SPECIFICATIONS
for
BIDDING

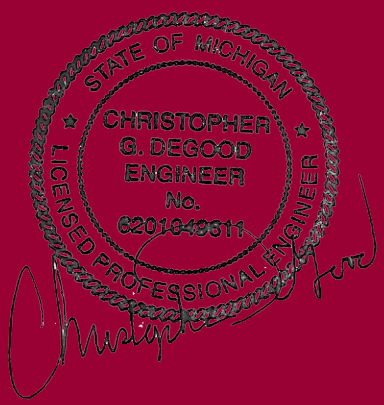
STANLEY PARK IMPROVEMENTS

10785 Elizabeth Lake Rd
White Lake Charter Township

in cooperation with
Michigan Department of Natural Resources

with funding provided by
The Land and Water Conservation Fund

MDNR Project Number 26-01868



Documents Issued for:
Bidding
January 4, 2024

Beckett & Raeder, Inc.
535 West William, Suite 101
Ann Arbor, MI 48103

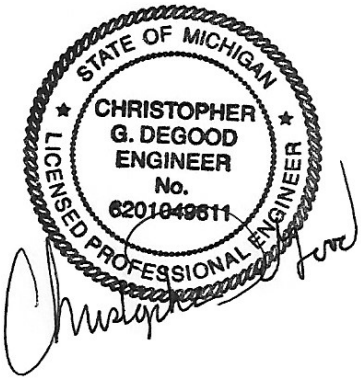
734.663.2622 ph
734.663.6759 fx

www.bria2.com

DOCUMENT 00 0107 - SEALS PAGE

1.1 DESIGN PROFESSIONALS OF RECORD

A. Civil Engineer:
   1. Christopher G. DeGood, Beckett & Raeder, Inc.
   2. Michigan Professional Engineer License #6201049611.



B. Landscape Architect:
   1. Brian D. Barrick, Beckett & Raeder, Inc..
   2. Michigan Landscape Architect License #3901001313.

END OF DOCUMENT 00 0107

SECTION 00 0110 - TABLE OF CONTENTS

DIVISION 07 THROUGH 19
NOT APPLICABLE

FACILITY SERVICES SUBGROUP
DIVISION 20 THROUGH DIVISION 29
NOT APPLICABLE

SITE AND INFRASTRUCTURE SUBGROUP
DIVISION 31 - EARTHWORK

DIVISION 32 - EXTERIOR IMPROVEMENTS

DIVISION 33 - UTILITIES

DIVISION 34 THROUGH DIVISION 39
NOT APPLICABLE

PROCESS EQUIPMENT SUBGROUP
DIVISION 40 THROUGH DIVISION 49
NOT APPLICABLE

APPENDICES

END OF SECTION 00 0110

SECTION 00 0115 - LIST OF DRAWING SHEETS

1.1 LIST OF DRAWINGS

A. Drawings: Drawings consist of the Contract Drawings and other drawings listed on the Table of Contents page of the separately bound drawing set titled **STANLEY PARK IMPROVEMENTS**, dated **JUNE 15, 2023 (2023-06-15)**, and as modified by subsequent Addenda and Contract modifications.

END OF SECTION 00 0115

DOCUMENT 00 1113 - ADVERTISEMENT FOR BIDS

1.1 White Lake Township Stanley Park Improvements

White Lake Township will **receive sealed bids for the construction of the Stanley Park Improvement Project at the White Lake Township Hall, care of the Township Clerk's Office, 7525 Highland Road, White Lake, MI 48383 until 2:00 p.m., local time, Tuesday, January 30, 2024**. At that time, the bids will be publicly opened and read aloud. Faxed, late or unsealed bids will be rejected.

The work includes, but is not limited to, site preparation, soil erosion/sedimentation control, miscellaneous demolition, clearing and grubbing, earthwork, bituminous road and pathways, gravel road, concrete sidewalk, modular boardwalk, floating pier and gangway, regulatory and interpretive signage, site furnishings, and native landscaping.

The Landscape Architect/Engineer for the project is Beckett & Raeder, Inc. Contact person is Brian D. Barrick, PLA, ASLA, who can be reached at 734.663.2622 or at bbarrick@bria2.com. Direct questions concerning the bidding documents should be addressed to this contact person.

Bidding documents may be downloaded electronically from the Michigan Inter-governmental Trade Network (MITN) Bidnet Direct Michigan website (www.bidnetdirect.com) beginning **Thursday, January 4, 2024**. Bidding documents will also be on file for examination at the office of the Landscape Architect / Engineer located at 535 W. William St., Ann Arbor, MI 48103; and the White Lake Township Community Development Department located in the Township Hall at 7525 Highland Road, White Lake, MI 48383.

A mandatory pre-bid meeting, conducted by the Landscape Architect/Engineer, will be held on **Tuesday, January 16, 2024** at 2:00 PM EDT at Stanley Park, 10785 Elizabeth Lake Road, White Lake, MI 48386. The park is located on the west side of Elizabeth Lake Road, opposite "The Neighborhoods of White Lake" retirement community, and is marked by a large temporary park sign. The pre-bid meeting is for dissemination of information and clarification of intent of Bid Documents. Attendance is mandatory for interested bidders. In addition to the mandatory pre-bid meeting, bidders may make supplemental visits to the site as desired during daylight hours.

Proposals shall be submitted on the Bid Form (provided in the Specifications) and shall be accompanied by required certifications, and a Bid Bond or Certified Check in the amount of 5% of the Base Bid. The accepted bidder will be required to furnish a satisfactory Performance Bond and a Labor and Materials Payment Bond in the amount of 100% of the Contract Sum, and a Guarantee Bond in the amount of 100% of the Contract Sum for a period of one year.

Notice of Award is anticipated on or about **Wednesday, February 21, 2024**. Accordingly, construction is anticipated to commence **Monday, April 15, 2024,** with completion by **Friday, October 15, 2024**.

Firms desiring to bid shall be able to document at least five years successful experience on projects similar in both type and scope/scale as this project with references available to attest to successful completion of similar work; be licensed as required by state or local law; and maintain required insurance including general liability and worker's compensation.

No Proposal may be withdrawn for at least sixty (60) consecutive calendar days after the official bid opening. The Township reserves the right to accept any bid, to reject any or all bids, to waive any irregularities and/or informalities in any bid, and to make the award in the manner deemed in the best interest of the Township. Only bids submitted in accordance with the specifications will be considered.

The Stanley Park Improvement Project is a Land and Water Conservation Fund Grant project. As such, Federal and State funds are being used to assist in construction and relevant Federal and State requirements will apply. Contractor and all subcontractors must comply with all requirements of 1976 PA 453 (Elliott-Larsen Civil Rights Act), the 1976 PA 220 (Persons with Disabilities Civil Rights Act), and Executive Directive 2019-09, as amended. In accordance with these laws, all contracts must contain a covenant by the contractor and any subcontractors not to discriminate against an employee or applicant for employment with respect to hire, tenure, terms, conditions, or privileges of employment, or a matter directly or indirectly related to employment, because of race, color, religion, national origin, age, sex, height, weight, marital status, partisan considerations, or a disability or genetic information that is unrelated to the individual's ability to perform the duties of a particular job or position.

END OF DOCUMENT 00 1113

DOCUMENT 002213 - INSTRUCTIONS TO BIDDERS

1.1 PROPOSALS

A. All proposals shall be submitted in duplicate on approved forms provided within. Proposals shall include the fully executed Bid Form and required certification forms. Bid Proposals shall be enclosed in an envelope and shall bear the name of the bidder and the name of the project. It shall be addressed as follows:

White Lake Township
Stanley Park Improvement Project Bid
7525 Highland Road
White Lake, MI 48383
Attn: Clerk's office

B. Proposal submitted by telephone, fax or telegram will not be accepted. Proposal shall be for the complete work as required by the Contract Documents.

1.2 BID GUARANTEE

A. Each proposal shall be accompanied by either a certified or cashier's check on an open, solvent bank or a bid bond with an authorized surety company in the amount of 5% of the base bid payable to the Owner as a guarantee of good faith. If the successful bidder fails to furnish satisfactory bonds and insurance within 15 days of notice of award, such guarantee shall be forfeited to the owner as liquidated damages. The guarantees of the three lowest bidders will be retained until the bonds and insurance of the Contractor have been approved by the Owner. The guarantees of all other bidders will be returned by the Owner within ten days after the bid opening.

1.3 TIME OF COMPLETION

A. The bidder, if awarded a Contract, agrees to proceed with construction as outlined within the Contract Documents and carry the project to completion without delay, with final completion of the work on or before **Friday, October 15, 2024**.
   1. The Contractor understands and agrees that work at the project site will be permitted Monday through Friday from 7:00 a.m. to 6:00 p.m., and that no work at the project site will be permitted on holidays, Saturdays or Sundays, except by written permission of the Owner.

1.4 CONTRACTS WITH SUBCONTRACTORS

A. All contracts made by the successful Bidder with Subcontractors shall be covered by the terms and conditions of the Contract. The successful Bidder shall see to it that his Sub-Contractors are fully informed in regard to these terms and conditions.

1.5 ADDITIONAL INFORMATION

A. If additional information is needed by the Bidder, or if revisions in the work are to be included in the proposal, written instructions covering such items will be issued by the Landscape Architect/Engineer to the Bidder, and such items shall be included in the proposal. No verbal instructions or interpretations will be considered as binding on the Owner unless confirmed by an addendum.

1.6 BIDDER'S SITE INVESTIGATION AND REPRESENTATIONS

A. Bidder shall visit the site, examine and verify conditions under which their work must be conducted. By submitting a bid, the Bidder has acknowledged that:
   1. The Bidder has investigated all required fees, permits, and regulatory requirements of authorities having jurisdiction and has properly included in the submitted bid the cost of such fees, permits, and requirements not otherwise indicated as provided by Owner.
   2. The Bidder is a properly licensed Contractor according to the laws and regulations of applicable jurisdictions and meets qualifications indicated in the Procurement and Contracting Documents.
   3. The Bidder has incorporated into the Bid adequate sums for work performed by installers whose qualifications meet those indicated in the Procurement and Contracting Documents.

1.7 TAXES

A. All proposals in original Contract work, and for all other work there under, shall include all applicable taxes, including social security, unemployment, and sales or use taxes, and any other taxes specifically levied on the work or on wages by local, city, state or federal government, except real property taxes on the site. Proposals shall also include all premiums, assessments and other like payments, charges and costs incidental to the work covered by the Contract Documents.

1.8 OWNER'S RIGHT TO REJECT BIDS

A. All proposals submitted shall remain firm for a period of sixty (60) days after the date specified or receipt of proposals. The Owner reserves the right to reject any or all proposals submitted and to waive any informalities therein.

1.9 TEMPORARY SERVICES

A. The Owner will not provide temporary water and electricity for the duration of the project. The Contractor will be responsible for all connections, charges, removal, and any related work relative to these temporary services.

1.10 ADDENDA

A. Addenda will be issued via the Michigan Inter-governmental Trade Network (MITN) Bidnet Direct Michigan website (www.bidnetdirect.com). Bidders are responsible for obtaining Addenda from the MITN Bidnet system. The Owner and Beckett & Raeder will not be responsible for Bidders not receiving notices for Addenda. It is the Bidder's responsibility to check the MITN Bidnet system for addenda prior to submitting a bid. Copies of addenda will be made available for inspection wherever Bidding Documents are on file for that purpose.

B. No Addenda will be issued later than three (3) days prior to the date for the receipt of Bids except an Addendum withdrawing the request for Bids or one which includes postponement of the date for receipt of Bids.

C. Each Bidder shall ascertain prior to submitting his bid that he has received all Addenda issued, and he shall acknowledge their receipt in the proper location on the Bid Proposal Form.

1.11 PERMITS

A. Contractor shall purchase and pick up all permits from applicable municipalities or agencies.

1.12 NATIONAL STORM WATER DISCHARGE PERMIT

A. Contractor shall file for National Storm Water Discharge permit (NOC) from the Michigan Department of Environment, Great Lakes, and Energy (EGLE) and provide registered storm water operator for all work related to the permit requirements.

1.13 CONSIDERATION OF BIDS

A. It is expressly understood that White Lake Township reserves the right to award a contract based solely on criteria as established by White Lake Township. White Lake Township reserves the right to award a contract based solely on what they determine to be in the best interest of the Township.

END OF DOCUMENT 00 2213

SECTION 00 3119 - EXISTING CONDITION INFORMATION

1.1 EXISTING CONDITION INFORMATION

A. This Section with its referenced attachments is part of the Procurement and Contracting Requirements for Project. They provide Owner's information for the Contractor's convenience and are intended to supplement rather than serve in lieu of the Contractor's own investigations. They are made available for Contractor's convenience and information, but are not a warranty of existing conditions.

B. Existing Condition drawings contained in the project drawings were developed from aerial-based survey with supplemental and selective ground-based survey within the project's proposed disturbance area. The Architect and the Owner make no warranty of their completeness or accuracy related to the current as-built condition. Contractor shall conduct pre-construction investigations it deems necessary to avoid damage to existing improvements, including below-grade utilities that may be inaccurate or not represented on the Existing Conditions drawings. Repair of existing improvement damage resulting from the Contractor's operations shall be at the Contractor's expense.

C. Contractor shall utilize MISSDIG and other private locating services as needed to validate and supplement available existing conditions information.

END OF SECTION 00 3119

DOCUMENT 00 3132 - GEOTECHNICAL DATA

1.1 GEOTECHNICAL DATA

A. This Document with its referenced attachments is part of the Procurement and Contracting Requirements for Project. They provide Owner's information for Bidders' convenience and are intended to supplement rather than serve in lieu of Bidders' own investigations. They are made available for Bidders' convenience and information.

B. Because subsurface conditions indicated by the soil borings are a sampling in relation to the entire construction area, and for other reasons, the Owner, the Architect, the Architect's consultants, and the firm reporting the subsurface conditions do not warranty the conditions below the depths of the borings or that the strata logged from the borings are necessarily typical of the entire site. Any party using the information described in the soil borings and geotechnical report shall accept full responsibility for its use.

C. A geotechnical investigation report for Project, prepared by G2 Consulting Group, dated March 28, 2023, is included as an appendix to this Project Manual.
   1. The opinions expressed in this report are those of a geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by a geotechnical engineer. Owner is not responsible for interpretations or conclusions drawn from the data.
   2. Any party using information described in the geotechnical report shall make additional test borings and conduct other exploratory operations that may be required to determine the character of subsurface materials that may be encountered.

D. Related Requirements:
   1. Document 002113 "Instructions to Bidders" for the Bidder's responsibilities for examination of Project site and existing conditions.
   2. Document 003119 "Existing Condition Information" for information about existing conditions that is made available to bidders.

END OF DOCUMENT 00 3132

SECTION 00 4113 - BID FORM

1.1 BID INFORMATION

A. Bidder: _____.

1. Address: _____.

2. Contact Person: _____.

3. Address: _____.

4. Telephone: _____.

5. Email: _____.

B. Project Name: Stanley Park Improvements.

C. Project Location: 10785 Elizabeth Lake Road, White Lake, MI 48383.

D. Project Grant Funding: Land and Water Conservation Fund, with MDNR Project Number 26-01868.

E. Owner: White Lake Charter Township
7525 Highland Road
White Lake, MI 48383

F. Owner's Consultant: Beckett & Raeder, Inc.
535 W. William Street, Suite 101
Ann Arbor, MI 48103

1.2 ACKNOWLEDGEMENT OF ADDENDA

A. Bidder acknowledges receipt of the following Addenda and has fully included all Addenda content in preparation of its bid.

1. Addenda No.: _____.

2. Addenda No.: _____.

3. Addenda No.: _____.

4. Addenda No.: _____.

5. Addenda No.: _____.

6. Addenda No.: _____.

1.3 TIME OF COMPLETION

A. The undersigned Bidder proposes and agrees hereby to commence the Work of the Contract Documents on a date specified in a written Notice to Proceed to be issued by Architect, and shall fully complete the Work prior to **Friday, October 15, 2024**.

1.4 CERTIFICATIONS AND BASE BID

A. **Base Bid:** The undersigned Bidder, having carefully examined the Procurement and Contracting Requirements, Conditions of the Contract, Drawings, Specifications, and all subsequent Addenda, having visited the site, and being familiar with all conditions and requirements of the Work, hereby agrees to furnish all material, labor, equipment and services, including all scheduled allowances, necessary to complete the construction of the above-named project, according to the requirements of the Procurement and Contracting Documents, for the stipulated sum of:

_____ Dollars ($_____).

1.5 ALTERNATES

A. **Alternate 1:** Road Paving. Provide and construct "Bituminous Pavement – Heavy Duty" for roadway and parking areas indicated as base bid "Gravel Drive". Portions of roadway included in Alternate 1 paving will be edged with 2' width gravel shoulder in lieu of concrete curb and gutter. Refer to Drawings for additional information.

Add/Deduct_____ Dollars ($_____).

B. **Alternate 2:** Parking. Provide and construct two (2) additional 9-space parking areas in the central portion of the park. Alternate also includes related grading, sidewalks, pathways, and signage associated with the parking areas. Refer to Drawings for additional information.

Add/Deduct_____ Dollars ($_____).

C. **Alternate 3:** Timber Bollards. Provide and construct timber traffic control bollards at roadway shoulders. Refer to Drawings for additional information.

Add/Deduct_____ Dollars ($_____).

D. **Alternate 4:** Exercise Station. Provide and construct Exercise Station 'B' in the central area of the park, including associated grading, timber edge, and safety surfacing. Refer to Drawings for additional information.

Add/Deduct_____ Dollars ($_____).

E. **Alternate 5:** Sidewalk. Provide and construct sidewalk as indicated on Drawings, north and west of remnant block building, including associated grading and restoration. Refer to Drawings for additional information.

Add/Deduct_____ Dollars ($_____).

1.6 BID GUARANTEE

A. The undersigned Bidder agrees to execute a contract for this Work in the above amount and to furnish surety as specified within 10 days after a written Notice of Award, if offered within 60 days after receipt of bids, and on failure to do so agrees to forfeit to Owner the attached cashier's check or bid bond, as liquidated damages for such failure, in the following amount constituting five percent (5%) of the Base Bid amount above:

1. _____ Dollars ($_____).

1.7 LIST OF SUBCONTRACTORS

A. The following companies shall execute subcontracts for the portions of the Work indicated. If none, indicate NONE on the first line.

1. Scope: _____.
   a. Firm: _____.
   b. Contact Person & Phone: _____.
2. Scope: _____.
   a. Firm: _____.
   b. Contact Person & Phone: _____.
3. Scope: _____.
   a. Firm: _____.
   b. Contact Person & Phone: _____.
4. Scope: _____.
   a. Firm: _____.
   b. Contact Person & Phone: _____.
5. Scope: _____.
   a. Firm: _____.
   b. Contact Person & Phone: _____.
6. Scope: _____.
   a. Firm: _____.
   b. Contact Person & Phone: _____.
7. Scope: _____.
   a. Firm: _____.
   b. Contact Person & Phone: _____.
8. Scope: _____.
   a. Firm: _____.
   b. Contact Person & Phone: _____.
9. Attach supplementary list to bid submittal if additional subcontractors are required.

1.8 LIST OF EXCEPTIONS

A. Contractor shall clearly list all exceptions made in preparation of this bid to requirements of the bid documents, Drawings and Specifications. If none, indicate NONE on the first line.

1. Exception: _____

_____.

2. Exception: _____

_____.

3. Exception: _____

_____.

4. Exception: _____

_____.

5. Exception: _____

_____.

6. Exception: _____

_____.

7. Exception: _____

_____.

8. Exception: _____

_____.

9. Exception: _____

_____.

10. Exception: _____

_____.

11. Exception: _____

_____.

12. Exception: _____

_____.

13. Attach supplementary list to bid submittal if additional exceptions have been made.

1.9 INFORMATIONAL UNIT PRICES

A. Contractor shall submit installed unit prices for items of work stated below. Prices shall include all base material required for the installation of the item. The Owner reserves the right to increase or decrease the base proposal sum by up to thirty percent (30%) on the basis of the unit prices stated. The Owner reserves the right to negotiate with the Bidder on any or all unit prices listed in this Bid Form. Unit prices given shall include all profit and overhead. Contractor "mark-up" will not be paid in addition to the prices given below.

DESCRIPTION	UNIT	UNIT COST
DEMOLITION		
Clearing and Grubbing Trees	ac	_____
Tree Removal (1-6" cal.)	ea	_____
Tree Removal (7-12"cal.)	ea	_____
Tree Removal (13-18"cal.)	ea	_____
Tree Removal (19-24"cal.)	ea	_____
Tree Removal (over 24" cal.)	ea	_____
SOIL EROSION AND SEDIMENTATION CONTROL		
Stabilized Construction Access	ls	_____
Turbidity Curtain	lf	_____
Tree Protection Fence	lf	_____
Filter Fabric Fence	lf	_____
Permanent Erosion Control Mat	sf	_____
EARTHWORK		
Strip and Stockpile Topsoil	cy	_____
Cut & Fill	cy	_____
Class II Sand	cy	_____
Undercut and Backfill with Class II Sand	cy	_____
Aggregate Base (MDOT 21AA)	cy	_____
Screen, Respread Topsoil	cy	_____
Fine Grade to Subgrade Elevation	sy	_____
Haul Material offsite and legally dispose	cy	_____
PAVING		
Vehicular Gravel Parking Drive 8"	sy	_____
Vehicular Concrete Pavement 8"	sf	_____
Concrete Curb & Gutter	lf	_____
Concrete Sidewalk 5"	sf	_____
Bituminous Pathway 8' Width	lf	_____
Bituminous Pathway 14' Width	lf	_____
RECREATION AND SITE FURNISHINGS		
Overlook Pier (including pier, gangway & headwall)	ls	_____
Boardwalk (excluding headwalls)	lf	_____
Concrete Boardwalk Headwall	ea	_____

Timber Bollard	ea	_____
Timber Removable Bollard	ea	_____
Regulatory Sign	ea	_____
Interpretive Sign	ea	_____
Bench – In-ground Mount	ea	_____
UTILITIES		
4' Dia. Storm Sewer Structure	ea	_____
12" RCP Storm Pipe	lf	_____
36" Diameter Wildlife Culvert	lf	_____
Stormwater Outlet Structure	ea	_____
Stone Check Dam	ea	_____
LANDSCAPE AND SEEDING		
Lawn Seeding	sy	_____
Stormwater Basin & Roadway Edge Native Seeding	sy	_____
Acer rubrum, 2.5" B&B	ea	_____
Acer saccharum, 2.5" B&B	ea	_____
Quercus alba, 2.5" B&B	ea	_____
Quercus rubra, 2.5" B&B	ea	_____

1.10 VOLUTARY ALTERNATES

The Bidder may offer self-identified opportunities for cost savings or added value. If none, indicate NONE on the first line.

A. **Voluntary Alternate A:** _____

_____.

Add/Deduct_____ Dollars ($_____).

B. **Voluntary Alternate B:** _____

_____.

Add/Deduct_____ Dollars ($_____).

C. **Voluntary Alternate C:** _____

_____.

Add/Deduct_____ Dollars ($_____).

D. **Voluntary Alternate D:** _____

_____.

Add/Deduct_____ Dollars ($_____).

E. Attach supplementary list to bid submittal if additional voluntary alternates are available.

1.11 BIDDER CERTIFICATIONS

By signature and submittal of this bid form, the undersigned hereby certifies work of Contract will be conducted in full compliance with the following requirements:

A. The undersigned Bidder hereby certifies that it, and all subcontractors, will comply with all **Land and Water Conservation Fund grant program and agency requirements**, including assisting Owner with grant reporting and reimbursement requirements. Refer to Specifications for additional information.

1. Authorized Signature:_____(Handwritten signature).

B. The undersigned Bidder hereby certifies that it, and all subcontractors, will comply with all requirements of **1976 PA 453 (Elliott-Larsen Civil Rights Act), the 1976 PA 220 (Persons with Disabilities Civil Rights Act), and Executive Directive 2019-09, as amended**. In accordance with these laws, all contracts must contain a covenant by the contractor and any subcontractors not to discriminate against an employee or applicant for employment with respect to hire, tenure, terms, conditions, or privileges of employment, or a matter directly or indirectly related to employment, because of race, color, religion, national origin, age, sex, height, weight, marital status, partisan considerations, or a disability or genetic information that is unrelated to the individual's ability to perform the duties of a particular job or position.

1. Authorized Signature:_____(Handwritten signature).

C. The undersigned Bidder hereby certifies that it, and all subcontractors, will comply with all requirements of **Build America, Buy America requirements, as required by Section 70914 of the Bipartisan Infrastructure Law**. In accordance with with these laws, all iron and steel, manufactured products, and construction materials provided for the project must have content greater than 55 percent (total cost of the component) mined, produced, and manufactured in the United States. Refer to Specifications for additional information.

1. Authorized Signature:_____(Handwritten signature).

D. The undersigned Bidder hereby certifies that it, and all subcontractors, will comply with all requirements of **United States Fish and Wildlife Service (USFWS) Ecological Services Program Biological Opinion**, including training and procedures related to the Eastern Massasauga Rattlesnake. Refer to Specifications for additional information.

1. Authorized Signature:_____(Handwritten signature).

E. The undersigned Bidder hereby certifies that it, and all subcontractors, will comply with construction of the project for accessibility compliance as required in the project Drawings and Specification, including requirements of the **Americans with Disabilities Act (ADA) of 2010, as amended** and the **2013 Access Board's Final Guidelines for Outdoor Developed Areas (ODA)**. Refer to Specifications for additional information.

1. Authorized Signature:_____(Handwritten signature).

F. The undersigned Bidder hereby certifies that it, and all subcontractors, are not "Iran-linked businesses" as defined by the **Michigan "Iran Economic Sanctions Act", Act 517, Public Acts of 2012 ("Act 517")**.

1. Authorized Signature:_____(Handwritten signature).

G. The undersigned Bidder hereby certifies that it, and all subcontractors, are not currently under debarment, suspension, legal sanctions, written warnings or reprimands, or contract termination by any Federal, State, or local agency.

1. Authorized Signature:_____(Handwritten signature).

H. The undersigned Bidder hereby certifies that it is a duly licensed contractor, for the type of work proposed, within the required jurisdictions, and that all fees, permits, etc., pursuant to submitting this proposal have been paid in full.

1. Authorized Signature:_____(Handwritten signature).

I. The undersigned Bidder hereby certifies that it will provide all instrumental surveying required to layout and construct the work. Surveying will be by a Michigan Licensed Land Surveyor.

1. Authorized Signature:_____(Handwritten signature).

1.12 CERTIFICATION OF BID

The undersigned affirms that neither he/she nor agents, officers or employees of the Bidder submitting this lump sum bid have directly or indirectly entered into any agreements, participated in any collusion, or otherwise taken action in restraint of free competitive bidding in connection with the bid for this project.

The undersigned agrees that if this lump sum proposal is accepted by the Owner, Bidder will enter into the Contract, furnishing all bonds and other contract requirements and commence construction, within 10 business days of the Notice of Award/Notice to Proceed, and will complete the entire Work of the Contract within the given schedule and the provisions of the project specifications.

Respectfully submitted this ____ day of _____, 2024.

Submitted By:_____(Name of bidding firm or corporation).

Authorized Signature:_____(Handwritten signature).

Signed By:_____(Type or print name).

Title:_____(Owner/Partner/President/Vice President).

Street Address:_____.

City, State, Zip:_____.

Phone:_____.

Witness Signature:_____(Notary Public signature).

Witness By:_____(Type or print name).

Notary Public Commission No.:_____.

Notary Public Seal:

END OF DOCUMENT 00 4113

SECTION 00 6000 – PROJECT FORMS

1.1 FORM OF AGREEMENT AND GENERAL CONDITIONS

A. The following form of Owner/Contractor Agreement and form of the General Conditions shall be used for Project, subject to review by Township Staff and Legal Counsel, and to Township Board approval:
   1. AIA Document A101-2017 "Standard Form of Agreement between Owner and Contractor Where the Basis of Payment is a Stipulated Sum."
   2. The General Conditions for Project are AIA Document A201-2017 "General Conditions of the Contract for Construction."

1.2 ADMINISTRATIVE FORMS

A. Administrative Forms: Additional administrative forms are specified in Division 01 General Requirements.

B. Copies of AIA standard forms may be obtained from the American Institute of Architects; https://www.aiacontractdocs.org; (800) 942-7732.

C. Preconstruction Forms:
   1. Form of Performance Bond and Labor and Material Bond: AIA Document A312-2010 "Performance Bond and Payment Bond."
   2. Form of Maintenance and Warranty Bond: AIA A313-2010 "Warranty Bond."
   3. Form of Certificate of Insurance: AIA Document G715-1991 "Supplemental Attachment, ACORD Certificate of Insurance."

D. Information and Modification Forms:
   1. Form for Requests for Information (RFIs): AIA Document G716-2004 "Request for Information (RFI)."
   2. Form of Request for Proposal: AIA Document G709-2001 "Work Changes Proposal Request."
   3. Change Order Form: AIA Document G701-2001 "Change Order."
   4. Form of Architect's Memorandum for Minor Changes in the Work: AIA Document G710-1992 "Architect's Supplemental Instructions."
   5. Form of Change Directive: AIA Document G714-2007 "Construction Change Directive."

E. Payment Forms:
   1. Schedule of Values Form: AIA Document G703-1992 "Continuation Sheet."
   2. Payment Application: AIA Document G702-1992/703-1992 "Application and Certificate for Payment and Continuation Sheet."
   3. Form of Contractor's Affidavit: AIA Document G706-1994 "Contractor's Affidavit of Payment of Debts and Claims."
   4. Form of Affidavit of Release of Liens: AIA Document G706A-1994 "Contractor's Affidavit of Payment of Release of Liens."
   5. Form of Consent of Surety: AIA Document G707-1994 "Consent of Surety to Final Payment."

END OF DOCUMENT 00 6000

SECTION 01 0000 - GENERAL REQUIREMENTS

PART 1 - GENERAL

1.1 LAND AND WATER CONSERVATION FUND (LWCF) GRANT REQUIREMENTS

A. The White Lake Township Stanley Park Improvements project is partially funded by The Land and Water Conservation Fund (LWCF) program, utilizing Federal fund administered locally by the Michigan Department of Natural Resources (MDNR).
   1. The Township and its design consultant will manage grant reporting and reimbursement requirements. The Contractor shall provide any necessary supporting documentation upon request.
   2. The Contractor shall comply with all applicable local, state, and federal codes.
   3. The Contractor shall comply with all LWCF grant program and agency requirements including, but not limited to:
      a. ***Build America, Buy America* requirements, as required by Section 70914 of the *Bipartisan Infrastructure Law***.
         1) Contractor will be required submit material and product certifications documenting:
            a) all iron and steel used in the project are produced in the United States--this means all manufacturing processes, from the initial melting stage through the application of coatings, occurred in the United States;
            b) all manufactured products used in the project are produced in the United States —this means the manufactured product was manufactured in the United States; and the cost of the components of the manufactured product that are mined, produced, or manufactured in the United States is greater than 55 percent of the total cost of all components of the manufactured product, unless another standard for determining the minimum amount of domestic content of the manufactured product has been established under applicable law or regulation; and
            c) all construction materials are manufactured in the United States—this means that all manufacturing processes for the construction material occurred in the United States.
         2) The Buy America preference only applies to articles, materials, and supplies that are consumed in, incorporated into, or affixed to an infrastructure project. As such, it does not apply to tools, equipment, and supplies, such as temporary scaffolding, brought to the construction site and removed at or before the completion of the infrastructure project. Nor does a Buy America preference apply to equipment and furnishings, such as movable chairs, desks, and portable computer equipment, that are used at or within the finished infrastructure project, but are not an integral part of the structure or permanently affixed to the infrastructure project.
         3) Definitions pertaining to Build America, Buy America requirements are as follows:
            a) "Construction materials" includes an article, material, or supply that is or consists primarily of non-ferrous metals; plastic and polymer-based products (including polyvinylchloride, composite building materials, and polymers used in fiber optic cables); glass (including optic glass); lumber; or drywall.
            b) "Construction Materials" does not include cement and cementitious materials, aggregates such as stone, sand, or gravel, or aggregate binding agents or additives.
            c) "Domestic content procurement preference'' means all iron and steel used in the project are produced in the United States; the manufactured products used in the project are produced in the

United States; or the construction materials used in the project are produced in the United States.

d) "Infrastructure" includes, at a minimum, the structures, facilities, and equipment for, in the United States, roads, highways, and bridges; public transportation; dams, ports, harbors, and other maritime facilities; intercity passenger and freight railroads; freight and intermodal facilities; airports; water systems, including drinking water and wastewater systems; electrical transmission facilities and systems; utilities; broadband infrastructure; and buildings and real property. Infrastructure includes facilities that generate, transport, and distribute energy.

e) ''Project'' means the construction, alteration, maintenance, or repair of infrastructure in the United States

b. **Americans with Disabilities Act (ADA) of 2010**, as amended.

c. **2013 Access Board's Final Guidelines for Outdoor Developed Areas (ODA)**

1.2 ENDANGERED SPECIES ACT (ESA) REQUIREMENTS

A. The US Fish and Wildlife Service (USFWS) has identified that Stanley Park contains habitat suitable for several protected status species. As a result the USFWS conducted a Endangered Species Act (ESA) of 1973, Section 7 Formal Consultation and produced a USFWS Ecological Services Program Biological Opinion. The Biological Opinion is incorporated into these contract documents as an appendix in this project manual.

1. The Contractor shall conform with all requirements contained within the Biological Opinion. Key Biological Opinion excerpts for the Contractor's activities include, but are not limited to, the following:
   a. To prevent adverse effects to Indiana bat (*Myotis sodalis*) or northern long-eared bat (*Myotis septentrionalis*) during construction, tree clearing will take place from November 2022 to March 2023, during the inactive season for both species.
   b. Construction will take place during the summer, well within the active season of EMR (approximately April 15th – October 15th), to prevent ground disturbing activities harming EMR while in hibernacula.
   c. To increase human safety and awareness of EMR, construction personnel will review the species fact sheet or watch DNR's "60-Second Snakes: The Eastern Massasauga Rattlesnake" video.
   d. Only wildlife-safe soil erosion and sedimentation control materials that do not contain plastic mesh netting will be used at the site. Several products for soil erosion and control exist that do not contain plastic netting including net-less erosion control blankets (for example, made of excelsior), loose mulch, hydraulic mulch, soil binders, unreinforced silt fences, and straw bales. Others are made from natural fibers (such as jute) and loosely woven together in a manner that allows wildlife to wiggle free.
   e. During construction, wildlife exclusion fencing will be installed at the perimeter of the disturbance area to minimize the risks to EMR. Fencing will be installed as follows:
      1) When installing the exclusionary fencing, care will be taken to avoid crayfish and small mammal burrows.
      2) When possible, exclusionary fence will be installed at least 24 hours before starting construction.
      3) Prior to the installation of exclusionary fencing, the area will be searched for EMR to ensure that individuals will not be trapped within the fence.
      4) The work area (i.e., interior of exclusionary fencing) will be cleared of EMR to ensure none are trapped in the work area prior to beginning construction activities.
      5) If any EMR are observed within the exclusionary fencing, work will halt until the snake can be safely relocated by a qualified individual and the fence examined for breaches. For more information on how to safely move snakes, watch DNR's "60-Second Snakes: Snake Removal" video or call a trained wildlife removal company for assistance.

6) The integrity of the exclusionary fencing will be ensured throughout the duration of construction activities and breaches of the barrier will be repaired promptly.
7) The exclusionary fencing will be properly removed after completion of construction, once soils are stable.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 0000

SECTION 01 1000 - SUMMARY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Project information.
2. Work covered by Contract Documents.
3. Work by Owner.
4. Future work.
5. Owner-furnished products.
6. Access to site.
7. Work restrictions.
8. Specification and Drawing conventions.

B. Related Requirements:
1. Section 01 5000 "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

1.3 PROJECT INFORMATION

A. Project Identification: Stanley Park Improvements.
1. Project Location: 10785 Elizabeth Lake Road, White Lake Township, Michigan 48386.

B. Owner: White Lake Charter Township.
1. Owner's Address: 7525 Highland Road, White Lake Township, Michigan 48383.

C. Owner's Consultant ('Architect'): Beckett & Raeder, Inc.
1. Consultant's Address: 535 W. William Street, Suite 101, Ann Arbor, Michigan 48103.
2. Consultant Contact: Brian D. Barrick, PLA, ASLA.

1.4 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of Project is defined by the Contract Documents and consists of the following:
1. Development of improvements to Stanley Park, a largely undeveloped 59-acre former private campground property, to provide infrastructure to access to the water, establish trails, and provide accessible community recreation opportunities among the natural features. Proposed improvements include accessible paved trails from the main entrance of the property to the waterfront; accessible benches and exercise stations along the trails; accessible interpretive signage highlighting the natural features of the site; and an accessible overlook/fishing pier on the shore of Brendel Lake. To provide universal access to these amenities, an access drive and parking areas flow into the core of the site to create accessible parking opportunities while limiting impacts to the existing natural area.
2. More specifically, the project construction scope includes site clearing, earthwork, stormwater utilities and infrastructure, road and parking pavements, multi-use trail pavements, floating overlook dock and gangway, modular boardwalks, exercise stations, interpretive signage, site furnishings, and other Work indicated in the Contract Documents.

B. Type of Contract:
1. Project will be constructed under a single prime contract.

1.5 WORK BY OWNER

A. General: Cooperate fully with Owner so work may be carried out smoothly, without interfering with or delaying work under this Contract or work by Owner. Coordinate the Work of this Contract with work performed by Owner.

B. Preceding Work: Owner will perform the following construction operations at Project site. Those operations are scheduled to be substantially complete before work under this Contract begins.
   1. Cutting of trees and brush indicated for removal on the plans. Project Contractor will remain responsible for stump and root removal. Contractor shall inspect the site prior to bidding to confirm completeness of Owner's work. Any additional removal required based on project plans shall be included in the Contractor's bid price.

1.6 FUTURE WORK

A. The Contract Documents include requirements that will allow Owner to carry out future work following completion of this Project; provide for the following future work:
   1. Renovation of an existing remnant building shell in the northern portion of the park.

1.7 OWNER-FURNISHED PRODUCTS

A. Owner will furnish products indicated. The Contractor's Work includes receiving, unloading, handling, storing, protecting, and installing Owner-furnished products.

B. Owner-Furnished Products:
   1. Dog Waste Stations (existing stations to be salvaged).
   2. Benches
   3. Trash Receptacles

1.8 ACCESS TO SITE

A. General: Contractor shall have limited use of Project site for construction operations as indicated on Drawings by the Contract limits and as indicated by requirements of this Section.

B. Use of Site: Limit use of Project site to areas within the Contract limits indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.
   1. Limits: Confine construction operations to Limits of Disturbance indicated on drawings and excluding Tree Protection Zones.

