

Appendix N
Dredging Specifications

SECTION 01100

SUMMARY

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes
 - 1. References
 - 2. Specification Formats and Conventions
 - 3. Work Covered by the Contract Documents
 - 4. Work Sequence
 - 5. Use of Premises
 - 6. Work By Others
 - 7. Future Work
 - 8. Owner-Furnished Products
 - 9. Project Utility Sources
 - 10. Miscellaneous Provisions

1.2 REFERENCES

- A. Definitions
 - 1. Basic Contract definitions and terminology are included in the General Conditions of the Contract.
 - 2. The term "approved," when used to convey Engineer's action on Contractor's submittals, applications, and requests, is limited to the corresponding duties and responsibilities of Engineer as stated in the Contract Documents.
 - 3. The term "regulations" includes laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, as well as rules, conventions, and agreements within the construction industry that control performance of the Work.
- B. Industry Standards
 - 1. Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.
 - 2. Comply with standards in effect as of date of the Contract Documents, unless otherwise indicated.
 - 3. If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement.
 - 4. Unless otherwise specified, the quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated

numeric values are minimum or maximum, as appropriate, for the context of requirements.

5. Each section of the specifications generally includes a list of reference standards normally referred to in that respective section. The purpose of this list is to furnish the Contractor with a list of standards normally used for outlining the quality control desired on the project. The lists are not intended to be complete or all inclusive, but only a general reference of standards that are regularly referred to.
6. Each entity engaged in construction on the Project shall be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents. Where copies of standards are needed to perform a required construction activity, obtain copies directly from the publication source and make them available on request.

1.3 SPECIFICATION FORMATS AND CONVENTIONS

- A. The Specifications are organized into Divisions and Sections using the 16-division format and CSI's "MasterFormat" numbering system.
- B. The Specifications use section numbers and titles to help cross-referencing in the Contract Documents.

1.4 WORK COVERED BY THE CONTRACT DOCUMENTS

- A. Project Identification
 1. Project Location: Nagawicka Lake and Sediment Dewatering Location, Delafield, Wisconsin, project "Site".
 2. Owner: City of Delafield, Wisconsin.
 3. Project Description: Nagawicka Lake Restoration Project.
- B. The Work includes:
 1. Hydraulic dredging of lake and river bed soft sediments.
 2. Construction of Shoreline Staging as needed by the Contractor.
 3. Booster Pump Station and associated piping.
 4. Construction of the dewatering facility.
 5. Dewatering of dredged material at the City-owned dewatering site using geotextile tubes.
 6. Treatment of carriage water prior to discharge and associated effluent piping to meet NPDES permit conditions.
 7. Maintaining roadway to and within the dewatering site.
 8. Stockpiling dewatered sediment and related materials at the dewatering site.
 9. Providing erosion control at the dewatering site and appurtenances and at the booster pump station staging area.
 10. Erosion control.
 11. Protection of water quality including lake, and river water, and groundwater quality in accordance with applicable permits.
 12. Reclamation of all disturbed areas upon completion of dredging activities.

1.5 WORK SEQUENCE

- A. Conduct the Work in sequence.
 - 1. Provide required submittals to the Owner's representative.
 - a. Preconstruction submittal approvals shall be obtained by the Owner's representative subject to timely reviews by outside parties (i.e. Owner and its contractors as well as assistance with regulatory approvals).
 - 2. Mobilization and Site Preparation –
 - Phase 1: April 13 through May 22, 2009.
 - Phase 2: June 15 through June 30, 2010.
 - 3. Dewatering Site Preparation – May 24 through July 2, 2009.
 - 4. Dredging –
 - Phase 1: July 1 through October 15, 2009; Zastrow's Bay dredging may extend beyond October 15, 2009.
 - Phase 2: July 1 through October 15, 2010; Zastrow's Bay dredging may extend beyond October 15, 2010.
 - 5. Dewatering and Water Treatment – July 1, 2009 through removal of dredged material, except as otherwise agreed to by Owner and Contractor.
 - 6. Demobilization at the completion of dredging for the 2009 season and upon completion of removal of all targeted sediments in 2010.
 - 7. Restoration of the booster pump station, shoreline staging area, and dewatering site by December 31, 2010.

1.6 USE OF PREMISES

- A. Contractor shall have full use of the premises for construction operations, including use of the Site, as allowed by law, ordinances, permits, easement agreements and the Contract Documents.
- B. Contractor's use of premises is limited only by Owner's right to perform work or to retain other contractors on portions of the Project.
- C. The Site is limited to property boundaries, rights-of-way, easements and other areas designated in the Contract Documents.
- D. Provide protection and safekeeping of material and products stored on or off the premises as purchased by the Contractor or its Subcontractors and vendors.
- E. Move any stored material or products which interfere with operations of Owner or other Contractors as purchased by the Contractor or its Subcontractors and vendors.
- F. Easement agreements have been secured by the city for work conducted on private properties.

1.7 WORK BY OTHERS (Not Used)

1.8 PROJECT UTILITY SOURCES

- A. Contractor will assume all utility costs for the booster pump station and dewatering site operations.

1.9 MISCELLANEOUS PROVISIONS

- A. Alternative excavation methods may be necessary for the sediment trap area due to potential hard material excavation. The Contractor shall provide methods for removal of hard material that cannot be removed by hydraulic dredging methods to establish sediment trap target elevations.
- B. Contractor shall demonstrate to the WDNR's satisfaction that the polymer dosage rate is effective at controlling discharge water quality and is at a dosage that will meet WDNR requirements and standards.
 - 1. Contractor must use polymer approved by the WDNR for compliance with the discharge permit for this project.
 - 2. Testing Protocol:
 - a. Contractor shall provide a testing protocol for WDNR approval, prior to implementation.
 - b. Testing protocol shall be as follows:
 - 1) _____

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

- END OF SECTION -

SECTION 01285

MEASUREMENT AND PAYMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes
 - 1. Project Operation and Implementation and Reclamation
 - a. Mobilization
 - b. Site Preparation
 - c. Dewatering Facility construction
 - d. Demobilization
 - e. Insurance
 - f. Dredging and Dewatering of Sediment
 - g. Dewatered Sediment Management

- B. Prices to Include Complete Project
 - 1. Prices include defined Work for each payment method and payment item which will provide a functionally complete Project when combined with all payment items and payment methods.
 - 2. If there are specific work items that the Contractor believes are not identified in any payment method and payment item, but is required to provide a functionally complete Project, then the identified specific work items shall be included in the appropriate payment item and payment method.

1.2 PROJECT OPERATION AND IMPLEMENTATION FOR 2009-2010

- A. Mobilization (Item ___)
 - 1. The lump sum price for Mobilization work includes:
 - a. Moving equipment, materials and personnel to the Site.
 - b. Set up of equipment for operation.
 - 2. Payment will be made in one lump sum when all equipment, materials and personnel are in place and ready for operation.

- B. Site Preparation, Dewatering Pad, and Shoreline Service Area Construction (Item ___)
 - 1. The lump sum price for Site Preparation, Dewatering Pad, and Shoreline Service Area construction includes:
 - a. Examination of existing conditions.
 - b. Temporary Facilities and Controls as necessary
 - c. Erosion and Sediment Control as necessary
 - d. Providing as necessary and maintaining on-site facilities including, but not limited to, access roads for loading and stockpiling dewatered material, clearing, earthwork, stormwater control facilities, any modifications to the dewatering pad, and any other work necessary to make facilities ready to

dredge, dewater, and remove sediment and to pump carriage water to the Lake.

e. Site Coordination

- 1) Coordinate Site preparation work with other contractors, if any, retained by Owner.
2. Payment will be made in one lump sum when the dewatering pad is accepted by Contractor and ready for operation and Site preparation is complete and accepted by Owner.
3. Obtain necessary Wisconsin Administrative Code NR 150 construction erosion control permits for site development.
4. All necessary utility hookups for site operations.

C. Quality Control Reports and Submittals (Item ____)

1. The lump sum price for Quality Control Reports and Submittals work includes:
 - a. Site and Facilities Design.
 - b. Quality control plans/reports.
 - c. Initial submittals stated in the various Specification Sections.
 - d. Assistance in obtaining regulatory approvals.
2. Payment will be made in one lump sum when all requirements have been met and approved by Owner.

D. Supervising Contractor, Project Management, Coordination, General Conditions, Meetings and Quality Control Submittals (Item ____)

1. The monthly price for Supervising Contractor, Project Management, Coordination, General Conditions, Meetings and Quality Control Submittals work includes:
 - a. Requirements of the General Conditions.
 - b. Project Management and Coordination in accordance with Section 01310.
 - c. QC Submittals specified in the various Specification Sections, coordinating, facilitating and cooperating with Owner, Engineer, and regulatory agencies in collection of QA/QC information collection.
 - d. Cooperation with regulatory agencies and responding to such agencies' reasonable requests for information, under the direction of Owner and/or the Engineer.
 - e. Preconstruction conference, progress meetings, operation reports, deliverables and all administrative, operations and maintenance of administrative facilities.
 - f. Maintaining temporary utilities, protection devices, support facilities and site surfaces.
 - g. Supervising Contractor responsibilities pursuant to Consent Decree.
 - h. Preparing required document deliverables.
2. Payment will be made at the per-month price or portion of the month prorated based on the number of work days performed and the number of work days in the month for this item. Payment will be made only while work is on-going at the Site.

- E. Site Health and Safety (Item ____)
1. The monthly price for Site Health and Safety work includes:
 - a. Preparation and implementation of the Safety and Environmental Protection for Hazardous Materials safety plan.
 - b. Implementation for safety requirements stated in the General Conditions and the safety plan.
 2. Payment will be made at the per-month price or portion of the month prorated based on the number of work days performed and the number of work days in the month for this item. Payment will be made only while work is on-going at the Site.
- F. Dredging Sediments (Item ____)
1. The unit price for Dredging Sediments work includes:
 - a. Acquisition, operation and maintenance of dredge equipment and pipelines to dewatering site.
 - b. Incidental removal of debris, cobbles, wood and other rubble prior to dredging as required to perform sediment removal.
 - c. Environmental protection.
 - d. Safety equipment, lights and other facilities. This includes, but is not limited to, the placement and maintenance of buoys that identify where the work is progressing.
 - e. Standby equipment as required to maintain continuous operation.
 - f. Suspension of operations due to weather or other conditions.
 - g. Minimum of weekly QC bathymetric surveys to verify and inform Owner that dredging operation achieving planned target elevations.
 - h. Provide access and facilities for Owner to perform field quality assurance sampling and testing.
 - i. Re-dredging areas found to not meet the planned target elevations in the QA bathymetric surveys.
 2. Dredging Requirements
 - a. Contractor shall in good faith attempt to dredge 100% of the areas shown on the Project Drawings.
 - b. Contractor understands that the retainage may be forfeited and other penalties may apply under this Contract and otherwise for a failure to attain removal at the forementioned 95% rate.
 3. General Payment Requirements
 - a. Contractor shall be paid for dredging sediments at the unit price set forth in the Agreement.
 - b. Payment will be based on the corresponding quantity for sediments in any given area as set forth in the Agreement.
 4. The Contractor may perform pre-dredging surveys as needed to verify dredge quantities.
 5. Post-Dredging QA bathymetric surveys are required to confirm attainment of the target elevations as required for payment purposes. Such surveys will be performed weekly by the Contractor to document dredge volumes. Target elevations will be measured to one-tenth of one foot for evaluation by Engineer that the target elevations have been achieved.

G. Dewatering Sediments (Item ____).

1. The daily rate for Dewatering Sediments work includes;
 - a. Acquisition, operation and maintenance of dewatering facilities.
 - b. Dewatering facilities include a screen, geotextile tubes, the dewatering pad, and associated conveyances.
 - c. On-Site handling and stockpiling of dewatered sediment.
 - d. Pumping effluent back to the Lake.
 - e. Any required polymer addition to achieve WPDES discharge standards.
 - f. Screen operations to remove oversize material.
2. Dewatering is to be performed on a “means and methods” basis, meaning that Contractor has ultimate responsibility to perform, to the best of its abilities and based upon its knowledge and experience, the dredging and dewatering actions to achieve efficient and effective dewatering of sediments and to maximize the workability, dryness, and strength of the dredged sediments prior to stockpiling. Contractor, however, must provide recommendations to, and consult with Owner regarding the following items, and Owner retains the right to direct Contractor, in good faith, as to the following items *provided*, however, that Owner’s direction of these activities may subject Owner to a change order if Owner’s direction increases costs to Contractor beyond the costs associated with Contractor’s recommendations.
 - a. Dewatering chemistry
 - b. Geotextile tube size
 - c. Geotextile tube layout and stacking
 - d. Geotextile tube dewatering periods
 - e. Sediment stockpiling

1.3 Owner agrees to use this retained right to direct sparingly and to work diligently with Contractor in good faith to resolve concerns through the consultation process.

1. Contractor shall be paid for dewatering sediment for the targeted sediment volume and the Planned Overcut volume based on the daily rate for dewatering in (Item ____).
 - a. The daily rate for dewatering sediment shall include the cost of the required dewatering polymers.
 - b. The daily rate shall include the costs of all labor, equipment, and supplies required to efficiently and effectively dewater the sediments.
2. Payment at 75% of the daily rate will be made for dredged volumes approved for payment after the post-dredge QA bathymetric survey under Section 01285, Paragraph 1.2.F. and the remaining 25% of the daily rate will be paid when the material passes the paint filter test and has been on the dewatering pad a minimum of thirty (30) days, each subject to retainage requirements set forth in the Agreement.
3. Payment Deducts for Volumes in Excess of Non-Penalty Overcut Volumes (Item ____)
 - a. A payment deduct of \$50.50 will be made for each cubic yard of measured in situ sediment removed that is greater than the Non-Penalty Overcut Volume averaged by sub-area. The payment deduct covers the additional cost to the Owner to load, haul and dispose of said volumes.

- B. Oversize Material Removal and Disposal (Item ____)
1. The tonnage price for Oversize Material Removal and Disposal work includes:
 - a. Locating and removing major debris from the dewatering site to a WDNR approved landfill.
- C. Geotextile Tube Management and Stockpiling of Sediment (Item ____)
1. The daily unit price for geotextile tube management and stockpiling of sediment work includes:
 - a. An excavator equipped with a clamshell bucket and, if requested, a front end loader.
 - b. Properly trained labor to load trucks and maintain the loading area.
 - c. Maintaining adequate access roads in the stockpile area.
 - d. Maintaining the proper thickness of gravel on the dewatering pad to protect the liner system.
 - e. Replacing any stone from the dewatering pad lost during activities or adversely impacted by blinding on the pad.
 2. Loading operations shall not exceed 6:00 am to 4:30 pm Monday through Friday and 6:00 am to 12:00 noon on Saturday without prior consent of the Owner.
- D. 2009 Demobilization and 2010 Remobilization (Item ____)
1. The lump sum price for 2009 Demobilization and 2010 Remobilization work includes:
 - a. Removal of all Contractor-supplied equipment and materials from the Site unless they are needed for the resumption of Work the following year and unless they can be safely stored on Site over the winter.
 - b. Cleaning of the Site, including the exposed dewatering pad gravel, access roads, and any other surfaces, as appropriate for good housekeeping over the winter and as sufficient to allow resumption of the Work without interruption the following year.
 - c. Remove and properly dispose of any decontamination fluids and chemicals, silt curtain debris, and spilled sediment from the completed dredging season.
 - d. Washing of sediment from external surfaces of equipment and facilities not normally in contact with sediment.
 - e. Removal of any temporary structures not required for resumption of the Work the following year.
 - f. Repair of pavements and other surfaces damaged by the Contractor during this work.
 - g. Winterizing any structures, facilities or equipment properly left on site for the resumption of Work the following year.
 2. With respect to any portion of the Site requiring cleanup under subparagraph I.1.b. above, Contractor shall be responsible for all costs associated with cleaning, loading and replacing impacted media, and shall be responsible for the transportation and proper disposal of such impacted media.
 3. Payment will be made in two lump sum payments, of one-half each, when all work is complete for a given Demobilization and Remobilization effort.

- E. Final Demobilization (Item ____)
1. The lump sum price for Final Demobilization work includes:
 - a. Removal of all Contractor-supplied equipment and materials from the Site.
 - b. Cleaning of the Site, including the dewatering pad, to the extent impacted by bag rupture(s) or residual sediments that significantly compromise the ability of the pad to operate as designed for the remainder of the Work (if any), access roads, and any other surfaces, unless such Cleaning is otherwise limited by agreement with Owner.
 - c. Restoration of the remainder of the Site and private properties impacted by the project to conditions existing at the time of contract award whereby all changes and improvements are kept in place
 - d. Remove and properly dispose of any decontamination fluids and chemicals, silt curtain debris, and spilled sediment from the completed dredging season.
 - e. Washing of sediment from external surfaces of equipment and facilities not normally in contact with sediment.
 - f. Removal of any temporary structures not required for the remainder of the Work (if any).
 - g. Repair of pavements and other surfaces damaged by the Contractor during this work.
 2. With respect to any portion of the Site requiring cleanup under subparagraph J.1.b. above, Contractor shall be responsible for all costs associated with cleaning, loading and replacing impacted media, and Contractor shall be responsible for the transportation and disposal of such impacted media.
 3. Payment will be made in one lump sum when all work is complete and ready to occupy by the Owner.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

- END OF SECTION -

SECTION 01290

PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. This section includes:
 - 1. Administrative and procedural requirements necessary to prepare and process Applications for Payment.

