WC	WATER COLUMN
CMU	CONCRETE MASONARY UNIT	FT/S	FEET PER SECOND	PE	PLAIN END	WORK	WORKING
CO	CLEANOUT	FS	FLOW SWITCH	PI	PRESSURE INDICATOR	WP	WEATHER PROTECTED
CONC	CONCRETE	FSI	FORMED SUCTION INTAKE	PIT	PRESSURE INDICATOR TRANSMITTER	WPI	WEATHER PROTECTED TYPE I
CONN	CONNECTION	FT	FEET	PLMB	PLUMBING	WPII	WEATHER PROTECTED TYPE II
CONT	CONTINUATION	FW	FLUSHING WATER	PO	PUSH-ON	WS	WATER SURFACE
CPVC	CHLORINATED POLYVINYLCHLORIDE	GAL	GALLONS	PRI	PRIMARY	XPROOF	EXPLOSION PROOF
CS	CARBON STEEL	GALV	GALVANIZED	PS	PRESSURE SWITCH	YD	YARD
DEG C	DEGREES CELSIUS	LG	LONG	PSH	PRESSURE SWITCH HIGH	GPM	GALLONS PER MINUTE
DEG F	DEGREES FAHRENHEIT	LP	LOW POINT	PSIA	POUNDS PER SQUARE INCH ABSOLUTE	GCIC	GRIT CONCENTRATOR INFLUENT CHANNEL
DET	DETAIL	LR	LONG RADIUS	PSIG	POUNDS PER SQUARE INCH GAGE	HDPE	HIGH DENSITY POLYETHYLENE
DI	DUCTILE IRON	L/S	LITERS PER SECOND	PSV	PRESSURE SAFETY SWITCH	HG	HOSE GATE
DIA	DIAMETER	LSH	LIQUID SAMPLE PORT	PVC	POLYVINYLCHLORIDE	HHMB	HEXAGONAL HEAD MACHINE BOLT
DISCH	DISCHARGE	LSP	LIQUID SAMPLE PORT	PVDF	POLYVINYLIDENE FLOURIDE	Hg	MERCURY
DN	DOWN	LxW	LENGTH X WIDTH	R	RADIUS	HP	HIGH POINT
DWG'S	DRAWINGS	LW	LOW WATER LEVEL	RED	REDUCER / REDUCING	HPT	HOSE PIPE THREAD
Exe	FLEXIBLE COUPLING	LLWL	LOW/LOW WATER LEVEL	RED FLG	REDUCING FLANGE	HVAC	HEATING VENTILATION
	(EXPANSION x EXPANSION)	M	METER	REF	REFERENCE	HWL	HIGH WATER LEVEL
ECC RED	ECCENTRIC REDUCER	MAX	MAXIMUM	REIN	REINFORCING	ID	INSIDE DIAMETER
EFF	EFFLUENT	MATL	MATERIAL	REQ'D	REQUIRED	IN	INCHES
EFF %	% EFFICIENCY	MCC	MOTOR CONTROL CENTER	RFG	RISING FLAP GATE	INSUL	INSULATION
ELEC	ELECTRICAL	MECH	MECHANICAL	RPM	REVOLUTIONS PER MINUTE	INV	INVERT
EL	ELEVATION	MGD	MILLION GALLONS PER DAY	SCH	SCHEDULE	IPT	IRON PIPE THREAD
ELL	ENCLOSURE	MH	MANHOLE	SH	SHEET	KG	KILOGRAM
ENCL	EQUIPMENT	MIN	MINIMUM	SPD	SUMP PUMP DISCHARGE	KW	KILOWATT
EQUIP	EQUIPMENT	MJ	MECHANICAL JOINT	SPECS	SPECIFICATIONS	LB	POUND
EXIST	EXISTING	MM	MILLIMETERS	SQ	SQUARE	LG	LONG
FxE	EXPANSION COUPLING	NAVD	NORTH AMERICAN VERTICAL DATUM	SR	SHORT RADIUS		
	(FIXED x EXPANSION)	NC	NORMALLY CLOSED	SS	STAINLESS STEEL		
FxF	RESTRAINED COUPLING	NGVD	NATIONAL GEODETIC VERTICAL DATUM	STD	STANDARD		