C. Condition of Existing Grounds: Maintain portions of existing grounds, landscaping, and hardscaping affected by construction operations throughout construction period. Repair damage caused by construction operations.

1.9 WORK RESTRICTIONS

A. Work Restrictions, General: Comply with restrictions on construction operations.
   1. Comply with limitations on use of public streets and with other requirements of authorities having jurisdiction.

B. On-Site Work Hours: Limit work on the site to normal business working hours of 7 a.m. to 6 p.m., Monday through Friday, unless otherwise indicated.
   1. Weekend Hours: Upon approval by Owner.
   2. Early Morning Hours: Upon approval by Owner..

C. Noise, Vibration, and Odors: Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption to adjacent properties with Owner. Contractor activities shall not exceed standards described in Section 5.18 of the Township Zoning Ordinance.

1. Notify Architect and Owner not less than 7 days in advance of proposed disruptive operations.
2. Obtain Owner's written permission before proceeding with disruptive operations.

D. Restricted Substances: Use of tobacco products and other controlled substances on Project site is not permitted.

1.10 SPECIFICATION AND DRAWING CONVENTIONS

A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.

B. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.

C. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:
1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
2. Abbreviations: Materials and products are identified by abbreviations and scheduled on Drawings.
3. Conflicts: The Contractor shall notify the Architect of any identified conflicts between the Specifications and Drawings. If conflicts occur, the higher standard as determined by the Architect shall govern.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 1000

SECTION 01 2300 – ALTERNATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for alternates.

1.3 DEFINITIONS

A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the bidding requirements that may be added to or deducted from the base bid amount if the Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.
   1. Alternates described in this Section are part of the Work only if enumerated in the Agreement.
   2. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternates into the Work. No other adjustments are made to the Contract Sum.

1.4 PROCEDURES

A. Coordination: Revise or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.
   1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.

B. Execute accepted alternates under the same conditions as other work of the Contract.

C. Schedule: A schedule of alternates is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

A. **Alternate 1:** Road Paving. Provide and construct "Bituminous Pavement – Heavy Duty" for roadway and parking areas indicated as base bid "Gravel Drive". Portions of roadway included in Alternate 1 paving will be edged with 2' width gravel shoulder in lieu of concrete curb and gutter. Refer to Drawings for additional information.

B. **Alternate 2:** Parking. Provide and construct two (2) additional 9-space parking areas in the central portion of the park. Alternate also includes related grading, sidewalks, pathways, and signage associated with the parking areas. Refer to Drawings for additional information.

C. **Alternate 3:** Timber Bollards. Provide and construct timber traffic control bollards at roadway shoulders. Refer to Drawings for additional information.

D. **Alternate 4:** Exercise Station. Provide and construct Exercise Station 'B' in the central area of the park, including associated grading, timber edge, and safety surfacing. Refer to Drawings for additional information.

E. **Alternate 5:** Sidewalk. Provide and construct sidewalk as indicated on Drawings, north and west of remnant block building, including associated grading and restoration. Refer to Drawings for additional information.

END OF SECTION 01 2300

SECTION 01 2500 - SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for substitutions.

B. Related Requirements:
   1. Section 01 2300 "Alternates" for products selected under an alternate.
   2. Section 01 6000 "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.

1.3 DEFINITIONS

A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.
   1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
   2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required in order to meet other Project requirements but may offer advantage to Contractor or Owner.

1.4 ACTION SUBMITTALS

A. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
   1. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
      a. Statement indicating why specified product or fabrication or installation method cannot be provided, if applicable.
      b. Coordination of information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors that will be necessary to accommodate proposed substitution.
      c. Detailed comparison of significant qualities of proposed substitutions with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes, such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
      d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
      e. Samples, where applicable or requested.
      f. Certificates and qualification data, where applicable or requested.
      g. List of similar installations for completed projects, with project names and addresses as well as names and addresses of architects and owners.
      h. Material test reports from a qualified testing agency, indicating and interpreting test results for compliance with requirements indicated.
      i. Research reports evidencing compliance with building code in effect for Project.

j. Detailed comparison of Contractor's construction schedule using proposed substitutions with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
k. Cost information, including a proposal of change, if any, in the Contract Sum.
l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents, except as indicated in substitution request, is compatible with related materials and is appropriate for applications indicated.
m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

2. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within 7 days of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within 7 days of receipt of request, or 7 days of receipt of additional information or documentation, whichever is later.

1.5 QUALITY ASSURANCE

A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage a qualified testing agency to perform compatibility tests recommended by manufacturers.

1.6 PROCEDURES

A. Coordination: Revise or adjust affected work as necessary to integrate work of the approved substitutions.

1.7 SUBSTITUTIONS

A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than 15 days prior to time required for preparation and review of related submittals.
1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
b. Substitution request is fully documented and properly submitted.
c. Requested substitution will not adversely affect Contractor's construction schedule.
d. Requested substitution has received necessary approvals of authorities having jurisdiction.
e. Requested substitution is compatible with other portions of the Work.
f. Requested substitution has been coordinated with other portions of the Work.
g. Requested substitution provides specified warranty.
h. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

B. Substitutions for Convenience: Architect will consider requests for substitution, but may be considered or rejected at discretion of Architect.
1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
a. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities

Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.

b. Requested substitution does not require extensive revisions to the Contract Documents.
c. Requested substitution is consistent with the Contract Documents and will produce indicated results.
d. Substitution request is fully documented and properly submitted.
e. Requested substitution will not adversely affect Contractor's construction schedule.
f. Requested substitution has received necessary approvals of authorities having jurisdiction.
g. Requested substitution is compatible with other portions of the Work.
h. Requested substitution has been coordinated with other portions of the Work.
i. Requested substitution provides specified warranty.
j. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 2500

SECTION 01 3100 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
   1. General coordination procedures.
   2. RFIs.
   3. Digital project management procedures.
   4. Project meetings.

1.3 DEFINITIONS

A. RFI: Request for Information. Request from Owner, Architect, or Contractor seeking information required by or clarifications of the Contract Documents.

1.4 INFORMATIONAL SUBMITTALS

A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:
   1. Name, address, telephone number, and email address of entity performing subcontract or supplying products.
   2. Number and title of related Specification Section(s) covered by subcontract.
   3. Drawing number and detail references, as appropriate, covered by subcontract.

1.5 GENERAL COORDINATION PROCEDURES

A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations included in different Sections that depend on each other for proper installation, connection, and operation.
   1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
   2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
   3. Make adequate provisions to accommodate items scheduled for later installation.

B. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
   1. Preparation of Contractor's construction schedule.
   2. Preparation of the schedule of values.
   3. Installation and removal of temporary facilities and controls.
   4. Delivery and processing of submittals.
   5. Progress meetings.
   6. Preinstallation conferences.
   7. Project closeout activities.

8. Startup and adjustment of systems.

1.6 REQUEST FOR INFORMATION (RFI)

A. General: Immediately on discovery of the need for additional information, clarification, or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.
   1. Architect will return without response those RFIs submitted to Architect by other entities controlled by Contractor.
   2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.

B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:
   1. Project name.
   2. Project number.
   3. Date.
   4. Name of Contractor.
   5. RFI number, numbered sequentially.
   6. RFI subject.
   7. Specification Section number and title and related paragraphs, as appropriate.
   8. Drawing number and detail references, as appropriate.
   9. Field dimensions and conditions, as appropriate.
   10. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
   11. Contractor's signature.
   12. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.

C. RFI Forms: Software-generated form with substantially the same content as indicated above, acceptable to Architect.

D. Architect's Action: Architect will review each RFI, determine action required, and respond. Allow seven working days for Architect's response for each RFI. RFIs received by Architect after 1:00 p.m. will be considered as received the following working day.
   1. The following Contractor-generated RFIs will be returned without action:
      a. Requests for approval of submittals.
      b. Requests for approval of substitutions.
      c. Requests for approval of Contractor's means and methods.
      d. Requests for coordination information already indicated in the Contract Documents.
      e. Requests for adjustments in the Contract Time or the Contract Sum.
      f. Requests for interpretation of Architect's actions on submittals.
      g. Incomplete RFIs or inaccurately prepared RFIs.
   2. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt by Architectof additional information.

E. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number.
   1. Project name.
   2. Name and address of Contractor.
   3. Name and address of Architect.
   4. RFI number including RFIs that were returned without action or withdrawn.
   5. RFI description.
   6. Date the RFI was submitted.
   7. Date Architect's response was received.

F. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within seven days if Contractor disagrees with response.

1.7 DIGITAL PROJECT MANAGEMENT PROCEDURES

A. Architect's Data Files: Upon Contractor's execution of Architect's Digital File Transfer Agreement, Architect will provide CAD drawing digital data files for Contractor's use during construction.

B. PDF Document Preparation: Where PDFs are required to be submitted to Architect, prepare as follows:
1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
2. Name file with submittal number or other unique identifier, including revision identifier.
3. Certifications: Where digitally submitted certificates and certifications are required, provide a digital signature with digital certificate on where indicated.

1.8 PROJECT MEETINGS

A. General: Schedule and conduct meetings and conferences at Project site unless otherwise indicated.

B. Preconstruction Conference: Architect will schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 15 days after execution of the Agreement.
1. Attendees: Authorized representatives of Owner Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Discuss items of significance that could affect progress, including the following:
   a. Responsibilities and personnel assignments.
   b. Tentative construction schedule.
   c. Phasing.
   d. Critical work sequencing and long lead items.
   e. Designation of key personnel and their duties.
   f. Lines of communications.
   g. Procedures for processing field decisions and Change Orders.
   h. Procedures for RFIs.
   i. Procedures for testing and inspecting.
   j. Procedures for processing Applications for Payment.
   k. Distribution of the Contract Documents.
   l. Submittal procedures.
   m. Preparation of Record Documents.
   n. Use of the premises.
   o. Work restrictions.
   p. Working hours.
   q. Responsibility for temporary facilities and controls.
   r. Construction waste management and recycling.
   s. First aid.
   t. Security.
   u. Progress cleaning.
3. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.

C. Progress Meetings: Conduct progress meetings at biweekly intervals.
1. Coordinate dates of meetings with preparation of payment requests.

2. Attendees: In addition to representatives of Owner and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
3. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
    a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
        1) Review schedule for next period.
    b. Review present and future needs of each entity present, including the following:
        1) Interface requirements.
        2) Sequence of operations.
        3) Status of submittals.
        4) Access.
        5) Site use.
        6) Temporary facilities and controls.
        7) Progress cleaning.
        8) Quality and work standards.
        9) Status of correction of deficient items.
        10) Field observations.
        11) Status of RFIs.
        12) Status of Proposal Requests.
        13) Pending changes.
        14) Status of Change Orders.
        15) Documentation of information for payment requests.
4. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.
    a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 3100

SECTION 01 3233 - PHOTOGRAPHIC DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for the following:
   1. Preconstruction photographs.
   2. Periodic construction photographs.

B. Related Requirements:
   1. Section 01 7700 "Closeout Procedures" for submitting photographic documentation as Project Record Documents at Project closeout.
   2. Section 31 1000 "Site Clearing" for photographic documentation before site clearing operations commence.

1.2 INFORMATIONAL SUBMITTALS

A. Key Plan: Submit key plan of Project site with notation of vantage points marked for location and direction of each photograph.

B. Digital Photographs: Submit image files within three days of taking photographs.
   1. Submit photos on CD-ROM or USB flash drive. Include copy of key plan indicating each photograph's location and direction.
   2. Identification: Provide the following information with each image description in file metadata tag:
      a. Name of Project.
      b. Name of Contractor.
      c. Date photograph was taken.
      d. Description of location, vantage point, and direction.
      e. Unique sequential identifier keyed to accompanying key plan.

1.3 QUALITY ASSURANCE

A. Photographer Qualifications: An individual who has been regularly engaged as a professional photographer of construction projects for not less than three years.

1.4 FORMATS AND MEDIA

A. Digital Photographs: Provide color images in JPG format, produced by a digital camera with minimum sensor size of 12 megapixels, and at an image resolution of not less than 3200 by 2400 pixels, and with vibration-reduction technology. Use flash in low light levels or backlit conditions.

B. Digital Images: Submit digital media as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.

C. Metadata: Record accurate date and time from camera.

D. File Names: Name media files with and sequential numbering suffix identified on key plan.

1.5 CONSTRUCTION PHOTOGRAPHS

A. General: Take photographs with maximum depth of field and in focus.
   1. Maintain key plan with each set of construction photographs that identifies each photographic location.

B. Preconstruction Photographs: Before commencement of demolition, take photographs of Project site and surrounding properties, including existing items to remain during construction, from different vantage points.
   1. Take photographs to show existing conditions before starting the Work. Accurately record physical conditions at start of construction. Take photographs as required to document pre-existing conditions or damage to items to remain.

C. Periodic Construction Photographs: Take photographs daily to document construction progress and locations of underground improvements as they are installed.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 3233

SECTION 01 3300 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Submittal schedule requirements.
2. Administrative and procedural requirements for submittals.

1.2 DEFINITIONS

A. Action Submittals: Written and graphic information and physical samples that require Architect's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."

B. Informational Submittals: Written and graphic information and physical samples that do not require Architect's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."

1.3 SUBMITTAL SCHEDULE

A. Submittal Schedule: Submit, as an action submittal, a list of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Architect and additional time for handling and reviewing submittals required by those corrections.

1.4 SUBMITTAL FORMATS

A. Submittal Information: Include the following information in each submittal:
1. Project name.
2. Date.
3. Name of Architect.
4. Name of Contractor.
5. Name of firm or entity that prepared submittal.
6. Names of subcontractor, manufacturer, and supplier.
7. Unique submittal number, including revision identifier. Include Specification Section number with sequential alphanumeric identifier; and alphanumeric suffix for resubmittals.
8. Category and type of submittal.
9. Submittal purpose and description.
10. Number and title of Specification Section, with paragraph number and generic name for each of multiple items.
11. Drawing number and detail references, as appropriate.
12. Indication of full or partial submittal.
13. Other necessary identification.
14. Remarks.
15. Signature of transmitter.

B. Options: Identify options requiring selection by Architect.

C. Deviations and Additional Information: On each submittal, clearly indicate deviations from requirements in the Contract Documents, including minor variations and limitations; include relevant additional information and revisions, other than those requested by Architect on

previous submittals. Indicate by highlighting on each submittal or noting on attached separate sheet.

D. PDF Submittals: Prepare submittals as PDF package, incorporating complete information into each PDF file. Name PDF file with submittal number.

1.5 SUBMITTAL PROCEDURES

A. Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
   1. Email: Prepare submittals as PDF package, and transmit to Architect by sending via email. Include PDF transmittal form. Include information in email subject line as requested by Architect.

B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
   1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
   2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
   3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.

C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
   1. Initial Review: Allow 7 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
   2. Resubmittal Review: Allow 7 days for review of each resubmittal.

D. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.

E. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

F. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Architect's action stamp.

1.6 SUBMITTAL REQUIREMENTS

A. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
   1. If information must be specially prepared for submittal because standard published data are unsuitable for use, submit as Shop Drawings, not as Product Data.
   2. Mark each copy of each submittal to show which products and options are applicable.
   3. Include the following information, as applicable:
      a. Manufacturer's catalog cuts.
      b. Manufacturer's product specifications.
      c. Standard color charts.
      d. Statement of compliance with specified referenced standards.
      e. Testing by recognized testing agency.
      f. Application of testing agency labels and seals.
      g. Notation of coordination requirements.
      h. Availability and delivery time information.

4. For equipment, include the following in addition to the above, as applicable:
   a. Wiring diagrams that show factory-installed wiring.
   b. Printed performance curves.
   c. Operational range diagrams.
   d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
5. Submit Product Data before Shop Drawings, and before or concurrent with Samples.

B. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.
1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
   a. Identification of products.
   b. Schedules.
   c. Compliance with specified standards.
   d. Notation of coordination requirements.
   e. Notation of dimensions established by field measurement.
   f. Relationship and attachment to adjoining construction clearly indicated.
   g. Seal and signature of professional engineer if specified.

C. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.

D. Certificates:
1. Certificates and Certifications Submittals: Submit a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity. Provide a notarized signature where indicated.
2. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
3. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
4. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
5. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
6. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.

E. Test and Research Reports:
1. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.
2. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.
3. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
4. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed

before installation of product, for compliance with performance requirements in the Contract Documents.

5. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
6. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:
   a. Name of evaluating organization.
   b. Date of evaluation.
   c. Time period when report is in effect.
   d. Product and manufacturers' names.
   e. Description of product.
   f. Test procedures and results.
   g. Limitations of use.

1.7 CONTRACTOR'S REVIEW

A. Action Submittals and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.

B. Contractor's Approval: Indicate Contractor's approval for each submittal with a uniform approval stamp. Include name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.
   1. Architect will not review submittals received from Contractor that do not have Contractor's review and approval.

1.8 ARCHITECT'S REVIEW

A. Action Submittals: Architect will review each submittal, indicate corrections or revisions required, and return it.
   1. PDF Submittals: Architect will indicate, via markup on each submittal, the appropriate action.

B. Informational Submittals: Architect will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.

C. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect.

D. Incomplete submittals will be considered unresponsive and will be returned for resubmittal without review.

E. Architect will return without review submittals received from sources other than Contractor.

F. Submittals not required by the Contract Documents will be returned by Architect without action.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 3300

SECTION 01 5000 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.

1.2 USE CHARGES

A. Water and Sewer Service from Existing System: Water and sewer services are not available on-site. Contractor shall provide legal water source and disposal method as required to complete project work.

B. Electric Power Service from Existing System: Electric power services are not available on-site. Contractor shall provide legal power source as required to complete project work.

1.3 INFORMATIONAL SUBMITTALS

A. Site Utilization Plan: Show temporary facilities, staging areas, construction site entrances, vehicle circulation, and parking areas for construction personnel.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SUPPORT FACILITIES INSTALLATION

A. Traffic Controls: Comply with requirements of authorities having jurisdiction.
   1. Protect existing site improvements to remain including curbs, pavement, and utilities.
   2. Maintain access for emergency responder equipment and access to fire hydrants.

B. Parking: Use designated areas of Owner's existing parking areas for construction personnel.

C. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.
   1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties or endanger permanent Work or temporary facilities.
   2. Remove snow and ice as required to minimize accumulations.

3.2 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.
   1. Where access to adjacent properties is required in order to affect protection of existing facilities, obtain written permission from adjacent property owner to access property for that purpose.

B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.

C. Temporary Erosion and Sedimentation Control: Provide measures to prevent soil erosion and discharge of soil-bearing water runoff and airborne dust to undisturbed areas and to adjacent

properties and walkways, according to requirements of EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.

1. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross tree- or plant-protection zones.
2. Inspect, repair, and maintain erosion- and sedimentation-control measures during construction until permanent vegetation has been established.
3. Clean, repair, and restore adjoining properties and roads affected by erosion and sedimentation from Project site during the course of Project.
4. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

D. Stormwater Control: Comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.

E. Tree and Plant Protection: Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from damage from construction operations. Protect tree root systems from damage, flooding, and erosion.

F. Site Enclosure Fence: Prior to commencing earthwork, furnish and install site enclosure fence in a manner that will prevent people from easily entering excavations or disturbed areas.
   1. Extent of Fence: As required to secure open excavations or other dangers to the public.

G. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.

H. Temporary Egress: Maintain temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction.

I. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities.

3.3 OPERATION, TERMINATION, AND REMOVAL

A. Maintenance: Maintain facilities in good operating condition until removal.
   1. Maintain operation of temporary enclosures, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.

B. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
   1. Materials and facilities that constitute temporary facilities are property of Contractor.
   2. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Section 01 7700 "Closeout Procedures."

END OF SECTION 01 5000

SECTION 01 5639 - TEMPORARY TREE AND PLANT PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes general protection and pruning of existing trees and plants that are affected by execution of the Work, whether temporary or permanent construction.

1.2 DEFINITIONS

A. Protection Zone: Area surrounding individual trees or groups of trees to be remain post-construction, within the dripline of the tree(s).

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Tree Pruning Schedule: Written schedule detailing scope and extent of pruning of trees to remain that interfere with or are affected by construction.

1.4 INFORMATIONAL SUBMITTALS

A. Certification: From arborist, certifying that trees indicated to remain have been protected during construction according to recognized standards and that trees were promptly and properly treated and repaired when damaged.

B. Maintenance Recommendations: From arborist, for care and protection of trees affected by construction during and after completing the Work.

C. Existing Conditions: Documentation of existing trees and plantings indicated to remain, which establishes preconstruction conditions that might be misconstrued as damage caused by construction activities.

1.5 QUALITY ASSURANCE

A. Arborist Qualifications: Certified Arborist as certified by ISA, licensed arborist in jurisdiction where Project is located, current member of ASCA, or registered Consulting Arborist as designated by ASCA.

B. Preinstallation Conference: Conduct conference at Project site.

1.6 PROJECT CONDITIONS

A. The following practices are prohibited within protection zones:
   1. Storage of construction materials, debris, or excavated material.
   2. Parking vehicles or equipment.
   3. Foot traffic.
   4. Erection of sheds or structures.
   5. Impoundment of water.
   6. Excavation or other digging unless otherwise indicated.
   7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

B. Do not direct vehicle or equipment exhaust toward protection zones.

C. Prohibit heat sources, flames, and ignition sources within or near protection zones and organic mulch.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Tree Protection Fence: Fence shall be extruded polyethylene or polypropylene mesh, commonly referred to as snow fence or safety fence.
1. Height: 4-feet minimum
2. Mesh: 4-gauge wire equivalent extrusion diameter, diamond pattern with approximate 2-inch openings.
3. Selvage: Minimum ½-inch ribbon extrusion top and bottom.
4. Color: Safety orange.
5. Posts: Steel t-posts, 1.33 pounds per foot. 2-foot minimum driving depth with exposed height to match fence height. Provide plastic safety caps.

PART 3 - EXECUTION

3.1 EXAMINATION AND PREPARATION

A. Erosion and Sedimentation Control: Examine the site to verify that temporary erosion- and sedimentation-control measures are in place. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.

B. Protect tree root systems from damage caused by runoff or spillage of noxious materials while mixing, placing, or storing construction materials. Protect root systems from ponding, eroding, or excessive wetting caused by dewatering operations.

3.2 PROTECTION ZONES

A. Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations, in a manner approved by Owner.

3.3 EXCAVATION

A. General: Excavate at edge of protection zones and for trenches indicated within protection zones according to requirements in Section 31 2000 "Earth Moving."

B. Excavating near Trees: Where excavation is required within protection zones, hand excavate under or around tree roots or tunnel under the roots by drilling, auger boring, or pipe jacking. Do not cut main lateral tree roots or taproots; cut only smaller roots that interfere with installation of utilities. Cut roots as required for root pruning.

C. Do not allow exposed roots to dry out before placing permanent backfill.

3.4 ROOT PRUNING

A. Prune roots that are affected by temporary and permanent construction. Prune roots as follows:
1. Cut roots manually by digging a trench and cutting exposed roots with sharp pruning instruments; do not break, tear, chop, or slant the cuts. Do not use a backhoe or other equipment that rips, tears, or pulls roots.
2. Temporarily support and protect roots from damage until they are permanently covered with soil.
3. Cover exposed roots with burlap and water regularly.
4. Backfill as soon as possible according to requirements in Section 31 2000 "Earth Moving."

3.5 CROWN PRUNING

A. Prune branches that are affected by temporary and permanent construction. Prune branches as follows:
   1. Prune trees to remain to compensate for root loss caused by damaging or cutting root system. Provide subsequent maintenance during Contract period as recommended by arborist.
   2. Pruning Standards: Prune trees according to ANSI A300 (Part 1).
   3. Cut branches with sharp pruning instruments; do not break or chop.
   4. Do not apply pruning paint to wounds.

B. Chip removed branches and dispose of off-site.

3.6 REGRADING

A. Lowering Grade: Where new finish grade is indicated below existing grade around trees, slope grade beyond the protection zone. Maintain existing grades within the protection zone.

B. Raising Grade: Where new finish grade is indicated above existing grade around trees, slope grade beyond the protection zone. Maintain existing grades within the protection zone.

C. Minor Fill within Protection Zone: Where existing grade is 2 inches or less below elevation of finish grade, fill with topsoil. Place topsoil in a single uncompacted layer and hand grade to required finish elevations.

3.7 FIELD QUALITY CONTROL

A. Inspections: Engage a qualified arborist to direct plant-protection measures in the vicinity of trees, shrubs, and other vegetation indicated to remain and to prepare inspection reports.

3.8 REPAIR AND REPLACEMENT

A. General: Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations, in a manner approved by Owner.
   1. Have arborist perform the root cutting, branch pruning, and damage repair of trees and shrubs.
   2. Treat damaged trunks, limbs, and roots according to arborist's written instructions.
   3. Perform repairs within 24 hours.
   4. Replace vegetation that cannot be repaired and restored to full-growth status, as determined by Owner.

3.9 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Remove excess excavated material, displaced trees, trash and debris, and legally dispose of them off Owner's property.

END OF SECTION 01 5639

SECTION 01 6000 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.

B. Related Requirements:
   1. Section 01 0000 "General Requirements" for Build America Buy America requirements.
   2. Section 01 2300 "Alternates" for products selected under an alternate.
   3. Section 01 2500 "Substitution Procedures" for requests for substitutions.

1.3 DEFINITIONS

A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
   1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature that is current as of date of the Contract Documents.
   2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
   3. Comparable Product: Product that is demonstrated and approved by Architect through submittal process to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

B. Basis-of-Design Product Specification: A specification in which a single manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation. In addition to the basis-of-design product description, product attributes and characteristics may be listed to establish the significant qualities related to type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other special features and requirements for purposes of evaluating comparable products of additional manufacturers.

C. Subject to Compliance with Requirements: Where the phrase "Subject to compliance with requirements" introduces a product selection procedure in an individual Specification Section, provide products qualified under the specified product procedure. In the event that a named product or product by a named manufacturer does not meet the other requirements of the specifications, select another product or manufacturer that does meet the requirements of the specifications. Submit a comparable product request, if applicable.

1.4 ACTION SUBMITTALS

A. Comparable Product Request Submittal: Submit request for consideration of each comparable product. Identify basis-of-design product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Include data to indicate compliance with the requirements specified in "Comparable Products" Article.
2. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within 7 days of receipt of a comparable product request. Architect will notify Contractor of approval or rejection of proposed comparable product request within 7 days of receipt of request, or 7 days of receipt of additional information or documentation, whichever is later.

B. Basis-of-Design Product Specification Submittal: Comply with requirements in Section 01 3300 "Submittal Procedures." Show compliance with requirements.

C. Build America Buy America Compliance Documentation: Comply with requirements in Section 01 0000 "General Requirements." Show compliance with Build America Buy America requirements.

1.5 QUALITY ASSURANCE

A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.

B. Identification of Products: Except for required labels and operating data, do not attach or imprint manufacturer or product names or trademarks on exposed surfaces of products or equipment that will be exposed to view in occupied spaces or on the exterior.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.

B. Delivery and Handling:
1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
4. Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and properly protected.

C. Storage:
1. Store products to allow for inspection and measurement of quantity or counting of units.
2. Store materials in a manner that will not endanger Project structure.
3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
4. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
6. Protect stored products from damage and liquids from freezing.
7. Provide a secure location and enclosure at Project site for storage of materials and equipment.

1.7 PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
   1. Manufacturer's Warranty: Written warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
   2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner.

B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.
   1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
   2. Specified Form: When specified forms are included with the Specifications, prepare a written document using indicated form properly executed.
   3. See other Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time: Comply with requirements in Section 01 7700 "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.
   1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
   2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
   3. Owner reserves the right to limit selection to products with warranties meeting requirements of the Contract Documents.
   4. Where products are accompanied by the term "as selected," Architect will make selection after consultation with Owner.
   5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
   6. Or Equal: For products specified by name and accompanied by the term "or equal," or "or approved equal," or "or approved," comply with requirements in "Comparable Products" Article to obtain approval for use of an unnamed product.
      a. Submit additional documentation required by Architect in order to establish equivalency of proposed products. Evaluation of "or equal" product status is by the Architect, whose determination is final.

B. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's full range" or similar phrase, select a product that complies with requirements. Architect will select, after consultation with Owner, color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.2 COMPARABLE PRODUCTS

A. Conditions for Consideration of Comparable Products: Architect will consider, in consultation with Owner, Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with these requirements:

1. Evidence that proposed product does not require revisions to the Contract Documents, is consistent with the Contract Documents, will produce the indicated results, and is compatible with other portions of the Work. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant product qualities include attributes such as type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other specific features and requirements.
2. Evidence that proposed product has cost, schedule, maintenance, or other benefits to the Owner.
3. Evidence that proposed product provides specified warranty.
4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
5. Samples, if requested.

B. Submittal Requirements: Approval by the Architect of Contractor's request for use of comparable product is not intended to satisfy other submittal requirements. Comply with specified submittal requirements.

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 6000

SECTION 01 7419 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for the following:
   1. Salvaging nonhazardous demolition and construction waste.
   2. Recycling nonhazardous demolition and construction waste.
   3. Disposing of nonhazardous demolition and construction waste.

B. Related Requirements:
   1. Section 31 1000 "Site Clearing" for disposition of waste resulting from site clearing and removal of above- and below-grade improvements.

1.2 DEFINITIONS

A. Construction Waste: Building, structure, and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.

B. Demolition Waste: Building, structure, and site improvement materials resulting from demolition operations.

C. Disposal: Removal of demolition or construction waste and subsequent salvage, sale, recycling, or deposit in landfill, incinerator acceptable to authorities having jurisdiction, or designated spoil areas on Owner's property.

D. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.

E. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.

F. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SALVAGING DEMOLITION WASTE

A. Salvaged Items for Owner's Use:
   1. Clean salvaged items.
   2. Pack or crate items after cleaning. Identify contents of containers with label indicating elements, date of removal, quantity, and location where removed.
   3. Store items in a secure area until delivery to Owner.
   4. Transport items to Owner's storage area designated by Owner.
   5. Protect items from damage during transport and storage.

3.2 RECYCLING DEMOLITION AND CONSTRUCTION WASTE, GENERAL

A. Preparation of Waste: Prepare and maintain recyclable waste materials according to recycling or reuse facility requirements. Maintain materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to the recycling process.

B. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical. Remove recyclable waste from Owner's property daily and transport to recycling receiver or processor as often as practical.

3.3 DISPOSAL OF WASTE

A. General: Except for items or materials to be salvaged or recycled, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.
   1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
   2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Burning: Do not burn waste materials.

END OF SECTION 01 7419

SECTION 01 7700 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
   1. Substantial Completion procedures.
   2. Final completion procedures.
   3. Warranties.
   4. Final cleaning.
   5. Repair of the Work.

B. Related Requirements:
   1. Section 01 7823 "Operation and Maintenance Data" for additional operation and maintenance manual requirements.
   2. Section 01 7839 "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.
   3. Section 01 7900 "Demonstration and Training" for requirements to train the Owner's maintenance personnel to adjust, operate, and maintain products, equipment, and systems.

1.2 ACTION SUBMITTALS

A. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.

B. Certified List of Incomplete Items: Final submittal at final completion.

1.3 CLOSEOUT SUBMITTALS

A. Certificates of Release: From authorities having jurisdiction.

1.4 SUBSTANTIAL COMPLETION PROCEDURES

A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's punch list), indicating the value of each item on the list and reasons why the Work is incomplete.

B. Submittals Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
   1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
   2. Submit closeout submittals specified in other Division 01 Sections, including project record documents, operation and maintenance manuals, damage or settlement surveys, property surveys, and similar final record information.
   3. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
   4. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Owner. Label with manufacturer's name and model number.
   5. Submit testing, adjusting, and balancing records.

6. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.

C. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
1. Complete startup and testing of systems and equipment.
2. Perform preventive maintenance on equipment used prior to Substantial Completion.
3. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Section 01 7900 "Demonstration and Training."
4. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
5. Complete final cleaning requirements.
6. Repair damages to pre-existing site improvements.

D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of 10 days prior to date the Work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's punch list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.

1.5 FINAL COMPLETION PROCEDURES

A. Submittals Prior to Final Completion: Before requesting final inspection for determining final completion, complete the following:
1. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.

B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.

1.6 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.
1. Organize list of spaces in sequential order.
2. Submit list of incomplete items in the following format:
a. MS Excel and PDF electronic file. Architect will return annotated file.

1.7 SUBMITTAL OF PROJECT WARRANTIES

A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where warranties are indicated to commence on dates other than date of Substantial Completion, or when delay in submittal of warranties might limit Owner's rights under warranty.

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

C. Warranty Electronic File: Provide warranties and bonds in PDF format. Assemble complete warranty and bond submittal package into a single electronic PDF file with bookmarks enabling navigation to each item. Provide bookmarked table of contents at beginning of document.

D. Warranties in Paper Form: Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 215-by-280-mm paper.

E. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 FINAL CLEANING

A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

B. Cleaning: Employ experienced workers for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
   1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:
      a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
      b. Clean exposed exterior pavements to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
      c. Remove debris and surface dust from limited access spaces, including equipment vaults, manholes, and similar spaces.
      d. Leave Project clean and ready for occupancy.

C. Construction Waste Disposal: Comply with waste disposal requirements in Section 01 7419 "Construction Waste Management and Disposal."

3.2 REPAIR OF THE WORK

A. Complete repair and restoration operations, before requesting inspection for determination of Substantial Completion.

B. Repair, or remove and replace, defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.

END OF SECTION 01 7700

SECTION 01 7823 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
   1. Systems and equipment operation manuals.
   2. Systems and equipment maintenance manuals.
   3. Product maintenance manuals.

1.2 CLOSEOUT SUBMITTALS

A. Submit operation and maintenance manuals indicated. Provide content for each manual as specified in individual Specification Sections, and as reviewed and approved at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
   1. Architect will comment on whether content of operation and maintenance submittals is acceptable.
   2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.

B. Format: Submit operation and maintenance manuals in the following format:
   1. Submit on digital media acceptable to Architect. Enable reviewer comments on draft submittals.
   2. After approval of digital manuals, submit three paper copies for Owner records.

C. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Architect will return copy with comments.

D. Comply with Section 01 7700 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

1.3 FORMAT OF OPERATION AND MAINTENANCE MANUALS

A. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.
   1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
   2. File Names and Bookmarks: Bookmark individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.

B. Manuals, Paper Copy: Submit manuals in the form of hard-copy, bound and labeled volumes.
   1. Binders: Heavy-duty, three-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 215-by-280-mm paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.
   2. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.

a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

1.4 REQUIREMENTS FOR OPERATION AND MAINTENANCE MANUALS

A. Organization of Manuals: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
1. Title page.
2. Table of contents.
3. Manual contents.

B. Title Page: Include the following information:
1. Subject matter included in manual.
2. Name and address of Project.
3. Name and address of Owner.
4. Date of submittal.
5. Name and contact information for Contractor.
6. Name and contact information for Architect.
7. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
8. Cross-reference to related systems in other operation and maintenance manuals.

C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.

D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.

1.5 PRODUCT MAINTENANCE MANUALS

A. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

B. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.

C. Product Information: Include the following, as applicable:
1. Product name and model number.
2. Manufacturer's name.
3. Color, pattern, and texture.
4. Material and chemical composition.
5. Reordering information for specially manufactured products.

D. Maintenance Procedures: Include manufacturer's written recommendations and the following:
1. Inspection procedures.
2. Types of cleaning agents to be used and methods of cleaning.
3. List of cleaning agents and methods of cleaning detrimental to product.
4. Schedule for routine cleaning and maintenance.
5. Seasonal care or winterization requirements and procedures, if applicable.

6. Repair instructions.

E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
   1. Include procedures to follow and required notifications for warranty claims.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 7823

SECTION 01 7839 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for project record documents, including the following:
   1. Record Drawings.
   2. Record Specifications.
   3. Record Product Data.

B. Related Requirements:
   1. Section 01 7823 "Operation and Maintenance Data" for operation and maintenance manual requirements.

1.2 CLOSEOUT SUBMITTALS

A. Record Drawings: Comply with the following:
   1. Number of Copies: Submit copies of record Drawings as follows:
      a. Initial Submittal:
         1) Submit PDF electronic files of marked-up record prints.
         2) Architect will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.
      b. Final Submittal:
         1) Submit three paper-copy set(s) of marked-up record prints.
         2) Submit PDF electronic files of marked-up record prints.
         3) Print each drawing, whether or not changes and additional information were recorded.

B. Record Specifications: Submit one paper copy and annotated PDF electronic files of Project's Specifications, including addenda and contract modifications.

C. Record Product Data: Submit one paper copy and annotated PDF electronic files of each submittal.
   1. Where record Product Data are required as part of operation and maintenance manuals, submit duplicate marked-up Product Data as a component of manual.

1.3 RECORD DRAWINGS

A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.
   1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.
      a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
      b. Accurately record information in an acceptable drawing technique.
      c. Record data as soon as possible after obtaining it.
      d. Record and check the markup before enclosing concealed installations.
      e. Cross-reference record prints to corresponding photographic documentation.
   2. Content: Types of items requiring marking include, but are not limited to, the following:
      a. Dimensional changes to Drawings.
      b. Revisions to details shown on Drawings.
      c. Locations and depths of underground utilities.

d. Revisions to routing of piping and conduits.
e. Revisions to electrical circuitry.
f. Actual equipment locations.
g. Changes made by Change Order or Construction Change Directive.
h. Changes made following Architect's written orders.
i. Details not on the original Contract Drawings.
j. Field records for variable and concealed conditions.
k. Record information on the Work that is shown only schematically.

3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
5. Mark important additional information that was either shown schematically or omitted from original Drawings.
6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

B. Record Digital Data Files: Immediately before inspection for Certificate of Substantial Completion, review marked-up record prints with Architect. When authorized, prepare a full set of corrected digital data files of the Contract Drawings, as follows:
1. Format: Annotated PDF electronic file with comment function enabled.
2. Incorporate changes and additional information previously marked on record prints. Delete, redraw, and add details and notations where applicable.
3. Refer instances of uncertainty to Architect for resolution.

C. Format: Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
1. Record Prints: Organize record prints into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
2. Format: Annotated PDF electronic file with comment function enabled.
3. Record Digital Data Files: Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.
4. Identification: As follows:
a. Project name.
b. Date.
c. Designation "PROJECT RECORD DRAWINGS."
d. Name of Architect.
e. Name of Contractor.

1.4 RECORD SPECIFICATIONS

A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
4. For each principal product, indicate whether record Product Data has been submitted in operation and maintenance manuals instead of submitted as record Product Data.
5. Note related Change Orders, record Product Data, and record Drawings where applicable.

B. Format: Submit record Specifications as annotated PDF electronic file.

1.5 RECORD PRODUCT DATA

A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and revisions to project record documents as they occur; do not wait until end of Project.

B. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
   1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
   2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
   3. Note related Change Orders, record Specifications, and record Drawings where applicable.

C. Format: Submit record Product Data as annotated PDF electronic file.
   1. Include record Product Data directory organized by Specification Section number and title, electronically linked to each item of record Product Data.