1.2 SCHEDULE OF VALUES

- A. Unit price work will be the Schedule of Values used as the basis for reviewing Applications for Payment.
- B. Format and Content
 - 1. Use the Project Manual table of contents as a guide to establish line items for the Schedule of Values. Provide at least one line item for each specification section.
 - 2. Include the following project identification on the Schedule of Values:
 - a. Project name and location.
 - b. Name of Engineer.
 - c. Engineer's project number.
 - d. Contractor's name and address.
 - e. Date of submittal.
 - 3. Arrange the Schedule of Values per specification section with the following subdivisions, description of work and dollar values for each:
 - a. Subcontractor work.
 - b. Manufacturer or fabricator.
 - c. Supplier.
 - d. Contractor work.
 - 4. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports.
 - 5. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
 - 6. Provide a separate line item in the Schedule of Values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
 - 7. Provide separate line items in the Schedule of Values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
 - 8. Provide a separate line item in the Schedule of Values for each allowance. Show line item value of unit cost allowances as a product of the unit cost multiplied by measured quantity. Use information indicated in the Contract Documents to determine quantities.
 - 9. Each item in the Schedule of Values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.
 - a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the

Schedule of Values or distributed as general overhead expense at Contractor's option.

1.3 APPLICATIONS FOR PAYMENT

- A. Each Application for Payment shall be consistent with previous applications and payments as recommended by the Engineer and approved by Owner.
- B. The period covered by each Application for Payment starts on the day following the end of the preceding period and ends 10 days before the date for each progress payment.
- C. Requests for progress payments shall be at least 10 days before the date established for each progress payment, but not more often than once a month.
- D. Use forms provided by Engineer for Applications for Payment.
- E. Application Preparation Procedures
 1. When requested by the Contractor, the Engineer will determine the actual quantities and classifications of Unit Price Work performed.
 - a. Preliminary determinations will be reviewed with the Contractor before completing Application for Payment.
 - b. Engineer will complete the Application for Payment based on Engineer's decision on actual quantities and classifications.
 - c. Engineer will submit 3 original copies of Application for Payment to Contractor for certification of all 3 original copies.
 - d. Contractor shall submit signed Application for payment to Owner for approval within time frame agreed to at the Preconstruction Conference.
 2. For a lump sum price contract, the Contractor shall prepare a preliminary determination for payment based on the approved Schedule of Values and review with Engineer before completing Application for Payment.
 - a. Submit all 3 original signed copies of Application for Payment to Engineer with signed certification within time frame agreed to at the Preconstruction Conference.
 - b. Engineer will submit all 3 original copies of the Application for Payment with recommendation to Owner.
 3. If payment is requested for materials and equipment not incorporated in the Work, then the following shall be submitted with the Application for Payment:
 - a. Evidence that materials and equipment are suitably stored at the site or at another location agreed to in writing.
 - b. A bill of sale, invoice, or other documentation warranting that the materials and equipment are free and clear of all liens.
 - c. Evidence that the materials and equipment are covered by property insurance.
 4. Complete every entry on form. Execute by a person authorized to sign legal documents on behalf of Contractor.
- F. With each Application for Payment, submit waivers of liens from subcontractors and suppliers for the construction period covered by the previous application.
 1. Submit partial waivers on each item for amount requested before deduction for retainage on each item.
 2. When an application shows completion for an item, submit final or full waivers.

3. Owner reserves the right to designate which entities involved in the Work shall submit waivers.
 4. Submit final Application for Payment with or preceded by final waivers from every entity involved with performance of the Work covered by the application.
 5. Submit waivers of lien on forms executed in a manner acceptable to Owner.
- G. The following administrative actions and submittals shall precede or coincide with submittal of first Application for Payment:
1. List of subcontractors.
 2. Schedule of Values.
 3. Contractor's construction schedule.
 4. Copies of building and other permits.
 5. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
- H. Submit final Application for Payment with releases and supporting documentation not previously submitted and accepted including, but not limited, to the following:
1. Evidence of completion of Project closeout requirements.
 2. Insurance certificates for products and completed operations where required and proof that taxes, fees and similar obligations were paid.
 3. Updated final statement, accounting for final changes to the Contract Sum.
 4. Consent of Surety to Final Payment.
 5. Final lien waivers as evidence that claims have been settled.
 6. Final liquidated damages settlement statement.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

- END OF SECTION -

SECTION 01310

PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative provisions for coordinating construction operations on the Project including, but not limited to, the following:
 - 1. Administrative and Supervisory Personnel
 - 2. Construction Progress Documentation
 - 3. Project Meetings

1.2 COORDINATION

- A. Coordinate construction operations included in different Sections of the Specifications to allow efficient and orderly completion of each part of the Work.
- B. Coordinate construction operations included in different Sections that depend on each other for proper installation, connection and operation.
- C. Coordinate installation of different components to allow maximum performance and accessibility for required maintenance, service, and repair of all components.
- D. Administrative Procedures
 - 1. Provide and implement administrative procedures to include, but are not limited to, the following activities:
 - a. Preparation of Contractor's Construction Schedule.
 - b. Installation and removal of temporary facilities and controls.
 - c. Delivery and processing of submittals.
 - d. Progress meetings.
 - e. Project closeout activities.

1.3 CONSTRUCTION PROGRESS DOCUMENTATION

- A. Prepare and maintain a work activity report for each day on which Work is performed by any personnel or entity for which the Contractor is responsible their activities. Report shall include, but not be limited to, the following:
 - 1. All relevant data and information concerning the progress of work activities including those of Subcontractors, suppliers and other Owner contractors.
 - 2. Document the effect of that activities have on the time of performance of the Contract and/or the cost thereof.
 - 3. Document relevant data and information concerning measurement and payment of the completed Work.
 - 4. Document data and information required to be maintained concerning dredging, dewatering, water treatment and erosion control (see Section 01400, 1.3 Operational Plan.
 - 5. The Contractor's project superintendent or other on-site authorized representative shall complete and sign the daily work activity reports.

- a. Maintain the daily activity report to assure that the information is current, accurate and complete.
 - b. The signature of the Contractor's authorized representative shall constitute a warranty to Owner that, after suitable inquiry, to the best of their knowledge and belief, that all such data is current, accurate and complete as of the date of the report.
- B. Maintain schedules of quantities, costs, progress schedules, wage rates, reports, estimates, invoices, records and other information concerning work performed or to be performed that is needed to substantiate Change Order proposals, claims, or to resolve disputes.

1.4 PROJECT MEETINGS

- A. Preconstruction Conference
1. Contractor shall schedule a preconstruction conference within 14 days after the Contract Times start to run and before Work at the site is started.
 2. Authorized representatives of the Owner, Engineer, and any applicable regulatory agencies, the Contractor and its superintendent; major subcontractors; and other concerned parties shall attend the conference. All participants at the conference shall be familiar with the Project and authorized to make binding decisions of matters relating to the Work.
 3. The purpose of the Preconstruction Conference is to:
 - a. Establish a working understanding among the parties as to the Work.
 - b. Discuss the following preliminary schedules prepared by the Contractor.
 - 1) Progress schedule.
 - 2) Schedule of submittals.
 - c. Processing Applications for Payment.
 - d. Maintaining required records.
 - e. Other Project requirements.
- B. Weekly Progress Meetings
1. Schedule weekly progress meetings at the Project Site to include representatives of the Contractor, Engineer, and Owner.
 2. All participants at the weekly progress meeting shall be familiar with the Project and authorized to make binding decisions on matters relating to the Work.
 3. The minutes and agenda will be a collaborative effort with the Engineer responsible for providing, recording and distributing meeting minutes.
 4. Meeting Agenda:
 - a. Review items of significance that could affect progress of the Work.
 - b. Review progress of the Work since the last meeting.
 - 1) Determine where each activity is in relation to the Contractor's construction schedule, whether on time or ahead or behind schedule.
 - 2) Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so.
 - 3) Discuss whether scheduled revisions are required to insure that current and subsequent activities will be completed within the Contract Time.
 5. Review the present and future needs of each entity present, including the following:
 - a. Interface requirements.
 - b. Time.

- c. Sequences.
 - d. Status of submittals.
 - e. Deliveries.
 - f. Access.
 - g. Site utilization.
 - h. Temporary facilities and services.
 - i. Hours of work.
 - j. Hazards and risks.
 - k. Housekeeping.
 - l. Quality and work standards.
 - m. Change orders.
 - n. Documentation of information for payment requests.
6. Revise the construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue the revised schedule within 5 days after each meeting.

C. Other Project meetings may be held at other times designated by the Owner.

1.5 SUBMITTALS

A. Submit documents as outlined in the following table:

Document	Owner/Engineer	Contractor
Daily Work Activity Report		X
Weekly Meeting Summary	X	X

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

- END OF SECTION

SECTION 01400

QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes

1. Administrative and procedural requirements for quality assurance and quality control.
2. Regulatory Requirements
3. References

1.2 QUALITY CONTROL

A. General

1. Specific quality assurance and quality control requirements for individual construction activities are specified in the Sections that specify those activities.
2. Specific tests, inspections, and related actions do not limit Contractor's other quality control procedures that facilitate compliance with the Contract Document requirements.
3. Quality control is defined as being provided by Contractor, quality assurance is provided by Engineer.

B. Conflicting Requirements

1. If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement.
2. Refer uncertainties and requirements that are different, but apparently equal, to Engineer for a decision before proceeding.
3. The quantity or quality level shown or specified shall be the minimum provided or performed.
 - a. The actual performance may comply with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits.
 - b. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements.
 - c. Refer uncertainties to the Engineer for a decision before proceeding.

C. Submittals

1. Schedule of Tests and Inspections: Prepare in tabular form and include the following:
 - a. Specification Section number and title.
 - b. Description of test and inspection.
 - c. Identification of applicable standards.
 - d. Identification of test and inspection methods.
 - e. Number of tests and inspections required.
 - f. Time schedule or time span for tests and inspections.
 - g. Entity responsible for performing tests and inspections.
 - h. Requirements for obtaining samples.

2. Reports: Prepare and submit certified written reports that include the following:
 - a. Date of issue.
 - b. Project title and number.
 - c. Name, address, and telephone number of testing agency.
 - d. Dates and locations of samples and tests or inspections.
 - e. Names of individuals making tests and inspections.
 - f. Description of the Work and test and inspection method.
 - g. Identification of Specification Section.
 - h. Complete test or inspection data.
 - i. Test and inspection results and an interpretation of test results.
 - j. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
 - k. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
 - l. Name and signature of laboratory inspector.
 - m. Recommendations on retesting and reinspecting.
3. Submit to Owner copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.
4. Tests and inspections not explicitly assigned to Owner are Contractor's responsibility.
5. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction.
6. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
7. Notify Engineer for required testing at least 24 hours in advance of time when Work that requires testing or inspecting by the Owner will be performed.
8. Coordinate sequence of activities to accommodate required quality assurance and quality control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.

1.3 OPERATIONAL PLAN

- A. Specific elements of the Operational Sampling and Analysis Plan that shall be maintained, recorded and reported include, but not be limited to, the following:
 1. Dredging Operation – Record Daily:
 - a. A log of the dates and times that dredging takes place and the approximate hours of actual dredging each day.
 - b. A description of the location of the dredging work each day and a site plan drawing showing the location of dredging work.
 - c. An estimate of in-situ volume of sediment dredged with daily estimates rectified on a weekly basis based on weekly post-dredge surveys conducted by Contractor.
 - d. A list of the equipment on the site with a notation as to the approximate hours of use for each dredge, scow, barge, tug or other operating equipment.
 - e. A description of any large debris encountered and the procedure used to remove and dispose of it.
 - f. A description of any accidents, pipe breaks, equipment failures or spills which occur and a description of corrective measures taken.

- g. At a minimum, weekly bathymetric surveys of the sediment dredging area performed by the Contractor with the data transmitted weekly to the Engineer.
- h. Upon completion of dredging, provide one copy of all records to the Engineer.
- 2. Sediment Dewatering and Water Treatment:
 - a. Comply with the sediment dewatering specification and WDPES permit requirements.
 - b. As a minimum, maintain, record and report the following information of dewatering operations and make available to the Engineer within 24 hours of work, if possible:
 - i. Estimate of cubic yards delivered to dewatering pad each day;
 - ii. Estimate of cubic yards dewatered sediments at the disposal facility each day.
 - iii. Reports describing all spills, accidents, equipment failures or other unforeseen events and corrective actions taken;
 - iv. Observations and test results of carriage water discharge TSS.
 - c. Make all records available for review by Owner at any reasonable time during the Work.
 - d. One bound copy of all records shall be delivered to Engineer upon completion of dewatering work.
- 3. Erosion Control:
 - a. Comply with Best Management Practices.
 - b. Provide erosion control inspection summaries and repair records.
 - c. Make all records available for review by Owner at any reasonable time during the Work.
 - d. One bound copy of all records shall be delivered to Engineer upon completion of dewatering work.
- 4. Effluent – Record daily the following:
 - a. Water volumes discharged to the lake.
 - b. Operation and maintenance activities.
 - c. Disposition of all contaminated filter media.

1.4 REFERENCES

- A. The following standards or organizations referenced in his specification are as follows:
 - AASHTO American Association of State Highway and Transportation Officials
 - ABMA American Boiler Manufacturers Association
 - ACPA American Concrete Pipe Association
 - AGA American Gas Association
 - AMCA Air Movement and Control Association
 - ANSI American National Standards Institute
 - ARI Air Conditioning and Refrigeration Institute
 - ASME American Society of Mechanical Engineers
 - ASPE American society of Plumbing Engineers
 - ASSE American Society of Sanitary Engineering
 - ASTM American Society for Testing and Materials
 - AWWA American Water Works Association
 - AWS American Welding Society
 - CISPI Cast Iron Soil Pipe Institute
 - CS Commercial Standards, Products Standards Sections, Office of Eng. Standards Service, NBS
 - EPA Environmental Protection Agency

FS	Federal Specifications, Superintendent of Documents, U.S. Government Printing Office
IAPMO	International Association of Plumbing & Mechanical Officials
IEEE	Institute of Electrical and Electronics Engineers
ISA	Instrument Society of America
MSSe	Reference is made to the "standard specifications", it shall be construed to mean the pertinent Manufacturer's Standardization Society of the Valve & Fitting Industry, Inc.
NBS	National Bureau of Standards
NEC	National Electric Code
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
NSF	National Sanitation Foundation
PDI	Plumbing and Drainage Institute
STI	Steel Tank Institute
UL	Underwriters Laboratories Inc.

1.5 SUBMITTALS

- A. Quality Control Submittals
1. Submit Operational Plan
 2. Provide data and information generated as required by the Operational Plan to Owner and Engineer at each weekly progress meeting.

- END OF SECTION -

SECTION 01410

REGULATORY REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes
 - 1. Underground Utilities
 - 2. Dewatering
 - 3. Property Monuments
 - 4. Construction Erosion Control, Wisconsin Administrative Code NR 150, NOI.

1.2 UNDERGROUND UTILITIES

- A. Under the provisions of Wisconsin Statutes, Section 182.0175, all contractors, subcontractors, and any firm or individual intending to do work on this contract shall contact all utility firms in the affected area of construction a minimum of three (3) working days prior to beginning construction so that affected utilities will be located and marked.

1.3 DREDGING

- A. Dredging permits obtained by the Owner are included as Appendix ____.

1.4 DEWATERING

- A. WDPES General Permit for discharge of carriage and interstitial water has been applied for by the Owner (Appendix ____). The Contractor shall meet all requirements of the WDPES Permit.
- B. The governing agency in Wisconsin is:

Wisconsin Department of Natural Resources (WDNR)
Private Water Supply Section
P.O. Box 7921
Madison, Wisconsin 53707

1.5 PROPERTY MONUMENTS

- A. Protect iron pipe monuments from movement.
- B. The cost of replacement of any monuments moved or destroyed during construction shall be the Contractor's responsibility.
- C. Perpetuation of destroyed or moved monuments shall be performed in accordance with state statutes by a registered land surveyor.

1.6 CONSTRUCTION EROSION CONTROL

- A. The Contractor is required to obtain all necessary permits for construction erosion control pursuant to Wisconsin Administrative Code NR150, NOI.

- END OF SECTION -

SECTION 01510

TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes
 - 1. Temporary utilities including:
 - a. Temporary electric power.
 - b. Temporary sanitary facilities, including drinking water.
 - 2. Support facilities including:
 - a. Dewatering facilities.
 - b. Project identification and other temporary signs.
 - c. Other construction aids and miscellaneous services and facilities.
 - 3. Protection including:
 - a. Barricades, warning signs, and lights.
 - b. Environmental protection.
- B. Provide temporary facilities and controls required for construction activities except, if any, for facilities and controls indicated as provided by the Owner.
- C. Provide temporary facilities for the Owner's Engineer during construction.

1.2 UTILITY USE CHARGES

- A. Cost or use charges for utilities will be paid by Contractor. Allow other entities to use temporary services and facilities without cost, including, but not limited to, the following:
 - 1. Engineer.
 - 2. Testing agencies.
- B. Contractor will pay water service use charges, whether metered or otherwise, for water used by all entities engaged in construction activities at Project site.
- C. Contractor will pay electric power service use charges, whether metered or otherwise, for electricity used by all entities engaged in construction activities at Site.

1.3 QUALITY CONTROL

- A. Comply with industry standards and with applicable laws and regulations of authorities having jurisdiction, including but not limited to the following:
 - 1. Health and safety regulations.
 - 2. Utility company regulations.
 - 3. Police, fire department and rescue squad rules.
 - 4. Environmental protection regulations.
 - 5. NFPA 241 "Standards for Safeguarding Construction, Alterations and Demolition Operations".

6. ANSI-A10 Series standards for "Safety Requirements for Construction and Demolition".
 7. NECA Electrical Design Library "Temporary Electrical Facilities", NFPA 70, and NEMA, NECA and UL standards and regulations for temporary electric service.
- B. Arrange for authorities having jurisdiction to inspect and test each temporary utility before use. Obtain required certifications and permits.