PROJECT

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LOWES POND DAM
CONTRACT NO.
P19-3264-D4A

CLIENT

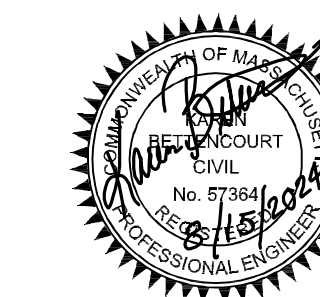
Massachusetts Department
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REGISTRATION



ISSUE/REVISION

I/R	DATE	DESCRIPTION

PROJECT NUMBER

60604936

Designed By:	D. YURK
Drawn By:	M. BENSON
Dept Check:	K. BETTENCOURT
Proj Check:	D. GOVE
Date:	AUGUST 2024
Scale:	AS NOTED

DISCIPLINE

MECHANICAL PROCESS
SHEET TITLE

PROCESS SCHEDULES AND ABBREVIATIONS

SHEET NUMBER

00 D-001

PROJECT

MASS DCR
 ABANDONED DAMS
 LOWES POND DAM
 CONTRACT NO.
 P19-3264-D4A

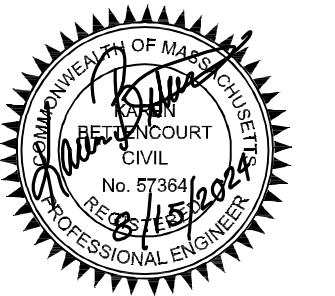
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DISCIPLINE