1.6 MAINTENANCE OF RECORD DOCUMENTS

A. Maintenance of Record Documents: Store record documents apart from the Contract Documents used for construction. Do not use project record documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project record documents for Architect's reference during normal working hours.

PART 2 - PRODUCTS

PART 3 - EXECUTION

END OF SECTION 01 7839

SECTION 01 7900 - DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:
   1. Instruction in operation and maintenance of systems, subsystems, and equipment.

1.2 COORDINATION

A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.

B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.

C. Coordinate content of training modules with content of approved operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data have been reviewed and approved by Architect.

1.3 INSTRUCTION PROGRAM

A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.
   1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
      a. System, subsystem, and equipment descriptions.
      b. Performance and design criteria if Contractor is delegated design responsibility.
      c. Operating standards.
      d. Regulatory requirements.
      e. Equipment function.
      f. Operating characteristics.
      g. Limiting conditions.
      h. Performance curves.
   2. Adjustments: Include the following:
      a. Alignments.
      b. Checking adjustments.
   3. Troubleshooting: Include the following:
      a. Diagnostic instructions.
      b. Test and inspection procedures.
   4. Maintenance: Include the following:
      a. Inspection procedures.
      b. Types of cleaning agents to be used and methods of cleaning.
      c. List of cleaning agents and methods of cleaning detrimental to product.
      d. Procedures for routine cleaning.
      e. Procedures for preventive maintenance.
      f. Procedures for routine maintenance.
      g. Procedures for seasonal maintenance or winterization, if applicable.
      h. Instruction on use of special tools.
   5. Repairs: Include the following:
      a. Diagnosis instructions.
      b. Repair instructions.
      c. Disassembly; component removal, repair, and replacement; and reassembly instructions.

d. Instructions for identifying parts and components.
e. Review of spare parts needed for operation and maintenance.

1.4 INSTRUCTION

A. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.

B. Scheduling: Provide instruction at mutually agreed-on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.
1. Schedule training with Owner with at least seven days' advance notice.

C. Training Location and Reference Material: Conduct training on-site with the completed and fully operational system using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.

PART 2 - PRODUCTS (not used)

PART 3 - EXECUTION (not used)

END OF SECTION 01 7900

SECTION 03 3053 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes cast-in-place concrete, including reinforcement, concrete materials, mixture design, placement procedures, and finishes.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Other Action Submittal:
   1. Design Mixtures: For each concrete mixture.

1.3 QUALITY ASSURANCE

A. Ready-Mix-Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

B. Comply with ACI 301.

C. Comply with ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

D. Comply with Michigan Department of Transportation Standard Specifications for Construction, most current edition.

PART 2 - PRODUCTS

2.1 FORMWORK

A. Furnish formwork and formwork accessories according to ACI 301.

2.2 STEEL REINFORCEMENT

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

B. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.

C. Plain-Steel Wire: ASTM A 82/A 82M, as drawn.

D. Plain-Steel Welded Wire Reinforcement: ASTM A 185/A 185M, fabricated from as-drawn steel wire into flat sheets.

E. Deformed-Steel Welded Wire Reinforcement: ASTM A 497/A 497M, flat sheet.

2.3 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source throughout Project:
   1. Portland Cement: ASTM C 150, Type I.
      a. Fly Ash: ASTM C 618, Class C or F.

b. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.

B. Normal-Weight Aggregate: ASTM C 33, graded, 3/4-inch nominal maximum aggregate size.

C. Water: ASTM C 94/C 94M.

2.4 ADMIXTURES

A. Air-Entraining Admixture: ASTM C 260.

B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
2. Retarding Admixture: ASTM C 494/C 494M, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

2.5 RELATED MATERIALS

A. Vapor Retarder: Plastic sheet, ASTM E 1745, Class A or B.

B. Vapor Retarder: Polyethylene sheet, ASTM D 4397, not less than 10 mils thick; or plastic sheet, ASTM E 1745, Class C.

C. Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber, or ASTM D 1752, cork or self-expanding cork.

2.6 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming; manufactured for application to fresh concrete.

B. Absorptive Cover: AASHTO M 182, Class 3, burlap cloth or cotton mats.

C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

D. Water: Potable.

E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.

2.7 CONCRETE MIXTURES

A. Normal-Weight Concrete: Prepare design mixes, proportioned according to ACI 301, as follows:
1. Minimum Compressive Strength: 4000 psi at 28 days.
2. Maximum Water-Cementitious Materials Ratio: 0.45.
3. Cementitious Materials: Use fly ash, pozzolan, ground granulated blast-furnace slag, and silica fume as needed to reduce the total amount of portland cement, which would otherwise be used, by not less than 40 percent.
4. Slump Limit: 5 inches, plus or minus 1 inch.
5. Air Content: Maintain within range permitted by ACI 301.

2.8 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M, and furnish batch ticket information.
1. When air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 FORMWORK

A. Design, construct, erect, brace, and maintain formwork according to ACI 301.

3.2 EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

3.3 STEEL REINFORCEMENT

A. Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

3.4 CONCRETE PLACEMENT

A. Comply with ACI 301for placing concrete.

B. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.

C. Do not add water to concrete during delivery, at Project site, or during placement.

D. Consolidate concrete with mechanical vibrating equipment.

3.5 FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defective areas repaired and patched. Remove fins and other projections exceeding 1/2 inch.
1. Apply to concrete surfaces not exposed to view.

B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defective areas. Remove fins and other projections exceeding 1/8 inch.
1. Apply to concrete surfaces exposed to view.

3.6 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and with ACI 301 for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing

operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

D. Curing Methods: Cure formed and unformed concrete for at least seven days by one or a combination of the following methods:
   1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
      a. Water.
      b. Continuous water-fog spray.
      c. Absorptive cover, water saturated and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
   2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
   3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

3.7 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Tests: Perform according to ACI 301.
   1. Testing Frequency: One composite sample shall be obtained for each day's pour of each concrete mix exceeding 5 cu. yd. but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.
   2. Testing Frequency: One composite sample shall be obtained for each 100 cu. yd. or fraction thereof of each concrete mix placed each day.

3.8 REPAIRS

A. Remove and replace concrete that does not comply with requirements in this Section.

END OF SECTION 03 3053

SECTION 05 5000 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Miscellaneous steel members and appurtenances for concrete abutment walls.
2. Park entrance gates.

B. Products furnished, but not installed, under this Section include the following:
1. Anchor bolts, steel weld plates and angles for casting into concrete.

C. Related Requirements:
1. Section 01 0000 "General Requirements" for Build America Buy America requirements.
2. Section 03 3053 "Miscellaneous Cast-in-Place Concrete" for concrete abutments.
3. Section 06 1535 "Gangways" for floating pier gangway.

1.2 ACTION SUBMITTALS

A. Product Data: For the following:
1. Fasteners.
2. Shop primers.
3. For all materials, products and product systems.
a. Documentation of compliance with Build America Buy America requirements. Refer to Section 01 0000 "General Requirements".

B. Shop Drawings: Show fabrication and installation details. Include plans, elevations, sections, and details of metal fabrications and their connections. Show live and dead load assumptions, anchorage and accessory items.

1.3 QUALITY ASSURANCE

A. Fabricator Qualifications: A firm experienced in producing metal fabrications similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to product required units.

B. Welding: Qualify procedures and personnel according to the following:
1. AWS D1.1, "Structural Welding Code – Steel."
2. Certify each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

1.4 REFERENCES

A. Steel Pipe: ASTM A120.

B. Plate and Structural Steel Shapes: ASTM A36 (Fy = 36,000 psi).

C. Splice plates, if required: ASTM A588.

D. ASTM A386 - Zinc-coated (hot dip) on assembled steel products (barrier free permit post).

E. FS TT-P-31 - Paint Oil: Iron oxide, ready mix, red and brown.

F. Welding: AISC Manual of steel Construction and Structural Welding Code of American Welding Society.

PART 2 - PRODUCTS

2.1 MISCELLANEOUS FRAMING AND SUPPORTS

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

B. General: Provide steel framing and supports indicated and as necessary to complete the Work.

C. Fabricate units from structural-steel shapes, plates, and bars of welded construction, unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction retained by framing and supports. Cut, drill, and tap units to receive hardware, hangers, and similar items.

D. Steel Plates, Shapes, and Bars: ASTM A36/A36M.

E. Stainless Steel Bars and Shapes: ASTM A276/A276M, Type 316L.

F. Steel Pipe: ASTM A120, Standard Weight (Schedule 40) unless otherwise indicated.

2.2 FASTENERS

A. General: Unless otherwise indicated, provide Type 316 stainless steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.
1. Provide stainless steel fasteners for fastening aluminum.

B. Cast-in-Place Anchors in Concrete: Either threaded or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A47/A47M malleable iron or ASTM A27/A27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F2329/F2329M.

2.3 MISCELLANEOUS MATERIALS

A. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.

B. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.

C. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

2.4 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. Form exposed work with accurate angles and surfaces and straight edges.

E. Weld corners and seams continuously to comply with the following:
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove welding flux immediately.
   4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.

G. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

H. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, not less than 8 inches from ends and corners of units and 24 inches o.c.

I. Provide for anchorage of type necessary to provide finished product; coordinate with supporting structure. Fabricate and space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

J. Allow for thermal movement resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening up of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

2.5 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A153/A153M for steel and iron hardware and with ASTM A123/A123M for other steel and iron products.
   1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

C. Field Welding: Comply with the following requirements:
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove welding flux immediately.

4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.

E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

3.2 REPAIRS

A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.

END OF SECTION 05 5000

SECTION 06 1063 - EXTERIOR ROUGH CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Timber Bollards.
   2. Timber Edging for Exercise Stations.

1.3 DEFINITIONS

A. Timber: Lumber of 5 inches nominal or greater in least dimension.

B. Lumber grading agencies, and the abbreviations used to reference them, include the following:
   1. NeLMA: Northeastern Lumber Manufacturers' Association.
   2. NLGA: National Lumber Grades Authority.
   3. RIS: Redwood Inspection Service.
   4. SPIB: The Southern Pine Inspection Bureau.
   5. WCLIB: West Coast Lumber Inspection Bureau.
   6. WWPA: Western Wood Products Association.

1.4 ACTION SUBMITTALS

A. Product Data: For preservative-treated wood products. Include chemical treatment manufacturer's written instructions for handling, storing, installing, and finishing treated material.

1.5 INFORMATIONAL SUBMITTALS

A. Material Certificates:
   1. For preservative-treated wood products. Indicate type of preservative used and net amount of preservative retained. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store materials under cover and protected from weather and contact with damp or wet surfaces. Stack lumber flat with spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 LUMBER, GENERAL

A. Comply with DOC PS 20 and with grading rules of lumber grading agencies certified by ALSC's Board of Review as applicable. If no grading agency is indicated, comply with the applicable rules of any rules-writing agency certified by ALSC's Board of Review.
   1. Factory mark each item with grade stamp of grading agency.
   2. For items that are exposed to view in the completed Work, mark grade stamp on end or back of each piece.

3. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry wood products.

B. Maximum Moisture Content:
1. Timber. 19 percent.

2.2 TIMBER BOLLARDS

A. Timber Posts: Balsam fir, Douglas fir-larch, Douglas fir-larch (North), eastern hemlock tamarack (North), hem-fir, southern pine, western hemlock, or western hemlock (North); No. 2; NeLMA, NLGA, SPIB, WCLIB, or WWPA.

2.3 PRESERVATIVE TREATMENT

A. Pressure treat timber with waterborne preservative according to AWPA U1; Use Category UC4a.
1. Treatment with CCA shall include post-treatment fixation process.

B. After treatment, redry timber to 19 percent maximum moisture content.

C. Mark treated wood with treatment quality mark of an inspection agency approved by ALSC's Board of Review.
1. For items indicated to receive a stained or natural finish, mark each piece on surface that will not be exposed.

D. Application: Treat all wood unless otherwise indicated.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Set work to required levels and lines, with members plumb, true to line, cut, and fitted. Fit work to other construction; scribe and cope as needed for accurate fit.

B. Sort and select lumber so that natural characteristics do not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of members or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

C. Apply copper naphthenate field treatment to comply with AWPA M4, to cut surfaces of preservative-treated lumber.

D. Securely attach exterior rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:

END OF SECTION 06 1063

SECTION 06 1534 – FLOATING PIER

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Floating Overlook & Fishing Pier.

B. Related Requirements:
1. Section 01 0000 "General Requirements" for Build America Buy America requirements.
2. Section 06 1535 "Gangways" for associated gangway connection between floating pier and shore abutment.

1.3 DESCRIPTION

A. Design, fabricate, construct, assemble, install and furnish all plant, labor, equipment, supplies and materials and perform all operations required for the installation of a complete, fully functional and operational floating pier system, including but not necessarily limited to head piers, finger piers, ramps, service pier, anchorage, and other work as indicated on the project drawings and as specified herein.

B. The project drawings are general in nature and show basic floating pier system(s) layouts with required dimensions, required cleat and fender locations, and certain required materials and details of construction and are not intended to be used for fabrication. The piers shown on the drawings are patterned after the type manufactured by Flotation Docking Systems, of Cedarville, Michigan. However, the intent is not to preclude other floating pier systems' of a different manufacturer as long as they meet the required design loads, are within the range of the required dimensions, are constructed with the same specified materials, and are of a quality equal to or better than the floating pier system specified in this Section.

C. Other materials and equipment shall be as indicated on the drawings, however, all other materials not specifically described but required for a complete and proper installation of the work under this Section, shall be new, first quality, and as selected by the Floating Pier System Contractor subject to Architect's approval.

1.4 DELEGATED DESIGN CRITERIA

A. Where the requirements of the Contract Documents exceed those of ASCE Report No. 50, "Small Craft Harbors" 1969 and ASCE's 2000 "Planning and Design Guidelines for Small Craft Harbors", the requirements of the Contract Documents shall govern.

B. All structural members shall be designed and appropriately sized to carry and accept all design loads without failure or excessive deformation. Members shall be so sized to compensate for reductions in cross section resulting from drilling bolt holes and cutting of openings needed for utilities. Only single width pier modules shall be allowed for piers up to 6 feet in width. Where the required width of the main piers, T-piers and service piers requires fabrication from narrower pier modules, the individual pier modules shall not be less than 4 feet in width. Overlapping adjacent modules by staggering transverse joints to insure maximum strength is required. However, overlapping is not required as long as sufficient longitudinal joint strength is provided.

C. The piers shall be of similar construction and shall have a structural framework in conjunction with the evenly spaced intermediate bulkheads, including the decking and the galvanized sheet metal flotation encasement, that shall be designed and constructed, as an integral part of the total floating individual pier system, to withstand as a unit, all of the physically induced stresses. Framing shall act as a bulkhead member to withstand compression and shall be the full width of the unit at 48" spacing along the length of each unit. This support framing/bulkhead shall be incorporated with a continuous floatation encasement to provide rigidly constructed units. The floatation continuous unit must be in the lowest portion of the floating piers.

D. The Floatation Encasement shall be 20 gauge 2 ounce psf galvanized sheet metal and it must be installed in full length uncut sheets for all piers up to an including 5'-0" widths. Pier widths 6'-0" and greater may incorporate two or more full length sheets for the full width required, (minimum 3 foot sheet width required) each with a continuous longitudinal lap of 1-1/2" on a full length center stringer continuously nailed at a 1-1/2" spacing on the galvanized steel sheet metal. Fastening of galvanized steel sheet metal encasement shall be provided with hot dip galvanized MG50 mechanically plated screw-shank 2-1/2" structural nails conforming to ASTM A153 Class D or Stainless Steel Grades 304 or 316 at a continuous maximum spacing of 1-1/2 inches and shall be applied to all wood stringers/bulkheads and exterior framing surfaces to which the said galvanized steel sheet metal is in contact with.

E. Dimensions: Pier layouts shall be constructed and installed in accordance with the configuration shown on the drawings. Widths of piers are to the edge of the piers and do not include rub-rails and fenders.
   1. Piers may be up to 3 inches less than the specified widths to allow some tolerance in the manufacturing process. However, the pier width shall be uniform and the 3-inch tolerance does not imply that variations in width over the length of the piers will be tolerated.
   2. Ramp widths shall be as shown on the project drawings.
   3. A minimum of 5'-0" clear deck travel width shall be maintained in accordance with the ADA (Americans with Disabilities Act) requirements and ADAAG (Americans with Disabilities Act Accessibility Guidelines).

F. Deflections Criteria: Piers, ramps, connections and anchorages shall be designed for the following loads and conditions in order to meet ADA (Americans with Disabilities Act) Requirements and ADAAG (Americans with Disabilities Act Accessibility Guidelines).
   1. Vertical
      a. Vertical Dead Load: Dead loads shall be the entire weight of the floating piers and attachments including anchorages and utilities. In addition, finger piers shall have their outer ends at least level with but in no case more than 2" higher than the elevation of the main pier at their plane of attachment under dead load conditions. The ends of finger piers shall be as level as practical but in no case shall a cross slope of more than 2% of width be tolerated in order to comply with ADA, and ADAAG. Adjacent floating pier units shall not have deck surface elevation differences or horizontal gaps between the decking greater than those allowed by ADA and ADAAG.
      b. Vertical Live Load: A uniform live load of not less than 30 pounds per square foot on ramps and on the deck and structural frame of the floating piers shall be used. Minimum live load for floatation shall be 30 pounds per square foot. Finger piers must be designed to withstand a 400 pound concentrated live load 1' from the end of the finger pier without a loss in freeboard of more than 4" at the time of acceptance, nor more than 6" at the end of 5 years.
      c. Combined Vertical Dead Load and Live Load: Combined dead load plus live load for piers, and ramps shall be the actual dead load including utilities plus 30 psf live load. However, for purposes of calculation, the combined dead load plus required 30 psf live load shall never be calculated as being less than 50 psf. Ramps shall be so designed that the maximum live load deflection of the ramp is limited to 1/180 of the span. Extra floatation of the same general type and design used for the floating piers shall be installed at end sections as required to compensate for end reactions of ramps due to combined loading. In no case shall the supporting pier module at

the ramp connection be less than the designated freeboard under combined loading nor more than 2" above the freeboard shown on the approved shop drawings under the full dead load including utilities. The combined vertical dead load and live load shall be such that the cross slope is no more than 2% of the width in order to comply with ADA and ADAAG.

d. Dead Load Freeboard: Floating Pier System manufacturers shall provide piers with dead load freeboards of not less than 22" or more than 26" (4" tolerance to allow for variations between manufacturers). However, actual dead load freeboard shall not vary appreciably from the freeboard designated on the manufacturer's approved shop drawings with piers presenting a reasonably level, flat, even surface to the eye under dead load conditions. As indicated, main piers shall be reasonably level, but in no case shall a cross slope exceeding 2% of the width be allowed in order to comply with ADA and ADAAG. At the design load of dead load plus 30 psf live load a freeboard of not less than 10 inches shall be maintained. Freeboard loss shall not be more than 2" at the end of 5 years.

2. Horizontal:
   a. Wind Load: The uniform wind load for determining lateral loading on an independent floating pier or floating pier system from any direction, will be 15 psf on all projected surfaces, assuming 100 percent boat occupancy, with boat beams and lengths assumed to be for purposes of calculation, the same as the widths and lengths of the respective slips. No deduction for piers or open areas between boats shall be allowed. Wind loads shall be calculated in directions both perpendicular to and parallel to the main pier and the maximum wind loading shall be used for design of piers and anchorages. A 10 percent wind stress, as defined in ASCE Report No. 50 for all shielded boats, shall be included in determining total wind loads on each independent floating pier or individual floating pier system (main pier with fingers). Profile heights of all boats shall be increased 100 percent over the profile heights specified on Fig. 4-9, ASCE Report No. 50, dated 1969.
   b. Current Load: Local current loading shall be applied on all submerged surfaces of moored craft, assuming 100 percent boat occupancy or maximum slip dimensions, whichever is greater. For purposes of calculating the current load, the largest cross-sectional area of a craft that might occupy the slip is used. Current pressure shall be calculated on the basis of pressure pounds per square foot of submerged Boat Surface. P = 0.75V2 where V is the velocity of the current in feet per second. (ASCE's 2000 Planning & Design Guidelines for Small Craft Harbors).
   c. Impact Loading: Impact loading shall be applied using the largest boat normally using that slip, striking the side of the pier at its outer end at a maximum angle of 10 degrees to the center line of that pier at a velocity of 2 knots (3 fps). For purposes of calculation, the weight of the largest boats normally using the slips shall be considered to be 17,000 pounds for 30 foot slips, and 31,000 pounds for 38 foot slips, 45,000 pounds for 45 foot slips, and 65,000 pounds for 60 foot slips.
   d. All floating piers and floatation units shall sustain the loads imposed by nonmoving ice without damage, fracture or puncture; and "ice push" as calculated for the subject water body without dislocation, damage, fracture or puncture.
   e. The floating pier system including ramps and anchorages shall be capable of sustaining waves of up to 1.5 feet without damage.
3. Torsion: Positively prevent torsion, racking and twisting by providing sufficient built-in torsional resistance to prevent no more than 3" variation from normal dead-load freeboard at the free end of all floating pier system units of whatever length (30' or longer) due to design impact loading transferred thru the fender system.

G. Codes and Standards:
   1. Reference is made in these specifications to the codes and/or standards promulgated by the following agencies and organizations:
      a. ADA Americans with Disabilities Act
      b. ADAAG ` Americans with Disabilities Act Accessibility Guidelines
      c. ANSI American National Standard Institute
      d. ASCE American Society of Civil Engineers

e. ASTM American Society for Testing and Materials
f. AWPA American Wood Preservers Association
g. AWPB American Wood Preservers Bureau
h. AWS American Welding Society, Inc.
i. MBC Michigan Building Code
j. SESC State of Michigan Soil Erosion and Sedimentation Control Act
k. SPIB Southern Pine Inspection Bureau

2. Compliance: Comply with those codes and/or standards specified in this Section and referenced above.
   a. All work and materials shall be furnished and installed in accordance with all Federal and State Codes, Laws, and Regulations as well as the current Michigan State Codes, Laws, and Regulations.
   b. Where requirements of the Contract Documents exceed those of above mentioned Codes, Laws, and Regulations the requirements of the Contract Documents shall govern.
   c. In case of conflict between the referenced Codes, Laws, and Regulations, the most stringent requirements shall govern.

1.5 ACTION SUBMITTALS

A. Product Data: For all materials, products and product systems.
   1. Documentation of compliance with Build America Buy America requirements. Refer to Section 01 0000 "General Requirements".

B. Shop Drawings: Detailed shop drawings as designed specifically for this project. Shop drawings shall include all design, structural calculations, fabrication, construction, assembly, and installation as required for a complete floating pier system.
   1. The shop drawings shall show all dimensions, clearances, and anchorage locations.
   2. The detailed shop drawings specifically for this project in compliance with these documents shall bear the seal of the Manufacturers/Contractors Michigan Registered Professional Engineer licensed by the State of Michigan who is experienced in the design of floating structures, floating piers, anchorages and related appurtenances.
   3. Submittal of complete design calculations in accordance with these documents is required for this project along with the shop drawings. Design calculations specifically for this project shall also bear the seal of a Michigan Registered Professional Engineer Licensed by the State of Michigan, who is experienced in design of floating structures, floating piers, anchorages and related appurtenances.

C. Samples: For decking, not less than 24 inches long, showing the range of variation to be expected in appearance of decking, including surface texture.

D. Construction Schedule: Submit a construction sequence schedule as well as a construction time schedule.

1.6 INFORMATIONAL SUBMITTALS

A. Quality Control: Submit a copy of the quality control program that is used to manufacture floating pier system. The following areas shall be included in the program:
   1. Weld quality.
   2. Certifications for materials such as steel, galvanizing, wood, wood treatment, bolts and fasteners, floatation, and floatation encasement.
   3. Dimensional inspection.
   4. Galvanizing.
   5. Quality of floatation material and encasement during manufacturing

B. As-built Record Drawings: At the completion of the work the Contractor shall provide as-built drawings of the floating pier system installation incorporating all changes made during the construction and installation process.

1.7 QUALITY ASSURANCE

A. Manufacturer: A minimum of five (5) years of proven experience in the design of floating structures, floating piers, anchorages and related appurtenances and fabrication, construction, assembly and installation is required.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Use all means necessary to protect the materials of this Section before, during and after installation and to protect the work and materials of all other trades.

B. In the event of damage, immediately make all repairs and replacements necessary to meet the approval of the Architect and at no additional cost to the Owner.

C. All floating piers required for this project shall be carefully transported and carefully unloaded and kept in orderly piles or stacks until placed in the water. None but competent craftsmen shall be employed to float and anchor the floating pier systems. Workmanship shall be first class throughout.

D. Each main pier and finger pier shall be securely tied to avoid damage until permanent connections to anchorages are made.

PART 2 - PRODUCTS

2.1 FLOATING PIER SYSTEM

A. Basis-of-Design System: Flotation Docking Systems, Cedarville, Michigan, or equal.

B. The project drawings are general in nature and show basic floating pier system(s) layouts with required dimensions, required cleat and fender locations, and certain required materials and details of construction and are not intended to be used for fabrication. The piers shown on the drawings are patterned after the type manufactured by Flotation Docking Systems, of Cedarville, Michigan. However, the intent is not to preclude other floating pier systems' of a different manufacturer as long as they meet the required design loads, are within the range of the required dimensions, are constructed with the same specified materials, and are of a quality equal to or better than the floating pier system specified in this Section.

2.2 LUMBER

A. Decking lumber shall be No. 1 select structural Southern Yellow Pine or better and shall conform to the rules of the SPIB as applicable. Framing lumber shall be No. 1 Southern Yellow Pine or better, and shall conform to the rules of the SPIB. Decking boards shall have rounded bevel edges. Decking pieces shall be full length of the width of the units. All Lumber shall be approved of by the OWNER and the Architect prior to acquisition and fabrication.

B. All timber, lumber and decking used on the project shall be pressure treated in accordance with AWPA Retention Standards for natural select wood and each piece shall bear AWPA Quality Mark. All milling shall be done prior to pressure treatment.

C. The American Wood Pressure Association Retention Standard for Natural select wood treatment shall consist of pressure treatment with Copper Azole CA-B for all Southern Pine with a minimum of 0.31 lbs per cubic foot average retention.

D. The Floating Pier System Contractor and/or Manufacturer shall note that if Douglas Fir is used that the pressure treatment shall be Copper Azole CA-B with 0.31 lbs per cubic foot average retention. The Floating Pier System Contractor and/or Manufacturer shall provide the Architect with an assay of pressure treatment prior to delivery and/or acceptance.

E. Field treatment of end cuts shall consist of 2 heavy coats of 1:1 mixture of original preservative.

F. Deck boards shall not have any holes, loose knots or wane and shall not have sap or free flowing preservative on the walking surface. All four upper edges of each deck board shall have a ½" radius eased edge.

G. Lumber shall be kiln dried prior to treating to the moisture content designated in accordance with SPIB rules.
   1. The Architect may assay the treated lumber and have the AWPB laboratory test the pressure treatment retention of all lumber prior to acceptance at the Floating Pier System Contractor's expense.
   2. After treatment, lumber shall again be kiln dried to a maximum moisture content of 19 percent.

H. Installed lumber on units shall have a uniform new pressure treated visual consistency with no visual banding or storing slat marks that have a different lumber appearance.

I. NOTE: Ramps over 30 feet long shall be fabricated truss type aluminum structural members and shall be designed to meet these specifications.

2.3 STRUCTURAL STEEL AND ALUMINUM

A. Structural and miscellaneous steel shall conform to the requirements of the Standard Specification for Structural Steel, ASTM Designation A36 or stronger. All steel shall be zinc coated (hot-dipped) in accordance with the requirements of ASTM Designation A123.

B. Structural aluminum shapes and/or extrusions shall be made from 6061-T6 aluminum conforming to the requirements of ASTM Designation B221.

C. Fasteners: Bolts, lag bolts, screws, nails, flat washers and lock washers shall be of the type and size best suited for the intended use. Low-carbon bolts shall conform to the requirements for Grade "A" bolts, ASTM Designation A307.
   1. High strength bolts shall conform to the requirements of ASTM Designation A325 or A490.
   2. Decking shall be installed with hearts down and no spaces between, and use a chalk line to install the decking nails. Use 2 each hot dip galvanized MG50 mechanically plated in accordance with ASTM A153 Class D, screw-shank nails at each end of the decking where decking is specified. Pre-drill decking, (pre-drill holes if splitting is a problem) and use 4" screw-shank nails or Stainless Steel Grades 304 or 316 for 2-1/2" penetration into support stringers or nailers below.
   3. The coating thickness shall be of a minimum so that corrosion of non-wear surfaces does not appear during the warranty period.

D. Arc welding electrodes shall conform to American Welding Society "Iron and Steel Arc Welding Electrodes."

E. Galvanized steel sheet metal shall be at least 20 gauge with galvanizing 2 ounces psf conforming to the requirements of either the Standard Specifications for zinc-coated (Galvanized Carbon Steel Sheets of a Commercial Quality, ASTM Designation A526) or zinc-coated (Galvanized) Steel sheets of structural quality, coils and cut lengths, ASTM Designation A446.
   1. The steel base metal, its formability and zinc coating shall be in accordance with ASTM Designation A525.
   2. The zinc coating shall have a minimum of 2.0 ounces per square foot.
   3. The 20 gauge galvanized Steel Sheet Metal floatation encasement shall be continuously fastened with 2-1/2" galvanized MG50 mechanically plated screw-shank nails spaced at 1-1/2" centers or stainless steel Grades 304 or 316 structural nails.

F. Aluminum alloy plate shall be equivalent in strength to 20 gauge steel and be 0.124 inch thick, alloy 5052, H36 Marine Aluminum conforming to the requirements of the Standard Specification for Aluminum-Alloy Sheet and Plate ASTM Designation: B209.

G. Lifting rings, where used in lieu of lifting straps or other acceptable methods of removal, shall be of galvanized cast steel of a size sufficient to safely handle the anticipated loads. The rings shall have an internal diameter of 2-1/2 inches.
1. Each pier module to be lifted using rings shall have four rings, so located that, the unit may be lifted without adversely stressing the pier module.
2. If lifting straps are used, the manufacturer shall provide the Owner with a pair of straps of adequate strength to lift the heaviest module provided.

H. Galvanized steel pipe for spud anchorage systems shall conform to the requirements of ASTM Designation: A120 or A123 as applicable.

2.4 FLOATATION MATERIAL

A. The floatation material shall be closed cell polystyrene with an average density of 1.0 pounds per cubic foot and a buoyancy factor of 59.0 pounds per cubic foot to allow for moisture absorption.

B. Medium density polyethylene shall be black in color having a nominal thickness of 0.1875 (3/16) inches with an allowable tolerance of □0.0375 inches and shall meet the following standards:
1. Density: 58.22 pounds per cubic foot □3/4%, ASTM 1505.
2. Environmental Stress Cracking F50: 1000 hours, ASTM D1693.
3. Ultimate Tensile Strength Range: 2490 to 2600 pounds per square inch, ASTM D638.
4. Vicant Softening Temperature Range: 235□ F. to 240□ F., ASTM D1525.
5. Brittleness Temperature: -180□ F., ASTM D746.
6. Flexure Modulus Range: 96,000 to 100,000 pounds per square inch. ASTM D790.

C. Floatation shall be provided by closed cell polystyrene cellular materials, either preformed or expanded in place.
1. The floatation material shall be fully encased in at least 20 gauge 2 ounces psf galvanized steel sheet metal, marine aluminum at least 0.124 inches thick, medium density polyethylene with a nominal thickness of 0.1875 (3/16) inches (see 2.3 B), wood having a nominal thickness of 2 inches, or a combination of these materials.
2. In the past, polystyrene filled, end capped galvanized corrugated pipe of at least 20 gauge have been used as floatation units. Substitution of floatation units consisting of closed end, polystyrene filled pipe having a minimum wall thickness of 1/8 inch are acceptable.
3. Such floatation units shall be completely galvanized including end closure plates.
4. If the pipe is used as a structural component, its thickness shall be sized accordingly.
5. Pipe and galvanizing shall meet applicable requirements described elsewhere in these specifications.

2.5 ACCESSORIES

A. All deck mounted accessories shall be bolted to or through the pier frame. Additional and/or intermediate members may be required to accommodate adequate bolting of deck mounted items.

2.6 OTHER MATERIALS

A. All other materials not specifically described but required for a complete and proper installation of the work of this Section, shall be as recommended by the manufacturer of the floating pier system and approved by the Architect.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. The Floating Pier System Contractor shall provide a full time superintendent at the job site to supervise and coordinate the unloading, assembly and installation of the floating pier system including anchorages, ramps and utilities as well as coordination of pier related activities with those activities that are the responsibility of other trades and/or contractors.

B. Maximum amount of fabrication and assembly shall be done at the floating pier system manufacturer's plant rather than on the job site.

3.3 PIERS AND HEAD PIERS

A. Piers shall be pre-fabricated within practical limits in the floating pier system manufacturing plant by the floating pier system manufacturer and delivered to the site and ready for floatation.
   1. All workmanship shall be first class in all respects as determined by the Architect, and any units not representing a finished and acceptable appearance will be rejected.

B. All connector plates, including those in-line, at the corners and at knee braces which receive loads from impact and anchorage forces shall be of a height, width and thickness sufficient to dissipate the required loads to the framework without distortion or damage.
   1. Connections may be either of the single or double shear type with hinge pin (bolt) holes parallel and along the hinge pin axis.
   2. Hinge pin holes shall be as tight as possible to eliminate excessive "slop" and unnecessary movement in the joints.
   3. Calculations may be required to demonstrate the frame's ability to accept such loads imposed through the connectors as well as the ability of the connections (single or double shear) to resist the loads without distortion or damage.
   4. Back plates or angles of a minimum of ¼" thick steel shall be used on interior back side of unit wall boards and shall be full height of bolted connection or backers of minimum 2½" square ¼" thick plate washers per bolt.

C. All finger or "T" piers shall have knee braces that extend at least 4 feet along the finger piers and main pier. Larger braces may be used if required to gain the necessary strength for the loads applied but in no case shall the braces extend more than 6 feet along the finger piers and main pier.
   1. The knee brace isosceles triangle area shall be covered with the same deck material used for other decking, no butt joints will be allowed.
   2. The edge of each fillet shall extend slightly beyond the knee brace and the edge of the fillet shall have a rub rail to protect a boat from impacting upon bare steel.
   3. Back plates or angles of a minimum of ¼" thick steel shall be used on interior back side of unit wall boards and shall be full height of bolted connection or backers of minimum 2½" square ¼" thick plate washers per bolt.

D. All steel galvanized members must be hot dip galvanized after fabrication, including welding, and after the drilling of bolt holes for the attachment of anchorages, utilities and deck mounted components.
   1. Exception is given only to those field welds that must be performed, as determined by the Architect, at a custom connection and done so in the interest of quality control. Where

applicable, enough coats of an acceptable cold galvanizing compound must be applied to the field weld to give a thickness equal to the adjoining original hot dip galvanizing.

E. All finished steel members shall be free from twists, bends, distortions, and open joints. All steel construction shall be free of sharp edges and burrs. Ends of exposed steel members shall be rounded or beveled. All coping and mitering shall be done with care. Projecting materials and burrs that would prevent bearing of the various members on each other shall be removed.

F. All welding shall conform to the requirements of the American Welding Society. Welds shall be solid and a homogeneous part of the metals joined and shall be free from pits or scale, and shall be of full area and length required to develop the required strength for the intended use. All shop welders, welding operators, welding equipment and welding procedures used in production of steel structures shall have been qualified in accordance with the qualification procedures of AWS D1.1. Welders shall be certified to perform the welds that are shown on the fabrication drawings. Proof of qualifications shall be required.

G. All bolts, nuts and washers shall be of a size and strength adequate for the loads imposed and shall be set square with connecting structural members with the nuts drawn up tight. Lock washers or other devices or techniques shall be used to prevent nuts from loosening after being properly tightened.
1. No bolt threads shall be allowed within the structural components in hinged type connections.
2. Hinge pins or bolts shall be of a positive locking type which will not allow loosening or loss of the pin or bolt from movement of the joint.
3. High strength bolts shall be used where required in accordance with the American Institute of Steel Construction's specifications for "Structural Joints using ASTM A325 or A490 Bolts."

H. Lumber shall be counter-bored wherever projecting bolt-heads or nuts may damage boats or provide a hazard to pier users. Counter-boring shall be sufficiently deep to permit installation of the bolts and nuts with washers well below the surface of the wood.

3.4 DECKING

A. Deck boards may be fastened either by nailing, screwing or bolting.
1. If nailed, nails shall be driven to set the heads flush with or slightly below the surface of the wood. Number of nails used per connection, type and size shall be sufficient to fasten the deck boards firmly to the nailing surface (timber framing or nailers) and provide a flat, even walking surface free from warp or any kind.
2. Decking shall be screwed down for easy removal in those locations where electrical boxes, valves, drains, etc. must be accessed.
3. Where decking is fastened directly to steel frames, fastening shall be done with galvanized self-tapping screws of a size and strength adequate to prevent shearing and breaking under normal operating conditions.
4. Deck screws shall be stainless steel and small and have heads flush with the deck surface or slightly depressed to provide a flat, even walking surface. Deck screws shall be installed so as not to fracture the wood and cause splintering at the hole.
5. Number of screws used per connection shall be adequate to firmly attach the deck boards and provide a flat, even walking surface. Fasteners of whatever type shall be located in symmetrical patterns throughout with fasteners in straight lines.
6. Fasteners shall be approved of by the manufacturer regarding the effects of corrosion that could occur from the Copper Azole Type B (CA-B) wood pressure treatment.

B. Deck boards shall be installed with no space between adjacent deck boards and placed hearts down. Decking shall be installed perpendicular to the longitudinal axis of the pier. All Deck boards shall have rounded beveled edges. All Deck boards shall be full length of the unit deck width.

C. Deck boards shall be supported at a maximum of 3 feet on center with the boards laid heart side down. Deck boards shall have no wane visible. Deck boards shall have uniform color consistency throughout.

D. Openings between adjacent floating pier modules shall not exceed 1-1/2 inches, however, the opening between adjacent pier module end deck boards shall not exceed 1/8 inch. All connections between floating pier modules shall not protrude above the level of the pier surface.

3.5 FLOATATION UNITS

A. The floatation units shall be securely connected to the pier framing and deck, so that the floating pier, including the floatation encasement, as previously defined, acts as an integral unit within the tolerances specified without damage or separation. The connections must be such as to prevent the tearing away or other damage to the floatation units and/or pier frames at the points of connection. Materials used to attach floatation units shall have a life expectancy as long as the unit itself.

B. Floatation units shall be so designed and supported so that no damage occurs during shipping, handling or under normal use. All floating pier system units shall have uniform appearance and color consistency throughout.