1.4 PROJECT CONDITIONS

- A. The following conditions apply to use of temporary services and facilities by all parties engaged in the Work:
1. Keep temporary services and facilities clean and neat.
 2. Relocate temporary services and facilities as required by progress of the Work.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Provide undamaged materials in serviceable conditions and suitable for use intended.

2.2 EQUIPMENT

- A. Provide undamaged equipment in serviceable conditions and suitable for use intended.
- B. Provide temporary self-contained toilet units of temporary single-occupant toilet units of the chemical, aerated recirculation, or combustion type for use by all construction personnel. Units shall be properly vented and fully enclosed with a glass-fiber-reinforced polyester shell or similar nonabsorbent material.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Locate facilities where they will serve the Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required.
- B. Provide each facility ready for use when needed to avoid delay. Maintain and modify as required. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.
- C. Temporary Lighting
1. Install and operate temporary lighting that will fulfill security and protection requirements without operating the entire system.
 2. Provide lighting that provides adequate illumination for construction operations and traffic conditions.

- D. Temporary Heat and Ventilation
1. Provide temporary heat and ventilation required for the construction activities, including but not limited to curing or drying completed installations and protecting construction from adverse effects of low temperatures and high humidity.
 2. Use safe equipment that will not have a harmful effect on elements being installed and on completed installations.
 3. Coordinate ventilation requirements to produce the ambient condition required for the work and to minimize energy consumption, and to protect personnel from fumes and other harmful effects.
- E. Heating Facilities
1. Provide vented self-contained heaters with individual space thermostatic control.
 2. Do not use gasoline-burning space heaters, open flame or salamander-type heating units.
- F. Temporary Telephone Service
1. Minimally provide a separate telephone line for each temporary office and first-aid station, and provide a dedicated telephone line for a fax machine in the Contractor's field office.
- G. Temporary Sanitary Facilities
1. Provide for toilets, wash facilities and drinking water fixtures in compliance with regulations and health codes for type, number, location, operation and maintenance of fixtures and facilities.
 2. Provide toilet tissue, paper towels, paper cups and similar disposable materials as appropriate for each facility, and provide covered waste containers for used materials.
 3. Install separate self-contained toilet units for male and female personnel shielded to ensure privacy.
 4. Install wash facilities supplied with potable water at convenient locations for personnel involved in handling materials that require wash-up for a healthy and sanitary condition.
 - a. Dispose of drainage properly.
 - b. Supply cleaning compounds appropriate for each condition.
 - c. Include safety showers, eyewash fountains and similar facilities for the convenience, safety and sanitation of personnel.
 5. Provide drinking water fountains or containerized tap-dispenser bottled-drinking water units, complete with paper cup supplies. Where power is accessible, provide electric water coolers to maintain dispensed water temperatures at 45 to 55°F (7 to 13°C).
- H. Sewers and Drainage
1. If sewers are available, provide temporary connections to remove effluent that can be discharged lawfully.
 2. If sewers can not be used, provide drainage ditches, dry wells, stabilization ponds and similar facilities.
 3. If neither sewers nor drainage facilities can be lawfully used for discharge of effluent, provide containers to remove and dispose of effluent off-site in a lawful manner.

3.2 TEMPORARY SUPPORT FACILITIES

- A. Locate field offices, storage sheds, sanitary facilities and other temporary construction and support facilities for easy access.
- B. Provide incombustible construction for offices, shops and sheds located within the construction area or within 30 feet (9 m) of building lines. Comply with NFPA 241. Provide project identification signs as necessary.
- C. Storage Sheds and Fabrication Shops
 1. Provide sheds and shops that are sized, furnished and equipped to accommodate materials and equipment involved.
 2. Include complete temporary utility services for intended use.
 3. Sheds and shops may be open shelters or fully enclosed spaces, as appropriate for use.
- D. Collection and Disposal of Waste
 1. Collect waste from construction areas and elsewhere daily. Enforce requirements strictly and dispose of material lawfully.
 2. Comply with NFPA 241 for removal of combustible waste material and debris.
 3. Do not hold waste materials more than 7 days.
 4. Handle and properly containerize hazardous, dangerous or unsanitary waste materials separately from other waste.
- E. Provide at least 100 sf office space for Engineer, including a desk, chair, and access to a printer/scanner/facsimile machine and telephone.

3.3 TEMPORARY PROTECTION FACILITIES

- A. Barricades, Warning Signs, and Lights
 1. Comply with standards and code requirements for erecting structurally adequate barricades.
 2. Paint with appropriate colors, graphics, and warning signs to inform personnel and the public of the hazard involved.
 3. Where appropriate and needed, provide lighting, including flashing red or amber lights.
- B. Environmental Protection
 1. Provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations, and minimize the possibility that air, waterways, and subsoil might be contaminated or polluted or that other undesirable effects might result.
 2. Avoid using tools and equipment that produce harmful noise.
 3. Restrict use of noise-making tools and equipment to hours that will minimize complaints from persons near the site.

3.4 OPERATION, TERMINATION, AND REMOVAL

- A. Supervision
 1. Enforce strict discipline in use of temporary facilities.

2. Limit availability of temporary facilities to essential and intended uses to minimize waste and abuse.
- B. Maintenance
1. Maintain facilities in good operating condition until removal.
 2. Protect from damage by freezing temperatures and similar elements.
 3. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
 4. Prevent water-filled piping from freezing.
 5. Maintain markers for underground lines.
 6. Protect underground lines from damage during excavation operations.
- C. Termination and Removal
1. Unless the Owner requests that a temporary facility be maintained longer, each temporary facility shall be removed when the need for its service has ended and can be replaced by authorized use of a permanent facility.
 2. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with the temporary facility.
 3. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
 4. Materials and facilities that constitute temporary facilities are the property of the Contractor, except the Owner reserves the right to take possession of project identification signs.
 5. Remove temporary paving not intended for or acceptable for integration into permanent paving.
 - a. Where the area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for subsoil or fill in the area.
 - b. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns.
 - c. Repair or replace street paving, curbs, and sidewalks at temporary entrances, in accordance with the requirements of the governing authority.

- END OF SECTION -

SECTION 01570

TEMPORARY EROSION AND SEDIMENT CONTROL

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes
 - 1. Erosion bales and bags.
 - 2. Silt fence.
 - 3. Riprap.
 - 4. Erosion mats.
 - 5. Temporary ditch checks (TDC).

1.2 REFERENCES

- A. Wisconsin Department of Transportation (DOT), Erosion Control, Product Acceptability Lists for Multi-Modal Applications (PAL), January 1999 edition.
- B. State of Wisconsin Construction Site Best Management Practice Handbook, Publication WR-222-89. Copies are available by contacting the following:
 - 1. State of Wisconsin
Department of Natural Resources
Non-Point Service and Land Management Section
101 S. Webster Street
P.O. Box 7921
Madison, WI 53707-7921
 - 2. Document Sales and Distribution
202 South Thornton Avenue
P.O. Box 7840
Madison, WI 53707
608/266-3358
- C. American Society for Testing and Materials (ASTM)
 - 1. ASTM D1388 Test Method for Stiffness of Fabrics
 - 2. ASTM D2487 Test Method for Classification of Soils for Engineering Purposes
 - 3. ASTM D3776 Test Method for Mass Per Unit Area (Weight) of Woven Fabric
 - 4. ASTM D4355 Test Method for Deterioration of Geotextiles from Exposure to Ultraviolet Light and Water (Xenon-Arc Type Apparatus)
 - 5. ASTM D4491 Test Method for Water Permeability of Geotextiles by Permittivity
 - 6. ASTM D4632 Test Method for Grab Breaking Load and Elongation of Geotextiles
 - 7. ASTM D4751 Test Method for Determining Apparent Opening Size of a Geotextile
 - 8. ASTM D4833 Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products

9. ASTM D5035 Test Method for Breaking Strength and Elongation of Textile Fabric (Strip Method)
10. ASTM D5338 Test Method for Determining Aerobic Biodegradation of Plastic Materials Under Controlled Composting Conditions

1.3 SYSTEM DESCRIPTION

- A. Design Requirements
 1. Select and design method of erosion and sediment control in accordance with local erosion control ordinances. Follow the State Construction Site Best Management Practices.
- B. Performance Requirements
 1. Provide and construct the erosion control measures necessary to prevent the runoff, tracking, or loss of soil materials by water or mechanical action from the disturbed portions of the Project Site.
 2. Maintain the existing erosion control system from a time period starting with Contractor mobilization and ending with Contractor demobilization and restoration.
 3. Provide erosion control shown on the Drawings, as a minimum.
 4. Provide erosion control as directed by the Engineer.
 5. Provide additional erosion and sediment control to prevent erosion which may be caused due to selected construction methods.

1.4 SUBMITTALS

- A. NR 150 NOI Application.
- B. Erosion control plan (at a minimum includes one plan view drawing per site with erosion control delineated and identified).
- C. Manufacturer's certification for manmade products.
- D. Catalog cuts and other information that verify's conformance to these Specifications.
- E. Riprap design (if used).

PART 2 - PRODUCTS

2.1 EROSION BALES AND BAGS

- A. Erosion Bales
 1. Tightly compacted bales of grain straw or hay.
 2. Use straw, if required to function for more than 15 days.
- B. Support Post
 1. Wood or steel construction, minimum length 4 feet.
 2. Wood posts - 2" x 2" or equivalent steel posts.

2.2 SILT FENCE

A. Geotextile Fabric

1. Fabric shall be either woven or non-woven polyester, polypropylene, stabilized nylon, polyethylene or polyvinylidene chloride.
2. Fabric shall have the minimum strength values in the weakest principal direction.
3. Non-woven fabric may be needle punched, heat bonded, resin bonded or combination thereof.
4. Fabric shall meet the following requirements:
 - a. If silty soils on-site then the following can be used:

i. Grab Tensile Strength	ASTM D4632	101 lbs. (450 N)
ii. Apparent Opening Size	ASTM D4751	0.3 mm
iii. UV Resistance Strength Retained at 500 Hours (%)	ASTM D4355	70
iv. Permittivity (per second)	ASTM D4491	0.14
 - b. If sandy soils on-site then the following can be used:

i. Grab Tensile Strength	ASTM D4632	101 lbs. (450 N)
ii. Apparent Opening Size	ASTM D4751	0.3 mm to 0.8 mm
iii. UV Resistance Strength Retained at 500 Hours (%)	ASTM D4355	70
iv. Permittivity (per second)	ASTM D4491	0.14

B. Support Posts

1. Wood or steel construction minimum length 5 feet.
2. Wood posts - 2" x 2" or equivalent steel posts.

2.3 RIPRAP

- A. Riprap is normally used for permanent erosion control. However, should this method of erosion control be selected, or for construction of temporary ditch checks, provide as follows:
1. Provide minimum thickness of 1.0 feet (300mm) measured perpendicular to the base.
 2. More than 50 percent of stones shall weigh more than 50 lb.
 3. If severe erosion is anticipated, submit riprap design to the Engineer.

2.4 TEMPORARY VEGETAL COVER

A. Temporary Seed Mixture Components

Species	Min. % Purity	Min. % Germ.	Lbs. per Acre
Oats	98	90	80
Rye	98	85	100

- B. Use rye grass when permanent seeding is to follow within one (1) year.

2.5 TEMPORARY EROSION MATS

A. General

1. Netting, if used, shall not exceed 15% of the total blanket weight.
2. Bond the netting to the parent material to prevent separation for the life of the project (minimum two months).

B. Types

1. Type A:
 - a. Used for slopes 2.5:1 or flatter (not to be used in channels).
 - b. Minimum shear stress required is 1.0 lbs/ft² (50 pa).
 - c. Not to be used in channels.
2. Type B:
 - a. Used for slopes 2:1 or flatter or in channels when design shear stress is less than the minimum shear stress of the mat used.
 - b. Minimum shear stress required is 1.5 lbs/ft² (70 pa).
 - c. Channel mat roll width shall be 6 feet (1.8m) or greater.
3. Type Urban (Urban Areas and Lawn Areas Where Mowing Will Occur):
 - a. Use only 100% organic biodegradable netted products including parent material, stitching and netting.
 - b. Minimum thickness shall be $\frac{3}{8}$ inch (9mm) as measured in-place.
 - c. Mats placed on slopes greater than 4:1 and up to 2.5:1 shall be double netted.
 - d. Netting and installation shall not pose a safety risk to pedestrians walking on or crossing the mat.

C. Anchoring Devices

1. Anchoring and components for temporary erosion mats shall be completely biodegradable as determined by ASTM D5338.
2. Materials shall be environmentally safe for soil and groundwater.
3. Do not use petroleum based plastics or composites.
4. Do not use materials which may present a hazard from splintering or spearing.
5. Design anchors to hold a minimum of two months and be substantially degraded within four months during the summer (warm soil conditions).

D. Jute fabric shall meet the following general requirements:

1. Uniform, open weave of single jute yarn.
2. Twisted construction having an average twist of not less than one and one-half turns per inch.
3. Furnished in rolled strips 48 inches wide with a minimum of 78 wrapped ends.
4. Fabric shall have a minimum of 41 weft yarns per linear yard of length.
5. Weight of fabric shall be a minimum of 92 lbs. per 100 square yards.
6. Non-toxic to vegetation.
7. Smolder resistant.

E. Wood fiber blanket shall meet the following general requirements:

1. Uniform web of interlocking wood excelsior fibers.
2. Uniform thickness.
3. Weight - 78 pounds per 80 square yards.
4. Have net backing on one side as follows:
 - a. Mesh size not exceeding 1½ inches by 3 inches.
 - b. Woven of twisted paper, cotton cord or biodegradable plastic.

5. Non-toxic to vegetation.
- F. Material Properties
1. Porosity Calculated 85-90%.
 2. Stiffness ASTM D1388 2,000 mg-cm (maximum).
 3. Weight ASTM D3776 18 oz/s.y.
 4. Tensile Strength ASTM D5035 (2 inch strip).
 - a. Length Direction 15 lb.
 - b. Width Direction 5 lb.
 5. Elongation ASTM D5035 (2 inch strip).
 - a. Length Direction 150%
 - b. Width Direction 100%
 6. Use flexible mat of polyvinylchloride monofilaments bonded together into a three-dimensional web designed exclusively to serve as an erosion control and revegetation mat.
- G. Staples
1. Staples for anchoring erosion mat shall meet the following minimum requirements:
 - a. U-shaped.
 - b. No. 11 gage or larger diameter steel wire.
 - c. Width of one to two inches.
 - d. Length:
 - i. Not less than six (6) inches for firm soil.
 - ii. Not less than twelve (12) inches for soft or loose soils.
 - iii. Not less than eight (8) inches where erosion mat is placed over sod.
 2. Pins shall have a 3/16 inch shank diameter with attached 1½ inch washer.
 3. Staples shall have a ¾ inch shank diameter with a 1" minimum top width.

2.6 TEMPORARY DITCH CHECKS (TDC)

- A. Make TDC of materials that are either biodegradable, that can be removed during long term erosion control construction activities, or that will not conflict with long term erosion and sediment control structures if left in-place.
- B. Submit a list of TDC materials to the Engineer for review.

2.7 GEOTEXTILE FABRICS

- A. In accordance with section "Geotextiles Fabrics."

PART 3 - EXECUTION

3.1 GENERAL

- A. Install erosion control devices in accordance with the approved NOI.
- B. Keep disturbed areas to a minimum.

- C. Stabilize and protect disturbed areas with temporary seed and mulch within 14 days of active disturbance of the soil surface.
- D. Place excavated trench material on the high side of the trench where appropriate.
- E. Discharge trench water to filter barrier prior to release into a drainage way.
- F. Install gravel mats at site vehicle entrance and site exit locations to prevent tracking of soil.
- G. Collect tracked soil and clean from paved roads near the construction site the same day it occurs.
- H. Sediment control measures shall be in place at the end of each working day.
- I. Locate soil stockpiles no closer than 25 feet of a roadway, wetland, or drainage control channel and control by covering the pile with tarpaulins, temporary seed and mulch or other suitable means, if the pile is exposed for 14 days or more.
- J. Protect storm inlets including inlets in paved roadways with erosion bales, geotextile fence or other suitable approved barriers.
- K. When it is necessary to cross waterways, provide crossing structures for machinery.
- L. Repair, replace, and maintain erosion and sedimentation structures until vegetation is re-established or permanent structures are installed.
- M. Remove temporary erosion control structures and accumulated sediment and/or debris when vegetation is established.

3.2 EARTH STRUCTURES

- A. Utilize one or more of the following:
 1. Earth Structures
 - a. Berms or embankments.
 - b. Sedimentation basins and traps.
 - c. Temporary diversion ditches.
 - d. Temporary chutes and ditches.
 - e. Grade control structures.
 2. Construct earthen structures using standard net weights and techniques including fine grading and compaction.

3.3 EROSION AND SEDIMENTATION CONTROL DEVICES

- A. Erosion Bales
 1. Place where shown on the Drawings at a minimum.
 2. Place bales or bags end to end across surface water flow path.
 3. Place bales or bags at right angles to the direction of water flow.
 4. Embed and securely anchor bales with wood or steel stakes or posts.
 5. Excavate shallow sump on the upstream side of bales or bags.

6. Place bales so that the bindings are oriented around the sides rather than on top and bottom.
7. Wedge gaps between bales with straw to prevent water from flowing between bales.
8. Entrench straw bales fence or sand bags at least 4 inches into the ground. Slope up the upslope side of fence to the bales at least 4 inches.
9. Place bales or bags prior to disturbing upslope areas.
10. Drive support posts a minimum of 12 inches into the subgrade and extend to the top of the bales or bags.
11. Remove from the site after final stabilization.