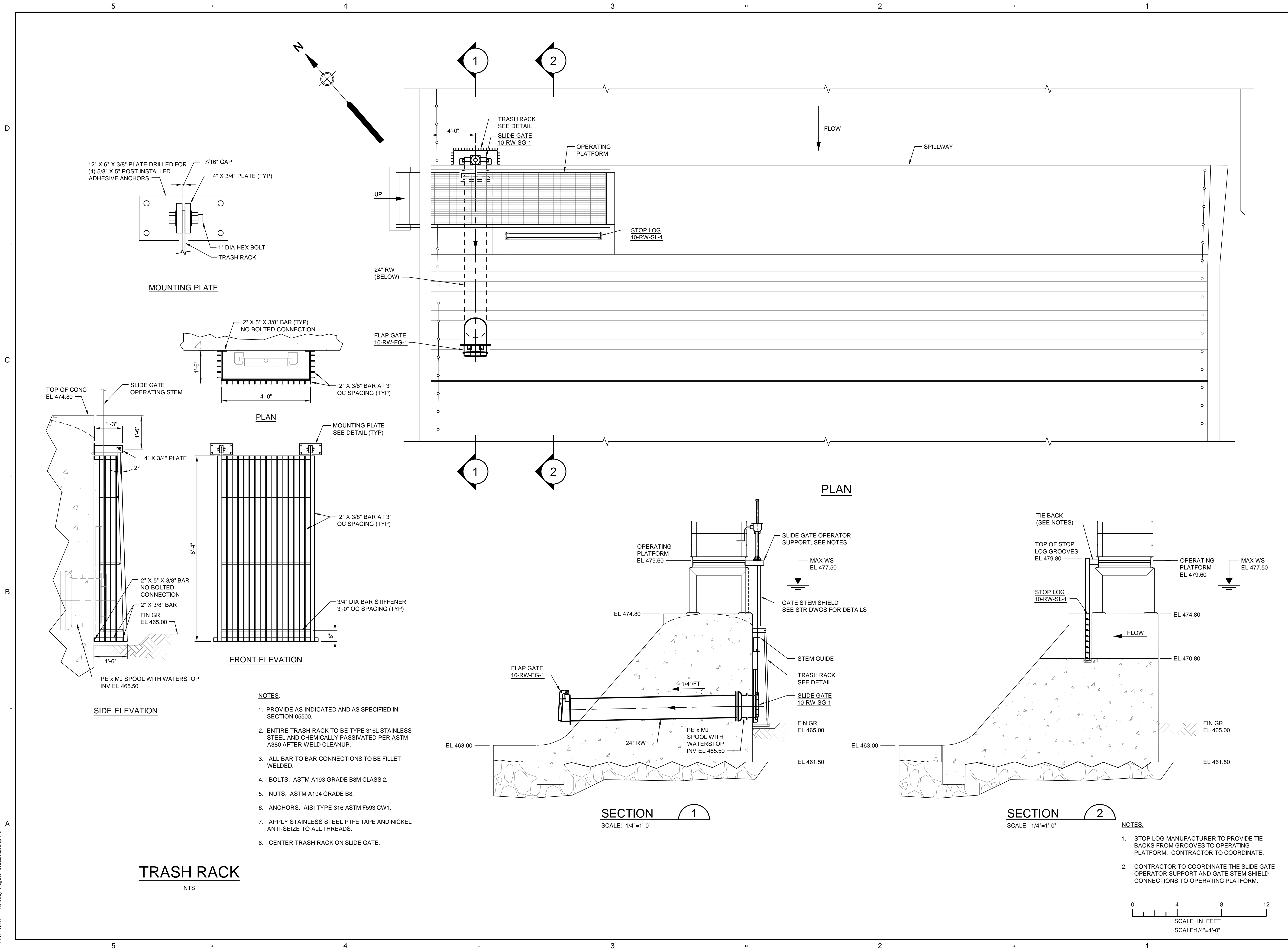
MECHANICAL PROCESS

SHEET TITLE

PLAN AND SECTION

SHEET NUMBER

10 D-101



TRASH RACK
 NTS

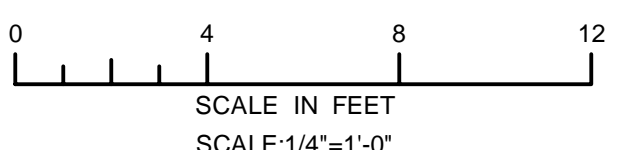
NOTES:

1. PROVIDE AS INDICATED AND AS SPECIFIED IN SECTION 05500.
2. ENTIRE TRASH RACK TO BE TYPE 316L STAINLESS STEEL AND CHEMICALLY PASSIVATED PER ASTM A380 AFTER WELD CLEANUP.
3. ALL BAR TO BAR CONNECTIONS TO BE FILLET WELDED.
4. BOLTS: ASTM A193 GRADE B8M CLASS 2.
5. NUTS: ASTM A194 GRADE B8.
6. ANCHORS: AISI TYPE 316 ASTM F593 CW1.
7. APPLY STAINLESS STEEL PTFE TAPE AND NICKEL ANTI-SEIZE TO ALL THREADS.
8. CENTER TRASH RACK ON SLIDE GATE.

SECTION 1
 SCALE: 1/4"=1'-0"

SECTION 2
 SCALE: 1/4"=1'-0"

- NOTES:**
1. STOP LOG MANUFACTURER TO PROVIDE TIE BACKS FROM GROOVES TO OPERATING PLATFORM. CONTRACTOR TO COORDINATE.
 2. CONTRACTOR TO COORDINATE THE SLIDE GATE OPERATOR SUPPORT AND GATE STEM SHIELD CONNECTIONS TO OPERATING PLATFORM.



PATH: \\P0664936 - MASSDCR SIX ABANDONED DAMS\SHEETS\10 D-101.DWG
 LAST UPDATE: Friday, August 9, 2024 11:01:02 AM
 PLOT DATE: Thursday, August 15, 2024 2:59:38 PM