C. If floatation is installed at the manufacturer's plant as an integral part of the floating piers, the Architect has the right to inspect the piers in various stages of manufacture to insure that the floatation as well as all other materials used meet the intent of the specifications. The Architect has the right to make inspections at unannounced times and to choose the units to be inspected at random.

D. If floatation units do not meet the specifications, changes shall be made in the materials and/or fabrication until units, chosen thereafter at random do meet the requirements of the specifications. Units purchased from other manufacturers shall be so modified that they do meet the specifications, or units from other manufacturers that do meet the specifications shall be substituted. Delays and costs due to tests, re-tests, modifications, substitutions and shipping shall be borne by the manufacturer of the floating pier units.

E. Additional floatation units may be destructively tested at the job site from a random selection by the Architect in accordance with the following:
   1. The Architect may select at random one of each type floatation unit for removal and destructive testing out of every 100 floatation units shipped or fraction thereof.
   2. Additional testing will be at the discretion of the Architect with approval of the Owner.
   3. If the floatation units tested meet the specifications, the cost of testing as well as the cost of the floatation units destructively tested will be borne by the Owner.
   4. If the floatation units tested do not meet the specifications, additional floatation units will be tested in accordance with the following:
      a. The Architect shall choose three additional floatation units for testing above the number originally required.
      b. If any of the three additional floatation units tested are found not to meet the specifications, the floatation unit manufacturer must stop manufacture, purchase or installation of additional floatation units until it is proven that all previously installed floatation units are satisfactory and that future floatation units will meet the specifications.
      c. The method of proving that all the floatation units are strictly manufactured in accordance with the project specifications shall be agreed upon by the Architect and the Floating Pier System Contractor.
   5. The costs of such testing shall be borne by the Floating Pier System Contractor.

3.6 RAMPS

A. A ramp shall be required between every floating pier system construction to shore. Ramps shall have timber decks constructed of 2 x 6 or 2 x 8 lumber, adequately supported, and installed perpendicular to the longitudinal axis of the ramp and meeting the material requirements of Article 2.1. Deck boards shall be installed with no spacing between them. Ramps less than 28' in length may be timber framed. Ramps over 28' in length shall be aluminum framed truss type structural units for each full length side of ramp.

B. Designated Required ADA and ADAAG accessible gangway ramps (all gangway ramps for this project) shall be constructed in accordance with ADA (Americans with Disabilities Act) requirements and ADAAG (Americans with Disabilities Act Accessibility Guidelines). Provide ramped rotation and unit ramps to provide a 1:12 max. slope in range of ordinary high water levels (580.8) and average water levels from monitoring the U.S. Army Corp of Engineers monthly charts and based upon ordinary low water, 1985 IGLD for this project. Ramps shall be designed and fabricated to withstand dead load, design live loadings and all utilities. Copies of guidelines are available from the Architect if needed. Place ramp length as shown on project drawings or longer as required.

C. The ramps may be hinged at one end and have a sliding or roller (wheeled) connection or galvanized steel L-bracket ears on each side of ramp end to allow for movement due to fluctuating water levels. Wheels shall be of adequate strength to carry the design live loads applied to the ramp in addition to the weight of the ramp, handrails, and utilities.

D. Hinged connections at both ends may be used if the anchorage system used allows for the horizontal movement of the floating pier(s) as long as one end is a galvanized steel L-bracket ear connection. In all cases, the ramp connections shall be so designed as not to present any excessive openings or significant differences in elevation between the ramp and the point of connection at the shore.

E. A hinged threshold plate shall be used with a sliding or roller type connection where the ramp joins the floating pier to avoid a step. The bottom of the ramp shall be designed so that the step, without the threshold plate, shall not exceed 6 inches. The required hinge threshold plate shall be attached at the bottom of the ramp, shall be the full width of the ramp and shall be 36 inches long if the step is 6 inches high. For lesser height steps the length of the threshold plate shall be proportioned accordingly. The threshold plate shall be fabricated from galvanized steel plate of adequate strength and design to prevent abnormal deflection and shall have a slip resistant surface.

F. Galvanized steel ramp plates of a minimum 10 gauge thickness shall be installed on the floating pier system deck using zinc or cadmium plated flat head wood screws under ramp wheels, sliding surfaces and threshold plates to prevent damage to the deck surface. Edges and corners of these plates shall be rounded to reduce the possibility of tripping. Plates shall be of adequate size that wheels, sliding surfaces and threshold plates will remain on them under any positioning which would occur due to movement of the anchorage system or variation in water levels. In pedestrian areas, plates shall have slip resistant surface to meet ADA (Americans with Disabilities Act) requirements and ADAAG (Americans with Disabilities Act Accessibility Guidelines).

G. The end of the floating pier under the ramp shall have a galvanized angle at least 4" x 4" x 1/4" in size installed horizontally across the full width of the floating pier on the top edge of the pier. It shall be installed in such a way that rails (wear resistant surfaced members) under the ramp will slide freely on the angle if the ramp goes above the level of the upper connection and rides on the end of the floating pier. The rails shall be of adequate length to ride on the end of the pier "angle" at high water due to movement of the anchorage system.

H. Handrails shall be required on both sides of all ramp side railing and may be part of the structural support or separate units. Top of side rails to be 42 inches above the deck surface with

intermediate balusters and bottom railing so spaced with vertical baluster members spaced as to allow less than 4 inches between adjacent balusters.

1. All railings shall be smooth with no sharp corners, burrs, etc., so as to make a smooth member for hand contact.
2. Handrail and handrail brackets shall be designed to withstand a minimum concentrated load of 200 pounds applied from any direction at any point on the handrail.
3. Fittings shall be galvanized.
4. Sharp corners on galvanized steel handrails or trusses used as handrails shall be avoided by the use of short 45 degree miters, short curved sections, or other approved methods.
5. Protrusions on the horizontal railing or any pieces on the ramps themselves shall not have sharp corners. Round ends of horizontal end pieces. Sand all railing pieces so they are smooth with no slivers.
6. Handrails shall be installed full length on each side of ramp in accordance with ADA (Americans with Disabilities Act) requirements and ADAAG (Americans with Disabilities Act Accessibility Guidelines).

3.7 SKIRTING AND FENDERING

A. Skirting is required. Required structural framework and floatation devices shall be skirted from decking to not greater than 2" above the waterline. In the case where skirting is the prime side wall member (timber box type floating piers) extend sidewall to the bottom of the unit with nominal 2" thick wood meeting the lumber requirements as specified under Section 2.1.
   1. The skirting must be adequately secured full depth to the frame members at a maximum 4'-0" spacing along the floating pier system units with bolts or other acceptable fasteners as required to prevent skirting and frame damage by ice, wave and impact design forces.
   2. All skirting lumber shall have uniform color consistency.

B. All fenders shall be of 6 x 6 or 8 x 8 where noted and nominal timber of the same type wood and treatment as wood decking. Fenders shall be located as shown on the drawings.
   1. The length shall allow adequate fastening to the pier(s) and will insure the heights above the pier deck(s) as specified in Article 1.3H of the Michigan Department of Natural Resources Parks and Recreation Division Floating Pier Specification.
   2. All fenders shall be securely attached to the framework with a minimum of two bolts and the framework must be structurally adequate to accept without distortion, design impact loadings applied to the fenders.
   3. Lag bolting of fenders to the timber side walls of wood type floating piers shall not be permitted along the "open" water side of service and T-piers or along those main piers where fendering is indicated on the project drawings.
   4. All bolts, nuts and washers shall be galvanized with all bolt heads counterbored. All bolted fenders shall have a minimum of ¼" thick x minimum 3" square plate washers on the back side of the side walls.
   5. Tops of fenders shall be "roofed" or have beveled edges in a manner satisfactory to the Architect.

C. Timber rub-rails shall be required along the edges of the floating pier system main piers where vertical fendering is not required to protect boats from rubbing on the "saw toothed" surface presented by the edges of deck boards. Since fendering is specified along the edges of finger piers, T-piers and service piers; rub-rails shall not be required in these locations.
   1. Skirting may be substituted for rub-rails if it is extended to cover the "saw toothed" surfaces previously described.
   2. The rub-rails shall be located so that their top edges are even with the top walking surface of the deck. Rub-rails shall be firmly attached to the pier framing with adequately sized bolts spaced at a maximum of 5 feet on center.
   3. Bolt heads shall be of a type providing a flush surface or the holes for the bolts shall be counter-bored.
   4. Rub-rails shall be nominal 2 x 6 unless noted otherwise and individual sections or rub-rail shall not be less than 8 feet long.

3.8 ANCHORAGE SYSTEM

A. General: The floating pier(s) shall be secured with telescoping spud type anchorage systems. The anchorage system shall secure the floating pier(s) under the most severe loading conditions given in Article 1.4 Design Criteria of the Michigan Department of Natural Resources Parks and Recreation Division Floating Pier Specifications and at all water levels from +5 feet above IGLD to -1 foot below IGLD. The floating pier system manufacturer shall provide a design for the telescoping spud type anchorage system to be used on this floating pier system. Place a minimum number of spuds shown on the project drawings and more as design may require.

B. The anchorage system design shall be approved prior to bidding in accordance with Article 1.2 Quality Assurance of Acceptable Floating Pier Systems of the Michigan Department of Natural Resources Parks and Recreation Division Floating Pier Specification. The shop drawings shall include the anchorage system design and shall be approved by the State of Michigan Professional Services Contractor prior to design, fabrication, construction, assembly and installation of the floating pier system.

C. Spud guides (wells) and their supporting members shall not protrude above the deck surface adjacent to the spud locations. If spud guides project below the bottoms of floating pier units they shall not be of a length that will allow "bottoming out" in the project depth/s shown on the drawings. For purposes of design, water depth shall be the difference between the project water depth shown on the drawings and a water surface 0.0 below L.W.D less one foot.
   1. Spuds shall be installed in a vertical position so that pier modules will not bind when moving up and down from fluctuating water levels.
   2. Telescoping spud sections shall overlap a minimum of 3 feet under all water level conditions specified in Article 3.9 of the Michigan Department of Natural Resources Parks and Recreation Division Floating Pier Specification.
   3. Telescoping spuds use shall be limited to water depth of -12' LWD and shallower.
   4. Back plates or angles of minimum ¼" thick steel shall be used on interior back side of unit wall boards and shall be full height of bolted connection or minimum 2½" square ¼" thick steel plates.

D. Where ramp connections cause movement of the piers in and out along the piers' longitudinal axis from fluctuating water levels, the spud guides (wells) shall be so designed to allow for this movement.

E. The section of inner spud in the lake bottom shall have an eye, bail or other device that shall allow the bottom spud section to be hooked and removed thru the upper spud section. Where soil conditions are such that the lower section may settle into the bottom, a cable retainer or other method of attachment shall be provided to insure the overlapping sections of telescoping spuds do not separate or lose their required three foot overlap.

F. Inboard spuds shall not be allowed except if a special design of the frame, floatation, connections, and deck by the manufacturer insure that the spud cover provides a flush, "trip free" walking surface; the spud wells can be easily accessed thru the deck; the spuds never raise the cover and project above the deck under all water level conditions specified above; and do not interfere with utilities.

G. If hard bottom soil conditions exist, the bottom spud segments shall be power driven into the bottom soils as required.

H. Concrete Block Anchors: Minimum size and construction of reinforced concrete block, size and connections shall be shown on the drawings. Use larger size as needed by design.

I. Shore Bulkhead Connections: Provide hinge ear or similar welded steel fabricated connection to existing abutment steel as shown and as required for ramp and system design.

3.9 CLEAN-UP

A. Before turning the floating pier system over to the Owner, clean all work areas, equipment and site and leave all in a clean, working order at the end of the work.

B. The Floating Pier System Contractor shall remove all rubbish and dirt from the premises where such rubbish and dirt has accumulated as a result of his work.

3.10 MAINTENANCE AND OPERATIONS MANUAL

A. Upon completion of the project, the Floating Pier System Contractor shall furnish the Owner five (5) copies of a "Maintenance and Operations Manual," which shall include instructions and related information for maintaining and operating the floating pier system and anchorages including utilities, if applicable. Utilities may include, but are not necessarily limited to electrical, lighting, water, sanitary pump-out, fuel, and telephone.

B. The Floating Pier System Contractor shall include in the manual a detailed procedure for systematically maintaining and winterizing the floating pier system and anchorages, as well as minimizing ice damage to the system during the winter.

C. Although it is intended to leave the floating pier system in place throughout the winter, the Floating Pier System Contractor shall also include in the manual, a detailed procedure for systematically removing, storing and reinstalling the floating pier system for the purposes of repair and maintenance.

D. The manual shall include reduced size copies of the final "as-built" layout and fabrication drawings; a listing of purchased items or parts likely to need repair or replacement such as flexible connections, cleats, "special" bolts and fasteners, etc.; and a copy of the warranty. The list of purchased items shall include the name, address and phone number of suppliers and shall be accompanied with appropriate catalog cuts and manufacturer's specifications.

E. The instructions for maintenance shall include preventive maintenance procedures as well as ordinary maintenance and shall include schedules for such activities.

3.11 WARRANTY

A. The Floating Pier System Contractor shall execute and deliver to the Owner, before final payment, on his/her letterhead, a letter of warranty plus labor and material guarantee which shall include at a minimum the following words and items of performance: (floating pier system contractor name) warrants for five years, from the date of acceptance of the entire floating pier system by the Owner, that the floating pier system and all related items shown on the drawings and included in the specifications shall be free from defects in design, construction, materials, workmanship and installation when utilized as intended and within the conditions specified.
   1. Should any defects develop during the warranty period, the Floating Pier System Contractor shall provide the necessary materials and labor needed to correct the defects by repair or replacement without expense to the Owner.
   2. The warranty specifically excludes acts of nature or use producing conditions beyond the design criteria set forth in these specifications.
   3. Commercially purchased items shall be warranted for one year or the warranty period provided by the floating pier system manufacturer, if longer than one year.
   4. Workmanship provided on the utility systems will be guaranteed for one year from the day of acceptance.

B. The Floating Pier System Contactor shall not be responsible for damages caused by the Owner not operating and/or maintaining and/or winterizing the floating pier system in accordance with the maintenance, operating and winterizing procedures provided by the floating pier system

manufacturer in the "Maintenance and Operations Manual" approved by the Owner at the time of final acceptance.

C. Specific items of the floating pier system performance during the warranty period are as follows:
   1. The average freeboard shall not have decreased more than 1" from the average freeboard that existed at the time of the original installation at the end of 1 year and not more than 2" at the end of the warranty period. However, it is expected that decrease in freeboard will be relatively uniform and that the floating pier system piers will remain relatively flat and level.
   2. Floatation units shall remain in their original condition, without cracks and show no signs of stress and damage that will result in premature failure.
   3. Deck boards shall not show signs of dangerous deflection or deterioration to a degree that would necessitate replacement.
   4. Deck nails shall not pull out or shear off during the warranty period.
   5. Connectors and connector bolts shall not show excessive wear to the point of needing replacement during the warranty period.
   6. Steel members showing evidence of rusting due to poor galvanizing of steel during the warranty period shall be repaired by methods described and pre-approved in the Operations and Maintenance Manual.
   7. At the end of the warranty period torsional deflections produced under dead loads and/or live loads at the end of the finger piers shall not be 50% greater than those allowed when the piers were initially installed.
   8. At the end of the warranty period the cross pier deck slopes shall not be greater than 2% of the width in order to comply with ADA (Americans with Disabilities Act) requirements and ADAAG (Americans with Disabilities Act Accessibility Guidelines), the maximum allowed when the piers were initially installed.
   9. Non-wear surfaces of bolts and nuts shall be replaced if they show signs of rust during the warranty period.

D. Items not meeting the conditions of this warranty and any damage caused to the floating pier system due to failure of items or units covered by this warranty shall be repaired or replaced under the direction of, and at the expense of, the Floating Pier System Contractor.

E. The agreed date of acceptance of the completed floating pier system shall be upon completion of the project.
   1. The warranty shall be for a period of five (5) years from the date on which the completed work is turned over to and accepted by the Owner.

F. The Owner shall give notice of defects, covered by this warranty, by phone in emergencies and in writing to the Floating Pier System Contractor immediately upon observance of the defects or when observed during the annual inspections.

G. It is intended that the above allowed changes in freeboard, torsional deflections, and cross pier slopes (items 1, 7 and 8) of the forgoing Article 3.20 C are due to normal deterioration of the floating pier system and/or absorption of water by flotation material. Such changes do not apply to effects caused by changed environmental factors such as increased loadings due to marine organisms or by loadings due to items added since the floating pier system was installed and which were not allowed for or included in the original design.

3.12 ANNUAL INSPECTION

A. The Floating Pier System Contractor shall provide a qualified person to make an annual inspection of the floating pier system every year throughout the warranty period, at the expense of the Floating Pier System Contractor.

B. The inspection shall be made in the presence of the Owner's representative at a time mutually agreeable to the Owner's and Floating Pier System Contractor's representatives.

C. The purpose of the inspection is to point out items needing repair and where routine maintenance is required.

D. Two copies of an inspection report covering the above items in need of repair or that require routine maintenance shall be prepared by the Floating Pier System Contractor and sent to the Owner's representative.

3.13 OPERATIONAL REVIEW

A. The Floating Pier System Contractor and subcontractors shall have a minimum of 4 hours of training with the Owner to review all maintenance, repair, and winterization procedures.

END OF SECTION 06 1534

SECTION 06 1535 – GANGWAYS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Floating Pier Gangway.

B. Related Requirements:
   1. Section 01 0000 "General Requirements" for Build America Buy America requirements.
   2. Section 03 3053 "Miscellaneous Cast-in-Place Concrete" for concrete abutments.
   3. Section 05 5000 "Metal Fabrications" for miscellaneous steel members and appurtenances for concrete abutments.
   4. Section 06 1534 "Floating Pier" for associated gangway connection between floating pier and shore abutment.

1.3 DESCRIPTION

A. Work Included: Design, fabricate, install, and furnish all plant, labor, equipment, supplies and materials, and perform all operations required for installation of complete, fully functional, and operational gangways.

B. Fabrication: The contract drawings are not intended to be used for fabrication. The Contractor shall prepare and submit digital drawings in PDF format to the Architect for approval prior to fabricating and installing the gangways.

C. Other Materials and Equipment: Other materials and equipment shall be as indicated on the drawings, however all other materials not specifically described but required for a complete and proper installation of the work under this section shall be new, first quality, and if selected by the Contractor, subject to Architect's approval.

1.4 DELEGATED DESIGN CRITERIA

A. General:
   1. Gangways railings shall be constructed of aluminum, as a free span truss design, unless specifically noted others on Project Drawings.
   2. Design of aluminum members shall conform to the current edition of The Aluminum Association Specification and Guidelines for Aluminum Structures.
   3. Aluminum welding shall be in accordance with ANSI / AWS D1.2-97 gas metal arc welding process, and shall be performed by experience and certified operators.
   4. All exposed surfaces and their welded joints shall be smooth and free of sharp or jagged edges.
   5. Gangways up to 80' in length must be constructed as a single and continuous unit. Spliced / bolt-together connections will not be permitted.
   6. Concrete abutments shall be designed based upon provided geotechnical report which indicates low bearing capacity, and likely need for helical pile support for the abutments. Delegated design of abutments and necessary support systems shall be by Manufacturers/Contractors Michigan Registered Professional Engineer licensed by the State of Michigan.

B. Dimensional:
   1. Width: All gangways shall provide a minimum clear width of 6' between handrails or innermost members.
      a. Wider frame dimensions shall be permitted to achieve the necessary clear width, but in no case shall gangways be wider than floating pier to which they attach.
      b. Clear widths shall never be less than 42".
   2. Length: Gangway lengths shall be as specified on Project Drawings, excluding transition plates.

C. Uniform Live Load:
   1. Gangways shall be designed for a uniform live load of 50 pounds per square foot with anticipated utility loading of not less than 45 pounds per linear foot over the length of the gangway.
   2. Maximum deflection shall be calculated using L/180, where "L" is the length of the gangway in inches.

D. Vertical Live Load:
   1. Decking shall be designed for a 100 pounds per square foot distributed live load, and a 300-pound concentrated live load over one square foot of area.
   2. Handrails shall be designed for a 20 pounds per linear foot distributed load, and a 200-pound concentrated load point in any direction.

E. Landside Transitions:
   1. Gangways shall be designed to adapt to the landside mounting surface.
   2. Connection(s) shall be capable of horizontal articulation by means of a centrally located pin (5th wheel design), multiple roller system, or other expansion device to accommodate lateral displacement of the floating pier system. If multiple roller systems are used, they shall be equipped with positive stops to prevent the gangway from losing contact with the bearing portion of the attachment.
   3. Include a non-skid aluminum transition plate measuring at least 1/4" thick and 24" long, full width of the gangway frame to bridge gap connection gap. The landing shall be level, with a slope not exceeding 2% in any direction.

F. Dockside Transitions:
   1. Connection(s) shall be roller or slider type and shall be equipped with positive stops or other form of to prevent sliders / rollers from sliding out of alignment and / or off the edge of the floating pier system.
   2. Hinge connections may be used when gangway landside transitions provide adequate means of articulation as specified herein.
   3. Include a non-skid aluminum transition plate measuring at least 1/4" thick and 24" long, full width of the gangway frame to bridge gap connection gap. The landing shall be level, with a slope not exceeding 2% in any direction.

G. Truss Requirements:
   1. Top chord shall be round, square, or rectangular tube sized per the manufacturer to accommodate all design loads specified herein and in Project Drawings.
      a. Top chord member shall extend 18" beyond the end of the walking surface at both ends of the gangway.
   2. Bottom chord shall be square or rectangular tube sized per the manufacturer to accommodate all design loads specified herein and in Project Drawings.
   3. Truss webs shall be round, square, or rectangular tube sized per the manufacturer to accommodate all design loads specified herein and in Project Drawings.
      a. Vertical members may be used but shall not be considered to be a primary load carrying member. Structural calculations shall rely solely on diagonal truss webs.

H. Handrails:
   1. Handrails shall be continuous 1 ½" diameter sch-40 aluminum pipe, installed 34" from the finished deck surface on both sides of the gangway.

2. A clear space of not less than 2" shall exist between handrails adjacent trusses / railing.
3. Supports shall be adequately spaced to withstand the loading criteria specified herein. Supports shall connect to handrails from beneath and shall maintain all necessary clearance for graspability in accordance with ADA requirements.

I. Railing:
1. Railing shall be installed on the exterior portion of gangway truss systems, and shall be of the type specified within Project Drawings.

J. Codes and Standards:
1. Reference is made in these specifications to the codes and/or standards promulgated by the following agencies and organizations:
   a. ADA Americans with Disabilities Act
   b. ADAAG ` Americans with Disabilities Act Accessibility Guidelines
   c. ANSI American National Standard Institute
   d. ASCE American Society of Civil Engineers
   e. ASTM American Society for Testing and Materials
   f. AWPA American Wood Preservers Association
   g. AWPB American Wood Preservers Bureau
   h. AWS American Welding Society, Inc.
   i. MBC Michigan Building Code
   j. SESC State of Michigan Soil Erosion and Sedimentation Control Act
   k. SPIB Southern Pine Inspection Bureau
2. Compliance: Comply with those codes and/or standards specified in this Section and referenced above.
   a. All work and materials shall be furnished and installed in accordance with all Federal and State Codes, Laws, and Regulations as well as the current Michigan State Codes, Laws, and Regulations.
   b. Where requirements of the contract documents exceed those of above mentioned Codes, Laws, and Regulations the requirements of the Contract Documents shall govern.
   c. In case of conflict between the referenced Codes, Laws, and Regulations, the most stringent requirements shall govern.

1.5 ACTION SUBMITTALS

A. Product Data: For all materials, products and product systems.
1. Documentation of compliance with Build America Buy America requirements. Refer to Section 01 0000 "General Requirements".

B. Shop Drawings: Detailed shop drawings as designed specifically for this project. Shop drawings shall include all design, structural calculations, fabrication, construction, assembly, and installation as required for a complete gangway system.
1. The shop drawings shall show all dimensions, clearances, and anchorage locations.
2. The detailed shop drawings specifically for this project in compliance with these documents shall bear the seal of the Manufacturers/Contractors Michigan Registered Professional Engineer licensed by the State of Michigan who is experienced in the design of floating structures, floating piers, abutments, foundation support systems, anchorages and related appurtenances.
3. Submittal complete design calculations in accordance with these documents is required for this project along with the shop drawings. Design calculations specifically for this project shall also bear the seal of a Michigan Registered Professional Engineer Licensed by the State of Michigan, who is experienced in design of floating structures, floating piers, anchorages and related appurtenances.

C. Samples: For decking, not less than 24 inches long, showing the range of variation to be expected in appearance of decking, including surface texture.

D. Construction Schedule: Submit a construction sequence schedule as well as a construction time schedule

1.6 INFORMATIONAL SUBMITTALS

A. Quality Control: Submit a copy of the quality control program that is used to manufacture gangway system. The following areas shall be included in the program:
1. Weld quality.
2. Certifications for materials such as steel, aluminum, galvanizing, wood, wood treatment, bolts and fasteners.
3. Dimensional inspection.
4. Galvanizing.
5. Quality of floatation material and encasement during manufacturing

B. As-built Record Drawings: At the completion of the work the Contractor shall provide as-built drawings of the gangway systems installation incorporating all changes made during the construction and installation process.

1.7 QUALITY ASSURANCE

A. Manufacturer: Gangways shall be manufactured by a firm with a minimum of ten (10) years' experience in design, construction, and installation of the gangway systems conforming to these specifications.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Use all means necessary to protect the materials of this Section before, during and after installation and to protect the work and materials of all other trades.

B. In the event of damage, immediately make all repairs and replacements necessary to meet the approval of the Architect and at no additional cost to the Owner.

PART 2 - PRODUCTS

2.1 GANGWAY SYSTEM

A. Basis-of-Design System: Following manufacturer systems, or equal.
1. Flotation Docking Systems, Cedarville, Michigan.
2. Ravens Marine, Inc., Kissimmee, Florida.

B. The project drawings are general in nature and show basic gangway system(s) layouts with required dimensions and certain required materials and details of construction and are not intended to be used for fabrication. The gangways shown on the drawings are patterned after the type manufactured by Flotation Docking Systems, of Cedarville, Michigan or Ravens Marine, of Kissimmee, Florida. However, the intent is not to preclude other gangways of a different manufacturer as long as they meet the required design loads, are within the range of the required dimensions, are constructed with the same specified materials, and are of a quality equal to or better than the gangway system specified in this Section.

2.2 LUMBER

A. Decking lumber shall be No. 1 select structural Southern Yellow Pine or better and shall conform to the rules of the SPIB as applicable. Framing lumber shall be No. 1 Southern Yellow Pine or better, and shall conform to the rules of the SPIB. Decking boards shall have rounded bevel edges. Decking pieces shall be full length of the width of the units. All Lumber shall be approved of by the OWNER and the Architect prior to acquisition and fabrication.

B. All timber, lumber and decking used on the project shall be pressure treated in accordance with AWPA Retention Standards for natural select wood and each piece shall bear AWPA Quality Mark. All milling shall be done prior to pressure treatment.

C. The American Wood Pressure Association Retention Standard for Natural select wood treatment shall consist of pressure treatment with Copper Azole CA-B for all Southern Pine with a minimum of 0.31 lbs per cubic foot average retention.

D. The gangway Contractor and/or Manufacturer shall note that if Douglas Fir is used that the pressure treatment shall be Copper Azole CA-B with 0.31 lbs per cubic foot average retention. The gangway Contractor and/or Manufacturer shall provide the Architect with an assay of pressure treatment prior to delivery and/or acceptance.

E. Field treatment of end cuts shall consist of 2 heavy coats of 1:1 mixture of original preservative.

F. Deck boards shall not have any holes, loose knots or wane and shall not have sap or free flowing preservative on the walking surface. All four upper edges of each deck board shall have a ½" radius eased edge.

G. Lumber shall be kiln dried prior to treating to the moisture content designated in accordance with SPIB rules.
   1. The Architect may assay the treated lumber and have the AWPB laboratory test the pressure treatment retention of all lumber prior to acceptance at the Floating Pier System Contractor's expense.
   2. After treatment, lumber shall again be kiln dried to a maximum moisture content of 19 percent.

H. Installed lumber on units shall have a uniform new pressure treated visual consistency with no visual banding or storing slat marks that have a different lumber appearance.

I. NOTE: Ramps over 30 feet long shall be fabricated truss type aluminum structural members and shall be designed to meet these specifications.

2.3 STRUCTURAL METALS

A. Aluminum extrusions shall be marine grade aluminum alloy 6063-T6, 6061-T6, 6063-T5, or 6005-T5, and shall be extruded in accordance with the requirements of applicable sections of Federal Specification QQ-A-200.

B. Stainless steel fasteners shall be grade 304.

C. Decking material and lumber shall be as specified in 061534 - Fishing Pier.

D. Low-carbon bolts shall conform to the requirements for Grade "A" bolts, ASTM A307. SAE Grade 2 is considered an acceptable equal to ASTM A307.

E. High strength bolts shall conform to the requirements of ASTM Designation A325 or A490. SAE Grade 5 is considered an acceptable equal to ASTM A325.

F. Wheel / rollers used at the end of gangways shall be heavy-duty construction of molded rubber or ultra-high molecular weight polyethylene (UHMW) with ultraviolet inhibitor, and be non-seizing type due to rust or ice.

2.4 OTHER MATERIALS

A. All other materials not specifically described but required for a complete and proper installation of the work of this Section, shall be as recommended by the manufacturer of the gangway system and approved by the Architect.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Design, fabrication, delivery, handling, and installation of gangways shall conform to the latest revisions of the Aluminum Construction Manual and all applicable standards and data as described by the Aluminum Association.

B. All connections to be welded shall be of new material, clean and free of any containments. All joints shall fit properly and be prepared for the appropriate welding procedure.

C. Gangways shall be installed, and connections adjusted as necessary, to allow the floating pier system free movement throughout the range of water levels without binding of stressing either the floating pier system or gangways.

D. Maximum amount of fabrication and assembly shall be done at the gangway system manufacturer's plant rather than on the job site.

3.3 DECKING

A. Deck boards may be fastened either by nailing, screwing or bolting.
   1. If nailed, nails shall be driven to set the heads flush with or slightly below the surface of the wood. Number of nails used per connection, type and size shall be sufficient to fasten the deck boards firmly to the nailing surface (timber framing or nailers) and provide a flat, even walking surface free from warp or any kind.
   2. Decking shall be screwed down for easy removal in those locations where electrical boxes, valves, drains, etc. must be accessed.
   3. Where decking is fastened directly to steel frames, fastening shall be done with galvanized self-tapping screws of a size and strength adequate to prevent shearing and breaking under normal operating conditions.
   4. Deck screws shall be stainless steel and small and have heads flush with the deck surface or slightly depressed to provide a flat, even walking surface. Deck screws shall be installed so as not to fracture the wood and cause splintering at the hole.
   5. Number of screws used per connection shall be adequate to firmly attach the deck boards and provide a flat, even walking surface. Fasteners of whatever type shall be located in symmetrical patterns throughout with fasteners in straight lines.
   6. Fasteners shall be approved of by the manufacturer regarding the effects of corrosion that could occur from the Copper Azole Type B (CA-B) wood pressure treatment.

B. Deck boards shall be installed with no space between adjacent deck boards and placed hearts down. Decking shall be installed perpendicular to the longitudinal axis of the pier. All Deck boards shall have rounded beveled edges. All Deck boards shall be full length of the unit deck width.

C. Deck boards shall be supported at a maximum of 3 feet on center with the boards laid heart side down. Deck boards shall have no wane visible. Deck boards shall have uniform color consistency throughout.

D. Openings between adjacent floating pier modules shall not exceed 1-1/2 inches, however, the opening between adjacent pier module end deck boards shall not exceed 1/8 inch. All connections between floating pier modules shall not protrude above the level of the pier surface.

3.4 RAMPS

A. A ramp shall be required between every floating pier system construction to shore. Ramps shall have timber decks constructed of 2 x 6 or 2 x 8 lumber, adequately supported, and installed perpendicular to the longitudinal axis of the ramp and meeting the material requirements of Article 2.1. Deck boards shall be installed with no spacing between them. Ramps less than 28' in length may be timber framed. Ramps over 28' in length shall be aluminum framed truss type structural units for each full length side of ramp.

B. Designated Required ADA and ADAAG accessible gangway ramps (all gangway ramps for this project) shall be constructed in accordance with ADA (Americans with Disabilities Act) requirements and ADAAG (Americans with Disabilities Act Accessibility Guidelines). Provide ramped rotation and unit ramps to provide a 1:12 max. slope in range of ordinary high water levels (580.8) and average water levels from monitoring the U.S. Army Corp of Engineers monthly charts and based upon ordinary low water, 1985 IGLD for this project. Ramps shall be designed and fabricated to withstand dead load, design live loadings and all utilities. Copies of guidelines are available from the Architect if needed. Place ramp length as shown on project drawings or longer as required.

C. The ramps may be hinged at one end and have a sliding or roller (wheeled) connection or galvanized steel L-bracket ears on each side of ramp end to allow for movement due to fluctuating water levels. Wheels shall be of adequate strength to carry the design live loads applied to the ramp in addition to the weight of the ramp, handrails, and utilities.

D. Hinged connections at both ends may be used if the anchorage system used allows for the horizontal movement of the floating pier(s) as long as one end is a galvanized steel L-bracket ear connection. In all cases, the ramp connections shall be so designed as not to present any excessive openings or significant differences in elevation between the ramp and the point of connection at the shore.

E. A hinged threshold plate shall be used with a sliding or roller type connection where the ramp joins the floating pier to avoid a step. The bottom of the ramp shall be designed so that the step, without the threshold plate, shall not exceed 6 inches. The required hinge threshold plate shall be attached at the bottom of the ramp, shall be the full width of the ramp and shall be 36 inches long if the step is 6 inches high. For lesser height steps the length of the threshold plate shall be proportioned accordingly. The threshold plate shall be fabricated from galvanized steel plate of adequate strength and design to prevent abnormal deflection and shall have a slip resistant surface.

F. Galvanized steel ramp plates of a minimum 10 gauge thickness shall be installed on the floating pier system deck using zinc or cadmium plated flat head wood screws under ramp wheels, sliding surfaces and threshold plates to prevent damage to the deck surface. Edges and corners of these plates shall be rounded to reduce the possibility of tripping. Plates shall be of adequate size that wheels, sliding surfaces and threshold plates will remain on them under any positioning which would occur due to movement of the anchorage system or variation in water levels. In pedestrian areas, plates shall have slip resistant surface to meet ADA (Americans with Disabilities Act) requirements and ADAAG (Americans with Disabilities Act Accessibility Guidelines).

G. The end of the floating pier under the ramp shall have a galvanized angle at least 4" x 4" x 1/4" in size installed horizontally across the full width of the floating pier on the top edge of the pier. It shall be installed in such a way that rails (wear resistant surfaced members) under the ramp will slide freely on the angle if the ramp goes above the level of the upper connection and rides on the end of the floating pier. The rails shall be of adequate length to ride on the end of the pier "angle" at high water due to movement of the anchorage system.

H. Handrails shall be required on both sides of all ramp side railing and may be part of the structural support or separate units. Top of side rails to be 42 inches above the deck surface with intermediate balusters and bottom railing so spaced with vertical baluster members spaced as to allow less than 4 inches between adjacent balusters.
   1. All railings shall be smooth with no sharp corners, burrs, etc., so as to make a smooth member for hand contact.
   2. Handrail and handrail brackets shall be designed to withstand a minimum concentrated load of 200 pounds applied from any direction at any point on the handrail.
   3. Fittings shall be galvanized.
   4. Sharp corners on galvanized steel handrails or trusses used as handrails shall be avoided by the use of short 45 degree miters, short curved sections, or other approved methods.
   5. Protrusions on the horizontal railing or any pieces on the ramps themselves shall not have sharp corners. Round ends of horizontal end pieces. Sand all railing pieces so they are smooth with no slivers.
   6. Handrails shall be installed full length on each side of ramp in accordance with ADA (Americans with Disabilities Act) requirements and ADAAG (Americans with Disabilities Act Accessibility Guidelines).

3.5 CLEAN-UP

A. Before turning the gangway system over to the Owner, clean all work areas, equipment and site and leave all in a clean, working order at the end of the work.

B. The angway Contractor shall remove all rubbish and dirt from the premises where such rubbish and dirt has accumulated as a result of his work.

3.6 MAINTENANCE AND OPERATIONS MANUAL

A. Upon completion of the project, the Gangway Contractor shall furnish the Owner five (5) copies of a "Maintenance and Operations Manual," which shall include instructions and related information for maintaining and operating the gangway system and anchorages including utilities, if applicable. Utilities may include, but are not necessarily limited to electrical, lighting, water, sanitary pump-out, fuel, and telephone.

B. The Gangway Contractor shall include in the manual a detailed procedure for systematically maintaining and winterizing the gangway system and anchorages, as well as minimizing ice damage to the system during the winter.

C. Although it is intended to leave the floating pier system in place throughout the winter, the Gangway Contractor shall also include in the manual, a detailed procedure for systematically removing, storing and reinstalling the gangway system for the purposes of repair and maintenance.

D. The manual shall include reduced size copies of the final "as-built" layout and fabrication drawings; a listing of purchased items or parts likely to need repair or replacement such as flexible connections, cleats, "special" bolts and fasteners, etc.; and a copy of the warranty. The list of purchased items shall include the name, address and phone number of suppliers and shall be accompanied with appropriate catalog cuts and manufacturer's specifications.

E. The instructions for maintenance shall include preventive maintenance procedures as well as ordinary maintenance and shall include schedules for such activities.

3.7 WARRANTY

A. The Gangway Contractor shall execute and deliver to the Owner, before final payment, on his/her letterhead, a letter of warranty plus labor and material guarantee which shall include at a minimum the following words and items of performance: (gangway system contractor name) warrants for five years, from the date of acceptance of the entire gangway system by the Owner, that the gangway system and all related items shown on the drawings and included in the specifications shall be free from defects in design, construction, materials, workmanship and installation when utilized as intended and within the conditions specified.
   1. Should any defects develop during the warranty period, the Gangway shall provide the necessary materials and labor needed to correct the defects by repair or replacement without expense to the Owner.
   2. The warranty specifically excludes acts of nature or use producing conditions beyond the design criteria set forth in these specifications.
   3. Commercially purchased items shall be warranted for one year or the warranty period provided by the gangway system manufacturer, if longer than one year.

B. The Gangway Contractor shall not be responsible for damages caused by the Owner not operating and/or maintaining and/or winterizing the gangway system in accordance with the maintenance, operating and winterizing procedures provided by the floating pier system manufacturer in the "Maintenance and Operations Manual" approved by the Owner at the time of final acceptance.