B. Silt Fences

1. Place geotextile (silt) fence prior to disturbing upslope areas.
2. Excavate trench approximately 4 inches by 4 inches along perimeter of area to be fenced.
3. Secure and continuously anchor bottom of geotextile (silt) fence with excavated material in trench bottom.
4. Install support post on downstream side of the geotextile to a depth adequate to stabilize geotextile fence (12" minimum depth).
5. Secure geotextile to posts.
 - a. Staples - ½" deep.
 - b. Staple to up slope side of post.
6. Backfill over geotextile in trench and compact.
7. Maximum spacing of the posts shall not exceed 10 linear feet.

C. Riprap

1. Place riprap by mechanical methods.
2. Place riprap upon appropriate geotextile fabric.

D. Erosion Mats

1. Installation
 - a. See plan details for anchor trench (at ends, checks and edges) installation procedures.
 - i. Anchor trenches shall be 12" deep.
 - ii. Compact anchor trench backfill.
 - iii. Place staples in end and check trenches spaced at 12 inches.
 - b. Follow manufacturer's specifications and instructions for placement unless project documents are more stringent.
 - c. Roll width overlaps shall be 12" at edges. Pin or staple every 3 feet along overlap length.
 - d. Roll end overlaps may be spliced by overlapping (in the direction of water flow) two feet with the upstream portion of the mat on top of the downstream portion. This overlap shall receive at least three pins or staples with a maximum spacing of 12 inches.
 - e. Pins or staples shall be 18" in length minimum driven flush with the mat.
 - f. Place mat flat conforming to contours in soil surface. Do not stretch mat.
 - g. Place mat from toe of slope toward top of slope.
 - h. Mat can be placed from downstream toward upstream or from upstream toward downstream.
2. Site Preparation (See also Section "Landscaping - Turf Establishment")
 - a. Place seed and fertilizer prior to placing permanent erosion geomat.

- b. Seed and fertilizer may be placed after permanent erosion mat installation with Engineer's approval.
 - c. Ground surface shall be smooth and compact.
 - d. Remove all rocks, dirt clods, stumps, roots, grass clumps, trash and other obstructions from lying in direct contact with the soil surface and the erosion mat.
- E. Temporary Ditch Checks
- 1. Installation:
 - a. TDC shall be capable of maintaining location and form during and after rainfall events.
 - b. TDC shall be placed at locations shown on the Drawings.
 - c. Place TDC generally perpendicular to the flow line of the ditch and extend far enough so the ground level on the ends of the TDC are a minimum 18 inches higher than the flow line.

3.4 MAINTENANCE

- A. Inspect silt fences and filter barriers immediately after each rainfall and at least daily during prolonged rainfall.
 - 1. Make any required repairs immediately.
 - 2. Maintain temporary erosion and sedimentation control structures until permanent soil erosion controls are completed and/or vegetation is established.
 - a. Repair damaged structures.
 - b. Replace lost structures.
 - c. Remove sediment from deposition areas adjacent to erosion control structures without damaging structures on a regular basis.
 - d. Refill eroded areas as required for grade stabilization.
- B. If the fabric on a silt fence or filter barrier decomposes or becomes ineffective prior to the end of the expected usable life and the barrier still be necessary, replace the fabric promptly.
- C. Remove sediment deposits after each major storm event and when deposits reach approximately one-half the height of the barrier.
- D. Remove any sediment deposits remaining in place after the silt fence or filter barrier is no longer required and dress to conform with the existing grade, prepared and seeded.
- E. Repair/restore any washed out areas.
- F. Maintenance period to be entire project period including the one year warranty.
- G. Owner may direct Contractor to remove the temporary erosion control measures any time during the one year correction period.
- H. Construct permanent erosion control measures immediately after earthwork is completed.

- END OF SECTION -

SECTION 01700

EXECUTION REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes
 - 1. Examination
 - 2. Preparation
 - 3. Site and facilities design
 - 4. Installation
 - 5. Demobilization
 - 6. Site Restoration

1.2 SUBMITTALS

- A. At least 14 days prior to planned commencement of dredging activities, provide Engineer designs and layouts of all project elements listed in Section 01700, 3.3.
- B. Engineer shall review and take action on each submittal prior to commencement of dredging activities.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Existing Conditions
 - 1. The existence and location of site improvements, utilities, and other construction indicated as existing are not guaranteed. Before beginning work, investigate and verify the existence and location of mechanical and electrical systems and other construction affecting the Work.
 - 2. The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning site work, investigate and verify the existence and location of underground and underwater utilities and other construction affecting the Work.
 - 3. Before construction, verify that the facilities provided are adequate, safe, operational and ready for use.
- B. Acceptance of Conditions
 - 1. Examine and record observations of substrates, areas, site conditions, and water treatment conditions for compliance with requirements and conditions affecting performance.
 - 2. Verify compatibility and suitability of the existing facilities with proposed facilities.

3. Correct unsatisfactory conditions before the dredging process begins.
4. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Furnish information to local utility that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.
- B. Field Measurements
 1. Take field measurements as required to fit the Work properly.
 2. Where portions of the Work are required to fit to other facilities, verify dimensions of other facilities by field measurements before progressing with the Work to avoid delaying the Work
 3. Verify space requirements and dimensions of items shown diagrammatically on Drawings.
- C. Review of Contract Documents and Field Conditions
 1. Immediately on discovery of the need for clarification of the Contract Documents, submit a request for information to Engineer.
 2. Include a detailed description of problem encountered, together with recommendations for changing the Contract Documents.

3.3 SITE AND FACILITIES DESIGN

- A. Contractor is responsible for designing the site, dredge process facilities and any other facilities required to complete the Work to meet the design parameters of the processes.
- B. Prior to the start of construction prepare site design drawings and detail design drawings showing the location and construction details of dredging process and other temporary facilities including, but not limited to, the following:
 1. Dredging pipeline layout.
 2. Buoy and safety marking plan.
 3. Booster pump facility.
 4. Disposal area access road and erosion control plan.
 5. Effluent booster pump station.
 6. Dewatering Pad alignment and support facilities.
- C. Site design drawings and detail design drawings shall show the location, size, dimensions, layout, materials, piping, and all other facilities required to complete the Work.
- D. Facilities that will handle, process, transport, and contain sediment; and convey carriage water and other temporary facilities shall be located on land approved by the Owner.
- E. Protect and maintain existing public roadways. Dredge pipes will be either installed through existing culverts at driveways or trenched below grade.

- F. Owner will provide the site for the dewatering facilities as presented on the Site Plans (Appendix ___).
- G. Contractor is responsible to prepare dewatering area including but not limited to clearing, grubbing, and construction of berms, access roads, and dewatering areas, grading and necessary appurtenances (discharge structure, effluent booster pump station, etc.) to convey carriage water and precipitation from dewatering area to Nagawicka Lake.
- H. Stormwater Facilities
 - 1. Provide facilities such as berms, curbs drainage ditches or other approved means which will protect the areas that handle, process, store and transport sediment against stormwater run-on or run-off.
 - 2. Design stormwater run-on and run-off facilities to handle, at a minimum, the run-on and run-off from a 24 hour storm with 25 year recurrence interval.
 - 3. Provide the means necessary including providing pumps and related equipment to manage stormwater from the time period prior to start of dredging and until all the Work is complete and the Site is restored.
- I. Dewatered Sediment Facilities
 - 1. Provide means and equipment for the temporary stockpiling and grading of dewatered sediments for disposal at the dewatering facility site.
- J. Design and prepare the stockpile and loading area on the dewatering area pad.

3.4 INSTALLATION

- A. Maintain conditions required for system performance.
- B. Conduct operations so no part of the Work is subjected to damaging operations or process loading in excess of that expected during normal conditions.

3.5 DEMOBILIZATION

- A. Remove equipment, building materials, temporary facilities and all other materials brought to the Site to complete the Work.
- B. Remove temporary piling, silt curtain anchors, tie downs, cables and buoys and any other facility items located in the river or on shore to complete the Work.
- C. Remove and dispose of debris placed on the shore.

3.6 RESTORATION

- A. Unless otherwise specified or noted on the Drawings, completely restore the Site to a condition present prior to the start of the Work except any items the Owner requests to be left in-place.
- B. Restore the surface of all disturbed areas to a like condition of that prior to the Work.

- C. Sawcut and remove all damaged pavements to the nearest existing joints, or with prior approval, to straight and neat lines and repair with like materials to the full depth of the pavement as existed prior to the Work.
- D. Upon completion of all dewatering operations, remove equipment and salvageable materials from Site.
- E. Replace trees and shrubs removed with grass seed fertilizer and mulch.
- F. Restore surfaces in kind, i.e., grass, asphalt, gravel, etc.
- G. Remove all temporary structures.

- END OF SECTION -

SECTION 02050

SOILS AND AGGREGATES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes
1. Engineered soils and aggregates materials
 2. Bank run soils materials
 3. Manufactured and special soils

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM)
1. ASTM C33 Spec. for Concrete Aggregates.
 2. ASTM C88 Test for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate.
 3. ASTM C117 Test for Material Finer than No. 200 Sieve in Mineral Aggregates by Washing.
 4. ASTM C131 Test for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
 5. ASTM C136 Sieve Analysis of Fine and Coarse Aggregates.
 6. ASTM C144 Spec. for Aggregate for Masonry Mortar.
 7. ASTM C207 Spec. for Hydrated Lime for Masonry Purposes.
 8. ASTM C535 Test for Resistance to Degradation of Large-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
 9. ASTM C602 Spec. for Agricultural Liming Materials.
 10. ASTM D75 Sampling Aggregates.
 11. ASTM D422 Particle Size Analysis of Soils.
 12. ASTM D448 Spec. for Standard Sizes of Coarse Aggregate for Highway Construction.
 13. ASTM D1140 Test for Amount of Material in Soils Finer than the No. 200 Sieve.
 14. ASTM D1241 Spec. for Materials for Soil-Aggregate Subbase, Base, and Surface Courses.
 15. ASTM D2216 Laboratory Determination of Water (Moisture) Content of Soil, Rock, and Soil Aggregate Mixtures.
 16. ASTM D2487 Classification of Soils for Engineering Purposes.
 17. ASTM D4318 Test Method for Liquid Limit, Plastic Limit, and Plasticity of Soils.
 18. ASTM D5268 Standard Specification for Topsoil Used for Landscaping Purposes.

1.3 SUBMITTALS

- A. Provide test reports showing the results of required material testing.

- B. Provide topsoil analysis performed in accordance with ASTM D5268 and demonstrating the topsoil meets Soil Conservation Service specified soil types. Also, submit results of test for nutrient levels and provide recommendations for fertilizer type and application.
- C. Daily delivery tickets for each load of material delivered to the site.

1.4 QUALITY ASSURANCE

- A. An independent testing laboratory approved by the Owner shall be obtained by the Contractor and provide quality control testing.

PART 2 - PRODUCTS

2.1 ENGINEERED SOILS AND AGGREGATES (SOIL CLASS A)

- A. General
 - 1. Material shall be clean, sound, hard, dense, durable, field or quarry stone which is free from seams, cracks, or other structural defects. It shall be angular material from shot rock (blasted) or crushed rock having substantially all face of which have resulted from artificial crushing.

2.2 ENGINEERED SOILS AND AGGREGATES (SOIL CLASS B)

- A. General
 - 1. Aggregate shall be hard, strong, durable particles free from seams, cracks, and other structural defects.
 - 2. Rounded to subangular.
 - 3. Free from organic impurities and debris.
 - 4. Material shall not be frozen.

B. Gradation

- 1. Soil Class B-2 (Coarse Aggregate - ASTM C33 - No. 6)

Sieve Size	% Passing by Weight
1-inch	100
¾-inch	90-100
½-inch	20-55
3/8-inch	0-15
No. 4	0-5

2.3 ENGINEERED SOILS AND AGGREGATES (Soil Class C)

- A. General
 - 1. Stone shall be hard, durable, granular material of uniform quality resulting from crushed rock or crushed bank run sand and gravel.
 - 2. Material shall be free from clay lump, organic matter, shale, excess, elongated or flat pieces, and other deleterious substances.

2.4 BANK RUN SOILS

A. Soil Class F-1 (Topsoil)

1. Topsoil shall meet the definition and specification stated in ASTM D5268 and meets one of the following SCS (Soil Conservation Service) soil textures:
 - a. Loam.
 - b. Sandy loam.
 - c. Silt loam.
 - d. Silty clay loam.
 - e. Clay loam.
2. The topsoil shall consist of adequate mineral content to support the growth of the intended vegetation and shall not contain herbicides which would be detrimental for the intended use.
3. The topsoil shall have adequate fertility for quick establishment of vegetation.
4. The pH of the topsoil shall be between 6.0 and 7.0.
5. Topsoil shall be free from deleterious substances.
6. Pulverize and screen the topsoil such that 100 percent passes the 1-inch (25 mm) sieve and at least 90 percent passes the No. 10 (2.00 mm).

B. Soil Class G-1 (Clean Earth Fill)

1. Soil Class G-1 shall be any soil material excavated on the project site or obtained from borrow areas.
2. Soil materials unsuitable and, therefore, not approved for this classification are:
 - a. Soils with high organic contents such as: topsoil, peat, muck, organic silts, and clays, marls, etc.
 - b. Manmade or rubble filled soils containing such materials as: foundry sand, fly ash cinders, asphalt, and concrete rubble, etc.
 - c. Silty soils such as: rock flour, loess, etc.
 - d. Soils with gravel larger than 3-inch.
 - e. Silty clay or clays with a high plasticity (CH soils as defined in ASTM D2487).
 - f. All soil contaminated with hazardous waste materials as defined by the EPA.

2.5 SOURCE QUALITY CONTROL

- A. To establish acceptability of material, perform tests for each soils class in accordance to the following standards:
 1. One (1) test per 500 cy of material placed.
 2. Perform one (1) acceptable test for each type of material at each source.

PART 2 - EXECUTION

2.1 APPLICATION

- A. Use the soil classification as specified or stated on Drawings.
- B. Place material in accordance with the Drawings and appropriate Specification Sections for the type of work being performed.

- END OF SECTION -

SECTION 02074

GEOTEXTILE FABRICS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes
 - 1. Geotextile fabrics for geotextile dewatering tubes
 - 2. Geotextile fabrics for dewatering pad geomembrane protection
 - 3. Geotextile fabrics for erosion control

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM)
 - 1. ASTM D4355 Test Method for Deterioration of Geotextiles from Exposure to Ultraviolet Light and Water.
 - 2. ASTM D4533 Test Method for Trapezoid Tearing Strength of Geotextiles.
 - 3. ASTM D4491 Test Methods for Water Permeability of Geotextiles by Permittivity.
 - 4. ASTM D4595 Test Method for Tensile Properties of Geotextiles by the Wide-Width Strip Method.
 - 5. ASTM D4632 Test Method for Grab Breaking Load and Elongation of Geotextiles.
 - 6. ASTM D4751 Test Method for Determining the Apparent Opening Size of a Geotextile.
 - 7. ASTM D4833 Test Method for Index Puncture Resistance of Geotextiles, Geomembranes and Related Products.
 - 8. ASTM D4884 Standard Test Method for Strength of Sewn or Thermally Bonded Seams of Geotextiles.
 - 9. ASTM D5261 Standard Test Method for Measuring Mass per Unit Area of Geotextiles.

1.3 SUBMITTALS

- A. Provide, at the time of delivery of the geotextile fabric, a manufacturer's Certificate of Compliance that the geotextile fabric meets the requirements of this Section.

1.4 DELIVERY, STORAGE AND HANDLING

- A. Deliver geotextile fabric in a wrapping which will protect the fabric from ultraviolet radiation and from abrasion due to shipping and hauling.
- B. Store geotextile fabric in a dry location until installed.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Provide geotextile fabric consisting of either woven or non-woven polyester, polypropylene, stabilized nylon, polyethylene or polyvinylidene chloride. All fabric shall have the minimum strength values in the weakest principle direction. Non-woven fabric may be needle punched, heat bonded, resin bonded or combinations thereof.
- B. The geotextile fabric shall be insect, rodent, mildew and rot resistant.
- C. Clearly mark the geotextile fabric rolls showing the type of fabric.
- D. Where sewn seams are used, provide a field sewn seam sample produced from the geotextile fabric and thread and with the equipment to be used on the project, prior to its incorporation into the work.

2.2 MATERIALS

- A. Non-Woven Geotextile Fabric
 - 1. Non-woven geotextile fabric shall be used beneath the dewatering pad drainage stone.
 - 2. The fabric shall comply with the following physical properties:

Test	Method	Value ¹
Grab Tensile Strength (lbs.)	ASTM D4632	160 min.
Puncture Strength (lbs.)	ASTM D4833	85 min.
Apparent Breaking Elongation (%)	ASTM D4632	50 min.
Apparent Opening Size (U.S. Standard Sieve)	ASTM D4751	70
Permittivity, sec. ⁻¹	ASTM D4491	1.30 min.

¹All numerical values represent minimum/maximum average roll values (i.e., the average of minimum test results on any roll in a lot should meet or exceed the minimum specified values).

- 3. The following fabrics are approved:
 - a. Propex Geotex 601
 - b. GSE NW6
 - c. Mirafi-160N
 - d. Approved equal

B. Woven Geotextile Fabric for Geotextile Dewatering Tubes

1. Geotextile dewatering tube material shall be fabricated from polypropylene multifilament and monofilament yarns, which are woven into a stable network such that the yarns retain their relative position. The geotextile dewatering tube material shall be inert to biological degradation and resistant to naturally encountered chemicals, alkalis, and acids.
2. The geotextile dewatering tube material shall be fabricated by sewing together mill widths of geotextile to form a tubular shape.
3. Geotextile dewatering tubes fabricated 45 feet or greater in circumference must be fabricated with the mill roll length of the geotextile and the adjacent seams being in the circumferential direction with the closure of the tube having a longitudinal seam on the bottom of the container. Each tube shall be fabricated with one or more PVC filling ports located along the top centerline. The filling port is comprised of 1.5 inch thick inside and outside flange rings that sandwich the geotextile surface between 1/8-inch thick rubber gaskets secured with 3/4-inch bolts. Additionally, the fill port shall include a fabric sleeve that clamps around the feed line to prevent leakage.
4. PVC fill ports for the attachment of the dredge to the tube shall be located at intervals of no more than 100 feet, or as recommended by the manufacturer. Fill ports shall be ridged PVC with an inner port body and outer port body each comprising one or more cellular surfaces capable of distributing a force caused by the clamping of the inner port body and outer port body together with steel bolts and nuts. Fill ports shall be either 4-inch or 8-inch in diameter with a 48-inch long, flexible non-woven 8 oz/sy geotextile sleeve.
5. The fabric shall comply with the following minimum physical requirements:

Parameter	Method	Value ¹	
		MD	XD
Wide Width Tensile Strength (ppi at ultimate)	ASTM D4595	400	550
Wide Width Tensile Elongation (percent)	ASTM D4595	20 max	
Apparent Opening Size (U.S. sieve size)	ASTM D4751	40	
UV Degradation (% strength retained after 500 hr)	ASTM D4355	80	
Water Flow Rate (gpm/sq ft)	ASTM D4491	20	
Mass/Unit Area (oz/sq yd)	ASTM D5261	17.3 (typical value)	
Factory Seam Strength (ppi)	ASTM D4884	400	

¹All numerical values represent minimum/maximum average roll values (i.e., the average of test results on any roll in a lot should meet or exceed the minimum values in the table.

6. The fabric shall be insect, rodent, mildew and rot resistant.
7. The following woven fabrics are approved:
 - a. Ten Cate Nicolon – GT 500
 - b. Approved Equal
8. Geotextile dewatering tubes shall be 60-foot circumference by 120 feet long.
9. Contractor shall provide dewatering tube geotextile with a factor of safety of at least 3 for failure of seams and material failure.

PART 3 - EXECUTION

3.1 SEWING

- A. Sew factory and field seams with a thread having the same or greater durability as the material in the fabric. The seams shall be parallel stitch lines with 1.4 inch spacing. The sewing thread shall be multi-ply polyester filament yarn.
- B. Seams shall develop a tensile strength equal to or greater than 80 percent of the specified grab tensile strength of the fabric, unless otherwise specified.

- END OF SECTION -

SECTION 02160

SEDIMENT DEWATERING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes
 - 1. Dewatering Requirements
 - 2. Collection of carriage water
 - 3. Dewatering pad construction

1.2 SYSTEM DESCRIPTION

- A. Current Requirements
 - 1. The design requires a screen followed by the use of geotextile tubes for sediment dewatering.
 - 2. The Contractor shall determine whether a thickener is needed for the process, based on sediment characteristics.
 - 3. Acceptance of sediment dewatering area pad for operation of the dewatering work.
 - 4. Maintain loading and hauling areas and surfaces for dewatered sediments for use by others and coordinate with others.
 - 5. Maintain facilities for the collection of water from dewatering sediments and conveying these waters for discharge.

- B. Performance Requirements for Design or Alternate Design

Selected dewatering equipment and methods shall dewater dredged sediments to the degree required to pass a paint filter liquids test, to achieve the efficient and effective dewatering of sediments, and to maximize the workability, dryness, and strength of the dredged sediments prior to loading for disposal (subject also to deducts set forth in Section 01285).

- C. Owner and Contractor will work together on a cooperative basis so that dewatered material can be handled in the optimal fashion at the dewatering facility site.

1.3 SUBMITTALS

- A. Quality Control Submittals
 - 1. Submit for approval a dewatering site layout plan including berm location, berm construction methods, a dewatering and water treatment process flow diagram and calculations, suspended solids, control measures, erosion control measures, and loadout facilities.
 - 2. Submit a description of the geotextile dewatering tubes and calculations indicating that the sediment will be dewatered to the required percent solid content to meet the paint filter test.
 - 3. Submit a description of the dewatered sediment handling and loading operation.

4. Prepare a process flow diagram showing the proposed method of dredging, dewatering, and water treatment of sediments and carriage water complete with information on the volumes or weights of sediments and water to be handled by each unit process through loadout procedures, including amendment (polymer) type (if any), application location and anticipated amount (rate).
 5. Submit dewatering pad geomembrane liner material information, including supplier, installer, etc.
 6. Proposed polymer MSDS sheets.
- B. Submit manufacturer's literature describing physical size, capacity, and other pertinent data for each major piece of equipment and/or material proposed for use in the dewatering systems.
- C. Prepare a site layout plan for installation of dewatering and stabilization system upgrades including, but not limited to, the following:
1. Screening equipment
 2. Pumps and piping
 3. Polymer storage tanks and feed systems
 4. Geotextile tube layout
 5. Other proposed facilities associated with dewatering.
- D. Prepare a mass balance chart and calculations that estimates the daily production of dewatered sediment.
- E. Prepare a submittal describing procedures and methods as to how the Contractor will meet all discharge requirements and provisions of the WPDES Permit.
- F. Prepare an alternative excavation procedure for removal of potential hard material in area of sediment trap. The Contractor shall provide methods for removal of hard material that may not be removed by hydraulic dredging.

PART 2 - PRODUCTS

2.1 SOIL

- A. Soil used to construct containment berms shall be on-site soils compacted to a minimum of 90 percent of the maximum dry density as determined by ASTM D1557, Modified Proctor test.

2.2 POLYMER ADDITIVES

- A. Polymer additives shall be used at minimum dosages to allow for successful treatment and not be toxic to fish or other fauna or flora when discharged to the lake in the effluent. Only state-approved polymers will be used.

2.3 SEDIMENT DEWATERING PAD

- A. The sediment dewatering pad will be constructed as shown in the project drawings. PVC geomembrane liner will conform to specification Section 02664.

2.4 GEOTEXTILE DEWATERING TUBES

- A. The Contractor shall supply geotextile dewatering tubes to dewater sediments to pass the paint filter test.

PART 3 - EXECUTION

3.1 DEWATERING OPERATIONS

- A. Conduct dewatering Operations as required to complete the Work within the project schedule and meet applicable WPDES discharge standards.
- B. Provide continuous operation of the dewatering process.
- C. Cover dewatered sediment stockpiles with tarpaulins or other approved materials to prevent precipitation from entering the dewatered sediment if large amounts of precipitation are anticipated and if the dewatered sediment is not sloped to shed water.
- D. Provide additional facilities and maintain existing facilities to prevent any leaks, spills, or other losses of sediment, carriage water or other contaminated substances on the site.
- E. Clean up any contamination caused by leaks, spills or other losses, including those otherwise associated with dewatering activities performed and kept on the dewatering pad that interface with proper operation of the dewatering pad, but excluding those caused by other contractors retained by the Owner.

3.2 EQUIPMENT INSTALLATION AND INITIAL TESTING

- A. Install dewatering equipment and facilities in general conformance with approved site layout plans and shop drawings.
- B. Test all equipment, piping and fittings for leaks prior to beginning dredging. Repair all leaks found.

3.3 REMOVAL OF DEWATERING EQUIPMENT

- A. Upon completion of all dewatering operations, remove equipment from site.
- B. Upon removal of dewatering equipment, remove any remaining sediment from stockpile pads, truck loading areas, and other operating areas with power sweeping or other approved equipment. Remove geotextile tubes and dispose of properly off-site.

- END OF SECTION -

SECTION 02230

SITE CLEARING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Clearing, grubbing, and disposal.
 - 2. Stripping and stockpiling topsoil.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Topsoil
 - 1. Topsoil is defined as the upper soil horizon consisting of mineral layers of maximum humus (organic) accumulation.

PART 3 - EXECUTION

3.1 CLEARING, GRUBBING, AND DISPOSAL

- A. General
 - Clear and grub the area of construction as identified on final Contractor submittal drawings.
- B. Clearing
 - Cut all brush, shrubs, stumps and trees to within 4 inches of the existing ground surface.
- C. Grubbing
 - 1. Remove all stumps, roots, logs, and timber.
 - 2. Grubbing shall be carried to a minimum depth of 12 inches.
- D. Disposal
 - 1. Contractor is responsible for the following:
 - a. Disposal of all material removed under clearing and grubbing.
 - b. Furnishing of a disposal site.
 - c. Obtain and conform to all necessary, federal, state, and local permits for land disturbance.
 - d. Conform to all requirements for disposal of diseased trees.
 - e. Burning of debris.
- E. Clearing operations shall be completed in a manner so as to prevent obstruction of traffic and to protect all remaining trees, shrubs, and other vegetation from injury.

3.2 STRIPPING AND STOCKPILING TOPSOIL

A. Stripping

1. Remove all topsoil beneath:
 - a. Structures.
 - b. Roadways.
 - c. All paved areas.
2. Remove topsoil to a depth of 6 inches in:
 - a. Areas disturbed by utility construction.
 - b. Areas requiring cuts or significant fills (significant fills are fills which cannot be obtained by the addition of topsoil only).

B. Stockpiling

1. Contractor shall stockpile topsoil obtained in the stripping operation for replacement.
 - a. For areas where topsoil is to be replaced after underground utility construction.
 - b. For areas involving site grading where topsoil is to be replaced in order to sustain vegetative growth.
2. In areas where topsoil will not be required as specified above, Contractor shall remove and dispose of excess material as defined in other sections.

- END OF SECTION -

SECTION 02301

EARTHWORK

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes
 - 1. Excavation.
 - 2. Test rolling.
 - 3. Filling and compacting.
 - 4. Backfilling around structures.
 - 5. Disposal of surplus materials.
 - 6. Finish grading.
- B. Allowances
 - 1. Testing costs shall be included in the cost for earthwork.

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM)
 - 1. D1556 Test for Density of Soil in Place by the Sand-Cone Method
 - 2. D1557 Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10-Lb (4.54 kg) Rammer and 18 in. (457 mm) Drop
 - 3. D2216 Laboratory Determination of Water (Moisture) Content of Soil, Rock, and Soil-Aggregate Mixtures
 - 4. D2922 Test for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
 - 5. D3017 Test for Moisture Content of Soil and Soil-Aggregate by Nuclear Method (Shallow Depth)

1.3 SUBMITTALS

- A. Submit two (2) copies of the results of quality control testing (include location where test was done):

1.4 QUALITY CONTROL

- A. An independent testing laboratory approved by the Owner shall be obtained by the Contractor and provide quality control testing.
- B. Material Testing Requirements
 - 1. Source Testing of Aggregate:
 - a. Test all select soils and aggregates for acceptance as required by Section "Soils and Aggregates".

2. Installation Testing:
 - a. Determine maximum density and optimum moisture content for compaction in accordance with ASTM D1557 (one test for each type of material for each source).
 - b. Conduct field density tests in accordance with ASTM D1556 and/or D2922 and D3017.
 - c. Minimum frequency for field density testing shall be two (2) acceptable tests per project or as follows, whichever number is greater:

Fill Utilized For	Number of Acceptable Tests
Embankments, dikes or berms	1 test per 600 cubic yards
Structural or controlled fills	1 test per 200 cubic yards
Trench backfill under paved or surfaced areas	1 test per 100 feet of trench
Non-structural fills	1 test per 2,000 cubic yards

3. Provide Additional Density and Gradation Testing:
 - a. Change in method of compaction.
 - b. Change in source or quality of soil or aggregate.
 - c. Disturbed cut areas.
- C. When the testing results show that the work is of an acceptable nature, the acceptance of the work shall not relieve the Contractor from making corrections to the tested work during the warranty period.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

- A. Soil used for borrow, fill, and backfilling shall meet the requirements of soil class as stated in the drawings or in the Specifications.

PART 3 - EXECUTION

3.1 EXCAVATION

- A. Excavation to Correct Grade
 1. Excavate site for structures and pavements as follows:
 - a. To elevation shown on the plans.
 - b. To such additional width as necessary for erections and removal of forms, shoring or sheeting, and finishing of walls.
 2. Excavation of unsuitable materials.
 - a. Excavate unsuitable soil materials under a proposed structure.
 - b. Extend excavation laterally a minimum of 5 feet beyond the building limits plus 1 foot for each foot of cut below the foundation.
 - c. Notify the Owner's project representative prior to proceeding with the removal of unsuitable material.

- B. Borrow Excavation
 1. Clear site as defined in Section "Site Clearing."
 2. Strip and stockpile topsoil.
 3. Excavate, haul, place, and compact borrow soil material.
 4. Regrade borrow areas as shown on the plans or in an acceptable manner to facilitate proper site drainage.
 5. Replace stockpiled topsoil.
 6. Surplus topsoil may be utilized in borrow area regrading.
 7. Seed and mulch in accordance with Section "Landscaping - Turf Establishment".

- C. Excavation Precautions
 1. Excavation Slope Stability:
 - a. Maintain excavation slope to ensure a stable excavation and prevent caving.
 - b. Provide and erect all timber work, shoring, sheeting, bracing, etc. necessary to prevent caving and displacement of adjacent property.
 - 1) Shoring shall be placed so as not to interfere with building work.
 - 2) Shoring shall be independent of footings.

3.2 TEST ROLLING

- A. Test roll finished cut or fill subgrades by rolling with a pneumatic-tire roller or a heavy weight loader rubber tire vehicle.
 1. Method and equipment used shall be suitable for intended use.
 2. Take necessary precautions to protect existing structures from damage during test rolling.
 3. Test roll an area equal to the area of the proposed construction plus a minimum of 3 feet on each side.

- B. Treat areas showing yielding or rutting under test rolling as follows:
 1. Replace and/or recompact as necessary to stabilize the area.
 2. Retest soil areas replaced or recompact.

3.3 FILLING AND COMPACTING

- A. Layer thickness for fill soil shall be as follows:
 1. Layer thickness shall be dependent on the soil classification type, weight, and soil contact pressure of compaction equipment being used.
 2. Layer thickness shall not exceed 8 inches.

- B. Compaction
 1. Compaction method for fill soils shall be appropriate for soil material being compacted and provide sufficient soil contact pressure to thoroughly compact entire lift thickness.

- C. Compaction requirements for all fill soils unless specified elsewhere shall be as follows:

Class 1	- Fills supporting structures. - Subgrade under pavements or floors. - Backfill under piping and conduits.
Class 2	- Fills which do not support structures. - Embankments, dikes, or berms.

COMPACTION REQUIREMENTS FOR
VARIOUS SOIL CLASSES

Required Compaction (%) of Modified
Proctor Density

Class 1	Class 2
95	90

- D. Soil classes not requiring compaction by the above schedule will be proof rolled when requested by the Engineer.

3.4 DISPOSAL OF SURPLUS MATERIALS

- A. Haul and dispose of all surplus materials.
- B. Provide disposal area for surplus materials.

3.5 FINISH GRADING

- A. Grade, trim, and shape subgrade to required grade and section.
 - 1. Adjust slopes by grading so that transition is smooth and gradual.
 - 2. The crests of cut banks shall be rounded and shaped.
 - 3. Refill, regrade and compact washouts and ruts.
 - 4. Remove all stones 1.5 inches or larger from beneath the dewatering pad liner.
- B. Vertical Grading Tolerances
 - 1. Rough grading tolerance.
 - a. Areas to be topsoiled - rough grade to within 0.2 foot of finish grades.
 - 2. Areas having paved surfaces (i.e., concrete, asphalt, etc.).
 - a. Maximum allowable variation from correct profile and section shall not be more than ¼ inch in 10 feet.

- END OF SECTION -

SECTION 02325

DREDGING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Dredging
 2. Debris Removal
 3. Post-Dredge Sampling and Testing
 4. Turbidity Monitoring

1.2 REFERENCES

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.
1. Chapter 30 Permit

1.3 SUBMITTALS

- A. Quality Control Submittals
1. Submit Dredging Plan within 7 days of the date of the Notice to Proceed. Acceptance by the Owner's Representative is required prior to dredging work.
 2. Submit results of Contractor's QC bathymetric surveys when target elevations have been attained in each sub-unit or multiple sub-units.

1.4 QUALITY CONTROL

- A. Prepare a Dredging Plan to include:
1. The dredge types, number of dredges and manufacturer;
 2. Pump size and capacity.
 3. Size, material, joint details, pressure rating and location of slurry pipeline.
 4. Draft of dredge boat and procedure for controlling depth of cut and location of dredge.
 5. Procedure to minimize re-suspension of sediments.
 6. Sequence of dredging including dredge progression plan and proper slope dredging without causing unstable slopes.
 7. Procedure for removing debris and removing or relocating stones and rubble too large for the dredge to pump.
 8. A buoy and safety marker plan.
 9. Polymer addition procedures, equipment, locations, etc.
 10. Booster pump size, location, and capacity.
 11. Effluent booster pump (at dewatering facility) size, location, and capacity.
 12. Values assumed for in-place density of sediment to be dredged.

- 13. Values assumed for percent solids of the dredged slurry piped from the lake to the sediment dewatering facility.
- 14. Values assumed for percent solids of dewatered sediment.

- B. Comply with conditions and substantive requirements of all applicable permits and permit requirements, Corps of Engineers Permit and State of Wisconsin Chapter 30 Permit.

1.5 PERFORMANCE REQUIREMENTS

- A. Volume of Material to be Removed in Dredge Locations:

Dredge Location	Approx. Dredge Prism Volume (cy) ⁽¹⁾	Dredge Volume ⁽²⁾ with Overcut Allowance and 5% Contingency
West Channels	13,652	16,485
Northwest Channels	37,000	44,678
Northeast Channels	3,542	4,277
Bark River Inlet	27,818	33,590
Zastrow's Bay	6,746	8,146
Total	88,758	107,175

(1) In-situ lake sediment volume or dredge prism. Upland disposal volume, after dewatering, will be substantially less than the dredge prism volume.