C. Specific items of the gangway system performance during the warranty period are as follows:
   1. Deck boards shall not show signs of dangerous deflection or deterioration to a degree that would necessitate replacement.
   2. Deck nails shall not pull out or shear off during the warranty period.
   3. Connectors and connector bolts shall not show excessive wear to the point of needing replacement during the warranty period.
   4. Steel members showing evidence of rusting due to poor galvanizing of steel during the warranty period shall be repaired by methods described and pre-approved in the Operations and Maintenance Manual.
   5. At the end of the warranty period torsional deflections produced under dead loads and/or live loads at the end of the finger piers shall not be 50% greater than those allowed when the piers were initially installed.
   6. At the end of the warranty period the cross pier deck slopes shall not be greater than 2% of the width in order to comply with ADA (Americans with Disabilities Act) requirements and ADAAG (Americans with Disabilities Act Accessibility Guidelines), the maximum allowed when the piers were initially installed.
   7. Non-wear surfaces of bolts and nuts shall be replaced if they show signs of rust during the warranty period.

D. Items not meeting the conditions of this warranty and any damage caused to the gangway system due to failure of items or units covered by this warranty shall be repaired or replaced under the direction of, and at the expense of, the Gangway Contractor.

E. The agreed date of acceptance of the completed gangway system shall be upon completion of the project.
   1. The warranty shall be for a period of five (5) years from the date on which the completed work is turned over to and accepted by the Owner.

F. The Owner shall give notice of defects, covered by this warranty, by phone in emergencies and in writing to the Gangway Contractor immediately upon observance of the defects or when observed during the annual inspections.

3.8 ANNUAL INSPECTION

A. The Gangway Contractor shall provide a qualified person to make an annual inspection of the gangway system every year throughout the warranty period, at the expense of the Gangway Contractor.

B. The inspection shall be made in the presence of the Owner's representative at a time mutually agreeable to the Owner's and Gangway Contractor's representatives.

C. The purpose of the inspection is to point out items needing repair and where routine maintenance is required.

D. Two copies of an inspection report covering the above items in need of repair or that require routine maintenance shall be prepared by the Gangway Contractor and sent to the Owner's representative.

3.9 OPERATIONAL REVIEW

A. The Gangway Contractor and subcontractors shall have a minimum of 4 hours of training with the Owner to review all maintenance, repair, and winterization procedures.

END OF SECTION 06 1535

SECTION 06 1536 – MODULAR PEDESTRIAN BOARDWALK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Fabrication and Installation of Modular Pedestrian Boardwalk.

B. Related Requirements:
1. Section 01 0000 "General Requirements" for Build America Buy America requirements.
2. Section 03 3053 "Miscellaneous Cast-in-Place Concrete" for concrete abutments.
3. Section 05 5000 "Metal Fabrications" for miscellaneous steel members and appurtenances for concrete abutments.

1.3 DESCRIPTION

A. Work Included: Design, fabricate, install, and furnish all plant, labor, equipment, supplies and materials, and perform all operations required for installation of complete, fully functional, and operational boardwalk system.

B. Fabrication: The contract drawings are not intended to be used for fabrication. The Contractor shall prepare and submit digital drawings in PDF format to the Architect for approval prior to fabricating and installing the boardwalks.

C. Other Materials and Equipment: Other materials and equipment shall be as indicated on the drawings, however all other materials not specifically described but required for a complete and proper installation of the work under this section shall be new, first quality, and if selected by the Contractor, subject to Architect's approval.

1.4 DELEGATED DESIGN CRITERIA

A. General:
1. Modular boardwalks shall be constructed of a galvanized steel framing system, adjustable non-penetrating pan-type support pads, and lumber decking as indicated in Project Drawings.
2. Pan-type support pads are to be sized by the manufacturer based on specified loading and project site soil conditions. Pads shall be sized such that boardwalk alignment is stable following the specified maintenance period.
3. Concrete abutments shall be designed based upon provided geotechnical report which indicates low bearing capacity, and likely need for helical pile support for the abutments. Delegated design of abutments and necessary support systems shall be by Manufacturers/Contractors Michigan Registered Professional Engineer licensed by the State of Michigan.
4. Boardwalk design, fabrication and installation shall comply with Americans with Disabilities Act (ADA) of 2010, as amended, and 2013 Access Board's Final Guidelines for Outdoor Developed Areas (ODA.

B. Dimensional:
1. Width: All boardwalks shall provide a minimum clear walking width of 8' between innermost members.

2. Length: Boardwalk lengths shall be as specified on Project Drawings, excluding transition plates.

C. Vertical Live Load:
1. Boardwalk system and decking shall be designed for a 100 pounds per square foot distributed live load, and a 500-pound concentrated live load over one square foot of area.
   a. In addition to the distributed loads, the boardwalk system shall be capable of supporting park lawn maintenance equipment and small utility vehicles.
2. Curb rails shall be designed for a 20 pounds per linear foot distributed load, and a 300-pound concentrated load point.

D. Codes and Standards:
1. Reference is made in these specifications to the codes and/or standards promulgated by the following agencies and organizations:
   a. ADA Americans with Disabilities Act
   b. ADAAG ` Americans with Disabilities Act Accessibility Guidelines
   c. ANSI American National Standard Institute
   d. ASCE American Society of Civil Engineers
   e. ASTM American Society for Testing and Materials
   f. AWPA American Wood Preservers Association
   g. AWPB American Wood Preservers Bureau
   h. AWS American Welding Society, Inc.
   i. MBC Michigan Building Code
   j. SESC State of Michigan Soil Erosion and Sedimentation Control Act
   k. SPIB Southern Pine Inspection Bureau
2. Compliance: Comply with those codes and/or standards specified in this Section and referenced above.
   a. All work and materials shall be furnished and installed in accordance with all Federal and State Codes, Laws, and Regulations as well as the current Michigan State Codes, Laws, and Regulations.
   b. Where requirements of the Contract Documents exceed those of above mentioned Codes, Laws, and Regulations the requirements of the Contract Documents shall govern.
   c. In case of conflict between the referenced Codes, Laws, and Regulations, the most stringent requirements shall govern.

1.5 ACTION SUBMITTALS

A. Product Data: For all materials, products and product systems.
1. Documentation of compliance with Build America Buy America requirements. Refer to Section 01 0000 "General Requirements".

B. Shop Drawings: Detailed shop drawings as designed specifically for this project. Shop drawings shall include all design, structural calculations, fabrication, construction, assembly, and installation as required for a complete floating pier system.
1. The shop drawings shall show all dimensions, clearances, and anchorage locations.
2. The detailed shop drawings specifically for this project in compliance with these documents shall bear the seal of the Manufacturers/Contractors Michigan Registered Professional Engineer licensed by the State of Michigan who is experienced in the design of boardwalk structures, abutments, foundation support systems, anchorages and related appurtenances.
3. Submittal complete design calculations in accordance with these documents is required for this project along with the shop drawings. Design calculations specifically for this project shall also bear the seal of a Michigan Registered Professional Engineer Licensed by the State of Michigan, who is experienced in design of boardwalk structures, anchorages and related appurtenances.

C. Samples: For decking, not less than 24 inches long, showing the range of variation to be expected in appearance of decking, including surface texture.

D. Construction Schedule: Submit a construction sequence schedule as well as a construction time schedule

1.6 INFORMATIONAL SUBMITTALS

A. Quality Control: Submit a copy of the quality control program that is used to manufacture boardwalk system. The following areas shall be included in the program:
1. Weld quality.
2. Certifications for materials such as steel, aluminum, galvanizing, wood, wood treatment, bolts and fasteners.
3. Dimensional inspection.
4. Galvanizing.

B. As-built Record Drawings: At the completion of the work the Contractor shall provide as-built drawings of the boardwalk system installation incorporating all changes made during the construction and installation process.

1.7 QUALITY ASSURANCE

A. Manufacturer: Modular boardwalks shall be manufactured by a firm with a minimum of ten (10) years' experience in design, construction, and installation of the boardwalk systems conforming to these specifications.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Use all means necessary to protect the materials of this Section before, during and after installation and to protect the work and materials of all other trades.

B. In the event of damage, immediately make all repairs and replacements necessary to meet the approval of the Architect and at no additional cost to the Owner.

PART 2 - PRODUCTS

2.1 MODULAR BOARDWALK SYSTEM

A. Basis-of-Design System: Wickcraft Company, Madison, Wisconsin, or equal.

B. The project drawings are general in nature and show basic modular boardwalk system(s) layouts with required dimensions and certain required materials and details of construction, and are not intended to be used for fabrication. The modular boardwalk shown on the drawings are patterned after the type manufactured by Wickcraft Company, of Madison, Wisconsin. However, the intent is not to preclude other modular boardwalk systems' of a different manufacturer as long as they meet the required design loads, are within the range of the required dimensions, are constructed with the same specified materials, and are of a quality equal to or better than the modular boardwalk system specified in this Section.

2.2 LUMBER

A. Decking lumber shall be No. 1 select structural Southern Yellow Pine or better and shall conform to the rules of the SPIB as applicable. Framing lumber shall be No. 1 Southern Yellow Pine or better, and shall conform to the rules of the SPIB. Decking boards shall have rounded bevel edges. Decking pieces shall be full length of the width of the units. All Lumber shall be approved of by the OWNER and the Architect prior to acquisition and fabrication.

B. All timber, lumber and decking used on the project shall be pressure treated in accordance with AWPA Retention Standards for natural select wood and each piece shall bear AWPA Quality Mark. All milling shall be done prior to pressure treatment.

C. The American Wood Pressure Association Retention Standard for Natural select wood treatment shall consist of pressure treatment with Copper Azole CA-B for all Southern Pine with a minimum of 0.31 lbs per cubic foot average retention.

D. Field treatment of end cuts shall consist of 2 heavy coats of 1:1 mixture of original preservative.

E. Deck boards shall not have any holes, loose knots or wane and shall not have sap or free flowing preservative on the walking surface. All four upper edges of each deck board shall have a ½" radius eased edge.

F. Lumber shall be kiln dried prior to treating to the moisture content designated in accordance with SPIB rules.
   1. The Architect may assay the treated lumber and have the AWPB laboratory test the pressure treatment retention of all lumber prior to acceptance at the modular boardwalk Contractor's expense.
   2. After treatment, lumber shall again be kiln dried to a maximum moisture content of 19 percent.

G. Installed lumber on units shall have a uniform new pressure treated visual consistency with no visual banding or storing slat marks that have a different lumber appearance.

2.3 STRUCTURAL METALS

A. Galvanized structural steel frame sections constructed from ASTM A500 Structural Steel.

B. Frame connections to be fabricated from ¼" A36 Structural Steel.

C. Legs and leg-sleeves to be fabricated from ASTM A500 Structural Steel pipe.

D. Entire post-fabrication frame assembly to be hot dipped galvanized (HDG) with a minimum of 3.9 mill thickness of zinc based galvanizing.

E. All post-galvanized frame assemblies must be hand rasped and free of any sharp edges without compromising the galvanized integrity.

F. Frame sections are to be adjustable and leveling. Height adjustments are to be constrained with a 3/8 set bolt and 2-1/4 self-tapping screws per leg.

2.4 OTHER MATERIALS

A. All other materials not specifically described but required for a complete and proper installation of the work of this Section, shall be as recommended by the manufacturer of the modular boardwalk system and approved by the Architect.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Design, fabrication, delivery, handling, and installation of boardwalks shall conform to the manufacturer's shop drawings and installation guidelines.

B. All connections to be welded shall be of new material, clean and free of any containments. All joints shall fit properly and be prepared for the appropriate welding procedure.

C. Maximum amount of fabrication and assembly shall be done at the boardwalk system manufacturer's plant rather than on the job site.

3.3 MODULAR SYSTEM INSTALLATION

A. Walkways assembled from prefabricated modular sections that are 74.5'' long by varying widths per plan. Each modular section consists of a frame and deck section that are pre-fabricated according to project specifications and ready to install upon delivery. Frames are pre-fabricated galvanized structural steel and supported by non-penetrating adjustable legs with support pans.

B. Complete deck panels are pre-fabricated to match specific frames and are constructed from 2"x6" deck boards.

C. Each adjustable leg, two per frame section, consists of a steel leg sleeve and steel leg plate that rests on a variable sized pan-foot based on specific ground bearing capacity. No ground penetration is necessary, while supporting a live load capacity of 100 lbs/sq. ft.

D. Installation shall be per manufacturer's instructions and recommendations.

3.4 CLEAN-UP

A. Before turning the modular boardwalk system over to the Owner, clean all work areas, equipment and site and leave all in a clean, working order at the end of the work.

B. The Modular Boardwalk Contractor shall remove all rubbish and dirt from the premises where such rubbish and dirt has accumulated as a result of his work.

3.5 MAINTENANCE AND OPERATIONS MANUAL

A. Upon completion of the project, the Modular Boardwalk Contractor shall furnish the Owner five (5) copies of a "Maintenance and Operations Manual," which shall include instructions and related information for maintaining and operating the boardwalk system and anchorages.

B. The manual shall include reduced size copies of the final "as-built" layout and fabrication drawings; a listing of purchased items or parts likely to need repair or replacement such as flexible connections, cleats, "special" bolts and fasteners, etc.; and a copy of the warranty. The list of purchased items shall include the name, address and phone number of suppliers and shall be accompanied with appropriate catalog cuts and manufacturer's specifications.

C. The instructions for maintenance shall include preventive maintenance procedures as well as ordinary maintenance and shall include schedules for such activities.

3.6 WARRANTY

A. The Modular Boardwalk Contractor shall execute and deliver to the Owner, before final payment, on his/her letterhead, a letter of warranty plus labor and material guarantee which shall include at a minimum the following words and items of performance: (boardwalk system contractor name) warrants for lifetime of the system (unlimited), that the boardwalk structural framing system and all related items shown on the drawings and included in the specifications

shall be free from defects in design, construction, materials, workmanship and installation when utilized as intended and within the conditions specified.

1. Should any defects develop during the warranty period, the Modular Boardwalk Contractor shall provide the necessary materials and labor needed to correct the defects by repair or replacement without expense to the Owner.
2. The warranty specifically excludes acts of nature or use producing conditions beyond the design criteria set forth in these specifications.
3. Commercially purchased items (including decking) shall be warranted for one year or the warranty period provided by the manufacturer, if longer than one year.

B. The Owner shall give notice of defects, covered by this warranty, by phone in emergencies and in writing to the Modular Boardwalk Contractor immediately upon observance of the defects or when observed during the annual inspections.

3.7 ANNUAL INSPECTION, MAINTENANCE, AND ADJUSTMENT

A. The Modular Boardwalk Contractor shall provide a qualified person to make an annual inspection of the modular boardwalk annually for the first three (3) years following installation, at the expense of the Modular Boardwalk Contractor.

B. The inspection shall be made in the presence of the Owner's representative at a time mutually agreeable to the Owner's and Modular Boardwalk Contractor's representatives.

C. The purpose of the inspection is to point out items needing repair and where routine maintenance and adjustment is required.

D. During the three (3) year period following installation, the Modular Boardwalk Contractor shall make any adjustments and repairs necessary to restore the boardwalk system to original vertical and horizontal alignment. Any variations in alignment due to settlement or heave shall be corrected.

E. Two copies of an inspection report covering the above items in need of repair or that require routine maintenance shall be prepared by the Modular Boardwalk Contractor and sent to the Owner's representative.

3.8 OPERATIONAL REVIEW

A. The Modular Boardwalk Contractor and subcontractors shall have a minimum of 4 hours of training with the Owner to review all maintenance, repair, and winterization procedures.

END OF SECTION 06 1536

SECTION 31 1000 - SITE CLEARING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Preparation
2. Existing Utilities
3. Clearing and grubbing.
4. Stripping and stockpiling topsoil.
5. Site Improvements
6. Disposal of Surplus and Waste Materials

B. Related Sections include:
1. Section 015639 "Temporary Tree and Plant Protection" for tree protection fencing and procedures.
2. Section 312000 "Earthmoving" for backfilling of areas and voids left after building utility demolition.
3. Section 312500 "Erosion and Sedimentation Controls" for erosion controls.

1.2 MATERIAL OWNERSHIP

A. Except for materials indicated to be stockpiled or otherwise remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.3 PROJECT CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.
1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.

B. Salvable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises where indicated.

C. Utility Locator Service: Notify utility locator service for area where Project is located before site clearing.

D. Do not commence site clearing operations until temporary erosion- and sedimentation-control and plant-protection measures are in place.

E. The following practices are prohibited within protection zones:
1. Storage of construction materials, debris, or excavated material.
2. Parking vehicles or equipment.
3. Foot traffic.
4. Erection of sheds or structures.
5. Impoundment of water.
6. Excavation or other digging unless otherwise indicated.

F. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Satisfactory Soil Material: Requirements for satisfactory soil material are specified in Section 312000 "Earth Moving."
   1. Obtain approved borrow soil material off-site when satisfactory soil material is not available on-site.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect and maintain benchmarks and survey control points from disturbance during construction.

B. Locate and clearly identify trees, shrubs, and other vegetation to remain or to be relocated.

C. Protect existing site improvements to remain from damage during construction.
   1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.2 EXISTING UTILITIES

A. Locate, identify, disconnect, and seal or cap utilities indicated to be removed or abandoned in place. Protect utilities to remain.
   1. Arrange with the Owner and utility companies to shut off indicated utilities.

B. Interrupting Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
   1. Notify Owner not less than seven days in advance of proposed utility interruptions.
   2. Do not proceed with utility interruptions without Architect's written permission.

3.3 CLEARING AND GRUBBING

A. Mark all trees, shrubs, and other vegetation to be removed with orange forestry ribbon. Obtain Owner approval prior to removal.

B. Remove obstructions, trees, shrubs, and other vegetation to permit installation of new construction.
   1. Grind down stumps and remove roots, obstructions, and debris to a depth of 18 inches below exposed subgrade. Complete removal of roots shall be performed in areas in which future structures are to be placed.
   2. Use only hand methods for grubbing within protection zones.

C. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.
   1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches, and compact each layer to a density equal to adjacent original ground.

3.4 TOPSOIL REMOVAL

A. Excavation for project is to be limited to the minimum required for installation of new walkways. Where excavation is required, remove lawn and topsoil full depth.

B. Where excavation is within a tree root zone, topsoil removal shall be by pneumatic excavation. Refer to Section 015639 "Temporary Tree and Plant Protection" for protection and pruning of tree roots.

C. All topsoil and lawn shall be removed from site and legally dispose of them off Owner's property.

3.5 SITE IMPROVEMENTS

A. Remove existing above- and below-grade improvements as indicated and necessary to facilitate new construction.

B. All improvements indicated for demolition shall be removed to full depth and extent including any footings, foundations, conduits, wiring, encasements, etc.

3.6 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus soil material, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.

B. Separate recyclable materials produced during site clearing from other nonrecyclable materials. Transport them to recycling facilities.

END OF SECTION 31 1000

SECTION 31 2000 - EARTH MOVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Excavating and backfilling for buildings and structures.

1.3 DEFINITIONS

A. Backfill: Soil material or controlled low-strength material used to fill an excavation.

B. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

C. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.
   1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Architect. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
   2. Bulk Excavation: Excavation more than 10 feet in width and more than 30 feet in length.
   3. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.

D. Fill: Soil materials used to raise existing grades.

E. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material that exceed 1 cu. yd. for bulk excavation or 3/4 cu. yd. for footing, trench, and pit excavation that cannot be removed by rock excavating equipment equivalent to the following in size and performance ratings, without systematic drilling, ram hammering, ripping, or blasting, when permitted:
   1. Excavation of Footings, Trenches, and Pits: Late-model, track-mounted hydraulic excavator; equipped with a 42-inch-wide, maximum, short-tip-radius rock bucket; rated at not less than 138-hp flywheel power with bucket-curling force of not less than 28,700 lbf and stick-crowd force of not less than 18,400 lbf with extra-long reach boom; measured according to SAE J-1179.
   2. Bulk Excavation: Late-model, track-mounted loader; rated at not less than 230-hp flywheel power and developing a minimum of 47,992-lbf breakout force with a general-purpose bare bucket; measured according to SAE J-732.

F. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

G. Subbase Course: Aggregate layer placed between the subgrade and base course for hot-mix asphalt pavement, or aggregate layer placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.

H. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.

I. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.4 INFORMATIONAL SUBMITTALS

A. Material Test Reports: For each on-site and borrow soil material proposed for fill and backfill as follows:
1. Classification according to ASTM D 2487.
2. Laboratory compaction curve according to ASTM D 1557.

B. Shop Drawings: Location and dimensions of Contractor's proposed bore pits.

C. Pre-excavation Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces that might be misconstrued as damage caused by earth moving operations. Submit before earth moving begins.

1.5 PROJECT CONDITIONS

A. Refer to project geotechnical report's preloading requirements for settlement mitigation of underlying peat and organic soils. Contractor shall adhere to preloading requirements.

B. Where excavation is required within protection zones, pneumatically excavate under or around tree roots or tunnel under the roots by drilling, auger boring, or piercing. Do not cut main lateral tree roots or taproots; cut only smaller roots that interfere with installation of utilities. Cut roots under direct supervision of Forester in accordance with Section 015639 "Temporary Tree and Plant Protection".

C. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earth moving operations.
1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.

D. Improvements on Adjoining Property: Authority for performing earth moving indicated on property adjoining Owner's property will be obtained by Owner before award of Contract.
1. Do not proceed with work on adjoining property until directed by Architect.

E. Utility Locator Service: Notify "Miss Dig" for area where Project is located before beginning earth moving operations.

F. Do not commence earth moving operations until temporary erosion- and sedimentation-control measures, specified in Section 311000 "Site Clearing," are in place.

G. Do not commence earth moving operations until plant-protection measures specified in Section 015639 "Temporary Tree and Plant Protection" are in place.

H. The following practices are prohibited within protection zones:
1. Storage of construction materials, debris, or excavated material.
2. Parking vehicles or equipment.
3. Foot traffic.
4. Erection of sheds or structures.
5. Impoundment of water.
6. Excavation or other digging unless otherwise indicated.

7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

I. Do not direct vehicle or equipment exhaust towards protection zones.

J. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

B. Satisfactory Soils: Soil Classification Groups GW, GP, GM, SW, SP, and SM according to ASTM D 2487, or a combination of these groups; free of rock or gravel larger than 3 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.

C. Unsatisfactory Soils: Soil Classification Groups GC, SC, CL, ML, OL, CH, MH, OH, and PT according to ASTM D 2487, or a combination of these groups.
1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.

D. Engineered Fill: MDOT Class II granular material.

E. Granular Base Material: MDOT Class II granular material.

F. Aggregate Base Material: MDOT 21AA Limestone.

G. Aggregate Road Surface Material: MDOT 22A.

2.2 GEOREINFORCEMENT

A. Georeinforcement: Triangular punched polypropylene geogrid. Tensar TriAx TX140, or approved equal.

PART 3 - EXECUTION

3.1 PREPARATION

A. Refer to project geotechnical report's preloading requirements for settlement mitigation of underlying peat and organic soils. Contractor shall adhere to preloading requirements.

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

C. Protect and maintain erosion and sedimentation controls during earth moving operations.

D. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

3.2 DEWATERING

A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.

B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.
   1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.

C. Dewater excavations as necessary to construct new work.

3.3 EXPLOSIVES

A. Explosives: Do not use explosives.

3.4 EXCAVATION, GENERAL

A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.
   1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.
   2. Remove rock to lines and grades indicated to permit installation of permanent construction.

B. Where excavation is required within protection zones, pneumatically excavate under or around tree roots or tunnel under the roots by drilling, auger boring, or piercing. Do not cut main lateral tree roots or taproots; cut only smaller roots that interfere with installation of utilities. Cut roots under direct supervision of Forester in accordance with Section 015639 "Temporary Tree and Plant Protection".

3.5 EXCAVATION, SUBGRADE PREPARATIONS, BACKFILL, AND COMPACTION FOR STRUCTURES

A. Refer to procedures contained within G2 Consulting Geotechnical Report. Adhere to geotechnical report's preloading requirements for settlement mitigation of underlying peat and organic soils.

3.6 EXCAVATION FOR WALKS AND PAVEMENTS

A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

3.7 EXCAVATION FOR UTILITIES

A. Excavation for bore sending/receiving pits shall the minimum required for operation of bore equipment. Sizes and locations of pits shall be reviewed and approved by Architect prior to start of operations.

B. Excavate trenches to indicated gradients, lines, depths, and elevations.

C. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit unless otherwise indicated.
   1. Clearance: As indicated.

D. Trench Bottoms: Excavate trenches 4 inches deeper than bottom of pipe and conduit elevations to allow for bedding course. Hand-excavate deeper for bells of pipe.
   1. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

3.8 SUBGRADE INSPECTION FOR SITE IMPROVEMENTS

A. Notify Architect when excavations have reached required subgrade.

B. If Architect determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.

C. Proof-roll subgrade below the building slabs and pavements with a pneumatic-tired and loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades. Owner's testing agency shall witness proof-roll.
   1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph.
   2. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.

D. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.

E. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect, without additional compensation.

3.9 UNAUTHORIZED EXCAVATION

A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2500 psi, may be used when approved by Architect.
   1. Fill unauthorized excavations under other construction, pipe, or conduit as directed by Architect.

3.10 STORAGE OF SOIL MATERIALS

A. Remove from site and dispose of legally all excavated soil materials without intermixing. Place, grade, and shape temporary stockpiles to drain surface water. Cover to prevent windblown dust.
   1. Place temporary stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.11 SITE IMPROVEMENTS BACKFILL

A. Place and compact backfill in excavations promptly, but not before completing the following:
   1. Construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.
   2. Surveying locations of underground utilities for Record Documents.
   3. Testing and inspecting underground utilities.
   4. Removing concrete formwork.
   5. Removing trash and debris.
   6. Removing temporary shoring and bracing, and sheeting.
   7. Installing permanent or temporary horizontal bracing on horizontally supported walls.

B. Place backfill on subgrades free of mud, frost, snow, or ice.

3.12 UTILITY TRENCH BACKFILL

A. Place backfill on subgrades free of mud, frost, snow, or ice.

B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

C. Trenches under Footings: Backfill trenches excavated under footings and within 18 inches of bottom of footings with satisfactory soil; fill with concrete to elevation of bottom of footings.

D. Trenches under Roadways: Backfill trenches excavated under roadway base with engineered fill.

E. Backfill voids with satisfactory soil while removing shoring and bracing.

F. Place and compact initial backfill of subbase material, free of particles larger than 1 inch in any dimension, to a height of 12 inches over the pipe or conduit.
   1. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.

G. Place and compact final backfill of satisfactory soil to final subgrade elevation.

3.13 SOIL FILL

A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

B. Place and compact fill material in layers to required elevations as follows:
   1. Under grass and planted areas, use satisfactory soil material.
   2. Under walks and pavements, use engineered fill.
   3. Under steps and ramps, use engineered fill.
   4. Under building slabs, use engineered fill.
   5. Under footings and foundations, use engineered fill.

C. Place soil fill on subgrades free of mud, frost, snow, or ice.

3.14 SOIL MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.
   1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
   2. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.15 COMPACTION OF SITE IMPROVEMENT AND UTILITY BACKFILLS AND FILLS

A. Place backfill and fill soil materials in layers not more than 8 inchesin loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.

C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 1557:
   1. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill soil material at 98 percent.

2. Under roads and walkways, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 95 percent.
3. Under turf or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 85 percent.

D. Compact base materials to not less than the following percentages of maximum dry unit weight according to ASTM D 1557:
1. Under paved areas, compact each layer of base material in maximum 6-inch lefts at 98 percent.

3.16 GRADING

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
1. Provide a smooth transition between adjacent existing grades and new grades.
2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

B. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:
1. Turf or Unpaved Areas: Plus or minus 1 inch.
2. Pavements: Plus or minus 1/2 inch.

C. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.

3.17 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:
1. Determine prior to placement of fill that site has been prepared in compliance with requirements.
2. Determine that fill material and maximum lift thickness comply with requirements.
3. Determine, at the required frequency, that in-place density of compacted fill complies with requirements.

B. Testing Agency: Owner will engage a qualified geotechnical engineering testing agency to perform tests and inspections.

C. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.

D. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Architect.

E. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable.

F. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.

3.18 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
   1. Scarify or remove and replace soil material to depth as directed by Architect; reshape and recompact.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
   1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.19 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus satisfactory soil and waste materials, including topsoil, trash, and debris, and legally dispose of them off Owner's property.

END OF SECTION 31 2000

SECTION 31 2500 – EROSION AND SEDIMENTATION CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes conducting earthwork and earth change activity operations in a manner to protect Waters of the State (of Michigan), storm drains, and adjacent properties from soil erosion and sedimentation.

1.2 DEFINITIONS

A. "Waters of the State" includes the Great Lakes and their connecting waters, lakes, ponds and streams which may or may not be serving as a County drain as defined by the drain code; or any other body of water that has definite banks, a bed and visible evidence of a continued flow or continued occurrence of water or wetlands regulated under Part 303.

1.3 SUBMITTALS

A. Submit product information for materials proposed for use.

1.4 QUALITY CONTROL

A. Requirements of Regulatory Agencies: For earth changes, comply with the following:
   1. Part 91, Soil Erosion and Sedimentation Control (SESC) of the Natural Resource & Environmental Protection Act, 1994 PA 451, as amended (Part 91).
   2. Local jurisdictional authority.

1.5 PERFORMANCE REQUIREMENTS

A. Implement the soil erosion and sedimentation control plan including required maintenance during construction and final removal as directed in the plans, and as needed per site conditions and as required by the local jurisdictional authority.

B. Control runoff, soil erosion, and sedimentation. No sediment should leave the site.

C. Prevent wind erosion. No visible emissions (dust) should leave the site.

1.6 REFERENCES

A. Guidebook of Best Management Practices for Michigan Watersheds http://www.michigan.gov/deq/0,1607,7-135-3313_3682_3714-118554--,00.html

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.1 PREPARATION

A. Where the following events result in the need for additional or modified soil erosion and sedimentation control installations to meet the objective of the referenced procedures, provide remedial installations on a timely basis.
   1. Unanticipated alterations to the construction schedule.
   2. Unanticipated site conditions except Acts of God such as a tornado or fire.

B. Install temporary erosion and sedimentation control measures prior to or upon commencement to earthwork activities.
   1. Install an entrance anti-tracking pad with a minimum of 50 feet in length. A geotextile filter fabric should be placed under 6 inches of limestone aggregate.
   2. Install temporary inlet protection at all adjacent and down-gradient storm water inlets, catch basins and manholes that may be impacted.
   3. Install silt fence with stakes on the side down gradient from the disturbed area. Toe in six inches of the fencing material.
   4. Place stockpiles and other spoil piles away from the drainage system to minimize sediment transport. Keep as few stockpiles as possible during the course of the project. If the stockpile and/or spoil pile must remain on-site overnight, or if the weather conditions indicate the chance for precipitation,
      a. cover the pile with water repellent material to prevent erosion or
      b. install silt fencing around the base of the pile to prevent transport of sediment to the storm water system and wet the pile as needed to prevent wind erosion, or
      c. apply other control methods as appropriate to the site.
   5. Where runoff enters the existing storm water system, protect the storm system from sedimentation.
      a. Temporary inlet protection must prevent the release of sediment and allow for proper drainage.
         1) Use of burlap is not acceptable as a SESC measure.
         2) If filter fabric is used on drains, ensure the filter fabric is placed over (not under) the storm grates to facilitate maintenance (cleaning) of the controls.
         3) If high storm water flows are expected, use silt sacks in lieu of filter fabric for drain protection. Based on site conditions select regular or high flow silt sacks as appropriate.

C. Utilize a water truck as needed for dust control.

D. Utilize a sweeping machine to remove sediment tracked onto the pavement on a daily basis at minimum. Use sweeper more frequently as dictated by site conditions.

E. Maintain erosion and sedimentation controls on a daily basis until the contract has been completed and accepted. Maintenance shall include:
   1. Repair of damaged installations.
   2. Replacement of lost soil erosion & sedimentation control measures.
   3. Periodic removal of collected silt and sedimentation as required or directed to maintain effectiveness of the silt traps, filters and basins.

F. Correct non-conforming soil erosion and sedimentation control Work on a timely basis within 24 hours, if Waters of the State are being impacted or within 5 days if not impacting Waters of the State.

G. Complete permanent soil erosion control measures for all slopes, channels, ditches, or any disturbed land area within 5 calendar days after final grading or the final earth change has been completed. Maintain temporary control measures until permanent soil erosion control measures are in place and the area is stabilized.

3.2 CLEAN UP

A. Remove temporary erosion control measures after permanent soil erosion measures are in place and the area is stabilized, unless ordered by the Owner's Representative to remain in place. Care shall be taken during removal to prevent soil erosion and sedimentation.

END OF SECTION 31 2500

SECTION 32 1216 - ASPHALT PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Hot-mix asphalt paving.

B. Related Requirements:
   1. Section 02 4119 "Selective Demolition" for demolition and removal of existing asphalt pavement.
   2. Section 31 2000 "Earth Moving" for subgrade preparation, fill material, unbound-aggregate subbase and base courses, and aggregate pavement shoulders.
   3. Section 32 1373 "Concrete Paving Joint Sealants" for joint sealants and fillers at pavement terminations.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include technical data and tested physical and performance properties.
   2. Job-Mix Designs: Certification, by authorities having jurisdiction, of approval of each job mix proposed for the Work.
   3. Job-Mix Designs: For each job mix proposed for the Work.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer.

B. Material Certificates: For each paving material.

C. Material Test Reports: For each paving material, by a qualified testing agency.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: A paving-mix manufacturer registered with and approved by authorities having jurisdiction or the DOT of state in which Project is located.

B. Testing Agency Qualifications: Qualified according to ASTM D 3666 for testing indicated.

1.6 FIELD CONDITIONS

A. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp, if rain is imminent or expected before time required for adequate cure, or if the following conditions are not met:
   1. Prime Coat: Minimum surface temperature of 60 deg F.
   2. Tack Coat: Minimum surface temperature of 60 deg F.
   3. Slurry Coat: Comply with weather limitations in ASTM D 3910.
   4. Asphalt Base Course: Minimum surface temperature of 40 deg F and rising at time of placement.
   5. Asphalt Surface Course: Minimum surface temperature of 60 deg F at time of placement.

PART 2 - PRODUCTS

2.1 AGGREGATES

A. General: Use materials and gradations that have performed satisfactorily in previous installations.

B. Coarse Aggregate: ASTM D 692/D 692M, sound; angular crushed stone, crushed gravel, or cured, crushed blast-furnace slag.

C. Fine Aggregate: ASTM D 1073 or AASHTO M 29, sharp-edged natural sand or sand prepared from stone, gravel, cured blast-furnace slag, or combinations thereof.
   1. For hot-mix asphalt, limit natural sand to a maximum of 20 percent by weight of the total aggregate mass.

D. Mineral Filler: ASTM D 242/D 242M or AASHTO M 17, rock or slag dust, hydraulic cement, or other inert material.

2.2 ASPHALT MATERIALS

A. Asphalt Binder: AASHTO M 320, PG 64-22.

B. Asphalt Cement: ASTM D 3381/D 3381M for viscosity-graded material and ASTM D 946/D 946M for penetration-graded material.

C. Cutback Prime Coat: ASTM D 2027, medium-curing cutback asphalt, MC-30 or MC-70.

D. Emulsified Asphalt Prime Coat: ASTM D 977 or AASHTO M 140 emulsified asphalt, or ASTM D 2397 or AASHTO M 208 cationic emulsified asphalt, slow setting, diluted in water, of suitable grade and consistency for application.

E. Tack Coat: ASTM D 977 or AASHTO M 140 emulsified asphalt, or ASTM D 2397 or AASHTO M 208 cationic emulsified asphalt, slow setting, diluted in water, of suitable grade and consistency for application.

F. Water: Potable.

2.3 AUXILIARY MATERIALS

A. Recycled Materials for Hot-Mix Asphalt Mixes: Reclaimed asphalt pavement; reclaimed, unbound-aggregate base material, equal to performance of required hot-mix asphalt paving produced from all new materials.

B. Herbicide: Commercial chemical for weed control, registered by the EPA, and not classified as "restricted use" for locations and conditions of application. Provide in granular, liquid, or wettable powder form.

C. Sand: ASTM D 1073 or AASHTO M 29, Grade No. 2 or No. 3.

D. Paving Geotextile: AASHTO M 288 paving fabric; nonwoven polypropylene; resistant to chemical attack, rot, and mildew; and specifically designed for paving applications.

E. Joint Sealant: ASTM D 6690 or AASHTO M 324, hot-applied, single-component, polymer-modified bituminous sealant.

2.4 MIXES

A. Recycled Content Limit: Recycled content no more than 20 percent by weight.

B. Hot-Mix Asphalt: Dense-graded, hot-laid, hot-mix asphalt plant mixes ; designed according to procedures in AI MS-2, "Mix Design Methods for Asphalt Concrete and Other Hot-Mix Types"; and complying with the following requirements:
   1. Provide mixes with a history of satisfactory performance in geographical area where Project is located.
   2. Road Leveling Course: MDOT 5C.
   3. Road Wearing Course: MDOT 5EML.
   4. Pedestrian Pathway Wearing Course: MDOT 13A.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that subgrade is dry and in suitable condition to begin paving.

B. Proof-roll subgrade below pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades. Owner's testing agency shall witness proof-roll.
   1. Completely proof-roll subgrade in one direction. Limit vehicle speed to 3 mph.
   2. Proof roll with a loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons.
   3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.

C. Proceed with paving only after unsatisfactory conditions have been corrected.

3.2 SURFACE PREPARATION

A. General: Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.

B. Herbicide Treatment: Apply herbicide according to manufacturer's recommended rates and written application instructions. Apply to dry, prepared subgrade or surface of compacted-aggregate base before applying paving materials.
   1. Mix herbicide with prime coat if formulated by manufacturer for that purpose.

C. Emulsified Asphalt Prime Coat: Apply uniformly over surface of compacted unbound-aggregate base course at a rate of 0.10 to 0.30 gal./sq. yd. per inch depth. Apply enough material to penetrate and seal, but not flood, surface. Allow prime coat to cure.
   1. If prime coat is not entirely absorbed within 24 hours after application, spread sand over surface to blot excess asphalt. Use enough sand to prevent pickup under traffic. Remove loose sand by sweeping before pavement is placed and after volatiles have evaporated.
   2. Protect primed substrate from damage until ready to receive paving.

D. Tack Coat: Apply uniformly to surfaces of existing pavement at a rate of 0.05 to 0.15 gal./sq. yd..
   1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
   2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

3.3 PLACING HOT-MIX ASPHALT

A. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand in areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.
   1. Place hot-mix asphalt base course in number of lifts and thicknesses indicated.
   2. Place hot-mix asphalt surface course in single lift.
   3. Spread mix at a minimum temperature of 250 deg F.
   4. Begin applying mix along centerline of crown for crowned sections and on high side of one-way slopes unless otherwise indicated.
   5. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.

B. Place paving in consecutive strips not less than 10 feet wide unless infill edge strips of a lesser width are required.
   1. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Overlap mix placement about 1 to 1-1/2 inches from strip to strip to ensure proper compaction of mix along longitudinal joints.
   2. Complete a section of asphalt base course before placing asphalt surface course.

C. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

3.4 JOINTS

A. Construct joints to ensure a continuous bond between adjoining paving sections. Construct joints free of depressions, with same texture and smoothness as other sections of hot-mix asphalt course.
   1. Clean contact surfaces and apply tack coat to joints.
   2. Offset longitudinal joints, in successive courses, a minimum of 6 inches.
   3. Offset transverse joints, in successive courses, a minimum of 24 inches.
   4. Construct transverse joints at each point where paver ends a day's work and resumes work at a subsequent time. Construct these joints using either "bulkhead" or "papered" method according to AI MS-22, for both "Ending a Lane" and "Resumption of Paving Operations."
   5. Compact joints as soon as hot-mix asphalt will bear roller weight without excessive displacement.
   6. Compact asphalt at joints to a density within 2 percent of specified course density.

3.5 COMPACTION

A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or with vibratory-plate compactors in areas inaccessible to rollers.
   1. Complete compaction before mix temperature cools to 185 deg F.

B. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.

C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:
   1. Average Density: 98 percent of reference laboratory density according to ASTM D 6927 or AASHTO T 245, but not less than 96 percent or greater than 100 percent.

D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.

E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while asphalt is still hot; compact thoroughly.

F. Repairs: Remove paved areas that are defective or contaminated with foreign materials and replace with fresh, hot-mix asphalt. Compact by rolling to specified density and surface smoothness.

G. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.

H. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.6 INSTALLATION TOLERANCES

A. Pavement Thickness: Compact each course to produce the thickness indicated within the following tolerances:
   1. Base Course: Plus or minus 1/2 inch.
   2. Surface Course: Plus 1/4 inch, no minus.

B. Pavement Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot straightedge applied transversely or longitudinally to paved areas:
   1. Base Course: 1/4 inch.
   2. Surface Course: 1/8 inch.
   3. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 1/4 inch.
   4. Positive drainage must be maintained regardless of tolerances.

3.7 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform on-site tests and inspections.

B. Thickness: In-place compacted thickness of hot-mix asphalt courses will be determined according to ASTM D 3549.

C. Surface Smoothness: Finished surface of each hot-mix asphalt course will be tested for compliance with smoothness tolerances.

D. In-Place Density: Testing agency will take samples of uncompacted paving mixtures and compacted pavement according to ASTM D 979 or AASHTO T 168.
   1. Reference maximum theoretical density will be determined by averaging results from four samples of hot-mix asphalt-paving mixture delivered daily to site, prepared according to ASTM D 2041, and compacted according to job-mix specifications.
   2. Field density of in-place compacted pavement will be determined by nuclear method according to ASTM D 2950 and correlated with ASTM D 1188 or ASTM D 2726.

E. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

3.8 WASTE HANDLING

A. General: Handle asphalt-paving waste according to approved waste management plan required in Section 01 7419 "Construction Waste Management and Disposal."

END OF SECTION 32 1216

SECTION 32 1313 - CONCRETE PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Walks.
2. Pavements.
3. Curbs.

B. Related Sections:
1. Section 033000 "Cast-in-Place Concrete" for general building applications of concrete.
2. Section 321373 "Concrete Paving Joint Sealants" for joint sealants in expansion and contraction joints within concrete paving and in joints between concrete paving and asphalt paving or adjacent construction.

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash and other pozzolans, and ground granulated blast-furnace slag.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: As required in project documents.

C. Other Action Submittals:
1. Design Mixtures: For each concrete paving and curb mixture. Include alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified ready-mix concrete manufacturer.

B. Material Certificates: For the following, from manufacturer:
1. Cementitious materials.
2. Steel reinforcement and reinforcement accessories.
3. Fiber reinforcement.
4. Admixtures.
5. Curing compounds.
6. Applied finish materials.
7. Bonding agent or epoxy adhesive.
8. Joint fillers.

C. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Ready-Mix-Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
   1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities" (Quality Control Manual - Section 3, "Plant Certification Checklist").

B. ACI Publications: Comply with ACI 301unless otherwise indicated.

C. Comply with Michigan Department of Transportation Standard Specifications for Construction, most current edition.

D. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Build mockups of full-thickness sections of concrete paving to demonstrate typical joints; surface finish, texture, and color; curing; and standard of workmanship.
   2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
   3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

E. Preinstallation Conference: Conduct conference at Project site.
   1. Review methods and procedures related to concrete paving, including but not limited to, the following:
      a. Concrete mixture design.
      b. Quality control of concrete materials and concrete paving construction practices.
   2. Require representatives of each entity directly concerned with concrete paving to attend, including the following:
      a. Contractor's superintendent.
      b. Independent testing agency responsible for concrete design mixtures.
      c. Ready-mix concrete manufacturer.
      d. Concrete paving subcontractor.

1.7 PROJECT CONDITIONS

A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required by Owner and jurisdictional authorities.

PART 2 - PRODUCTS

2.1 FORMS

A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, and smooth exposed surfaces.
   1. Use flexible or uniformly curved forms for curves with a radius of 100 feet or less. Do not use notched and bent forms.

B. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and that will not impair subsequent treatments of concrete surfaces.

2.2 STEEL REINFORCEMENT

A. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

B. Plain-Steel Welded Wire Reinforcement: ASTM A 185/A 185M, fabricated from galvanized-steel wire into flat sheets.

C. Deformed-Steel Welded Wire Reinforcement: ASTM A 497/A 497M, flat sheet.

D. Epoxy-Coated Welded Wire Reinforcement: ASTM A 884/A 884M, Class A, plain steel.

E. Reinforcing Bars: ASTM A 615/A 615M, Grade 60; deformed.

F. Galvanized Reinforcing Bars: ASTM A 767/A 767M, Class II zinc coated, hot-dip galvanized after fabrication and bending; with ASTM A 615/A 615M, Grade 60 deformed bars.

G. Epoxy-Coated Reinforcing Bars: ASTM A 775/A 775M or ASTM A 934/A 934M; with ASTM A 615/A 615M, Grade 60 deformed bars.

H. Steel Bar Mats: ASTM A 184/A 184M; with ASTM A 615/A 615M, Grade 60, deformed bars; assembled with clips.

I. Plain-Steel Wire: ASTM A 82/A 82M, galvanized.

J. Deformed-Steel Wire: ASTM A 496/A 496M.

K. Epoxy-Coated-Steel Wire: ASTM A 884/A 884M, Class A coated, deformed.

L. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60 plain-steel bars; zinc coated (galvanized) after fabrication according to ASTM A 767/A 767M, Class I coating. Cut bars true to length with ends square and free of burrs.

M. Epoxy-Coated, Joint Dowel Bars: ASTM A 775/A 775M; with ASTM A 615/A 615M, Grade 60, plain-steel bars.

N. Tie Bars: ASTM A 615/A 615M, Grade 60, deformed.

O. Hook Bolts: ASTM A 307, Grade A, internally and externally threaded. Design hook-bolt joint assembly to hold coupling against paving form and in position during concreting operations, and to permit removal without damage to concrete or hook bolt.

P. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars, welded wire reinforcement, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete of greater compressive strength than concrete specified, and as follows:
   1. Equip wire bar supports with sand plates or horizontal runners where base material will not support chair legs.
   2. For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer-coated wire bar supports.

Q. Epoxy Repair Coating: Liquid, two-part, epoxy repair coating, compatible with epoxy coating on reinforcement.

R. Zinc Repair Material: ASTM A 780.

2.3 CONCRETE MATERIALS

A. Cementitious Material: Use ONE of the following cementitious materials, of same type, brand, and source throughout Project:
   1. Portland Cement: ASTM C 150, gray portland cement Type I/II. Mix designs may be supplemented with the following subject to Architect's review and approval:

a. Fly Ash: ASTM C 618, Class C or Class F.
b. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.

2. Blended Hydraulic Cement: ASTM C 595, Type IL, portland-limestone cement.

B. Normal-Weight Aggregates: ASTM C 33, , uniformly graded. Provide aggregates from a single source with documented service-record data of at least 10 years' satisfactory service in similar paving applications and service conditions using similar aggregates and cementitious materials.

1. Maximum Coarse-Aggregate Size: 1 inch nominal.
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

C. Water: Potable and complying with ASTM C 94/C 94M.

D. Air-Entraining Admixture: ASTM C 260.

E. Chemical Admixtures: Admixtures certified by manufacturer to be compatible with other admixtures and to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material.

1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.

2.4 FIBER REINFORCEMENT

A. Synthetic Fiber: Monofilament polypropylene fibers engineered and designed for use in concrete paving, complying with ASTM C 1116/C 1116M, Type III, 1/2 to 1-1/2 inches long.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   a. Monofilament Fibers:
      1) Axim Italcementi Group, Inc.; FIBRASOL II P.
      2) Euclid Chemical Company (The), an RPM company; Fiberstrand 100, Fiberstrand 150.
      3) Grace, W. R. & Co. - Conn.; Grace MicroFiber.
      4) Metalcrete Industries; Polystrand 1000.
      5) QC Construction Products; QC FIBERS.

2.5 CURING MATERIALS

A. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.

2.6 RELATED MATERIALS

A. Joint Fillers: ASTM D 1751, asphalt-saturated cellulosic fiber in preformed strips.

B. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

2.7 CONCRETE MIXTURES

A. Prepare design mixtures, proportioned according to ACI 301 for each type and strength of normal-weight concrete, and as determined by either laboratory trial mixtures or field experience.

1. Use a qualified independent testing agency for preparing and reporting proposed concrete design mixtures for the trial batch method.
2. When automatic machine placement is used, determine design mixtures and obtain laboratory test results that meet or exceed requirements.

B. Proportion mixtures to provide normal-weight concrete with the following properties:

1. Compressive Strength (28 Days): 4000 psi
2. Maximum Water-Cementitious Materials Ratio at Point of Placement: 0.45.

3. Slump Limit: 4 inches plus or minus 1 inch

C. Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement having an air content as follows:
   1. Air Content: 6 percent plus or minus 1.0 percent for 1-inchominal maximum aggregate size.

D. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.

E. Chemical Admixtures: Use admixtures according to manufacturer's written instructions.
   1. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.

F. Cementitious Materials: Limit percentage by weight of cementitious materials other than portland cement according to ACI 301requirements as follows:
   1. Fly Ash or Pozzolan: 25 percent.
   2. Ground Granulated Blast-Furnace Slag: 50 percent.
   3. Combined Fly Ash or Pozzolan, and Ground Granulated Blast-Furnace Slag: 50 percent, with fly ash or pozzolan not exceeding 25 percent.

G. Synthetic Fiber: Uniformly disperse in concrete mixture at manufacturer's recommended rate, but not less than 1.5 lb/cu. yd.

2.8 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Furnish batch certificates for each batch discharged and used in the Work.
   1. When air temperature is between 85 and 90 deg F reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.

B. Test subgrades and subbase for specified compaction.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove loose material from compacted subbase surface immediately before placing concrete.

3.3 EDGE FORMS AND SCREED CONSTRUCTION

A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.

B. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

3.4 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.

C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.

D. Epoxy-Coated Reinforcement: Use epoxy-coated steel wire ties to fasten epoxy-coated reinforcement. Repair cut and damaged epoxy coatings with epoxy repair coating according to ASTM D 3963/D 3963M.

3.5 JOINTS

A. General: Form construction, isolation, and contraction joints and tool edges true to line, with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline unless otherwise indicated.
   1. When joining existing paving, place transverse joints to align with previously placed joints unless otherwise indicated.

B. Construction Joints: Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than one-half hour unless paving terminates at isolation joints.
   1. Continue steel reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of paving strips unless otherwise indicated.
   2. Provide tie bars at sides of paving strips where indicated.
   3. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or coat with asphalt one-half of dowel length to prevent concrete bonding to one side of joint.

C. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, other fixed objects, and where indicated.
   1. Locate expansion joints as indicated on the drawings.
   2. Extend joint fillers full width and depth of joint.
   3. Terminate joint filler not less than 1/2 inchor more than 1 inchbelow finished surface if joint sealant is indicated.
   4. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.
   5. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.
   6. During concrete placement, protect top edge of joint filler with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.

D. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness, as follows:
   1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with grooving tool to a 1/8-inchradius. Repeat grooving of contraction joints after applying surface finishes. Eliminate grooving-tool marks on concrete surfaces.

E. Edging: After initial floating, tool edges of paving, gutters, curbs, and joints in concrete with an edging tool to a 1/4-inch radius. Repeat tooling of edges after applying surface finishes. Eliminate edging-tool marks on concrete surfaces.

3.6 CONCRETE PLACEMENT

A. Before placing concrete, inspect and complete formwork installation and items to be embedded or cast-in.

B. Remove snow, ice, or frost from subbase surface before placing concrete. Do not place concrete on frozen surfaces.

C. Moisten subbase to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.

D. Comply with ACI 301requirements for measuring, mixing, transporting, and placing concrete.

E. Do not add water to concrete during delivery or at Project site. Do not add water to fresh concrete after testing.

F. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.

G. Consolidate concrete according to ACI 301by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping.
   1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies or side forms. Use only square-faced shovels for hand spreading and consolidation. Consolidate with care to prevent dislocating joint devices.

H. Screed paving surface with a straightedge and strike off.

I. Commence initial floating using bull floats or darbies to impart an open-textured and uniform surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.

J. Curbs and Gutters: Use design mixture for automatic machine placement. Produce curbs and gutters to required cross section, lines, grades, finish, and jointing.

K. Slip-Form Paving: Use design mixture for automatic machine placement. Produce paving to required thickness, lines, grades, finish, and jointing.
   1. Compact subbase and prepare subgrade of sufficient width to prevent displacement of slip-form paving machine during operations.

L. Cold-Weather Placement: Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing, or low temperatures. Comply with ACI 306.1 and the following:
   1. When air temperature has fallen to or is expected to fall below 40 deg F uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg Fand not more than 80 deg Fat point of placement.
   2. Do not use frozen materials or materials containing ice or snow.
   3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in design mixtures.

M. Hot-Weather Placement: Comply with ACI 301and as follows when hot-weather conditions exist:
   1. Cool ingredients before mixing to maintain concrete temperature below 90 deg Fat time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated in total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.

2. Cover steel reinforcement with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
3. Fog-spray forms and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

3.7 FLOAT FINISHING

A. General: Do not add water to concrete surfaces during finishing operations.

B. Float Finish: Begin the second floating operation when bleed-water sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.
1. Medium-to-Fine-Textured Broom Finish: Draw a soft-bristle broom across float-finished concrete surface perpendicular to line of traffic to provide a uniform, fine-line texture.

3.8 CONCRETE PROTECTION AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

B. Comply with ACI 306.1 for cold-weather protection.

C. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x hbefore and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete but before float finishing.

D. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

E. Curing Methods: Cure concrete by curing compound as follows:
1. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas that have been subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating, and repair damage during curing period.

3.9 CONCRETE WASHOUT

A. Do not discharge concrete washout into storm drains, catch basins or to the sanitary sewer system. Perform washing of concrete trucks in designated areas or an approved offsite location.
1. Designated areas should be clearly labeled. They should be in a pit to prevent run-off of waste water. Place designated areas a minimum of 50 feet from storm drains, bodies of water and ditches. All designated areas should be lined to prevent seepage and should have a barrier.
2. Alternative to a designated area: Provide a concrete box. If only a small amount of concrete washing is to occur, one option is to line a roll-off box. For very small projects this could be done with a drum.

B. Once concrete washout has hardened, break up and dispose of properly. Disposal of hardened concrete should occur on a regular basis.

C. Washout facilities must be cleaned, or new facilities provided once the washout area is 75% full.

3.10 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Testing Services: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
   1. Testing Frequency: Obtain at least one composite sample for each ready mix loador fraction thereof of each concrete mixture placed each day.
      a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
   2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
   3. Air Content: ASTM C 231, pressure method; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
   4. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg Fand below and when it is 80 deg Fand above, and one test for each composite sample.
   5. Compression Test Specimens: ASTM C 31/C 31M; cast and laboratory cure one set of three standard cylinder specimens for each composite sample.
   6. Compressive-Strength Tests: ASTM C 39/C 39M; test one specimen at seven days and two specimens at 28 days.
      a. A compressive-strength test shall be the average compressive strength from two specimens obtained from same composite sample and tested at 28 days.

C. Strength of each concrete mixture will be satisfactory if average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi

D. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.

E. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.

F. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.

G. Concrete paving will be considered defective if it does not pass tests and inspections.

H. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

I. Prepare test and inspection reports.

3.11 REPAIRS AND PROTECTION

A. Remove and replace concrete paving that is broken, damaged, or defective or that does not comply with requirements in this Section. Remove work in complete sections from joint to joint unless otherwise approved by Architect.

B. Drill test cores, where directed by Architect, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory paving areas with portland cement concrete bonded to paving with epoxy adhesive.

C. Protect concrete paving from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.

D. Maintain concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep paving not more than two days before date scheduled for Substantial Completion inspections.

3.12 WASTE MANAGEMENT

A. Separate and recycle waste materials, packaging, and all other materials in accordance with the Waste Management Plan and to the maximum extent possible, send to reuse or recycle centers.

B. Concrete Washout:
   1. Do not discharge concrete washout into storm drains, catch basins or to the sanitary sewer system. Perform washing of concrete trucks in designated areas or offsite.
      a. Designated areas should be clearly labeled. They should be in a pit to prevent run-off of waste water. Place designated areas a minimum of 50 feet from storm drains, bodies of water and ditches. All designated areas should be lined to prevent seepage and should have a barrier.
      b. Alternative to a designated area: Provide a concrete box. If only a small amount of concrete washing is to occur, one option is to line a roll-off box. For very small projects this could be done with a drum.
   2. Once concrete washout has hardened, break up and dispose of properly. Disposal of hardened concrete should occur on a regular basis.

C. Washout facilities must be cleaned, or new facilities provided once the washout area is 75% full.

END OF SECTION 32 1313

SECTION 32 1373 - CONCRETE PAVING JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section applies to areas outside building footprint and includes:
   1. Cold-applied joint sealants.
   2. Hot-applied joint sealants.

1.2 PRECONSTRUCTION TESTING

A. Preconstruction Compatibility and Adhesion Testing: Submit to joint-sealant manufacturers samples of materials that will contact or affect joint sealants. Use ASTM C 1087 manufacturer's standard test method to determine whether priming and other specific joint-preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.

1.3 SUBMITTALS

A. Product Data: For each joint-sealant product indicated.

B. Samples: For each kind and color of joint sealant required.

C. Pavement-Joint-Sealant Schedule: Include the following information:
   1. Joint-sealant application, joint location, and designation.
   2. Joint-sealant manufacturer and product name.
   3. Joint-sealant formulation.
   4. Joint-sealant color.

D. Product certificates.

E. Product test reports.

F. Preconstruction compatibility and adhesion test reports.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021.

B. Pre-installation Conference: Conduct conference at Project site.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Compatibility: Provide joint sealants, backing materials, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer based on testing and field experience.

B. Colors of Exposed Joint Sealants: To match color of adjacent materials and as selected by Architect from manufacturer's full range.

2.2 COLD-APPLIED JOINT SEALANTS

A. Vertical Joints: Multicomponent, Nonsag, Urethane, Elastomeric Joint Sealant: ASTM C920, Type M, Grade NS, Class 25, for Use T.

B. Pavement Joints: Multicomponent, Pourable, Traffic-Grade, Urethane Joint Sealant for Concrete: ASTM C 920, Type M, Grade P, Class 25, for Use T.

2.3 HOT-APPLIED JOINT SEALANTS

A. Hot-Applied, Single-Component Joint Sealant for Asphalt: ASTM D 6690, Types I, II, and III.

2.4 JOINT-SEALANT BACKER MATERIALS

A. Round Backer Rods for Cold-Applied Joint Sealants: ASTM D 5249, Type 3, of diameter and density required to control joint-sealant depth and prevent bottom-side adhesion of sealant.

2.5 PRIMERS

A. Primers: Product recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated unless more stringent requirements apply.

B. Cleaning of Joints: Clean out joints immediately before installing joint sealants.

C. Joint-Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

D. Install joint-sealant backings of kind indicated to support joint sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
   1. Do not leave gaps between ends of joint-sealant backings.
   2. Do not stretch, twist, puncture, or tear joint-sealant backings.
   3. Remove absorbent joint-sealant backings that have become wet before sealant application and replace them with dry materials.

E. Install joint sealants using proven techniques that comply with the following and at the same time backings are installed:
   1. Place joint sealants so they directly contact and fully wet joint substrates.
   2. Completely fill recesses in each joint configuration.
   3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

F. Tooling of Nonsag Joint Sealants: Immediately after joint-sealant application and before skinning or curing begins, tool sealants according to the following requirements to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint:
   1. Remove excess joint sealant from surfaces adjacent to joints.
   2. Use tooling agents that are approved in writing by joint-sealant manufacturer and that do not discolor sealants or adjacent surfaces.

G. Provide joint configuration to comply with joint-sealant manufacturer's written instructions unless otherwise indicated.

H. Clean off excess joint sealant or sealant smears adjacent to joints as the Work progresses, by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

END OF SECTION 32 1373

SECTION 32 1713 - PARKING BUMPERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes concrete wheel stops.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 PARKING BUMPERS

A. Concrete Wheel Stops: Precast, steel-reinforced, air-entrained concrete, 4000-psi minimum compressive strength, 4-1/2 inches high by 9 inches wide by 72 inches long. Provide chamfered corners, transverse drainage slots on underside, and a minimum of three factory-formed or -drilled vertical holes through wheel stop for anchoring to substrate.
   1. Surface Appearance: Free of pockets, sand streaks, honeycombs, and other obvious defects. Corners shall be uniform, straight, and sharp.
   2. Surface Sealer: Manufacturer's standard salt-resistant, clear sealer, applied at precasting location.
   3. Mounting Hardware: Galvanized-steel spike or dowel, 1/2-inch diameter, 24-inch minimum length.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that pavement is in suitable condition to begin installation according to manufacturer's written instructions.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install wheel stops according to manufacturer's written instructions unless otherwise indicated.

B. Install wheel stops in bed of adhesive before anchoring.

C. Securely anchor wheel stops to pavement with hardware in each preformed vertical hole in wheel stop as recommended in writing by manufacturer. Recess head of hardware beneath top of wheel stop.

END OF SECTION 32 1713

SECTION 32 1723 - PAVEMENT MARKINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes painted markings applied to asphalt and concrete pavement.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include technical data and tested physical and performance properties.

B. Shop Drawings: For pavement markings.
   1. Indicate pavement markings, colors, lane separations, defined parking spaces, and dimensions to adjacent work.
   2. Indicate, with international symbol of accessibility, spaces allocated for people with disabilities.

1.4 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of local jurisdictional authority for pavement-marking work.

1.5 FIELD CONDITIONS

A. Environmental Limitations: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 55 deg F, and not exceeding 95 deg F.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Accessibility Standard: Comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design".

2.2 PAVEMENT-MARKING PAINT

A. Pavement-Marking Paint: Latex, waterborne emulsion, lead and chromate free, ready mixed, complying with FS TT-P-1952, Type II, with drying time of less than 45 minutes.
   1. Color: White parking space striping.
   2. Color: Blue ADA parking space symbols and striping.
   3. Color: White traffic stop bars.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that pavement is dry and in suitable condition to begin pavement marking according to manufacturer's written instructions.

B. Proceed with pavement marking only after unsatisfactory conditions have been corrected.

3.2 PAVEMENT MARKING

A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Architect and Owner.

B. Allow paving to age for a minimum of 30 days before starting pavement marking.

C. Sweep and clean surface to eliminate loose material and dust.

D. Apply paint with mechanical equipment to produce pavement markings, of dimensions indicated, with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils.
   1. Apply graphic symbols and lettering with paint-resistant, die-cut stencils, firmly secured to pavement. Mask an extended area beyond edges of each stencil to prevent paint application beyond stencil. Apply paint so that it cannot run beneath stencil.

3.3 PROTECTING AND CLEANING

A. Protect pavement markings from damage and wear during remainder of construction period.

B. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 32 1723

SECTION 32 3300 - SITE FURNISHINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Benches.
2. Exercise Stations.
3. Interpretive Signage.
4. Regulatory Signage.
5. Salvaged Signage

B. Related Requirements:
1. Section 033000 "Cast-in-Place Concrete" for concrete footings.
2. Section 061063 "Exterior Rough Carpentry" for exercise station timber edging.
3. Section 312000 "Earth Moving" for excavation for installing concrete footings.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For Pre-Cast Concrete Benches and Bicycle Shelters.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For site furnishings to include in maintenance manuals.

PART 2 - PRODUCTS

2.1 BENCHES

A. Modular Benches: Provided by Owner, Installed by Contractor.
1. Manufacturer: Victor Stanley, Dunkirk, MD.
2. Product: Subject to compliance with requirements, provide the product indicated on Drawings and as described below, or approved equal:
a. Model: 6' FS-50, round bar steel
b. Mount: Embedded.
c. Color: Black.

2.2 EXERCISE STATIONS

A. Exercise Stations:
1. Manufacturer: Columbia Cascade Company, Camas, WA.
2. Product: Subject to compliance with requirements, provide the product indicated on Drawings and as described below, or approved equal:
a. Exercise Station A:
1) Model: TimberForm, Group 5100-A
2) Mount: Embedded.
3) Metal Finish: Manufacturer's standard powdercoat, Black.
b. Exercise Station B:

1) Model: TimberForm, Group 5100-D
2) Mount: Embedded.
3) Metal Finish: Manufacturer's standard powdercoat, Black.

B. Safety Surface: Engineered Wood Fiber certified for playground safety surface use.

2.3 INTERPRETIVE SIGNAGE

A. Interpretive Signage Frames and Panels:
1. Manufacturer: Windsor Fireform, Tumwater, WA.
2. Product: Subject to compliance with requirements, provide the product indicated on Drawings and as described below, or approved equal:
a. Sign Panel Size: 24"x36"
b. Frame Model: Double-Leg Traditional Low Profile Base.
c. Frame Finish: Manufacturer's standard powder coat.
d. Frame Color: Black
e. Frame Mount: Embedded.
f. Sign Panel Graphics: High-resolution porcelain enamel imaging, utilizing manufacturer's full range of colors capable of photo-quality images. Owner will provide electronic vector file artwork for manufacturer's production use.

2.4 SALVAGED SIGNAGE

A. Salvaged site signage and dog waste stations as shown in the Drawings.

2.5 REGULATORY SIGNAGE

A. Traffic and parking regulatory signage as shown in the Drawings shall meet requirements of the Michigan Manual of Uniform Traffic Control Devices.

2.6 FABRICATION

A. Metal Components: Form to required shapes and sizes with true, consistent curves, lines, and angles. Separate metals from dissimilar materials to prevent electrolytic action.

B. Welded Connections: Weld connections continuously. Weld solid members with full-length, full-penetration welds and hollow members with full-circumference welds. At exposed connections, finish surfaces smooth and blended so no roughness or unevenness shows after finishing and welded surface matches contours of adjoining surfaces.

C. Pipes and Tubes: Form simple and compound curves by bending members in jigs to produce uniform curvature for each repetitive configuration required; maintain cylindrical cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of handrail and railing components.

D. Exposed Surfaces: Polished, sanded, or otherwise finished; all surfaces smooth, free of burrs, barbs, splinters, and sharpness; all edges and ends rolled, rounded, or capped.

E. Factory Assembly: Assemble components in the factory to greatest extent possible to minimize field assembly. Clearly mark units for assembly in the field.

2.7 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.8 STEEL AND GALVANIZED STEEL FINISHES

A. Baked-Enamel, Powder-Coat Finish: Manufacturer's standard, baked, polyester, powder-coat finish complying with finish manufacturer's written instructions for surface preparation, including pretreatment, application, baking, and minimum dry film thickness.

B. PVC Finish: Manufacturer's standard, UV-light stabilized, mold-resistant, slip-resistant, matte-textured, dipped or sprayed-on, PVC-plastisol finish, with flame retardant added; complying with coating manufacturer's written instructions for pretreatment, application, and minimum dry film thickness.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for correct and level finished grade, mounting surfaces, installation tolerances, and other conditions affecting performance.
   1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Comply with manufacturer's written installation instructions unless more stringent requirements are indicated. Complete field assembly of site furnishings where required.

B. Unless otherwise indicated, install site furnishings after landscaping and paving have been completed.

C. Install site furnishings level, plumb, true, and securely anchored at locations indicated on Drawings.

D. Post Setting: Set cast-in support posts in concrete footing with smooth top, shaped to shed water. Protect portion of posts above footing from concrete splatter. Verify that posts are set plumb or at correct angle and are aligned and at correct height and spacing. Hold posts in position during placement and finishing operations until concrete is sufficiently cured.

3.3 CLEANING

A. After completing site furnishing installation, inspect components. Remove spots, dirt, and debris. Repair damaged finishes to match original finish or replace component.

END OF SECTION 32 3300

SECTION 32 9200 - TURF AND GRASSES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Lawn Hydroseeding
   2. Native Seeding.

B. Related Requirements:
   1. Section 329300 "Plants" for trees, shrubs, ground covers, and other plants as well as border edgings and mow strips.
   2. Section 334600 "Subdrainage" for below-grade drainage of landscaped areas.

1.2 DEFINITIONS

A. Duff Layer: The surface layer of native topsoil that is composed of mostly decayed leaves, twigs, and detritus.

B. Finish Grade: Elevation of finished surface of planting soil.

C. Manufactured Topsoil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.

D. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. This includes insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. It also includes substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.

E. Pests: Living organisms that occur where they are not desired or that cause damage to plants, animals, or people. These include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.

F. Planting Soil: Standardized topsoil; existing, native surface topsoil; existing, in-place surface soil; imported topsoil; or manufactured topsoil that is modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.

G. Subgrade: Surface or elevation of subsoil remaining after excavation is complete, or top surface of a fill or backfill before planting soil is placed.

H. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.

I. Surface Soil: Whatever soil is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil, but in disturbed areas such as urban environments, the surface soil can be subsoil.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Certification of sod.

C. Product certificates for fertilizers, pesticides, and herbicides.

D. Soil Analysis: For each unamended and amended soil type, furnish soil analysis and a written report by a qualified soil-testing laboratory.
   1. The soil-testing laboratory shall oversee soil sampling.
   2. Report suitability of tested soil for turf growth.
      a. State recommendations for nitrogen, phosphorus, and potash nutrients and soil amendments to be added to produce satisfactory planting soil suitable for healthy, viable plants.
      b. Report presence of problem salts, minerals, or heavy metals; if present, provide additional recommendations for corrective action.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: A qualified landscape installer whose work has resulted in successful turf establishment.
   1. Professional Membership: Installer shall be a member in good standing of either the Professional Landcare Network or the American Nursery and Landscape Association.
   2. Experience: Five years' experience in turf installation in addition to requirements in Section 014000 "Quality Requirements."
   3. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.
   4. Personnel Certifications: Installer's field supervisor shall have certification in one of the following categories from the Professional Landcare Network:
      a. Landscape Industry Certified Technician - Exterior.
      b. Landscape Industry Certified Lawncare Manager.
      c. Landscape Industry Certified Lawncare Technician.
   5. Pesticide Applicator: State licensed, commercial.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Seed and Other Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of conformance with state and federal laws, as applicable.

B. Sod: Harvest, deliver, store, and handle sod according to requirements in "Specifications for Turfgrass Sod Materials" and "Specifications for Turfgrass Sod Transplanting and Installation" sections in TPI's "Guideline Specifications to Turfgrass Sodding." Deliver sod within 24 hours of harvesting and in time for planting promptly. Protect sod from breakage and drying.

C. Bulk Materials:
   1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
   2. Provide erosion-control measures to prevent erosion or displacement of bulk materials; discharge of soil-bearing water runoff; and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
   3. Accompany each delivery of bulk materials with appropriate certificates.

1.6 MAINTENANCE SERVICE

A. Initial Turf Maintenance Service: Provide full maintenance by skilled employees of landscape Installer. Maintain as required in Part 3. Begin maintenance immediately after each area is planted and continue until acceptable turf is established but for not less than the following periods:
   1. Sodded Turf: 60 days from date of Substantial Completion.
      a. When initial maintenance period has not elapsed before end of planting season, or if turf is not fully established, continue maintenance during next planting season.

B. Initial Native Seed Maintenance Service: Provide full maintenance by skilled employees of landscape Installer. Maintain as required in Part 3. Begin maintenance immediately after each area is planted and continue until acceptable growth is established but for not less than the following periods:
   1. Seeded Native Plantings: 3 years from date of Substantial Completion.
      a. When initial maintenance period has not elapsed before end of planting season, or if seed is not fully established, continue maintenance during next planting season.

PART 2 - PRODUCTS

2.1 SEED

A. Turfgrass Species: Seed of grass species as follows, with not less than 85 percent germination, not less than 95 percent pure seed, and not more than 0.5 percent weed seed:
   1. Sun and Partial Shade: Proportioned by weight as follows:
      a. 35 percent Red Fescue (min. 2 varieties).
      b. 35 percent Chewings Fescue (min. 2 varieties).
      c. 20 percent Turf Type Perennial Ryegrass.
      d. 10 percent Kentucky Bluegrass

B. Stormwater and Roadway Edge Native Seed Mix: Fresh, clean, dry, new-crop seed complying with AOSA's "Journal of Seed Technology; Rules for Testing Seeds" for purity and germination tolerances.
   1. Native Seed Mix: Proprietary seed mix as follows: "Swale Mix" by Stantec (previously Cardno JFNew), Walkerton, IN.

2.2 INORGANIC SOIL AMENDMENTS

A. Lime: ASTM C 602, agricultural liming material containing a minimum of 80 percent calcium carbonate equivalent and as follows:
   1. Class: T, with a minimum of 99 percent passing through No. 8sieve and a minimum of 75 percent passing through No. 60sieve.

B. Sulfur: Granular, biodegradable, containing a minimum of 90 percent sulfur, and with a minimum of 99 percent passing through No. 6sieve and a maximum of 10 percent passing through No. 40sieve.

C. Iron Sulfate: Granulated ferrous sulfate containing a minimum of 20 percent iron and 10 percent sulfur.

D. Aluminum Sulfate: Commercial grade, unadulterated.

E. Perlite: Horticultural perlite, soil amendment grade.

F. Agricultural Gypsum: Minimum 90 percent calcium sulfate, finely ground with 90 percent passing through No. 50sieve.

G. Sand: Clean, washed, natural or manufactured, and free of toxic materials.

H. Diatomaceous Earth: Calcined, 90 percent silica, with approximately 140 percent water absorption capacity by weight.

I. Zeolites: Mineral clinoptilolite with at least 60 percent water absorption by weight.

2.3 ORGANIC SOIL AMENDMENTS

A. Compost: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 3/4-inchsieve; soluble salt content of 5 to 10 decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings.

B. Sphagnum Peat: Partially decomposed sphagnum peat moss, finely divided or of granular texture, with a pH range of 3.4 to 4.8.

C. Muck Peat: Partially decomposed moss peat, native peat, or reed-sedge peat, finely divided or of granular texture, with a pH range of 6 to 7.5, and having a water-absorbing capacity of 1100 to 2000 percent.

D. Wood Derivatives: Decomposed, nitrogen-treated sawdust, ground bark, or wood waste; of uniform texture and free of chips, stones, sticks, soil, or toxic materials.

E. Manure: Well-rotted, unleached, stable or cattle manure containing not more than 25 percent by volume of straw, sawdust, or other bedding materials; free of toxic substances, stones, sticks, soil, weed seed, and material harmful to plant growth.

2.4 FERTILIZERS

A. Fertilizers: Use only phosphorus-free fertilizers on turfgrass. Phosphorus may be added to turfgrass only if soils are tested for nutrients and a need for phosphorus is demonstrated. Phosphorus fertilizers shall be applied only as prescribed by the soil test results.

B. Bonemeal: Commercial, raw or steamed, finely ground; a minimum of 1 percent nitrogen and 10 percent phosphoric acid.

C. Superphosphate: Commercial, phosphate mixture, soluble; a minimum of 20 percent available phosphoric acid.

D. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:
   1. Composition: 1 lb/1000 sq. ft.of actual nitrogen and 2 percent potassium, by weight.

E. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:
   1. Composition: 20 percent nitrogen and 10 percent potassium, by weight.

2.5 PLANTING SOILS

A. Planting Soil for Lawn Hydroseeding and Native Seeding: Stockpiled topsoil or imported topsoil from off-site sources; do not obtain from agricultural land, bogs or marshes. Verify suitability of soil to produce viable planting soil. Clean soil of roots, plants, sod, stones, clods, clay lumps, pockets of coarse sand, concrete slurry, concrete layers or chunks, cement, plaster, building debris, and other extraneous materials harmful to plant growth.

B. Contractor shall have stockpiled and imported topsoil sampled and analyzed by an approved laboratory for suitability for lawn and native seeding. The contractor shall amend the stockpiled and/or imported topsoil as recommended by the laboratory.
   1. Report suitability of tested soil for lawn seeding.
      a. Based on the test results, state recommendations in weight per 1000 sq. ft. nitrogen, phosphorus, and potash nutrients and soil amendments to be added to produce satisfactory planting soil suitable for healthy, viable plants.

b. Report presence of problem salts, minerals, heavy metals; if present, provide additional recommendations for corrective action.
c. Test report shall also indicate pH levels, organic content and clay content.

C. Beyond the laboratory recommendations, the amended lawn planting soil shall have the following attributes:
1. Organic matter content between 5% and 30%.
2. pH range between 5.0 and 7.5
3. soluble salts maximum 500 parts per million (ppm)
4. clay content between 5% and 25%

2.6 PESTICIDES

A. General: Pesticide, registered and approved by EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.

2.7 MULCHES

A. Fiber Mulch: Biodegradable, dyed-wood, cellulose-fiber mulch; nontoxic and free of plant-growth or germination inhibitors; with a maximum moisture content of 15 percent and a pH range of 4.5 to 6.5.

B. Non-asphaltic Tackifier: Colloidal tackifier recommended by fiber-mulch manufacturer for slurry application; nontoxic and free of plant-growth or germination inhibitors.

2.8 EROSION-CONTROL MATERIALS

A. Erosion-Control Blankets: Wildlife safe blankets composed of one of the following:
1. Biodegradable wood excelsior, straw, or coconut-fiber mat, non-enclosed (meshless). Include manufacturer's recommended steel wire staples, 6 inches long.
2. Erosion-Control Fiber Mesh: Biodegradable burlap or spun-coir mesh, a minimum of 0.92 lb/sq. yd., with 50 to 65 percent open area. Include manufacturer's recommended steel wire staples, 6 inches long.

PART 3 - EXECUTION

3.1 PROTECTION

A. Protect areas of porous unit pavers from dirt, dust, and debris from Contractor's operations. Contractor will be responsible for cleaning and corrective actions as deemed necessary by the Architect and Owner.