(2) Assume a 0.5 ft. overcut allowance to establish target elevation.

Prepared by: MJP1
Checked by: JOS1

- B. Dredge Area Schedule
 - 1. Contractor to begin with Stage 1 Dredge Area beginning with the West Channel, South Area.
- C. Work Completion Time and Work Hours
 - 1. Remove designated in-place sediment areas and volumes sediments during the following time periods:
 - a. To limit potential impacts to fish spawning, no dredging may occur from mid-March through June 30th of the calendar year. To avoid potential impacts to reptiles and amphibians, dredging may not occur from October 16th to April 1st of each calendar year, except in Zastrow's Bay.
 - 2. Provide equipment and personnel to dredge 24 hours per day, 5 days per week.
 - 3. Dredge to target elevations.
 - a. Target dredge elevations are shown on Figures ____.
- D. Dredge Isopachs:
 - a. Figures --- through ----- in Attachment --- contain CAD derived dredge isopachs, which indicate the thickness of the sediments to be removed.

- b. If necessary, the Contractor can elect to propose independent dredge isopachs and volume estimates specific to the Contractor's proposed dredging approach, prior to the start of dredging.

1.6 PROJECT CONDITIONS

- A. The Project is located at Nagawicka Lake, Delafield, Wisconsin.
- B. Characteristics of Sediment Material to be Removed
 1. Samples have been taken by the Owner to determine the character of materials to be removed. Although the results of such explorations are representative of subsurface conditions near the sediment surface at their respective locations, local minor variations in the subsurface materials are to be expected and, if encountered, will not be considered materially different within the purview of the contract. Grain size curves of samples taken from the areas to be dredged, and a map of the locations where the samples were taken are provided in Appendix _____. The material to be removed to accomplish the specified dredging work is anticipated to be generally highly organic silt or silty organics. The native lakebed is primarily gray clay. The Contractor is expected to examine the site of the work and confirm the character of the material. Table ___, attached as Appendix ___, presents a summary of the physical characteristics and geotechnical test results for the sediment samples obtained.
- C. Utilities may be located within the Work Site.
 1. Locate all utilities and industrial and municipal water intake and discharge structures classified in the area of his work prior to beginning dredging.
 2. Protect all utilities and structures from damage.

1.7 WORK AREA

- A. Access

The Contractor shall be responsible for providing and maintaining access necessary for his equipment to and from the work site, mooring area, and dewatering, and disposal areas. The Contractor shall ascertain the environmental conditions which can affect the access such as climate, winds, currents, waves, depths, shoaling, and scouring tendencies.
- B. Protection of Existing Waterways

The Contractor shall conduct his operations in such a manner that material or other debris are not pushed outside of dredging limits or otherwise deposited in existing side channels, basins, docking areas, or other areas being utilized by vessels. The Contractor will be required to change his method of operations as may be required to comply with the above requirements. Should any bottom material or other debris be pushed into areas described above, as a result of the Contractor's operations, the material must be promptly removed.

C. Adjacent Property and Structures

The Contractor shall conduct the dredging operation such that it does not undermine, weaken or otherwise impair existing structures located in or near the areas to be dredged. The Contractor shall investigate the existing structures at the site and plan the dredging work accordingly.

Damage to private or public property or structures resulting from the dredging or disposal operations shall be repaired promptly by the Contractor at his expense. Damage to structures resulting from the Contractor's negligence will result in suspension of dredging and require prompt repair at the Contractor's expense as a prerequisite to the resumption of dredging.

D. Artificial Obstructions

The Contractor may encounter bottom debris such as, but not limited to, pieces of broken cable, rope, miscellaneous metal, and broken and derelict moorings. The Owner has no knowledge of existing wrecks, wreckage, or other artificial obstructions of such size or character as to require the use of explosives for its removal. However, special or addition plant may be required for economical removal of some items, such as derelict moorings. During dredging operations, the Contractor shall remove all debris encountered. Floating debris removed from the dredging area shall be separated and stockpiled for disposal. Disposal in accordance with local, Federal, and state laws and regulations shall be the responsibility of the Contractor.

E. Existing Utilities

There are no known utility lines in the areas to be dredged. Contractor is responsible for contacting Diggers Hotline prior to any work.

1.8 OVERCUT AND SIDE SLOPES

A. Allowable Overcut

To cover unavoidable inaccuracies of dredging processes, material may be removed to a maximum overcut of six inches below target elevations. The dredge area is shown on Figures _____. The allowable overcut dredge volume within the dredging limits will be measured and paid for at full contract price.

B. Side Slopes

Material dredged to provide for final indicated side slopes will be measured and paid for at the applicable unit price. The material may be dredged from the original position or by dredging the space below the pay slope plane at the bottom of the slope for upslope material capable of falling into the cut. Payment will not be made for material in excess of the amount originally lying above the pay slope plane. The limiting amount of side-slope overcut will be measured vertically.

Dredging on side slopes shall follow, as closely as practicable, the cross sections indicated on the drawings. The amount of material excavated from side slopes will be determined by post-dredge bathymetric survey by the Engineer.

- C. Excessive Dredging
Material taken from beyond the allowable overcut depth (greater than 6" overcut) will be considered excessive and will be deducted from the total amount dredged.
Payment will not be made for excessive dredged volumes.

1.9 INSPECTION

- A. Inspect the work, keep records of work performed, and ensure that gages, targets, ranges, and other markers are in-place and useable for the intended purpose.
- B. Method of Communication
Provide a system of communication between the dredge crew, dewatering crew, and the Owner's representative. Portable two-way marine radios are acceptable.
- C. Transportation
The Contractor shall furnish, at the request of the Owner's representative, the use of such boats, boatmen, laborers, and material forming a part of the ordinary and usual equipment and crew of the marine plant as may be reasonably necessary in inspecting and monitoring the work. The Contractor shall furnish, on the request of the Owner's representative, suitable transportation from all points on shore designated by the contracting officer to and from the various pieces of plant and the work site.

1.10 MOORINGS

- A. Active Moorings
Prior to the Contractor's mobilization at the site, Owner will be responsible for the removal and replacement of all visible moorings and floats from the dredge areas, at no cost to the Contractor, except as shown on Figures _____. The Contractor shall coordinate and confirm the time schedule necessary for the removal of the moorings with the Owner.

1.11 DOCKS AND PIERS

- A. Active Moorings
All docks and piers will be removed by Owners prior to dredging.

PART 2 - PRODUCTS

2.1 DREDGING SYSTEMS

- A. Provide hydraulic dredging equipment which is capable of removing sediments from undisturbed deposits.
- B. Provide equipment redundancy necessary to provide continuous dredging operation.

- C. Dredge Slurry Pipelines
 1. Provide floating pipelines unless otherwise approved by the Owner's Representative.
 2. Provide single walled pipe.
 3. Provide influent/effluent piping to/from dewatering facility and associated valves, fittings, etc., as necessary.

- D. Booster Pump Station
 1. Provide booster pump stations, as necessary, in location shown on the Drawings.
 2. Design pump/piping to manage slurry based on operational criteria and carry the slurry to the dewatering facility via route shown on the Drawings.
 3. Provide equipment redundancy necessary to provide continuous dredging operation.

PART 3 - EXECUTION- DREDGING

3.1 PREPARATION

- A. Provide facilities as necessary to protect structures, including piers and docks, from damage during the dredging operation.

- B. Provide 10-foot offset from permanent piers and docks, as identified by the Owner.

- C. Provide facilities necessary to control the re-suspension of sediments in the lake and protection of industrial intakes.

- D. Debris, Wood, Cobbles and Other Rubble
 1. As is necessary, remove debris and rubble prior to and/or during hydraulic dredging.
 2. Cobbles, wood or other rubble in the dredge area which are too large to be removed by the hydraulic dredge will be removed from the river and transported to the sediment dewatering area.

- E. Environmental Protection
 1. Protect against fuel or oil spills when refueling or servicing equipment. Immediately correct any fuel or oil leaks in waterborne equipment.
 2. Deploy oil absorption booms when refueling equipment in the water
 3. Wherever possible, use biodegradable hydraulic oil.
 4. Protect Oil or Other Petroleum Products Released from the Sediments During Dredging
 - a. Provide an oil adsorbent boom around the area being dredged to control the movement.
 - b. Use care in handling of any floating petroleum products released from the sediments during dredging.
 5. Floating Debris
 - a. Remove floating debris from the area daily.

- b. Prevent floating debris from damaging silt curtains and escaping from the dredging area.
 6. Provide necessary facilities to comply with Federal, State and local requirements concerning air, noise and water pollution.
 7. Notify the city and the WDNR of fuel or oil spills immediately.
- F. Provide and properly place water safety markers or other devices as to meet all local, state and federal navigations requirements.

3.2 DREDGING

A. Dredging Limits

1. Remove sediment to the target dredge elevations from designated areas, as shown in Figures --- through ---.
2. The approximate thickness of required dredging is shown in Figures--- through ---.
3. Preserve stable side slopes and avoid leaving residual sediment above the target elevations in any areas where dredging has been performed. In shoreline areas and at the termination of dredge cuts to other adjacent sediments, the maximum slope of the finished dredge cut shall not be steeper than 4 horizontal to 1 vertical (4H:1V).

B. Dredge Slurry Pipeline

1. Pressure test all pipeline sections prior to putting them into service to ensure connections, welds, and piping are free from leaks.
2. Maintain pipelines in good condition free from leaks at all times during use.
 - a. Suspend dredging operation immediately upon any pipeline leak or break.
 - b. Repair breaks or leaks immediately upon identification.
 - c. Record pipeline breaks on daily reports.
 - d. Remove any material spilled during a pipeline break.
3. Mark floating pipelines as required by the appropriate government agency.
 - a. Provide approved lights for all floating pipelines, equipment, barges, markers and buoys for the period between sunset and sunrise.
 - b. Also provide approved lights whenever visibility is restricted to less than 200 feet.
4. Maintain submerged section of pipeline a minimum of 10 feet below water surface as shown on the Drawings. Provide markings for identification of the location of the submerged section of pipeline.
5. Provide access points along floating section of pipeline to allow boat navigation.

C. Dredging Operations

1. Provide dredging using hydraulic dredging equipment and techniques.
 - a. Provide sufficient safe and efficient equipment and plant to meet the requirements of the Work.
 - b. Maintain equipment in satisfactory operating condition.
 - c. Make equipment available for inspection by Owner at any time.
2. Blasting will not be permitted.

3. Unless otherwise directed, dredge in a manner that prevents sloughing of sediments into dredged areas.
4. Minimize re-suspension of sediment
 - a. Control dredge speed and operations of cutterheads or other devices employed to loosen sediments as required to minimize the re-suspension of sediment into the water and to minimize the settling out of re-suspended solids in areas previously dredged.
 - b. Provide shrouds or other approved devices to reduce re-suspension over cutterheads or horizontal augers.
5. Overlap dredge cuts to avoid leaving ridges or windrows of sediments between adjacent cuts.
 - a. Use dredging procedures to remove sediment to target elevations while avoiding redistributing sediments from areas which are being dredged into areas where dredging has been completed.
 - b. Any material pushed, deposited or moved into areas outside the limits of dredging, as shown on the Drawings, or into areas previously dredged shall be removed at no additional cost to Owner.
6. Dredge to target elevations.
 - a. Minimize overcut necessary to achieve dredging to the target elevations.
 - b. Any areas determined by the post-dredge QA bathymetric survey to be above the target elevation shall either be redredged to achieve the target elevations or be determined by Engineer to be a "high subgrade area".
 - c. High subgrade areas are so designated when the proposed dredge area has hard clay or rock subgrade exposed above the target elevation.
 - 1) In order to determine the existence of a "high subgrade area" provide Engineer and Contractor will work together to perform high subgrade sampling, coring and analysis of the cored sediments.
 - 2) All the cores shall indicate less than 4" of soft, targeted sediment existing above the underlying hard subgrade.
 - 3) Areas containing 4 inches or more of loose sediment shall be re-dredged to the targeted elevation.
7. Costs for dredging and dewatering of sediment dredged beyond the planned Overcut Volume, as identified during the QA post-dredge bathymetric survey, shall be the sole responsibility of the Contractor.

D. Suspending Dredging Operations

1. Suspend dredging operations whenever weather, water stage or other conditions exist which might reasonably be expected to endanger the work or result in an environmental impact.
2. The Owner reserves the right to receive, evaluate and direct project operations based on the turbidity monitoring data.
3. Dredging will be suspended if exceedances to the WPDES Permit conditions are exceeded.

E. Dredging will be considered complete when sediments have been removed to target elevations.

- F. Upon completion of the Work, promptly remove dredging platforms including ranges, markers, buoys and other equipment.
- G. Interference with Navigation
Minimize interference with the use of channels and passages. The Owner may direct the shifting or moving of dredges or the interruption of dredging operations to accommodate the movement of vessels and floating equipment, if necessary. The Contractor shall comply with all requests from the Owner to move or interrupt dredging operations for a reasonable time period at no additional cost to the Owner.
- H. Debris Management
Debris removed from the bottom during dredging operations, which is not suitable for disposal at the specified disposal areas, shall be collected and removed from the site. Unsuitable materials include large items such as timbers, pilings, sections of piers, and metallic debris. A debris management plan shall be developed by the Contractor, reviewed by the Owner, and followed by the Contractor. Each day during dredging operations, the Contractor shall use a boat to collect and remove floating debris resulting from project activities. Floating debris shall also be removed from within scows or barges. Containers for temporary storage of the collected debris shall be maintained on the dredge or support barge.

3.3 FIELD QUALITY CONTROL/QUALITY ASSURANCE

- A. Contractor Bathymetric Surveys
 1. Provide at a minimum weekly bathymetric surveys to track progress in achieving target elevations.
 2. Inform Owner's Representative when target elevations have been reached and the sub-units, sub-area and/or dredge management units are ready for Owner's QA bathymetric survey.
 3. Submit bathymetric survey to the Owner's Engineer.
- B. Owner QA Bathymetric Surveys
 1. Coordinate and provide access to the dredge areas for the Owner to perform pre- and post-dredging bathymetric surveys to be used to verify that dredging to target elevations has been met and determine quantity of material removed, if requested by Owner.

3.4 FINAL CLEANUP

- A. Final cleanup shall include the removal of all of the Contractor's equipment either for disposal or reuse. Equipment and materials to be disposed of shall only be disposed in a manner and at locations approved by the Owner's representative. Unless otherwise approved by the Owner's representative, the Contractor will not be permitted to abandon any equipment in the dewatering area or other areas adjacent to the work site.

- B. Failure to promptly remove all equipment and materials upon completion of the dredging will be considered a delay in the completion of the final cleanup and demobilization work. In such case, the Owner will exercise its right to remove any equipment and materials at the Contractor's expense.

- END OF SECTION -

SECTION 02664

POLYVINYL CHLORIDE (PVC) LINERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes
 - 1. PVC Geomembrane

1.2 REFERENCES

- A. American Society for Testing and Materials
 - 1. ASTM D413 Test Methods for Rubber Property – Adhesion to Flexible Substrate
 - 2. ASTM D792 Test Method for Specific Gravity (Relative Density) and Density of Plastics by Displacement
 - 3. ASTM D882 Test Method for Tensile Properties of Thin Plastic Sheeting
 - 4. ASTM D1004 Test Method for Initial Tear Resistance of Plastic Film and Sheeting
 - 5. ASTM D1203 Test Methods for Volatile Loss from Plastics Using Activated Carbon Methods
 - 6. ASTM D1204 Test Method for Linear Dimensional Changes of Nonrigid Thermoplastic Sheeting or Film at Elevated Temperature
 - 7. ASTM D1239 Test Method for Resistance of Plastic Films to Extraction by Chemicals
 - 8. ASTM D1593 Specification for Nonrigid Vinyl Chloride Plastic Film and Sheeting
 - 9. ASTM D1790 Test Method for Brittleness Temperature of Plastic Sheeting by Impact
 - 10. ASTM D2240 Test Method for Rubber Property – Durometer Hardness
 - 11. ASTM D4545 Practice for Determining the Integrity of Factory Seams
 - 12. ASTM D5321 Test Method for Determining the Coefficient of Soil and Geosynthetic or Geosynthetic and Geosynthetic Friction by the Direct Shear Method
 - 13. ASTM D6392 Test Method for Determining the Integrity of Nonreinforced Geomembrane Seams Produced Using Thermo-Fusion Methods
- B. PVC Geomembrane Institute (PGI)
 - 1. 1197, Specification for PVC Geomembrane
 - 2. Technical Bulletin, Specification for Thermal Welding of PVC Geomembranes, December 1998.

1.3 DEFINITIONS

- A. Boot – Watertight collar fabricated from geomembrane sheet for sealing geomembrane to pipes and other objects that penetrate geomembrane.

- B. Panel – Piece of geomembrane composed of two or more sheets, factory seamed together.
- C. Sheet – Seamless piece of geomembrane.
- D. Watertight – Geomembrane installation, free of flaws and defects that would allow passage of water and gases, liquids, and solids to be contained under anticipated service conditions.