3.2 LAWN HYDROSEED AND NATIVE SEED AREA PREPARATION

A. Newly Graded Subgrades: Loosen subgrade to a minimum depth of 8 inches except in tree protection zones. Remove stones larger than 1 inch in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.
1. Apply fertilizer as recommended by soils tests directly to subgrade before loosening.
2. Thoroughly blend planting soil off-site before spreading or spread topsoil, apply soil amendments and fertilizer on surface, and thoroughly blend planting soil.
3. Spread planting soil to a depth of 6 inches but not less than required to meet finish grades after light rolling and natural settlement. Do not spread if planting soil or subgrade is frozen, muddy, or excessively wet.

B. Finish Grading: Grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Grade to within plus or minus 1/2 inchof finish elevation. Roll and rake, remove ridges, and fill depressions to meet finish grades. Limit finish grading to areas that can be planted in the immediate future.

C. Moisten prepared area before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

D. Before installation of seed, obtain Architect's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

3.3 LAWN HYDROSEEDING

A. Hydroseeding: Mix specified seed, commercial fertilizer, and fiber mulch in water, using equipment specifically designed for hydroseed application. Continue mixing until uniformly blended into homogeneous slurry suitable for hydraulic application.
1. Mix slurry with non-asphaltic tackifier.
2. Spray-apply slurry uniformly to all areas to be seeded in a two-step process. Apply first slurry coat at a rate so that mulch component is deposited at not less than 500-lb/acre dry weight, and seed component is deposited at not less than the specified seed-sowing rate. Apply slurry cover coat of fiber mulch (hydromulching) at a rate of 1000 lb/acre.

3.4 NATIVE SEEDING

A. Sow seed with spreader or seeding machine. Do not broadcast or drop seed when wind velocity exceeds 5 mph.
1. Evenly distribute seed by sowing equal quantities in two directions at right angles to each other.
2. Do not use wet seed or seed that is moldy or otherwise damaged.
3. Do not seed against existing trees. Limit extent of seed to outside edge of planting saucer.

B. Sow seed at seed suppliers recommended rate.

C. Rake seed lightly into top 1/8 inch of soil, roll lightly, and water with fine spray.

D. Protect seeded areas within swales and with slopes exceeding 1:6 with erosion-control fiber mesh installed and stapled according to manufacturer's written instructions.

E. Protect seeded areas with slopes not exceeding 1:6 by spray applying fiber mulch (hydromulch) and non-asphaltic tactifier slurry at not less than 1500-lb/acre dry weight.

3.5 TURF RENOVATION

A. Renovate turf damaged by Contractor's operations, such as storage of materials or equipment and movement of vehicles.
1. Reestablish turf where settlement or washouts occur or where minor regrading is required.
2. Install new planting soil as required.

B. Remove sod and vegetation from diseased or unsatisfactory turf areas; do not bury in soil.

C. Remove topsoil containing foreign materials, such as oil drippings, fuel spills, stones, gravel, and other construction materials resulting from Contractor's operations, and replace with new planting soil.

D. Mow, dethatch, core aerate, and rake existing turf.

E. Remove weeds before seeding. Where weeds are extensive, apply selective herbicides as required. Do not use pre-emergence herbicides.

F. Remove waste and foreign materials, including weeds, soil cores, grass, vegetation, and turf, and legally dispose of them off Owner's property.

G. Till stripped, bare, and compacted areas thoroughly to a soil depth of 6 inches.

H. Apply soil amendments and initial fertilizer required for establishing new turf and mix thoroughly into top 4 inchesof existing soil. Install new planting soil to fill low spots and meet finish grades.
1. Soil Amendment(s): Apply according to soil test results and requirements of this specification for new lawn.
2. Initial Fertilizer: Apply according to soil test results and requirements of this specification for new lawn.

I. Apply lawn hydromulch or native seeding as directed by Architect. Comply with respective requirements of lawn hydromulch or native seeding.

J. Protect seeded areas within swales and with slopes exceeding 1:6 with erosion-control fiber mesh installed and stapled according to manufacturer's written instructions.

K. Water newly planted areas and keep moist until new turf is established.

3.6 CLEANUP AND PROTECTION

A. Promptly remove soil and debris created by turf work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.

B. Remove surplus soil and waste material, including excess subsoil, unsuitable soil, trash, and debris, and legally dispose of them off Owner's property.

C. Erect temporary fencing or barricades and warning signs as required to protect newly planted areas from traffic and wildlife damage. Maintain fencing and barricades throughout initial maintenance period and remove after plantings are established.

D. Remove nondegradable erosion-control measures after grass establishment period.

3.7 TURF MAINTENANCE

A. Maintain and establish turf by watering, fertilizing, weeding, mowing, trimming, replanting, and performing other operations as required to establish healthy, viable turf. Roll, regrade, and replant bare or eroded areas and remulch to produce a uniformly smooth turf. Provide materials and installation the same as those used in the original installation.

B. Mow turf as soon as top growth is tall enough to cut. Repeat mowing to maintain height appropriate for species without cutting more than 1/3 of grass height. Remove no more than 1/3 of grass-leaf growth in initial or subsequent mowings.

C. Apply pesticides and other chemical products and biological control agents in accordance with authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with Owner's operations and others in proximity to the Work. Notify Owner before each application is performed.

3.8 NATIVE SEEDING MAINTENANCE

A. Maintain and establish seed by watering, weeding, mowing, trimming, replanting, and performing other operations as required to establish healthy, viable native vegetation. Regrade,

and replant bare or eroded areas and remulch to produce a uniformly smooth turf. Provide materials and installation the same as those used in the original installation.

B. Employ hand pulling, trimming, hand-applied herbicides and mowing to control weeds and invasive species. Contractors recommended action shall be approved by Architect prior to implementation.

C. Mow native seed areas to height of 8" at end of second growing season.

D. Apply pesticides and other chemical products and biological control agents in accordance with authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with Owner's operations and others in proximity to the Work. Notify Owner before each application is performed.

3.9 SATISFACTORY LAWN HYDROSEEDING AND NATIVE SEEDING

A. installations shall meet the following criteria as determined by Architect and Owner:
1. Satisfactory Establishment: At end of maintenance period, a healthy, uniform, close stand has been established, free of weeds and surface irregularities, with coverage exceeding 90 percent over any 10 sq. ft.nd bare spots not exceeding 5 by 5 inches

B. Use specified materials to reestablish areas that do not comply with requirements and continue maintenance until establishment is satisfactory.

END OF SECTION 32 9200

SECTION 32 9300 - PLANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Plants.
   2. Planting soils.
   3. Organic mulch.

1.2 DEFINITIONS

A. Backfill: The earth used to replace or the act of replacing earth in an excavation.

B. Duff Layer: The surface layer of native topsoil that is composed of mostly decayed leaves, twigs, and detritus.

C. Finish Grade: Elevation of finished surface of planting soil.

D. Manufactured Topsoil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.

E. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. This includes insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. It also includes substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.

F. Pests: Living organisms that occur where they are not desired, or that cause damage to plants, animals, or people. These include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.

G. Planting Soil: Standardized topsoil; existing, native surface topsoil; existing, in-place surface soil; imported topsoil; or manufactured topsoil that is modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.

H. Root Flare: Also called "trunk flare." The area at the base of the plant's stem or trunk where the stem or trunk broadens to form roots; the area of transition between the root system and the stem or trunk.

I. Subgrade: Surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.

J. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.

K. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil; but in disturbed areas such as urban environments, the surface soil can be subsoil.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated, including soils.

B. Samples of soils, soil amendments, and mulches.

C. Product certificates.

D. Maintenance Instructions: Recommended procedures to be established by Owner for maintenance of plants during a calendar year.

E. Soil Analysis: For each unamended and amended soil type, furnish soil analysis and a written report by a qualified soil-testing laboratory.
   1. The soil-testing laboratory shall oversee soil sampling.
   2. Report suitability of tested soil for plant growth.
      a. State recommendations for nitrogen, phosphorus, and potash nutrients and soil amendments to be added to produce satisfactory planting soil suitable for healthy, viable plants.
      b. Report presence of problem salts, minerals, or heavy metals; if present, provide additional recommendations for corrective action.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: A qualified landscape installer whose work has resulted in successful planting establishment.
   1. Professional Membership: Installer shall be a member in good standing of either the Professional Landcare Network or the American Nursery and Landscape Association.
   2. Experience: Five years' experience in similar installation
   3. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.
   4. Personnel Certifications: Installer's field supervisor shall have certification in one of the following categories from the Professional Landcare Network:
      a. Landscape Industry Certified Technician - Exterior.
      b. Landscape Industry Certified Landscape Manager.
      c. Landscape Industry Certified Landscape Technician.
   5. Pesticide Applicator: State licensed, commercial.

B. Provide quality, size, genus, species, and variety of plants indicated, complying with applicable requirements in ANSI Z60.1.

C. Preinstallation Conference: Conduct conference at Project site.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver bare-root stock plants freshly dug. Immediately after digging up bare-root stock, pack root system in wet straw, hay, or other suitable material to keep root system moist until planting.

B. Do not prune trees and shrubs before delivery. Protect bark, branches, and root systems from sun scald, drying, wind burn, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie trees or shrubs in such a manner as to destroy their natural shape. Provide protective covering of plants during shipping and delivery. Do not drop plants during delivery and handling.

C. Handle planting stock by root ball.

D. Store bulbs, corms, and tubers in a dry place at 60 to 65 deg F until planting.

E. Deliver plants after preparations for planting have been completed, and install immediately. If planting is delayed more than six hours after delivery, set plants and trees in their appropriate aspect (sun, filtered sun, or shade), protect from weather and mechanical damage, and keep roots moist.

1.6 WARRANTY

A. Special Warranty: Installer agrees to repair or replace plantings and accessories that fail in materials, workmanship, or growth within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Death and unsatisfactory growth, except for defects resulting from abuse or incidents that are beyond Contractor's control.
      b. Death and unsatisfactory growth due to lack of water.
      c. Structural failures including plantings falling or blowing over.
   2. Warranty Periods from Date of Substantial Completion:
      a. Trees, Shrubs, Vines, and Ornamental Grasses: 24 months.
      b. Ground Covers, Biennials, Perennials, and Other Plants: 24 months.

1.7 MAINTENANCE SERVICE

A. Initial Maintenance Service: Provide maintenance by skilled employees of landscape Installer. Maintain as required in Part 3. Begin maintenance immediately after plants are installed and continue until plantings are acceptably healthy and well established but for not less than maintenance period below.
   1. Maintenance Period for Trees and Shrubs: 36 months from date of Substantial Completion.
   2. Maintenance Period for Ground Cover and Other Plants: 36 months from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PLANT MATERIAL

A. General: Furnish nursery-grown plants true to genus, species, variety, cultivar, stem form, shearing, and other features indicated in Plant Schedule or Plant Legend shown on Drawings and complying with ANSI Z60.1; and with healthy root systems developed by transplanting or root pruning. Provide well-shaped, fully branched, healthy, vigorous stock, densely foliated when in leaf and free of disease, pests, eggs, larvae, and defects such as knots, sun scald, injuries, abrasions, and disfigurement.

B. Root-Ball Depth: Furnish trees and shrubs with root balls measured from top of root ball, which shall begin at root flare according to ANSI Z60.1. Root flare shall be visible before planting.

2.2 INORGANIC SOIL AMENDMENTS

A. Lime: ASTM C 602, agricultural liming material containing a minimum of 80 percent calcium carbonate equivalent and as follows:
   1. Class: T, with a minimum of 99 percent passing through No. 8sieve and a minimum of 75 percent passing through No. 60sieve.
   2. Class: O, with a minimum of 95 percent passing through No. 8sieve and a minimum of 55 percent passing through No. 60sieve.

B. Sulfur: Granular, biodegradable, and containing a minimum of 90 percent sulfur, with a minimum of 99 percent passing through No. 6sieve and a maximum of 10 percent passing through No. 40 sieve.

C. Iron Sulfate: Granulated ferrous sulfate containing a minimum of 20 percent iron and 10 percent sulfur.

D. Aluminum Sulfate: Commercial grade, unadulterated.

E. Perlite: Horticultural perlite, soil amendment grade.

F. Agricultural Gypsum: Minimum 90 percent calcium sulfate, finely ground with 90 percent passing through No. 50sieve.

G. Sand: Clean, washed, natural or manufactured, and free of toxic materials.

H. Diatomaceous Earth: Calcined, 90 percent silica, with approximately 140 percent water absorption capacity by weight.

I. Zeolites: Mineral clinoptilolite with at least 60 percent water absorption by weight.

2.3 ORGANIC SOIL AMENDMENTS

A. Compost: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 3/4-inchsieve; soluble salt content of 5 to 10 decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:

B. Sphagnum Peat: Partially decomposed sphagnum peat moss, finely divided or granular texture, with a pH range of 3.4 to 4.8.

C. Muck Peat: Partially decomposed moss peat, native peat, or reed-sedge peat, finely divided or of granular texture, with a pH range of 6 to 7.5, and having a water-absorbing capacity of 1100 to 2000 percent.

D. Wood Derivatives: Decomposed, nitrogen-treated sawdust, ground bark, or wood waste; of uniform texture and free of chips, stones, sticks, soil, or toxic materials.

E. Manure: Well-rotted, unleached, stable or cattle manure containing not more than 25 percent by volume of straw, sawdust, or other bedding materials; free of toxic substances, stones, sticks, soil, weed seed, debris, and material harmful to plant growth.

2.4 FERTILIZERS

A. Bonemeal: Commercial, raw or steamed, finely ground; a minimum of 1 percent nitrogen and 10 percent phosphoric acid.

B. Superphosphate: Commercial, phosphate mixture, soluble; a minimum of 20 percent available phosphoric acid.

C. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:
   1. Composition: 1 lb/1000 sq. ft.of actual nitrogen, 4 percent phosphorous, and 2 percent potassium, by weight.

D. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:
   1. Composition: 20 percent nitrogen, 10 percent phosphorous, and 10 percent potassium, by weight.

E. Planting Tablets: Tightly compressed chip type, long-lasting, slow-release, commercial-grade planting fertilizer in tablet form. Tablets shall break down with soil bacteria, converting nutrients into a form that can be absorbed by plant roots.
   1. Size: 21-gram tablets.
   2. Nutrient Composition: 20 percent nitrogen, 10 percent phosphorous, and 5 percent potassium, by weight plus micronutrients.

2.5 PLANTING SOILS

A. Planting Soil: Planting soil for use in all landscape beds and planters. Use imported topsoil or manufactured topsoil from off-site sources; do not obtain from agricultural land, bogs or marshes. Verify suitability of soil to produce viable planting soil. Screen soil with ¾" screen to be free of roots, plants, sod, stones, clods, clay lumps, pockets of coarse sand, concrete slurry, concrete layers or chunks, cement, plaster, building debris, and other extraneous materials harmful to plant growth. Mix soil with the following soil amendments and fertilizers in the following quantities to produce planting soil:
   1. Ratio of Loose Compost to Topsoil by Volume: 1:3.
   2. Ratio of Loose Sand to Topsoil by Volume: 1:3.
   3. Fertilizers and amendments as recommended by soil tests.
   4. Contractor shall have imported topsoil used in planting mixes sampled and analyzed by an approved laboratory for suitability for planting. The contractor shall amend the imported topsoil as recommended by the laboratory.
      a. Report suitability of tested soil for planting beds.
         1) Based on the test results, state recommendations in weight per 1000 sq. ft. nitrogen, phosphorus, and potash nutrients and soil amendments to be added to produce satisfactory planting soil suitable for healthy, viable plants.
         2) Report presence of problem salts, minerals, heavy metals; if present, provide additional recommendations for corrective action.
         3) Test report shall also indicate pH levels, organic content and clay content.
   5. Beyond the laboratory recommendations, the amended planting soil shall have the following attributes:
      a. Organic matter content between 5% and 30%.
      b. pH range between 5.0 and 7.5
      c. soluble salts maximum 500 parts per million (ppm)
      d. clay content between 5% and 25%

2.6 MULCHES

A. Organic Mulch: Double shredded hardwood bark. Natural, non-dyed dark brown color.

2.7 PESTICIDES

A. General: Pesticide registered and approved by EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.

PART 3 - EXECUTION

3.1 PROTECTION

A. Protect areas of porous unit pavers from dirt, dust, and debris from Contractor's operations. Contractor will be responsible for cleaning and corrective actions as deemed necessary by the Architect and Owner.

3.2 PLANTING AREA ESTABLISHMENT

A. Areas to receive Planting Mix: Loosen subgrade of planting areas to a minimum depth of 12 inches. Remove stones larger than 1 inch in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.
   1. Thoroughly blend planting soil off-site before spreading or spread topsoil, apply soil amendments and fertilizer on surface, and thoroughly blend planting soil.
   2. Spread first 4 inches of planting soil and incorporate into top 4 inches of subgrade.

3. Spread remaining planting soil to a total depth of 12 inches but not less than required to meet finish grades after natural settlement. Do not spread if planting soil or subgrade is frozen, muddy, or excessively wet.

B. Finish Grading: Grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades.

3.3 EXCAVATION FOR TREES AND SHRUBS

A. Planting Pits and Trenches: Excavate circular planting pits with sides sloping inward at a 45-degree angle. Excavations with vertical sides are not acceptable. Trim perimeter of bottom leaving center area of bottom raised slightly to support root ball and assist in drainage away from center. Do not further disturb base. Ensure that root ball will sit on undisturbed base soil to prevent settling. Scarify sides of planting pit smeared or smoothed during excavation.
1. Excavate approximately three times as wide as ball diameter.
2. Excavate at least 12 inches wider than root spread and deep enough to accommodate vertical roots for bare-root stock.
3. Do not excavate deeper than depth of the root ball, measured from the root flare to the bottom of the root ball.

B. Subsoil and topsoil removed from excavations may not be used as planting soil.

3.4 TREE, SHRUB, AND VINE PLANTING

A. Before planting, verify that root flare is visible at top of root ball according to ANSI Z60.1.

B. Remove stem girdling roots and kinked roots. Remove injured roots by cutting cleanly; do not break.

C. Set stock plumb and in center of planting pit or trench with root flare 2 inches above adjacent finish grades.
1. Use planting soil for backfill.
2. Balled and Burlapped: After placing some backfill around root ball to stabilize plant, carefully cut and remove burlap, rope, and wire baskets from tops of root balls and from sides, but do not remove from under root balls. Remove pallets, if any, before setting. Do not use planting stock if root ball is cracked or broken before or during planting operation.
3. Container-Grown: Carefully remove root ball from container without damaging root ball or plant.
4. Fabric Bag-Grown Stock: Carefully remove root ball from fabric bag without damaging root ball or plant. Do not use planting stock if root ball is cracked or broken before or during planting operation.
5. Backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets. When planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.
6. Place planting tablets in each planting pit when pit is approximately one-half filled; in amounts recommended in soil reports from soil-testing laboratory. Place tablets beside the root ball about 1 inchfrom root tips; do not place tablets in bottom of the hole.
7. Continue backfilling process. Water again after placing and tamping final layer of soil.

D. When planting on slopes, set the plant so the root flare on the uphill side is flush with the surrounding soil on the slope; the edge of the root ball on the downhill side will be above the surrounding soil. Apply enough soil to cover the downhill side of the root ball.

3.5 TREE, SHRUB, AND VINE PRUNING

A. Remove only dead, dying, or broken branches. Do not prune for shape.

B. Prune, thin, and shape trees, shrubs, and vines according to standard professional horticultural and arboricultural practices. Unless otherwise indicated by Architect, do not cut tree leaders; remove only injured, dying, or dead branches from trees and shrubs; and prune to retain natural character.

3.6 PLANTING AREA MULCHING

A. Mulch backfilled surfaces of planting areas and other areas indicated.
   1. Trees and Tree-like Shrubs in Turf Areas: Apply organic mulch ring of 3-inch average thickness, with 36-inch radius around trunks or stems. Do not place mulch within 3 inches of trunks or stems.
   2. Organic Mulch in Planting Areas: Apply 3-inch average thickness of mulch over whole surface of planting area, and finish level with adjacent finish grades. Do not place mulch within 3 inches of trunks or stems.

3.7 CLEANUP AND PROTECTION

A. Promptly remove soil and debris created by installation work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.

B. Remove surplus soil and waste material, including excess subsoil, unsuitable soil, trash, and debris, and legally dispose of them off Owner's property.

C. Erect temporary fencing or barricades and warning signs as required to protect newly planted areas from traffic. Maintain fencing and barricades throughout initial maintenance period and remove after plantings are established.

D. Remove nondegradable erosion-control measures after grass establishment period.

3.8 PLANT MAINTENANCE

A. Maintain plantings by pruning, cultivating, watering, weeding, fertilizing, mulching, restoring planting saucers, resetting to proper grades or vertical position, and performing other operations as required to establish healthy, viable plantings. Spray or treat as required to keep trees and shrubs free of insects and disease.

B. Fill in as necessary soil subsidence that may occur because of settling or other processes. Replace mulch materials damaged or lost in areas of subsidence.

C. Apply treatments as required to keep plant materials, planted areas, and soils free of pests and pathogens or disease. Use practices to minimize the use of pesticides and reduce hazards.

D. Apply pesticides and other chemical products and biological control agents in accordance with authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with Owner's operations and others in proximity to the Work. Notify Owner before each application is performed.

E. Protect plants from damage due to landscape operations and operations of other contractors and trades. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged plantings.

END OF SECTION 32 9300

SECTION 33 4100 - STORMWATER CONVEYANCE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Pipe and fittings.
2. Cleanouts.
3. Nonpressure transition couplings.
4. Manholes, catch basins, outlets & inlets.

1.3 DEFINITIONS

A. ACI: American Concrete Institute.

B. ANSI: American National Standards Institute.

C. ASTM: American Society of Testing and Materials.

D. AASHTO: American Association of State and Highway Transportation Officials.

E. MDOT: Michigan Department of Transportation.

F. OSHA: Occupational Safety and Health Administration.

G. PSI: Pounds per Square Inch.

H. SDR: Standard Dimension Ratio.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings:
1. Manholes: base sections, riser sections, eccentric and concentric conical top sections, flat slab tops, grade rings with notarized certificating indicating compliance with ASTM C478.
2. Catch basins, storm water inlets, and trench drains: Include plans, elevations, sections, details, frames, covers, and grates.
3. Storm Water Detention Structures: Include plans, elevations, sections, details, inlet and outlet elevations, structures, storage volume capacities, structural load calculations, waterproofing, and material certifications.
4. Storm water management structures and systems, including but not limited to water quality units and detention structures
5. Pipe connections to manholes, catchbasins, structures.
6. Manhole frame and cover and catch basin frame and grate with notarized certificate indicating compliance with the specified ASTM standard and Class designation
7. Adjustable weir plates and fasteners.

C. Manufacturer Certification: All pipe furnished shall be accompanied by the manufacturer's certification.

D. Manufacturer's Performance Certification that shows hydrodynamic separator unit is capable of achieving the specified removal efficiencies per plan and specs.

E. Cut sheets for Contractor layout and staking locations

1.5 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

B. Storm water management – site specific feature installation checklists, signed and approved by the engineer/Owner site representative

1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not store plastic manholes, pipe, and fittings in direct sunlight.

B. Protect pipe, pipe fittings, and seals from dirt and damage.

C. Handle manholes according to manufacturer's written rigging instructions.

D. Handle catch basins and stormwater inlets according to manufacturer's written rigging instructions.

1.7 PROJECT CONDITIONS

A. Interruption of Existing Storm Drainage Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:
   1. Notify Construction Manager and Owner no fewer than seven days in advance of proposed interruption of service.
   2. Do not proceed with interruption of service without Construction Manager's written permission.

PART 2 - PRODUCTS

2.1 PVC PIPE AND FITTINGS

A. Source Limitations: Obtain PVC pipe and fittings from single manufacturer.

B. NSF Marking: Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-drain" for plastic storm drain and "NSF-sewer" for plastic storm sewer piping.

C. PVC Type PSM Sewer Piping:
   1. Pipe: ASTM D3034, SDR 26, PVC Type PSM sewer pipe with bell-and-spigot ends for gasketed joints.
   2. Fittings: ASTM D3034, PVC with bell ends.
   3. Gaskets: ASTM F477, elastomeric seals.

D. Adhesive Primer: ASTM F656.

2.2 HDPE PIPE AND FITTINGS

A. Storm sewer specified as high density polyethylene (HDPE) shall meet the requirements of AASHTO M294.

B. The pipe hall be corrugated with an integrally formed smooth interior. Joints shall be gasketed water tight joints using water tight sleeves. Sleeves shall be factory installed on one end of the pipe with a factory installed gasket on the opposite end of the pipe.

2.3 CONCRETE PIPE AND FITTINGS

A. Reinforced-Concrete Sewer Pipe and Fittings: ASTM C 76, Class IV.
   1. Integral bell-and-spigot ends and gasketed joints with ASTM C 443, rubber O-ring gaskets.
   2. Elliptical pipe shall conform to ASTM C 507.
   3. Cement shall conform to ASTM C 150 for types I and II.
   4. Outside joints shall be provided with cement mortar collar. Inside joints of sewers larger than 36 inches in diameter shall also have the inside joint pointed with mortar.
   5. Lubricants used in joints shall be supplied by the pipe manufacturer and joints shall be coupled in accordance with the manufacturer's requirements.
   6. The following information shall be clearly marked on each length of pipe:
      a. The pipe designation and class.
      b. The name or trademark of the manufacturer.
      c. Identification of the manufacturing plant.
      d. The date of manufacture.
      e. Testing lot number or testing lab stamp.
      f. Reinforced concrete pipe with elliptical reinforcement shall be clearly marked on the inside and the outside opposite walls along the minor axes of the elliptical reinforcing.

2.4 CLEANOUTS

A. Match storm sewer material type. See detail on the plans.

B. Casting: Neenah R-7506-D, EJCO 1574 or Engineer approved equal. Casting shall be stamped with "Storm".

2.5 NONPRESSURE TRANSITION COUPLINGS

A. Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground nonpressure piping. Include ends of same sizes as piping to be joined, and corrosion-resistant-metal tension band and tightening mechanism on each end.

B. Sleeve Materials:
   1. For Concrete Pipes: ASTM C 443, rubber.
   2. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
   3. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

2.6 MANHOLES AND CATCH BASINS

A. Designed Precast Concrete Manholes:
   1. ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for sealant joints.
   2. Diameter: 48 inches minimum unless otherwise indicated.
   3. Ballast: Increase thickness of precast concrete sections or add concrete to base section as required to prevent flotation.
   4. Base Section: 8-inch minimum thickness for floor slab and 4-inch minimum thickness for walls and base riser section, and separate base slab or base section with integral floor.
   5. Riser Sections: 4-inch minimum thickness, and lengths to provide depth indicated.
   6. Top Section: Eccentric-cone type unless concentric-cone or flatslab-top type is indicated, and top of cone of size that matches grade rings.

7. Joint Sealant: ASTM C 443, rubber O-ring gasket, joints pointed with mortar after installation both inside and outside of the manhole.
8. Resilient Pipe Connectors: ASTM C 923, cast or fitted into manhole walls, for each pipe connection. Neoprene rubber shall meet ASTM C 443 and have a minimum thickness of 3/8 inch. Pipe clamps shall be of corrosion-resistant steel. Pipe connectors shall be one of the following:
   a. Flexible neoprene rubber boot securely clamped into a core drilled pipe port. Pipe ports shall be core-drilled at the point of manhole manufacture and shall be accurately located within ½ inch of proposed sewer centerline.
   b. Self-adjusting mechanical pipe to manhole seal providing resilient flexible and infiltration-proof joint.
   c. Flexible rubber wedge firmly secured against a rubber gasket cast into the manhole.
   d. Engineer approved equal.
9. Steps: ASTM C 478 injection molded copolymer, polypropylene, encapsulating a ½ inch grade 60 steel reinforcing bar with an impact resistance of 300 ft-lbs and a pull out force resistance of 1500 lbs; cast or anchor steps into sidewalls at 15-inch intervals. Step depth shall be a minimum of 6 inches.
10. Cut pipe so that it does not extend more than 2" into the manhole and patch water tight inside and outside of pipe insert location.
11. Grade Rings: 2-inch reinforced concrete rings or ASTM C 55 grade N-I concrete bricks, 2-inch minimum and 6-inch maximum height, with diameter matching manhole frame and cover. Interior and exterior of the grade rings and brick shall be pointed with mortar to seal the joints.
12. Aggregate Base: Structure shall be placed on a minimum of 6 inches of 21AA stone bedding.

B. Manhole Frames and Covers:
   1. Description: Include indented top design with lettering cast into cover, using wording equivalent to "STORM SEWER" and cast environmental message "DUMP NO WASTE, DRAINS TO WATERWAYS" Use the following manufacturers and models for each structure type:
      a. Storm Manhole
         1) Frame
            a) NEENAH NF-16422310 HS-25 loading
            b) East Jordan Company, EJCO heavy duty frame for 1040 cover, minimum HS20 loading
         2) Solid Cover
            a) Neenah, R-1642T474, no vent holes, enviro notice
            b) East Jordan Company, EJCO 1040, Type A1, enviro notice
         3) ADA compliant grate
            a) Neenah NF-23703010, Type "Q" grate, enviro notice
            b) East Jordan Company, EJCO 1040 type M3, enviro notice
         4) Grate, Non ADA compliant
            a) Neenah, NF-23703005 Type "Q" grate, enviro notice
            b) East Jordan Company, EJCO 1040 Type M2, enviro notice
         5) Beehive
            a) Neenah, NF-25610011 beehive grate, enviro notice
            b) East Jordan Company, EJCO 1040, Type 02, enviro notice
      b. Storm Catch Basin
         1) 7210, Type M1 grate by East Jordan Company, enviro message
         2) R-3281-A, Type C grate by Neenah, enviro message.
         3) Or Engineer approved equal.
   2. Material: ASTM A 48, Class No. 30, gray iron unless otherwise indicated.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Excavation, trenching, and backfilling are specified in Section 312000 "Earth Moving."

3.2 PIPING INSTALLATION

A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Location and arrangement of piping layout take into account design considerations. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.

B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.

C. Install manholes for changes in direction and grade.

D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited unless deliberate storm water management design.

E. Install gravity-flow, nonpressure drainage piping according to the following:
1. Install piping pitched down in direction of flow.
2. Install piping with manufacturer recommended minimum cover or as indicated on the drawings.
3. Install corrugated steel piping according to ASTM A 798/A 798M.
4. Install corrugated aluminum piping according to ASTM B 788/B 788M.
5. Install ABS sewer piping according to ASTM D 2321 and ASTM F 1668.
6. Install PVC sewer piping according to ASTM D 2321 and ASTM F 1668.
7. Install reinforced-concrete sewer piping according to ASTM C 1479 and ACPA's "Concrete Pipe Installation Manual."

3.3 PIPE JOINT CONSTRUCTION

A. Join gravity-flow, nonpressure drainage piping according to the following:
1. Join corrugated steel sewer piping according to ASTM A 798/A 798M.
2. Join corrugated aluminum sewer piping according to ASTM B 788/B 788M.
3. Join ABS sewer piping according to ASTM D 2321 and ASTM D 2751 for elastomeric-seal joints.
4. Join PVC cellular-core piping according to ASTM D 2321 and ASTM F 891 for solvent-cemented joints.
5. Join PVC sewer piping according to ASTM D 2321 and ASTM D 3034 for elastomeric-seal joints or ASTM D 3034 for elastomeric gasketed joints.
6. Join reinforced-concrete sewer piping according to ACPA's "Concrete Pipe Installation Manual" for rubber-gasketed joints.
7. Join dissimilar pipe materials with nonpressure-type flexible couplings.

3.4 CLEANOUT INSTALLATION

A. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Use cast-iron soil pipe fittings in sewer pipes at branches for cleanouts and cast-iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.

B. Set cleanout frames and covers in earth in cast-in-place concrete block, 6" deep. Set with tops 1-inch above surrounding earth grade.

C. Set cleanout frames and covers in concrete pavement and roads with tops flush with pavement surface.

3.5 MANHOLE AND CATCH BASIN INSTALLATION

A. General: Install manholes, complete with appurtenances and accessories indicated.

B. Install precast concrete manhole sections with sealants according to ASTM C 891.

C. Where specific manhole construction is not indicated, follow manhole manufacturer's written instructions.

D. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. Set tops 3 inches above finished surface elsewhere unless otherwise indicated.

E. Manholes shall be placed at every change in grade, direction and pipe size as well as at junctions of sewers.

F. All sewer connections shall occur at a manhole.

G. Install aggregate base beneath structure prior to placement of structure.

3.6 CONCRETE PLACEMENT

A. Place cast-in-place concrete according to ACI 318.

3.7 CONNECTIONS

A. Connect nonpressure, gravity-flow drainage piping from building with cleanout outside of building.

B. Make connections to existing piping and underground manholes.
   1. Make connections to underground manholes and structures by cutting into existing unit and creating an opening large enough to allow 3 inches of concrete to be packed around entering connection. Cut end of connection pipe passing through pipe or structure wall to conform to shape of and be flush with inside wall unless otherwise indicated. On outside of pipe, manhole, or structure wall, encase entering connection in 6 inches of concrete for minimum length of 12 inches to provide additional support of collar from connection to undisturbed ground.
      a. Use concrete that will attain a minimum 28-day compressive strength of 3000 psi unless otherwise indicated.
      b. Use epoxy-bonding compound as interface between new and existing concrete and piping materials.
   2. Protect existing piping, manholes, and structures to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.
   3. Use nonpressure-type flexible couplings where required to join gravity-flow, nonpressure sewer piping unless otherwise indicated.
      a. Flexible couplings for same or minor difference OD pipes.
      b. Unshielded, increaser/reducer-pattern, flexible couplings for pipes with different OD.
      c. Ring-type flexible couplings for piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.

3.8 CLOSING ABANDONED STORM DRAINAGE SYSTEMS

A. Abandoned Piping: Close open ends of abandoned underground piping indicated to remain in place. Include closures strong enough to withstand hydrostatic and earth pressures that may result after ends of abandoned piping have been closed. Use either procedure below:
   1. Close open ends of piping with at least 8-inch thick, brick masonry bulkheads or Grade S3 concrete.

2. Close open ends of piping with threaded metal caps, plastic plugs, or other acceptable methods suitable for size and type of material being closed. Do not use wood plugs.
3. Fill abandoned pipe with flowable fill.

B. Abandoned Manholes and Structures: Excavate around manholes and structures as required and use one procedure below:
1. Remove entire abandoned structure unless noted to leave in place on the plans. Remove manhole or structure and close open ends of remaining piping.
2. If indicated to abandon structure in place, remove top of manhole or structure down to at least 36 inches below final grade. Fill to within roadway cross section with class II sand. Fill remainder with the roadway or restoration cross section.

C. Backfill to grade according to Section 312000 "Earth Moving."

3.9 IDENTIFICATION

A. Materials and their installation are specified in Section 312000 "Earth Moving." Arrange for installation of green warning tape directly over piping and at outside edge of underground structures.
1. Use detectable warning tape over nonferrous piping and over edges of underground structures.

3.10 FIELD QUALITY CONTROL

A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.
1. Submit separate reports for each system inspection.
2. Defects requiring correction include the following:
a. Alignment: Less than full diameter of inside of pipe is visible between structures.
b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
c. Damage: Crushed, broken, cracked, or otherwise damaged piping.
d. Infiltration: Water leakage into piping.
e. Exfiltration: Water leakage from or around piping.
3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
4. Re-inspect and repeat procedure until results are satisfactory.

B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.
1. Do not enclose, cover, or put into service before inspection and approval.
2. Test completed piping systems according to requirements of authorities having jurisdiction.
3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
4. Submit separate report for each test.
5. Gravity-Flow Storm Drainage Piping: Test according to requirements of authorities having jurisdiction, UNI-B-6, and the following:
a. Exception: Piping with soil tight joints unless required by authorities having jurisdiction.

C. Mandrel Testing
1. All PVC and HDPE storm sewers shall be mandrel tested for deflection by the Contractor.
2. The mandrel shall be a commercially produced, nine fin mandrel, with the pipe diameter, percent deflection and applicable ASTM or ASHTO standard fins.
3. The testing is to take place after the sewers have been in place for a minimum of 30 days. Allow time for corrective action.
4. The mandrel shall be pulled from structure to structure. Any portion of the pipe through which the mandrel passes freely shall be deemed to have passed the mandrel test.

Sections of pipe through which the mandrel does not pass freely shall be exposed and examined and corrected.

5. The mandrel is to be construction in accordance with the following table. The mandrel shall meet the following schedule of sizing:

Pipe I.D.	HDPE Mandrel P.D.	PVC Mandrel O.D.
8"	7.54"	7.28"
10"	9.41"	N/A
12"	11.54"	N/A
15"	14.27"	N/A
18"	17.24"	N/A
24"	23.18"	N/A

D. Television Inspection
1. Television inspection shall follow MDOT Requirements. Television inspection is not required for extensions of existing catch basin leads less than 20 feet. Allow time for corrective action.
2. All sewer lines shall be thoroughly cleaned prior to television inspection.
3. Television inspection shall consist of wetting the invert of the section by pouring clean water in the upstream manhole until it appears in the downstream manhole, and then, after the water has stopped flowing, passing a camera through the section.
4. The camera shall be connected to a monitor and video tape recorder. The tape shall indicate the date, the section tested and the actual distance from the beginning manhole to each tee or wye, and each visible defect. The tape shall be furnished to the Owner's representative.

E. Sewer Repairs
1. If a sewer repair is required as a result of damaged during construction operations or fails mandrel or television inspection, the Contractor shall expose the sewer pipe and perform the required correction(s).
2. If the repair is required due to the pipe being out of alignment or off grade, the pipe shall be adjusted so as to be placed in proper alignment and grade. Dense graded aggregate material shall be carefully placed under the haunches of the realigned pipe and compacted by the use of a tee bar.
3. If the pipe cannot be satisfactorily realigned or an open joint reset; of if the pipe is cracked, broken, or permanently deflected, the affected pipe shall be removed and replaced with the same pipe material. The pipe to be removed is to be sawed on each side of the damaged section in a neat and workmanlike manner without damage to the adjacent pipe. The replacement pipe section shall fit flush to the remaining pipe at each end. These sawed joints shall be coupled using a Fernco flexible coupling and stainless steel ring. These joints shall be encased to the pipe centerline with concrete one foot on either side of the flexible coupling.

3.11 CLEANING

A. Clean interior of piping of dirt and superfluous materials. Flush with potable water.

END OF SECTION 33 4100

APPENDIX A
for
SUPPLEMENTAL GENERAL CONDITIONS

STANLEY PARK IMPROVEMENTS

B R i
Beckett&Raeder

SUPPLEMENTAL GENERAL CONDITIONS

1. Overview

   A. All requirements contained in the *SUPPLEMENTAL GENERAL CONDITIONS* shall take precedence over conflicting information found elsewhere in the *SPECIFICATIONS*.