1.4 SUBMITTALS

- A. Shop Drawing Submittals
 - 1. Manufacturer's specifications, literature for geomembrane furnished and products used to complete installation.
 - 2. Polymer Resin: Product identification and supplier.
 - 3. Geomembrane sheet/panel layout with proposed size, number, position, and sequence of sheet/panel placement, and location of field seams.
 - 4. Proposed equipment for material placement.
 - 5. Procedures for material installation.
- B. Quality Assurance Submittals
 - 1. Qualifications:
 - a. Manufacturer
 - b. Installer
 - c. Fabricator
 - 2. Qualifications of proposed independent geomembrane testing laboratory.
 - 3. Production dates for geomembrane.
 - 4. Quality Assurance Program(s): Written description of geomembrane manufacturer's and installer's formal programs for manufacturing, fabricating, handling, installing, seaming, testing, and repairing geomembrane.
 - 5. Manufacturer's Certificate of Compliance in accordance with Section 01640, Manufacturer's Services.
 - 6. Recommended methods for handling and storage of products.
 - 7. Factory Test Results: Peel and shear tests of factory seams in accordance with ASTM D4545 and for parent material in accordance with ASTM D882.
 - 8. Testing Equipment: Certified calibrations, manufacturer's product data, and test procedures.
 - 9. Field seam test results.
 - 10. Geomembrane Installer's Certification of Subsurface Acceptability: Form attached at end of this section.
 - 11. Manufacturer's Certificate of Proper Installation.
 - 12. Record Documents: Include panel and sheet numbers, seaming equipment and operator identification, temperature and speed setting of equipment, date seamed, identity and location of each repair, cap, strip, penetration, boot, and sample taken from installed geomembrane for testing.
 - 13. Material and seam test results.
 - 14. Special guarantee.

1.5 QUALITY ASSURANCE

A. Qualifications

1. Manufacturer: Has successfully manufactured a minimum of 5 million square feet of PVC geomembrane material specified.
2. Fabricator and Installer: Has successfully installed a minimum of 5 million square feet with the geomembrane product specified in applications similar to the Project.
3. In the event that the fabricator is different than the installer, provide separate qualifications for each.

B. Pre-Installation Meetings

1. Meet at least once prior to commencing each of the following activities:
 - a. Manufacture of geomembrane sheets.
 - b. Fabrication of panels and boots.
 - c. Installation of geomembrane.
2. Attendees:
 - a. Subcontractor's designated quality control representative.
 - b. Contractor.
 - c. Representatives of geomembrane installer.
 - d. Others requested by Contractor.
3. Topics:
 - a. Specifications and Drawings.
 - b. Submittal requirements and procedures.
 - c. Schedule for beginning and completing geomembrane installation.
 - d. Training for installation personnel.
 - e. Installation crew size.
 - f. Establishing geomembrane marking system, to include sheet identification, defects, and satisfactory repairs, to be used throughout the work.
4. Seam Installation and Testing Demonstration: Performed by geomembrane installer, for each type of seam required.

1.6 DELIVERY, STORAGE AND HANDLING

A. Geomembrane

1. Individually package each sheet or fabricated panel of geomembrane in heavy cardboard, fully enclosed, and protect from damage during shipment.
2. Mark each package with identification of material type, size, and weight.

B. Epoxy Adhesive

1. Control temperature above 60°F.
2. If stored at temperatures below 60°F, test adhesive prior to use to determine if adhesive meets specified requirements.
3. Dispose of cartridges if shelf life has expired.

1.7 PROJECT ENVIRONMENTAL REQUIREMENTS

A. Do not install geomembrane or perform seaming under the following conditions, unless it can be demonstrated to satisfaction of Engineer that performance requirements can be met under these conditions:

1. Air temperature is less than 35°F or more than 90°F.

2. Relative humidity is more than 90%.
 3. Raining, snowing, frost is in ground, or wind is excessive.
- B. Do not place granular materials on geomembrane when ambient temperature is less than 35°F or more than 100°F, unless it can be demonstrated to the satisfaction of Engineer that such materials can be placed at temperatures outside this range without damage to geomembrane.

1.8 WARRANTY

- A. Provide manufacturer's extended warranty, with Owner named as beneficiary, in writing, as special guarantee. Provide warranty for correction, or at option of Owner, removal and replacement of Work specified in this specification section found defective during periods below, commencing on date of Substantial Completion. Duties and obligations for correction or removal and replacement of defective Work as specified in General Conditions.
1. Guarantee geomembrane against manufacturing defects, deterioration due to ozone, ultraviolet, and other exposure to elements for period of 20 years on a pro rata basis.
 2. Guarantee geomembrane against defects in material and factory seams for period of two years.
 3. Guarantee geomembrane against defects resulting from installation for period of two years.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. PVC Geomembrane
1. Rocheux International, Inc., Carson, CA
 2. Hüls America, Inc., Edison, NJ
 3. Occidental Chemical Corp., Burlington, NJ
 4. Vernon Plastics, Haverhill, MA

2.2 MATERIALS

- A. Polyvinyl Chloride (PVC) Geomembrane
1. Compounded from domestic virgin polyvinyl chloride resin and high quality ingredients to produce flexible, durable, watertight product. Uniform throughout in color, thickness, and size, and surface quality.
 2. Completely disperse formula ingredients in mix stage prior to calendaring.
 3. Carbon Black Pigment:
 - a. Use to produce an opaque film ranging from dark gray to black in color.
 - b. Introduce during premix stage and evenly disperse so as to produce uniform color.
 - c. Film: Smooth, dull matte finish on both sides.
 4. Material shall be free from dirt, oil, foreign matter, scratches, cracks, creases, bubbles, pits, tears, holes, or other defects that may affect its serviceability.
 5. Physical properties shall meet or exceed manufacturer's most recent published specifications, and conforming to following requirements:

30-mil PVC Geomembrane Physical Properties

Property	Required Values	Test Method
Thickness	30 mils, plus or minus 5%	ASTM D5199
Specific Gravity	1.20 min.	ASTM D792
Elongation at Break	380% min.	ASTM D882, Method A
Tensile Strength	73 lbs/in. width, min.	ASTM D882, Method A
Tear Resistance, Each Direction	8.0 lbs. min.	ASTM D1004, Die C
100% Modulus	32 lbs/in.	ASTM D882, Method A
Water Extraction, as Compared to Blanks of Same Nominal Thickness	0.15% loss, max.	ASTM D1239
Volatility	0.7% loss, max.	ASTM D1203, Method A
Low Temperature, Pass	Minus 29 degrees F	ASTM D1790
Dimensional Stability, Each Direction	3% change, max. (100°C/15 min.)	ASTM D1204 (MD and TD)

B. Chemical Adhesive

1. Manufacturer: Clifton Adhesive, Inc., Wayne, NH, or as recommended by geomembrane manufacturer.
2. Use seaming chemical adhesives, including bodied chemical adhesive, used for making required geomembrane connections.
3. Clear color or same as geomembrane.
4. Provide film tearing bond within 48 hours of field seaming for seams.

C. Termination Strip

1. Manufacturer and Product: Ameron Protective Linings Division, Brea, CA; Commodity Code No. 2600920 (black), 290052 (white).

D. Panel Fabrication

1. Fabricators:
 - a. Watersaver Co., Inc., Denver, CO
 - b. C.W. Neal Corp., Santee, CA
 - c. Environmental Protection, Inc., Mancelona, MI
2. Factory fabricate up to 20,000 square feet to minimize field seams.
3. Panel Marking:
 - a. Mark each panel with prominent, unique indelible identification conforming to approved panel/sheet layout.
 - b. Indicate proper direction for unrolling or unfolding to facilitate layout and positioning at site.
4. Seams:
 - a. Do not use prepared adhesive tapes for seaming.
 - b. Fully bonded across entire lapped area, including encapsulated edges, so that no loose edge is present on top side of fabricated panel.
 - c. Provide film tearing bond between sheets.
 - d. Make with liquid solvent-based adhesive or hot air with minimum ¾ inch lap; or dielectrically with minimum ½ inch lap; or hot wedge with minimum ½ inch lap.

- 1) Bonded Seam Strength: Minimum 30 mils: 58.4 pounds per inch width, as determined in accordance with ASTM D4545, ASTM D6392 (for heat bonded seams), and ASTM D882 (for solvent bonded seams).
- 2) Peel Adhesion: Minimum 30 mils: 15 pounds per inch width, as determined in accordance with ASTM D4545, ASTM D6392 (for heat bonded seams), and ASTM D413 (for solvent bonded seams).

2.3 SOURCE QUALITY CONTROL

- A. Test factory seams by air lance in accordance with ASTM D4545, or air channel testing in accordance with PGI Technical Bulletin – "Specifications for Thermal Welding of PVC Geomembranes."

PART 3 - EXECUTION

3.1 PREPARATION

- A. Do not place geomembrane until condition of previously installed geosynthetics is acceptable to Contractor.
- B. Subgrade
Maintain in smooth, uniform, and compacted condition, as specified in Section 02319, Subgrade Preparation, during installation of geomembrane.

3.2 GEOMEMBRANE INSTALLATION

- A. Protection During Construction
 1. Do not use geomembrane surfaces as a work area for preparing patches, storing tools and supplies, or other uses. Use protective cover as work surface, if necessary.
 2. Instruct workers about requirements for protection of geomembrane such as handling geomembrane material in high winds, handling of equipment, and walking on geomembrane surfaces. Shoes of personnel walking on geomembrane shall be smooth bonded sole or be covered with smooth type of overboot. Prohibit smoking, eating, or drinking on geomembrane, placing heated equipment directly on geomembrane, or other activities that may damage geomembrane.
 3. Do not operate equipment without spark arrestors in vicinity of geomembrane material nor place generators or containers of flammable liquid on geomembranes.
 4. Protect from vehicle traffic and other hazards.
 5. Keep free of debris during placement.
 6. Prevent uplift, displacement, and damage by wind.
 7. Only small rubber-tired equipment, with maximum tire inflation pressures of 5 pounds per square inch, shall be allowed directly on geomembrane, unless otherwise approved by Contractor.
- B. Placement
 1. Unless specified otherwise, each product required for completion of geomembrane installation shall be installed in strict accordance with geomembrane manufacturer's recommendations.

2. Reduce field seaming to the minimum possible. Horizontal seams on slopes will not be acceptable. Seams parallel to toe shall be at least 5 feet from toe.
3. Prevent wrinkles, folds, or other distress that can result in damage or prevent satisfactory alignment or seaming. Provide for factors such as expansion, contraction, overlap at seams, anchorage requirements, seaming progress, and drainage.
4. Temporarily weight sheets with sandbags as necessary to anchor or hold down in position during installation. Use sandbags continuously along edges to reduce wind flow under sheet.
 - a. Bag Fabric: Sufficiently close knit to preclude fines from working through bags.
 - b. Bags: Contain not less than 40 nor more than 60 pounds of sand having 100 percent passing No. 8 screen and shall be securely closed after filling to prevent sand loss.
 - c. Do not use tires or paper bags, whether or not lined with plastic. Burlap bags, if used, shall be lined with plastic.
 - d. Immediately remove damaged or improperly sealed bags from work area, and immediately clean up spills.
5. Anchor perimeter of geomembrane as shown, or as otherwise approved by Contractor. Anchor and seal geomembrane to structures, pipes, and other types of penetrations as shown.
6. Place overlying geotextile and soil cover immediately following completion of geomembrane installation and field testing as acceptable to Contractor.

C. Field Seams

1. Adjust edges to be seamed and temporarily anchor to prevent wrinkling and shrinkage.
2. Wipe sheet contact surfaces clean to remove dirt, dust, moisture, and other foreign materials and prepare contact surfaces in accordance with seaming method accepted by Contractor.
3. Lap sheet edges minimum of 4 inches to form seams.
4. Make with seam supported on a firm, smooth. Avoid seam intersections involving more than three thicknesses of geomembrane material and offset seam intersections at least 2 feet.
5. Extend seams through anchor trench, boots, and mechanical attachments to sheet edges.
6. Capping of Field Seams:
 - a. Where lap seam is not possible, use 6 inch wide (minimum) cover strip of same thickness as geomembrane (and from same roll, if available).
 - b. Position strip over center of field seam and seal entire width in accordance with seaming requirements.
7. When ambient conditions result in temperatures below 85°F at time of seaming, warm geomembrane material, adhesive, or solvent by artificial means to temperature above 85°F.
8. Accessories:
 - a. Rags: Use clean, white cotton rags for seaming procedures. When rag shows discoloration from use, discard and replace with fresh one.
 - b. Scissors: Blades with rounded points.
9. Uneven Seams: Avoid fishmouths, pleats, folds, and tucks in field seams. Repair each one by slitting out far enough from seam to dissipate it and patch in accordance with this Specification.

10. Completed Seams: Sealed, smooth, watertight, and conforming with factory seam strengths specified in Article Panel Fabrication.

D. Boot Seals

1. Preparation: Thoroughly clean contact surfaces.
2. Place boot around penetrations so flange is supported everywhere and is free of wrinkles.
3. Seal boot to surrounding geomembrane as specified for field seams.
4. Tighten steel clamping bands until rubber pads are compressed minimum of 12 to 15 percent of total pad thickness.

3.3 PLACING PRODUCTS OVER GEOMEMBRANE

- A. Prior to placing material over geomembrane, notify Contractor. Do not cover installed geomembrane until after Contractor provides authorization to proceed.
- B. If tears, punctures, or other geomembrane damage occurs during placement of overlying products, remove overlying products as necessary to expose damaged geomembrane, and repair damage as specified in Article Repairing Geomembrane.
- C. Geomembrane installer shall remain available during placement of overlying products to repair geomembrane if damaged.

3.4 REPAIRING GEOMEMBRANE

- A. Damaged Geomembrane Surface
Mark and correct injury due to scuffing, penetration by foreign objects, or distress from rough subgrade by replacement or covering and sealing geomembrane with additional layer of geomembrane material of proper size.
- B. Geomembrane installer shall remain available during placement of overlying products to repair geomembrane if damaged.
- C. Repair damaged or rejected seams with pieces of flat and unwrinkled geomembrane material free from defects and seams. Patches shall be tightly bonded on completion of repair work.
- D. Patch shall be neat in appearance and size 6 inches larger in directions than areas to be repaired. Round corners of each patch to minimum 1 inch radius.
- E. Prepare contact surfaces and seam patch in accordance with Article Field Seams.
 1. Pull and hold flat receiving surface in area to be patched.
 2. Bond patches less than 12 inches in narrowest plan dimension across their entire width.
 3. Seam each patch more than 12 inches across in narrowest dimension with minimum bonded width of 4 inches along edge, with no free edge remaining.

3.5 FIELD QUALITY CONTROL

- A. Installer's Certification
Prior to starting geomembrane installation and daily thereafter for installation on subgrade, certify in duplicate that surface upon which geomembrane will be installed is acceptable.
- B. Identify each test by date of sample, date of test, sample location, name of individual who performed test, standard test method used, list of departures from standard test methods, at a minimum.
- C. In-Place Observation and Testing
 1. Visually inspect geomembrane sheets, seams, anchors, seals, and repairs for defects as installation progresses and again on completion.
 2. In addition, check seams and repairs using metal probe. Run metal probe, such as dull-pointed ice pick, along entire length of each seam, including repairs, to check for continuity of seams and absence of leak paths.
 3. Depending on seam welding equipment used, test each seam and repair, using air lance device or air channel pressure for double wedge welded seams.
 4. Perform testing in presence of Contractor.
- D. Tensiometer for Field Testing
 1. Motor driven portable tensile tester with jaws capable of traveling at measured rate of 2 inches per minute and 20 inches per minute.
 2. Equipped with gauge which measures force in unit pounds exerted between jaws
 3. Minimum capacity of 500 pounds.
- E. Field Seam Sampling
 1. Verify that seaming equipment and operators are performing adequately. Produce test seam samples at beginning of each shift for each seaming crew. In addition, if seaming has been suspended for more than one-half hour, or if breakdown of seaming equipment occurs, produce test seam samples prior to resuming seaming.
 2. Minimum Sample Size: 12 inches wide plus seam width, and 30 inches long.
 3. Nondestructive Sampling:
 - a. Frequency: Minimum one sample per 500 feet of field seam, or portion thereof, and minimum one sample per seaming crew per 4 hour work period.
 - b. Produce samples using the same materials, equipment, personnel, and procedures as field seams made at time of the work in progress and under same conditions.
 4. Destructive Sampling:
 - a. Frequency: Determined by Contractor.
 - b. Remove samples from field seams at locations selected by Contractor.
 - c. Repair field seams in accordance with repair procedures specified in these specifications.
 5. Sample Identification:
 - a. Number, date, and identify each sample as to personnel making seam and location of sample or location of field seam work in progress at time sample is made.
 - b. Mark location of sample, or location of field seam in progress at time sample is made, on panel/sheet layout drawing.
 - c. Include at a minimum:

- 1) Panel and sheet numbers.
- 2) Seaming equipment and operator identification.
- 3) Temperature and speed setting of equipment.
- 4) Date seamed.
- 5) Identity and location of each repair, cap strip, penetration, boot, and sample taken from installed geomembrane for testing.

F. Field Seam Strength Sample Testing

1. Testing includes tensile and peel strength tests, air lance tests, air channel tests, and probing.
2. General: Conform to ASTM D6392 for field thermo-fusion welds.
 - a. Test each sample for seam peel and tensile strength.
 - b. Save test samples, including specimens tested, until notified by Contractor relative to their disposal.
 - c. Each sample that fails under test shall be shipped immediately by express delivery to Contractor for determination of corrective measures required.
3. Bonded Seam Strength of 30-mil PVC:
 - a. In Shear: Minimum 58.4 pounds per inch width as determined in accordance with ASTM D6392 (for heat bonded seams) and D882 (for solvent bonded seams).
 - b. In Peel: Minimum film tearing bond 15 pounds per inch as determined in accordance with ASTM D6392 (for heat bonded seams) and D413 (for solvent bonded seams).
4. Test Failure: Each sample tested shall be required to pass. If sample fails, entire field seam from which it was taken shall be considered as failure shall be rejected due to nonconformance with specification requirements. Comply with following corrective measures:
 - a. Nondestructive Sample Failure: Rerun field weld test using same sample. If that test passes, Contractor may assume an error was made in first test and accept field seam. If second test fails, cap each field seam represented by failed sample and submit new test sample made during capping procedure.
 - b. Destructive Sample Failure: Rerun field weld test using new sample from same seam. If that test passes, Contractor may assume an error was made in first test and accept field seam. If second test fail, either cap field seam between two previous passed seam test locations that include failed seam or take another sample on each side of failed seam location (10 feet minimum) and test both. If both pass, cap field seam between two locations. If either fails, repeat process of taking samples for test. Each field seam shall be bounded by two passed test locations prior to acceptance.

G. Air Lance Testing

1. Perform on each seam including patches and factory seams in accordance with the following:
2. Air Lance:
 - a. Created with 3/16 inch diameter orifice at minimum pressure of 50 psi, held not more than 2 inches from seam edge.
 - b. Direct jet of air at edges of seams and patches to result in lifting of unbonded seam areas.
3. Perform air lancing in presence of Contractor and allow sufficient time for Contractor to mark leaks or suspicious areas for repair.

- H. Air Channel Pressure Testing for Double Hot Wedge Seam
1. Perform the following testing where seaming is done by the double hot wedge seaming method.
 - a. Insert a needle with gauge in air space between welds. Pump air into space to 25 pounds per square inch and hold for 5 minutes.
 - b. At end of 5 minutes, depressurize seam by placing needle hole in air space between welds at opposite end of seam and observe gauge.
 - c. Seam is acceptable if seam maintains at least 20 pounds per square inch during the 5 minute hold and the pressure drops within 30 seconds of depressurization.
 - d. Repair needle holes and retest seam by the same procedure or by air lance procedure if pressure drops below 20 pounds per square inch during the 5 minute hold, or does not drop during the 30 second depressurization period.
 - e. Air lance entire seam if the second air pressure test fails.
 - 1) If air lance test passes, failure will be assumed to be in the inside seam and outer seam will be judged acceptable.
 - 2) If air lance test fails, mark and repair defective area.

3.6 MANUFACTURER'S SERVICES

- A. Provide authorized representative of geomembrane manufacture on-site for technical supervision and assistance during installation of geomembrane system, and also during inspection of geomembrane prior to installation, during preparation and inspection of surfaces on which geomembrane is to be placed, and during placement of soil cover or other products over installed geomembrane.

3.7 CLEANUP

- A. Cleanup work area as the work proceeds. Take particular care to ensure that no trash, tools, and other unwanted materials are trapped beneath geomembrane and that scraps of geomembrane material are removed from work area prior to completion of installation.

- END OF SECTION -

SECTION 02920

LANDSCAPING - TURF ESTABLISHMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Topsoiling.
 - 2. Fertilizing.
 - 3. Seeding.
 - 4. Mulching.
 - 5. Erosion Mat.

1.2 REFERENCES

- A. Association of Official Seed Analysis (AOSA):
 - 1. Rules for testing seed.
- B. American Association of State Highway and Transportation Officials (AASHTO):
 - 1. AASHTO M140 Emulsified Asphalt.

1.3 SUBMITTALS

- A. Topsoil
 - 1. Provide topsoil analysis performed in accordance with ASTM D5268 demonstrating that the topsoil meets Soil Conservation Service specified soil types.
 - 2. Submit results of tests for nutrient levels and provide recommendations for fertilizer type and application.
- B. Fertilizer
 - 1. Furnish certification from supplier attesting to:
 - a. Brand name, chemical analysis, and guarantee of analysis.
- C. Seed
 - 1. Furnish certification of conformance with AOSA "Rules for Testing Seed" and attest to:
 - a. Mix, age, weed content, purity, and germination.
- D. Sod
 - 1. Furnish certification that sod complies with all State and Federal regulations with respect to inspection for plant diseases and insect infestation.
 - 2. Furnish certification of origin and date of cut.
- E. Mulch Material
 - 1. Furnish sample of mulch material when requested by Owner's representative.

- F. Erosion Mat
 - 1. Furnish sample of erosion mat material along with a certification of its physical properties.

PART 2 - PRODUCTS

2.1 TOPSOIL

- A. Consists of adequate mineral content to support the growth of the intended vegetation, consists of Soils Class F-1 or F-2 (Soils and Aggregates) as required, shall meet the definition and specification stated in ASTM D5268, and meets one of the following SCS (Soil Conservation Service) soil textures:
 - 1. Loam.
 - 2. Sandy loam.
 - 3. Silt loam.
 - 4. Silty clay loam.
 - 5. Clay loam.
- B. The topsoil shall consist of adequate mineral content to support the growth of the intended vegetation and shall not contain herbicides which would be detrimental for the intended use.
- C. The topsoil shall have adequate fertility for quick establishment of vegetation.
- D. The pH of the topsoil shall be between 6.0 and 7.0.
- E. Topsoil shall be free from deleterious substances.
- F. Topsoil shall be free from roots, sticks, weeds, brush, stones or other litter and waste products.
- G. Pulverize and screen the topsoil such that 100 percent passes the 1-inch (25 mm) sieve and at least 90 percent passes the No. 10 (2.00 mm).

2.2 FERTILIZER AND AGRICULTURAL LIMESTONE

- A. Fertilizer shall meet the recommendations of the soil analysis report required by Section "Soils and Aggregates".
- B. Agricultural Limestone
 - 1. Shall conform to Soil Class J-1 as defined in Section "Soils and Aggregates."

2.3 SEED

- A. Conform with the requirements of the governing authority for seeding and for restrictions on noxious weed seed.
- B. Seed mixture shall be composed of seeds of the purity, germination, and proportion by weight as follows:

Seed Mix #1 Ditches - Inslope Areas - Heavy Soil

Percent	Variety	Min. % Purity	Min. % Germination
35	85/80 KY Bluegrass	85	80
20	Creeping Red Fescue	97	85
20	Perennial Ryegrass	97	90
20	Tall Fescue (varieties below)	95	90
5	Redtop	92	85
100% Total			

Tall Fescue Varieties: Choose one or both:

- Fawn Tall Fescue
- KY31 Tall Fescue

Seeding rate of 3 to 4 lbs per 1M sq. ft.

Seed Mix #2 Ditches - Inslope Areas - Light Soil

Percent	Variety	Min. % Purity	Min. % Germination
10	85/80 KY Bluegrass	85	80
25	Creeping Red Fescue	97	85
25	Hard Fescue (varieties below)	97	85
20	Turf Type Tall Fescue (varieties below)	98	85
20	Perennial Ryegrass	97	90
100% Total			

Hard Fescue Varieties: Choose one or both:

- Scaldis Hard Fescue
- SR3100 Hard Fescue

Turf type tall fescue varieties: choose two of the five:

- Tulsa turf type tall fescue
- Regiment turf type tall fescue
- Crossfire turf type tall fescue
- Shortstop turf type tall fescue
- SR8200 turf type tall fescue

Seeding rate of 5 to 6 lbs per 1M sq. ft.

Seed Mix #3 Rural Areas - Cut & Fill Slopes >6/8'

Percent	Variety	Min. % Purity	Min. % Germination
20	85/80 KY Bluegrass	85	80
25	Creeping Red Fescue	97	85
25	Tall Fescue (varieties below)	95	90
20	Perennial Ryegrass	97	90
10	Empire Trefoil	95	80
100% Total			

Tall Fescue Varieties: Choose one or both:

Fawn Tall Fescue
KY31 Tall Fescue

Seeding rate of 5 to 6 lbs per 1M sq. ft.

Seed Mix #4 Urban Areas - Lawn Turf

Percent	Variety	Min. % Purity	Min. % Germination
30	Elite Bluegrass (varieties below)	98	85
20	98/85 KY Bluegrass	98	85
25	Creeping Red Fescue	97	85
25	Turf Type Perennial Ryegrass	96	85
100% Total			

Bluegrass Varieties: Include a maximum of 4 and a minimum of 2.

Adelphi Geronimo SR2100
Banff Gnome
Cynthia Merit
Cannan Parade

Seeding rate of 3 to 4 lbs per 1M sq. ft.

Seed Mix #5 Critical Area Stabilization

Percent	Variety	Min. % Purity	Min. % Germination
20	Improved Hard Fescue	97	85
20	Turf Type Tall Fescue (varieties below)	98	85
15	Little Bluestem	Pure live seed	
15	Side Oats Grama	Pure live seed	
5	Canada Wild Rye	Pure live seed	
25	Turf Type Perennial Ryegrass	95	85
100% Total			

Turf Type Tall Fescue Varieties: Choose two of the five:

Tulsa Regiment
Crossfire Shortstop
SR8200

Seeding rate of 2 to 3 lbs per 1M sq. ft.

Seed Mix #6 Critical Area - Poorly Drained Soils

Percent	Variety	Min. % Purity	Min. % Germination
20	85/80 KY Bluegrass	85	80
25	Tall Fescue (varieties below)	95	90
25	Perennial Ryegrass	96	85
10	Redtop	92	851
5	Climax Timothy	98	90

Percent	Variety	Min. % Purity	Min. % Germination
5	Alsike Clover	97	90
5	Mammoth Red Clover	98	90
5	Canada Wild Rye	Pure live seed	
100% Total			

Tall Fescue Varieties: Choose one or both:

- Fawn Tall Fescue
- KY31 Tall Fescue

Seeding rate of 2 to 3 lbs per 1M sq. ft.

Seed Mix #7 Low Maintenance - Light or Sandy Soils/Shade Areas			
Percent	Variety	Min. % Purity	Min. % Germination
15	SR 3100 Hard Fescue	98	85
15	Scaldis Hard Fescue	98	85
10	Moxie Red Fescue	98	85
10	Dawson Red Fescue	98	85
20	SR 5100 Chewings Fescue	98	85
20	Azay Sheep Fescue	98	85
10	SR 4200 Dwarf Rye Grass	98	90
100% Total			

Seeding rate of 5 lbs per 1M sq. ft.

C. Temporary Nurse Crop

1. When required the Contractor shall furnish one of the following seed mixtures:

Species	Min. % Purity	Min. % Germ	Lbs. per Acre
Oats	98	90	80
Rye	98	85	100

2.4 MULCH

- A. Mulch shall consist of straw, hay, marsh hay, or wood chips which are free of noxious weeds and other objectionable foreign matter.

1. If wood chips are used, the mulch area shall be treated with one (1) pound of available nitrogen per 1,000 square feet.

- B. Mulch binder shall conform to one of the following:

1. Emulsified asphalt shall meet the requirements for Type SS-1 AASHTO M140.
2. Terra Tack I, or equal.

2.5 EROSION MATS

- A. Jute fabric shall meet the following general requirements:

1. Uniform, open weave of single jute yarn.

2. Twisted construction having an average twist of not less than one and one-half turns per inch.
 3. Furnished in rolled strips 48 inches wide with a minimum of 78 wrapped ends.
 4. Fabric shall have a minimum of 41 weft yarns per linear yard of length.
 5. Weight of fabric shall be a minimum of 92 pounds per 100 square yards.
 6. Non-toxic to vegetation.
 7. Smolder resistant.
- B. Wood fiber blanket shall meet the following general requirements:
1. Uniform web of interlocking wood excelsior fibers.
 2. Uniform thickness.
 3. Weight - 78 pounds per 80 square yards.
 4. Have net backing on one side as follows:
 - a. Mesh size not exceeding 1½ inches by 3 inches.
 - b. Woven of twisted paper, cotton cord, or biodegradable plastic.
 5. Non-toxic to vegetation.
- C. Permanent Geomats
1. Consist of a tough, flexible matting made of a high density polyethylene or similar material.
 2. Ultra-violet resistant.
 3. Have a minimum thickness of 0.4 inch (1.0 cm).
 4. Non-toxic to vegetation.
 5. Contain no petroleum solvents or other agents toxic to plant or animal life.
- D. Staples
1. Staples for anchoring erosion mat shall meet the following minimum requirements:
 - a. U-shaped.
 - b. No. 11 gage or larger diameter steel wire.
 - c. Width of 1 to 2 inches.
 - d. Length.
 - 1) Not less than 6 inches for firm soil.
 - 2) Not less than 12 inches for soft or loose soils.
 - 3) Not less than 8 inches where erosion mat is placed over sod.

PART 3 - EXECUTION

3.1 TOPSOILING

- A. Topsoil all areas which are required to be seeded or sodded. Place topsoil to the following depth:
1. Seeded Areas: 4 inches when settled.
 2. Sodded Areas: 3 inches when settled.
- B. Topsoil placement in rural areas:
1. Place to required depth.
 2. Remove all cobble larger than 3 inches.
 3. Remove all debris.
 4. Mechanically break down all clods and lumps.

5. Mechanically level and rake prior to applying seed.
- C. Topsoil placement for seeding lawns:
1. Mechanically level subgrade to allow uniform placement of topsoil.
 2. Remove rocks, roots, clods, and other foreign material.
 3. Place topsoil to required depth.
 4. Mechanically level topsoil.
 5. Rake topsoil smooth and remove all lumps.
 6. Seed as required.

3.2 FERTILIZING AND LIMING

- A. Fertilize and lime all areas to be seeded or sodded.
- B. Application rate shall conform to soil analysis report.
- C. Incorporation shall be performed by mechanical means during seeding operation.

3.3 SEEDING

- A. Selection of seed mixtures, rate of seeding and intended use of the mixtures shall be as follows:

Seed Mixture	Rate of Seeding (Lbs. per 1,000 sq. ft.)	Intended Use
No. 1	3-4	Average loam or heavy clay soils.
No. 2	5-6	Light, sandy or gravelly soils. All ditches, inslopes.
No. 3	5-6	In rural areas on cut and fill slopes exceeding 6 to 8 feet.
No. 4	3-4	In urban area or other areas where a lawn type turf is desired.
No. 5	2-3	Critical area stabilization. May be used in conjunction with mixture No. 1 and No. 2 on steep slopes.
No. 6	2-3	Poorly drained soils Critical area stabilization (usually not mowed).
No. 7	5	Low maintenance, light or sandy soils, shade areas.

- B. Seeding period shall be as recommended by the seed supplier.
- C. Seeding
 1. Utilize a machine or combination of machinery which will produce the following:
 - a. Apply seed uniformly at the rate specified.
 - b. Cover seed with approximately ¼ inch of topsoil.
 - c. Roll lightly.
 - d. Apply seed at right angles to surface drainage.

3.4 MULCHING

- A. Complete mulching as follows:
 1. Within 48 hours after seeding has been completed.
 2. Place all mulch uniformly to a loose depth of 1 to 1½ inches (2 to 3 tons per acre).

3. Mulching operation shall begin at the top of slopes and proceed downward.
- B. Mulching shall be secured using one of the following methods:
1. Method "A"
 - a. Secure mulch with heavy twine or netting.
 - i. Twine to be fastened with pegs or staples to form a grid of 6- to 10-foot spacing.
 2. Method "B"
 - a. Apply emulsified asphalt at the rate of 200 to 300 gallons per acre.
 - b. Machinery used for placing mulch and emulsified asphalt shall produce a spotty tack sufficient to hold together and retain in-place the deposited mulch material.
 3. Method "C"
 - a. Anchor mulch in soil by means of a mulch tiller.
 - b. Mulch shall be impressed in the topsoil to a depth of 1½ to 2½ inches in one pass of the tiller.

3.5 EROSION MAT

- A. Erosion Mat – Installation
1. Install erosion mat at locations designated on the plans within 48 hours after completion of seeding.
 2. Use only jute fabric over sodded areas.
 3. All stones, soil clods, roots, sticks, and other foreign material shall be removed prior to placing the mat.
- B. Installation of Jute Fabric Wood Fiber Blanket (Excelsior):
1. Matting strips to be laid in the direction of surface water flow.
 2. Adjacent strips shall overlap at least 4 inches.
 3. Mat strip ends shall overlap at least 10 inches.
 4. Wood fiber blanket shall be installed with netting on top.
 5. Bury the upgrade end of each strip of fabric at least 8 inches in a vertical slot cut in the soil and firmly tamping soil against fabric as follows:
 - a. For ditch grades of 4 percent or less, construct vertical slots every 50 feet.
 - b. For ditch grades of 4 percent or more, construct vertical slots every 25 feet.
 6. Form terminal fold at the bottom end of the erosion mat by folding under approximately 4 inches of mat and stapling it to the ground.
 7. Install staples as follows:
 - a. Vertically until tops are flush with the soil.
 - b. Space staples at 3-foot centers along overlap at mat edges and alternate at 3-foot centers through mat centers.
 - c. Space staples at 10-inch centers at mat ends and junction slots.
- C. Installation of Permanent Geomats
1. Geomats shall be installed in accordance with the procedure recommended by the manufacturer and be suitable for the intended use.

3.6 APPLICATION

- A. Apply landscaping and turf establishment procedures as follows:
1. Rural and unmowed areas with less than 4 to 1 slope:

- a. Topsoil.
 - b. Seed.
 - c. Fertilize.
 - d. Mulch and mulch binder.
2. Rural and unmowed areas with 4 to 1 slopes to 3 to 1:
 - a. Topsoil.
 - b. Seed.
 - c. Fertilize.
 - d. Stabilize with wood fiber erosion mat.
 3. Rural and unmowed areas with 3 to 1 slopes or greater:
 - a. Topsoil.
 - b. Seed.
 - c. Fertilize.
 - d. Stabilize with permanent geomat.

3.7 MAINTENANCE

- A. Maintain all seeded and sodded areas until all the following conditions are met.
 1. Seeding: Establish a good stand of grass (uniform in density and color) satisfactory to Owner.
 2. Sodding: Establish a root system into sod bed.
 3. Capable of resisting erosion.
- B. Watering of turf shall be included in maintenance.

- END OF SECTION -