2. Bonds

   A. In addition to the Performance Bond and Labor and Materials Bond required in the Standard General Conditions of the Construction Contract, Contractor shall provide a Maintenance and Guarantee Bond payable to the Owner in an amount equal to 100 percent of the Contract Price for a period of one year.

3. Insurance Requirements

   A. Prior to commencement of the Work, the Contractor shall purchase and maintain during the term of the project such insurance as will protect him, the Owner and the Landscape Architect/Engineer from claims arising out of the Work described in this Contract and performed by the Contractor, Subcontractor(s) or Sub-subcontractor(s) consisting of:

      1. Workers Compensation Insurance including Employer's Liability to cover employee injuries or disease compensable under the Worker's Compensation Statutes of the states in which work is conducted under this Contract; disability benefit laws, if any; or Federal compensation acts such as US Longshoremen or Harbor Worker's, Maritime Employment, or Railroad Compensation Act(s), if applicable. Self-insurance plans approved by the regulatory authorities in the state in which work on this project is performed are acceptable.

      2. A Comprehensive General Liability policy to cover bodily injury to persons other than employees and for damage to tangible property, including loss of use thereof, including the following exposure:

         a. All premises and operations.
         b. Explosion, collapse and underground damage.
         c. Contractor's Protective coverage for independent contractors or subcontractors employed by him.
         d. Contractual Liability for the obligation assumed in the Indemnification or Hold Harmless agreement found in Paragraph 6.20 of the Standard General Conditions of the Construction Contract.
         e. The usual Personal Injury Liability endorsement with no exclusions pertaining to employment.
         f. Products and Completed Operations coverage. This coverage shall extend through the contract guarantee period.

      3. A Comprehensive Automobile Liability policy to cover bodily injury and property damage arising out of the ownership, maintenance or use of any motor vehicle, including owned, non-owned and hired vehicles. In light of standard policy provisions concerning (a) loading and unloading and (b) definitions pertaining to motor vehicles licensed for road use vs. unlicensed or self-propelled construction equipment, it is strongly recommended that the Comprehensive General Liability and the Comprehensive Auto Liability be written by the same insurance carrier, though not necessarily one policy.

4. The Contractor will purchase for the Owner an Owner's Protective Liability policy to protect the Owner, the Landscape Architect/Engineer, their consultants, agents, employees, and such public corporations in whose jurisdiction the work is located for their contingent liability for work performed by the Contractor, the Subcontractor(s) or the Sub-subcontractor(s) under the Contract.

5. The Contractor shall purchase a Builder's Risk-Installation Floater in a form acceptable to the Owner covering property of the project for full cost of replacement as of the time of any loss which shall include, as named insureds, (a) the Contractor, (b) all Subcontractors, (c) all Sub-subcontractors, (d) the Owner, (e) the Landscape Architect/Engineer, (f) the Landscape Architect/Engineer's subconsultants, and their respective interests may provide to be at the time of loss, covering insurable property which is the subject of this contract, whether in place, stored at the job site, stored elsewhere, or in transit at the risk of the insured(s). Coverage shall be effected on an "ALL RISK" form including, but not limited to, the perils of fire, wind, vandalism, collapse, theft, and earthquake, with exclusions normal to cover.

6. Umbrella or Excess Liability: The Owner or its representative may, for certain projects, require limits higher than those stated in the following paragraphs. The Contractor is granted the option of arranging coverage under a single policy for the full limit required or by a combination of underlying policies with the balance provided by an Excess or Umbrella Liability policy equal to the total limit(s) requested. Umbrella or Excess policy working shall be at least as broad as the primary or underlying policy(ies) and shall apply both to the Contractor's general liability and to his automobile liability insurance.

B. Limits of Liability: The required limits of liability for insurance coverages shall be not less than the following:

1.	Workers Compensation	
	Coverage A – Compensation	1,000,000.00
	Coverage B – Employer's Liability	1,000,000.00
2.	Comprehensive General Liability	
	Bodily Injury – Each occurrence	2,000,000.00
	Bodily Injury – Aggregate (Completed Operations)	2,000,000.00
	Property Damage – Each occurrence	1,000,000.00
	Property Damage – Aggregate	2,000,000.00
	or Combined Single Limit	2,000,000.00
3.	Comprehensive Automobile Liability	
	Bodily Injury	2,000,000.00
	Property Damage	1,000,000.00
	Or Combined Single Limit	2,000,000.00
4.	Owner's Protective	
	Bodily Injury – Each occurrence	2,000,000.00
	Property Damage – Each occurrence	1,000,000.00
	Property Damage – Aggregate	1,000,000.00
	or Combined Single Limit	2,000,000.00
5.	Builder's Risk – Installation Floater	Cost to Replace At Time of Loss

6. Umbrella or Excess Liability 2,000,000.00

C. Other Requirements

1. Notice of Cancellation or Intent Not to Renew: Policies will be endorsed to provide that at least 30 days written notice shall be given to the Owner and to the Landscape Architect/Engineer of cancellation or of intent not to renew.

2. Evidence of Coverage: Prior to commencement of Work, the Contractor shall furnish to the Owner four (4) Certificates of Insurance. The Owner reserves the right to request complete copies of policies it deemed necessary to ascertain details of coverage not provided by the certificates. Such policy copies shall be "Originally Signed Copies" and so designated.

D. Insurance Required for the Contractor

1. Worker's Compensation and Employer's Liability Comprehensive General Liability including:

   a. All premises and operations.
   b. Explosion, collapse and underground damage.
   c. Contractor's Protective.
   d. Contractual Liability for obligations assumed in the Indemnification or Hold Harmless agreement found in Paragraph 6.20 of the Standard General Conditions of the Construction Contract.
   e. Personal Injury Liability.
   f. Products and Completed Operations.

2. Comprehensive Automobile Liability including owned, non-owned and hired vehicles.

3. Umbrella or Excess Liability.

E. Insurance Required for the Owner

1. Owners' Protective Liability which names as insured the Owner, the Landscape Architect/Engineer, their consultants, agents, and employees and such public corporations in whose jurisdiction the work is located.

2. Additional Insured:

   a. Beckett & Raeder, Inc.
   b. SDI - Structures
   c. White Lake Township

F. Insurance Required for the Contractor and the Owner

1. Builder's Risk – Installation Floater which names as insured(s) the Owner, Landscape Architect/Engineer, their consultants, agents, and employees, the Contractor and all Subcontractors.

G. Qualification of Insurers

1. In order to determine financial strength and reputation of insurance carriers, all companies providing the coverage required shall be licensed or approved by the Insurance

Bureau of the State of Michigan and shall have a financial rating not lower than X1 and a policyholder's service rating no lower than B+ as listed in A.M. Best's Key Rating Guide, current edition. Companies with ratings lower than B+:X1 will be acceptable only upon written consent of the Owner.

H. Delete Paragraph 5.06 of the Standard General Conditions of the Construction Contract.

4. Discrimination Clause

A. In connection with the performance of services to be provided, the Contractor agrees to comply with the provisions of the Elliott-Larsen Civil Rights Act, Public Act- (MCL 37.2101 – 37.2804), the Persons With Disabilities Civil Rights Act (MCL 37.1101 – 37.1607 and specifically agrees not to discriminate against any individual, employee or applicant for employment with respect to hire, tenure, terms conditions, or privileges of employment because of a handicap that is unrelated to the individual's ability to perform the duties of a particular job position, or because of race, color, religion, national origin, age, sex, height, weight, or marital status. Breach of this covenant may be regarded as a material breach of this agreement.

- END OF SUPPLEMENTAL GENERAL CONDITIONS -

APPENDIX B
for
USFS
BIOLOGICAL OPINION

STANLEY PARK
IMPROVEMENTS

B R i
Beckett&Raeder

United States Department of the Interior

FISH AND WILDLIFE SERVICE

2651 Coolidge Road, Suite 101
East Lansing, Michigan 48823-6360

August 8, 2022

Mr. Brandon Pace
National Park Service
601 Riverfront Drive
Omaha, ME 68102

Re: Formal Section 7 Consultation and Biological Opinion on the Stanley Park Development Project– Ecosphere Log # 2022-0020352

Dear Mr. Pace:

This letter transmits the U.S. Fish and Wildlife Service's Biological Opinion for the Stanley Park Development Project, in accordance with Section 7 of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 et seq.). This project is being funded through the National Park Service Land and Water Conservation Fund, and National Park Service is serving as the lead agency for formal consultation. The National Park Service determined that the proposed actions were "Likely to Adversely Affect" eastern massasauga rattlesnake (*Sistrurus catenatus,* EMR).

We base the enclosed Biological Opinion on information provided in your Biological Assessment for the Stanley Park Development Project, dated July 29, 2022. Other sources of information include meetings, a site visit, telephone and virtual conversations, and e-mails. A complete administrative record of this consultation is on file at the Service's Michigan Ecological Services Field Office.

Indiana and Northern-long eared bats

You determined that this project is not likely to adversely affect both Indiana bats and northern long-eared bats. We concur with this determination for the following reasons:

- Only selective tree and vegetation removal will occur along the driveway alignment to accommodate the driveway and associated grading. Approximately 30-40 canopy trees will be removed for the proposed driveway alignment.
- Preparatory tree and vegetation removals for Phase 1 construction will occur in the inactive season between November 2022 and March 2023.
- For long-term property management, non-emergency tree removals and maintenance will also occur in inactive seasons between November and March.

Based on this information, we expect any potential effects from this project on NLEB to be discountable.

Species Likely To Be Adversely Affected By the Proposed Action

Eastern Massasauga Rattlesnake
After considering the current overall stable range-wide status of EMR and the condition of the species within the action area (environmental baseline), we assessed the effects of the proposed action and the potential for cumulative effects in the action area on individuals, populations, and the species as a whole. As stated in the Jeopardy Analysis, we do not anticipate any long-term reductions in the overall reproduction, numbers, and distribution of EMR. It is our Opinion that the Stanley Park Development Project, as proposed, is not likely to jeopardize the continued existence of EMR.

With respect to the Act's compliance, all aspects of the project description are binding. Reasonable and Prudent Measures and the accompanying Terms and Conditions provided within the enclosed Biological Opinion are nondiscretionary and are designed to minimize incidental take of listed species.

We appreciate the opportunity to cooperate with the U.S. Fish and Wildlife Service in conserving endangered species. If you have any questions, please contact Michelle Kane of this office at 517-351-5350 or michelle_kane@fws.gov.

Sincerely,

SCOTT HICKS

Digitally signed by SCOTT HICKS
Date: 2022.08.08 16:05:24 -04'00'

Scott Hicks
Field Supervisor

cc: Christie Bayus, MDNR, Lansing, MI
Justin Quagliata, White Lake Township, White Lake, MI
Brian Barrick, Beckett & Raeder, Inc., Ann Arbor, MI
Amy Bleisch, MDNR, Wildlife Division, Lansing, MI

BIOLOGICAL OPINION

Effects to the Eastern Massasauga (*Sistrurus catenatus*), from Stanley Park Development, White Lake Township

Prepared by:
U.S. Fish and Wildlife Service
Michigan Ecological Services Field Office
East Lansing, MI

Ecosphere Log # 2022-0020352

August 8, 2022

Table of Contents

INTRODUCTION

This document transmits the US Fish and Wildlife Service's (USFWS) Ecological Services Program's Biological Opinion based on our review of the National Park Service (NPS) proposed improvements to Stanley Park in White Lake Township, and the project's effects on the eastern massasauga rattlesnake (*Sistrurus catenatus,* EMR) in accordance with Section 7(a)(2) of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531 *et seq.*). NPS determined that the proposed project was "likely to adversely affect" EMR. In addition, NPS has concluded this project is "not likely to adversely affect" Indiana bat and northern long-eared bat.

This project is being funded through the NPS Land and Water Conservation Fund. NPS is serving as the lead agency for formal consultation. Michigan Department of Natural Resources (DNR) has been designated as the non-federal representative for NPS. White Lake Township is the award recipient and project manager. Beckett&Raeder, Inc. are serving as consultants for White Lake Township.

This Opinion is based on information provided in the biological assessment received on July 29, 2022 and additional information provided by the NPS, DNR, White Lake Township, and Beckett&Raeder. Other sources of information include meetings, a site visit, telephone and virtual conversations, and e-mails. A complete administrative record of this consultation is on file at the USFWS Michigan Ecological Services Field Office.

Consultation History

- March 16, 2022 – Beckett&Raeder used the All-Species Michigan Determination Key in IPaC to assess potential project effects to listed species.
- March 18, 2022 – An initial meeting was held between USFWS, Beckett&Raeder, and White Lake Township to discuss the project and next steps in the consultation process.
- March 31, 2022 – A meeting was held with USFWS, NPS, DNR, Beckett&Raeder, and White Lake Township to discuss the project and the consultation process.
- May 17, 2022 – A site visit was conducted by USFWS, DNR, Beckett&Raeder, and White Lake Township to gain a better understanding of the project and assess potential EMR habitat at the site.
- May 31, 2022 – Beckett&Raeder delivered an informal draft of the Biological Assessment (BA) to USFWS for technical assistance.
- June 16, 2022 – USFWS returned the informal draft BA with comments.
- July 5, 2022 – USFWS provided more information to DNR about designated non-federal representatives and their role in the formal consultation process.
- July 29, 2022 – USFWS received the Designation of Authority Letter and the formal submission of the BA from NPS.
- August 1, 2022 – USFWS acknowledged receipt of the request for consultation and the log number 2022-0020352 was assigned to the consultation.
- August 8, 2022 – A final Biological Opinion was delivered to NPS, DNR, White Lake Township, and Beckett&Raeder.

BIOLOGICAL OPINION

DESCRIPTION OF THE PROPOSED ACTION

As defined in the ESA Section 7 regulations (50 CFR 402.02), "action" means "all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by Federal agencies in the United States or upon the high seas." The "action area" is defined as "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action." The direct and indirect effects of the actions and activities must be considered in conjunction with the effects of other past and present Federal, State, or private activities, as well as the cumulative effects of reasonably certain future State or private activities within the action area.

Proposed Action

White Lake Township is proposing to improve a former RV campground for use as a public day-use park. The development of the park is being funded through the NPS Land and Water Conservation Fund. Park improvements include a vehicular driveway, parking areas, non-motorized pathways, a fishing pier, and park amenities including benches, exercise stations, and interpretive signs. The existing two-track through the park will be widened and realigned to allow motor vehicle traffic into the park. Concrete curb and gutter and bituminous pavement will be utilized for the road in the upper portion of the park. The road and driveways in the lower portion of the park will be gravel, except where bituminous pavement will be used at the turnaround circle and where required for accessible parking spaces (Figure 1). Timber bollard posts will be used to confine vehicular traffic. The park speed limit will be 15 mph. Non-motorized pathways were designed to minimize impacts to natural features. Pathways will be bituminous pavement in upland areas and wooden boardwalk in wetland areas. Where the non-motorized pathway meets Brendel Lake, a deteriorating concrete boat ramp will be removed, and an accessible fishing pier will be constructed in the same location. No hydrologic impacts are expected as part of this project. Stormwater from developed areas will be managed with vegetated bioswales. Existing conveyance connections at roads and trails will be improved with open bottom culverts. The former campground maintained the open area of the property as lawn areas with scattered trees, and White Lake Township has continued this maintenance since obtaining the property. White Lake Township plans to continue this maintenance by mowing turf grass weekly or bi-weekly to a height of less than six inches.

Preparatory removal of 1.5 acres of vegetation and 30-40 canopy trees will occur between November 2022 and March 2023, and park construction is expected to occur in Summer 2023. To minimize site disturbance, construction staging will occur in an open, upland location immediately adjacent to the Elizabeth Lake Road entrance. Moderately sized heavy equipment will be used for the project, including, but not limited to, dump trucks, tracked bulldozers, tracked excavators, wheeled compactors, and bituminous pavers. Heavy equipment and soil disturbance will be limited to the proposed road and non-motorized pathway alignments and their associated grading limits. Grading limits vary based on adjacent topography but will be limited to the minimum possible distance. Wildlife exclusion fencing will be installed at the perimeter of the disturbance area, and properly removed after project completion. Approximately 0.2 acres of wetland will be impacted by fill for the road and pier/foundation installation for the wooden boardwalks.

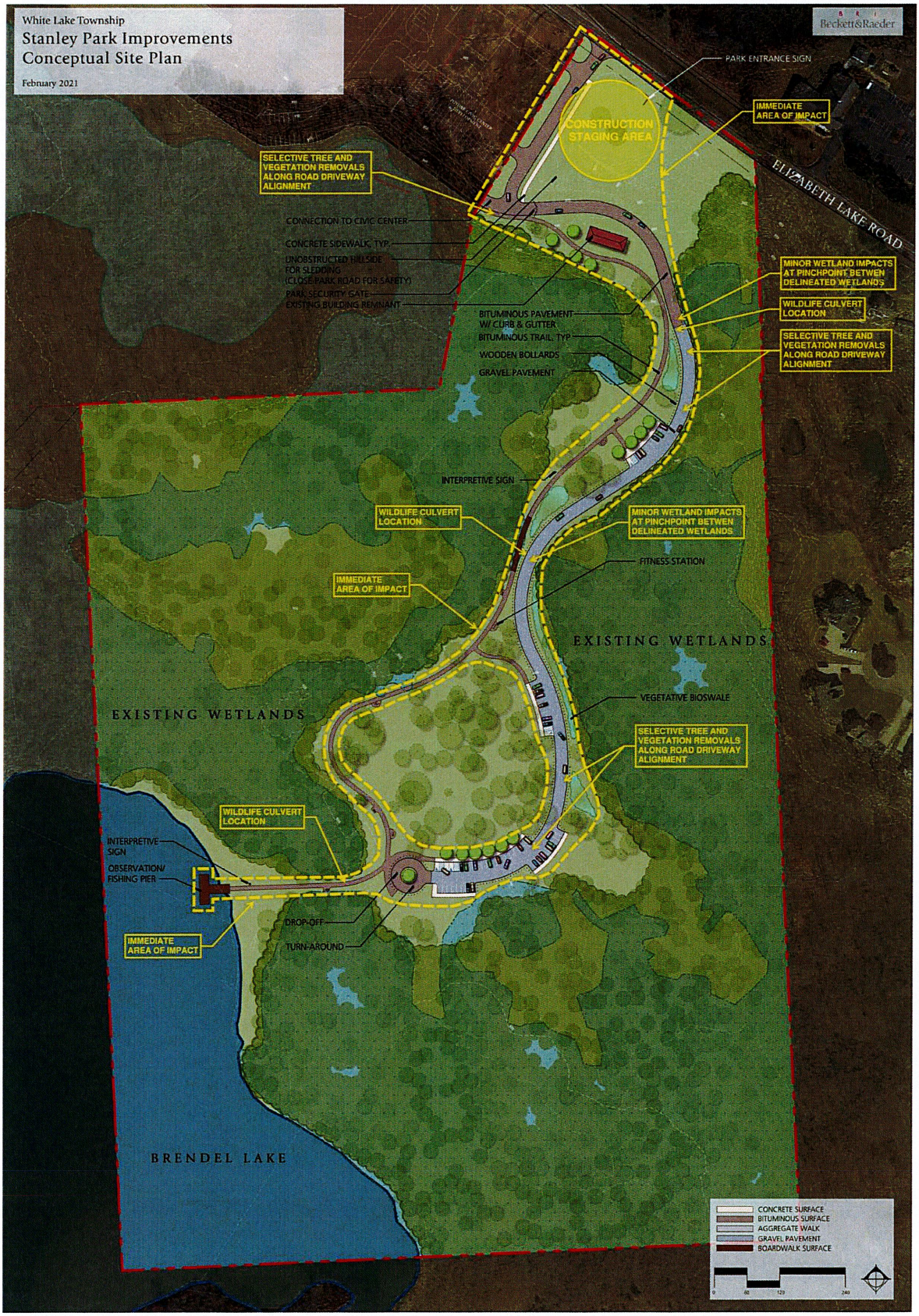


Figure 1. Stanley Park Conceptual Site Plan prepared by Beckett&Raeder

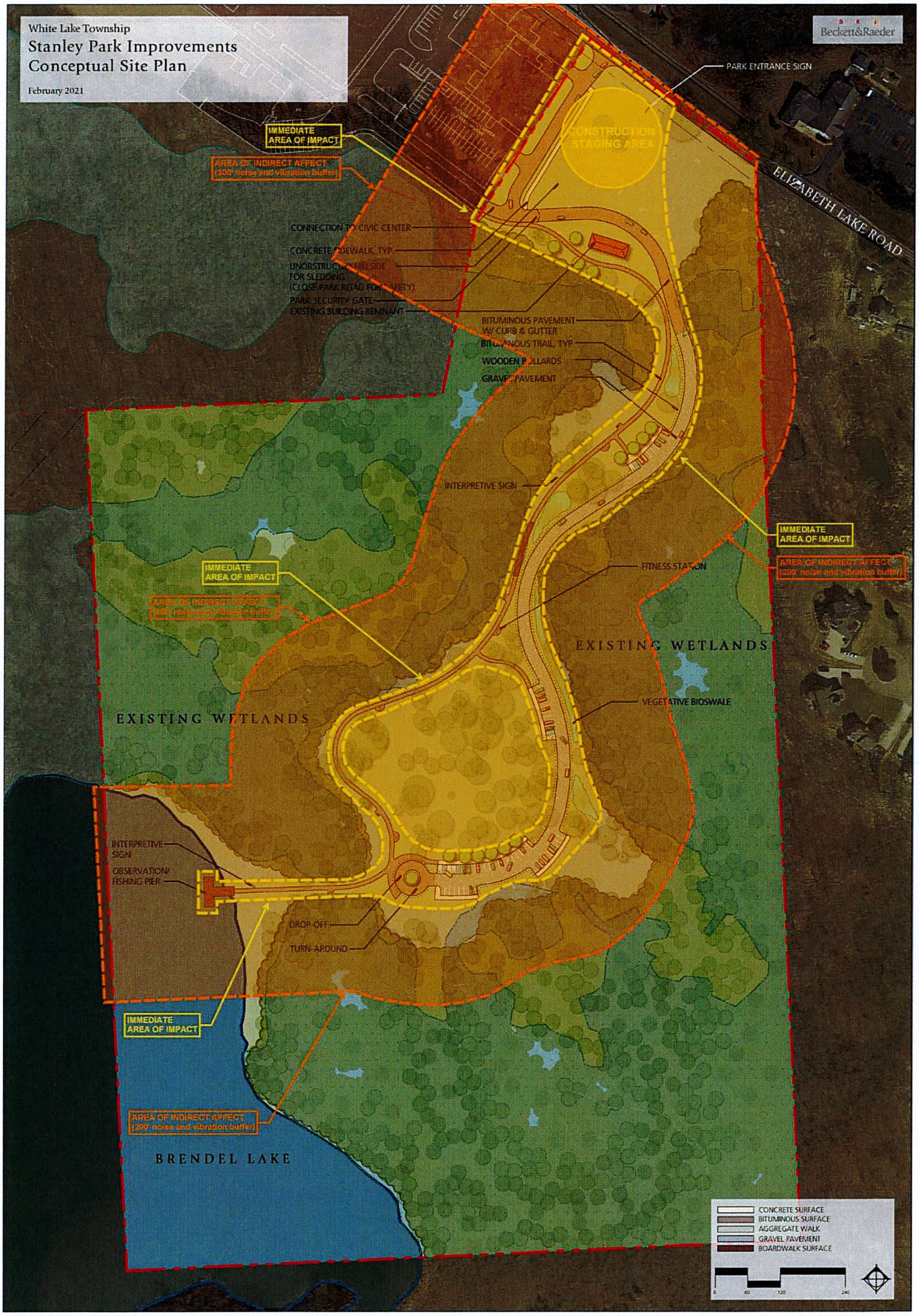


Figure 2. Stanley Park Action Area, prepared by Beckett&Raeder

Action Area

The Action Area is defined (50 CFR 402.02) as "all areas to be affected directly or indirectly by the federal action and not merely the immediate area involved in the action."

Stanley Park is located at 10785 Elizabeth Lake Rd, White Lake Charter Township, MI 48386. The property consists of forests and forested wetlands along the eastern side of Brendel Lake. The site contains a large open area that was previously used as a campground. Construction is mainly concentrated in this open area. Indirect effects from the sound and vibration of heavy equipment, earthmoving, and recreational use are expected within a 200 ft buffer of the construction area (Figure 2).

Conservation Measures

Conservation measures are those actions taken to benefit or promote the recovery of the species. Several conservation measures will be used to minimize adverse effects to EMR. These include:

- Construction will take place during the summer, well within the active season of EMR (approximately April 15th – October 15th), to prevent ground disturbing activities harming EMR while in hibernacula.
- During construction, wildlife exclusion fencing will be installed at the perimeter of the disturbance area to minimize the risks to EMR. Fencing will be installed as follows:
    - When installing the exclusionary fencing, care will be taken to avoid crayfish and small mammal burrows.
    - When possible, exclusionary fence will be installed at least 24 hours before starting construction.
    - Prior to the installation of exclusionary fencing, the area will be searched for EMR to ensure that individuals will not be trapped within the fence.
    - The work area (i.e., interior of exclusionary fencing) will be cleared of EMR to ensure none are trapped in the work area prior to beginning construction activities.
    - If any EMR are observed within the exclusionary fencing, work will halt until the snake can be safely relocated by a qualified individual and the fence examined for breaches. For more information on how to safely move snakes, watch DNR's "60-Second Snakes: Snake Removal" video or call a trained wildlife removal company for assistance.
    - The integrity of the exclusionary fencing will be ensured throughout the duration of construction activities and breaches of the barrier will be repaired promptly.
    - The exclusionary fencing will be properly removed after completion of construction, once soils are stable.
- Fill will be sourced on site to avoid spreading invasive plant species that do not already exist at the site. The applicant will continue or increase current efforts to control invasive plant species at the site.
- To increase human safety and awareness of EMR, construction personnel will review the species fact sheet or watch DNR's "60-Second Snakes: The Eastern Massasauga Rattlesnake" video.
- Only wildlife-safe soil erosion and sedimentation control materials that do not contain plastic mesh netting will be used at the site. Several products for soil erosion and control

exist that do not contain plastic netting including net-less erosion control blankets (for example, made of excelsior), loose mulch, hydraulic mulch, soil binders, unreinforced silt fences, and straw bales. Others are made from natural fibers (such as jute) and loosely woven together in a manner that allows wildlife to wiggle free.

- Open-bottom culverts will be used in three locations to connect existing wetlands and facilitate unobstructed wildlife passage beneath the road and pathways. To encourage wildlife use:
    - Culvert length will be minimized,
    - Culverts will be broken into separate segments for the road and pathways, and
    - Native vegetation will be restored at the ends of the culverts for continuity with adjacent wetlands.
- Motor vehicle speeds in the park will be limited to 15 mph, to reduce the potential of a park visitor accidently striking an EMR with a vehicle.
- To reduce the potential of striking an EMR with a mower and reduce potential negative interactions with park visitors, the open areas of the park will continue to be maintained as a lawn area, with grass less than six inches.
- An interpretive sign will be placed in the park informing park guests about the potential presence of EMR on the property and their protected status.
- During project implementation, personnel will report sightings of any federally listed species, including EMR, to USFWS within 24 hours at (517) 351-2555 and EastLansing@fws.gov.

To prevent adverse effects to Indiana bat (*Myotis sodalis*) or northern long-eared bat (*Myotis septentrionalis*) during construction, tree clearing will take place from November 2022 to March 2023, during the inactive season for both species. Based on this information, we expect any potential effects from this project on Indiana bat and northern long-eared bat to be insignificant. The applicant used the Michigan All-Species Determination key to evaluate this project and made "not likely to adversely affect" determinations for both bat species on March 16, 2022.

STATUS OF THE SPECIES

Pursuant to the ESA section 7 regulations (50 CFR 402.14(g)(2)), it is USFWS's responsibility to "evaluate the current status of the listed species or critical habitat." The USFWS listed EMR as threatened on September 30, 2016 (81 FR 67193-67214). The following is a summary of EMR general life history drawn from the recovery plan, species status assessment, unpublished reports, literature, and expert opinion. For a more detailed account of the species description, life history, population dynamics, threats, and conservation needs, refer to the final rule (81 FR 67193-67214), the EMR Species Status Assessment (Szymanski et al. 2016), and https://www.fws.gov/species/massasauga-sistrurus-catenatus.

Description of the Species

The EMR is a small, heavy-bodied snake with a heart-shaped head and vertical pupils. The average length of an adult is approximately 0.6 m (two ft), with a maximum length of approximately one m (three ft). Adult EMRs are most often gray or light brown with large, light-edged chocolate brown to black blotches on the back and smaller blotches on the sides, though in some areas, including southeast Michigan, significant numbers of individuals in populations may be nearly or completely black in color. The belly is marbled dark gray or black and there are

brown stripes on the sides of the head, each of these bordered by a narrow, white stripe. Its tail has several dark brown rings and is tipped by gray-yellow keratinized rattles.

As a pit viper, this species has an extrasensory "pit" located on each side of the head between the eyes and nares. These pits allow thermal sensing of the environment, potential prey, and other objects.

Young snakes have the same markings as adults, but are paler, and have bright yellow tails that darken in color as age progresses. Until the first time the neonates (newborns) shed their skin, the rattle is represented by a single "pre-button" and between the first and second time they shed, the rattle is represented by a complete terminal segment called a "button."

Compared to other venomous snakes, EMR is not threatening and to protect themselves, individual snakes rely on their cryptic coloration to keep them hidden as opposed to aggressive attack (Kingsbury 2002). Individuals typically do not rattle, strike, or even move unless they are physically disturbed (Kingsbury 2002). EMR is considered non-aggressive (Bielema 1973).

General Habitat Requisites

EMR have been found in a variety of wetland habitat types across their range, including bogs, fens, shrub swamps, wet meadows, marshes, moist grasslands, wet prairies, peatlands, coniferous forests, and floodplain forests (Minton 1972; Seigel 1986; Hallock 1991; Weatherhead and Prior 1992; Johnson 1995; Kingsbury 1996; Harding 1997; Sage 2005). At many locations, EMR also move from wetlands to drier upland sites during certain parts of the year to forage, disperse, gestate, and even hibernate in some cases (Reinert and Kodrich 1982; Seigel 1986; Weatherhead and Prior 1992; Johnson 1995; King 1997; Bissell 2006). Suitable upland habitat types range from forest edges and openings, savannahs, and prairies to meadows, old fields, and some agricultural lands.

During the active season, EMR need highly intermixed and interspersed opportunities to bask and retreat from sun, hide from predators, attack prey without a chase, find mates, and travel to and from hibernacula seasonally through corridors that lack lethal barriers. EMR are more sedentary than other snakes and they also move more slowly, which increases the probability of being killed while crossing roads (Andrews and Gibbons 2005).

During the winter months, EMR occupy hibernacula that include existing features, such as crayfish burrows. Consistent hydrology at EMR sites is important in maintaining conditions that support their over-winter survival. To survive the winter, each individual EMR requires a suitable hibernation site which is critical to avoid lethally low temperatures and reduce the risk of desiccation (Reinert and Kodrich 1982). Consequently, hibernation sites must provide insulated and moist subterranean spaces below the frost line where individuals can avoid freezing and dehydration (Sage 2005). Most EMRs will either return to the same hibernacula annually (Johnson et al. 2000) or to an area within roughly 100 m (328 ft) of their previous hibernation site (Sage 2005; Harvey and Weatherhead 2006).

These hibernation sites can occur in wetland, wetland edges, wet prairie, closed canopy forests with mossy substrates (DeGregorio 2008), wet grassland, and sedge meadow (Mauger and Wilson 1999). Across its range, EMRs have been reported to hibernate for up to six months of the year, and have used crayfish burrows, mammal burrows, rocky crevices, rodent holes, hummocks, old stumps, rotten logs, and tree and shrub root systems (Wright 1941; Johnson 1995; Johnson and Leopold 1998; Mauger and Wilson 1999; McCumber and Hay 2003; Dreslik 2005; Sage 2005; Harvey and Weatherhead 2006) or any excavation that reaches the water table

(Reinert 1978). In Michigan, hibernacula are often found along wetland edges, in areas with seasonally high-water tables that are near, but not at the surface (Sage 2005).

The EMR occupies a variety of ecologically distinct habitats (e.g., prairie, bog, fen, open woods). Each habitat supports different prey communities, and thus, habitat drives a shift in prey species for the EMR. Diet may be stable over short periods of time (one year) but highly variable among years and populations across the range of the EMR. The importance of specific prey items varies by population (Chiucchi 2011). In Grayling, Michigan, researchers observed the opportunistic and diverse diet of adult EMR who had foraged a variety of items including an American red squirrel, an adult eastern garter snake, two northern red-bellied snakes, a nestling brown thrasher, and a mostly digested small murid mammal (Tetzlaff et al. 2015).

Home Range and Microhabitat Requirements

Individual EMRs require open, sunny areas, intermixed with shaded areas, that provide thermoregulation (basking sites), abundant and available prey (foraging sites), the ability to escape both temperature extremes and predators (retreat sites), presence of the water table near the surface for hibernation (hibernation sites), and connectivity between each of these habitats.

Particular plant species or soils within EMR habitat do not seem to be as important as the structure of the habitat (Beltz 1993). Preferred habitats tend to have a generally open vegetative/shrub structure, where trees and shrubs are thinly distributed, relative to surrounding areas (Johnson et al. 2000). This open vegetative structure provides the desirable thermoregulatory areas, increases prey densities for the snakes by enhancing the growth of sedges and grasses (Johnson et al. 2000), and provides retreat sites. Regardless of the season, all EMR habitats include sunny and shaded areas, and an open vegetative or early successional structure (Beltz 1993; Reinert and Kodrich 1982; Johnson et al. 2000).

The actual size of a habitat patch that is needed to support an EMR population depends upon the quality and distance between microhabitats, life stage and reproductive condition, and availability of basking sites, hibernation sites, gestation sites, prey, and mates (Johnson et al. 2000). For example, neonate EMRs have smaller movement patterns than adults and shorter distances traveled (Jellen and Kowalski 2007). For these reasons, movement and resource use varies within and among populations. Indeed, studies have documented home range sizes for EMRs varies from 1.0 ha (2.5 ac) to 136 ha (336.1 ac) (Reinert and Kodrich 1982; Weatherhead and Prior 1992; King 1999; Mauger and Wilson 1999; Johnson 2000; Dreslik 2005; Bissell 2006; Marshall et al. 2006; Moore and Gillingham 2006; Durbian et al. 2008; DeGregorio et al. 2011). Movement patterns in Michigan varied considerably between Indian Springs (southern Michigan) and Camp Grayling (northern Michigan), with respective seasonal range estimates of approximately five ha and 19 ha (Sage et al. 2006). Generally speaking, the larger the habitat patch size, the larger the population that can be supported.

Requirement for Connectivity between Microhabitats

EMR need corridors between microhabitats (basking sites, retreat sites, and foraging areas) and between seasonal habitats. EMRs can traverse corridors most successfully (reduced likelihood of mortality) between habits when there are no barriers such as roads, rivers, or anything else that can act as a barrier to snake movement. The absence of roads is an important criterion because

roads are a strong barrier to EMR movement due to road mortality (Shepard et al. 2008a; Shepard et al. 2008b; Choquette 2011; Choquette and Valliant 2016) or road avoidance behavior.

Connectivity between the active season (summer) habitat and inactive season (winter) habitat is crucial for the population sustainability. Similarly, when temperatures shift the snakes must have the unimpeded ability to either access or retreat to a particular (summer or winter) habitat. EMR populations require access to connected habitats where they are not subject to road mortality while traversing from one habitat to the other.

Habitat Requirements for Successful Reproduction

Male EMR may exhibit prolonged periods of mate searching, longer daily movements, and defensive female polygyny during the mating season (Johnson 2000; Jellen 2005). Males may use chemical cues to simultaneously trail and pursue individual females during the mating season (Johnson 1989). Because mature male EMRs often occur in higher numbers than receptive females, competition for mates can be intense.

Thermoregulation is so important to gravid female EMR that they spend the majority of the gestation period within open-canopy areas (Reinert and Kodrich 1982). This type of habitat has significantly higher mean soil temperature than early to mid-successional wetlands (Foster et al. 2009). Depending on the location of the population, gestation habitat of gravid female EMRs could be rock outcroppings, open grassland, shoreline, sedge meadow, barrens, or any suitable land characteristic that provides the snake the ability to thermoregulate and avoid predators.

Usually, gravid females will remain near their winter hibernacula until parturition in late July or early August and then move to other foraging locations (Johnson 1995; Marshall et al. 2006). Foster et al. (2009) identified "the importance of accessible early/mid-successional upland areas adjacent to wetlands for the reproductive success of EMR. This vegetation type apparently provides gravid females with favorable thermal conditions, which ultimately may enhance EMR productivity."

Local gestation sites may be used by several females in a given season and appear to be used by the same individuals in successive breeding years. While at their chosen gestation sites, gravid female snakes generally engage exclusively in basking behavior, forfeiting opportunities for other essential behaviors such as feeding (Keenlyne and Beer 1973; Weatherhead and Prior 1992; Marshall et al. 2006). Since gravid females feed very little, if at all, it appears that they maintain themselves on reserved body energy (fat) throughout their pregnancies (Keenlyne and Beer 1973). In the fall, gravid females continue to thermoregulate more than males or non-gravid female snakes, despite giving birth in late summer (Harvey et al. 2014).

Distribution and Abundance

EMR historically occupied sections of Western New York, Western Pennsylvania, Southeastern Ontario, the Upper and Lower Peninsulas of Michigan, the northern two thirds of Ohio and Indiana, the northern three quarters of Illinois, the southern half of Wisconsin, extreme southeast Minnesota, east central Missouri, and the eastern third of Iowa. The limits of the current range of the EMR are similar to the historical range, however, the geographic distribution of extant localities has been restricted by the loss of the populations from much of the area within the boundaries of that range.

Historically and rangewide there were 558 known EMR populations. Currently, 263 of these are known to be extant, 211 are extirpated or likely extirpated, and 84 are of uncertain status

(Szymanski et al. 2016). The EMR Species Status Assessment (Szymanski et al. 2016) grouped the current number of extant rangewide EMR populations (263) with the current number of EMR populations of unknown status (84) and considered these populations in total as currently being "presumed extant". The total number of currently presumed extant EMR populations is 347.

The Species Status Assessment for EMR describes the breadth of adaptive diversity expressed by the wide distribution of populations within the three broad regions identified by Ray et al. 2013 (Szymanski et al. 2016). The three regions identified are: 1) the western analysis unit (WAU) consisting of populations in Minnesota, Missouri, Iowa, Wisconsin, and Illinois; 2) the central analysis unit (CAU) consisting of populations in Indiana, southern and central Michigan, Ohio, and far southwestern Ontario; and 3) the eastern analysis unit (EAU) consisting of populations in New York, Pennsylvania, northern Michigan, and the remaining portions of Ontario (Figure 3).

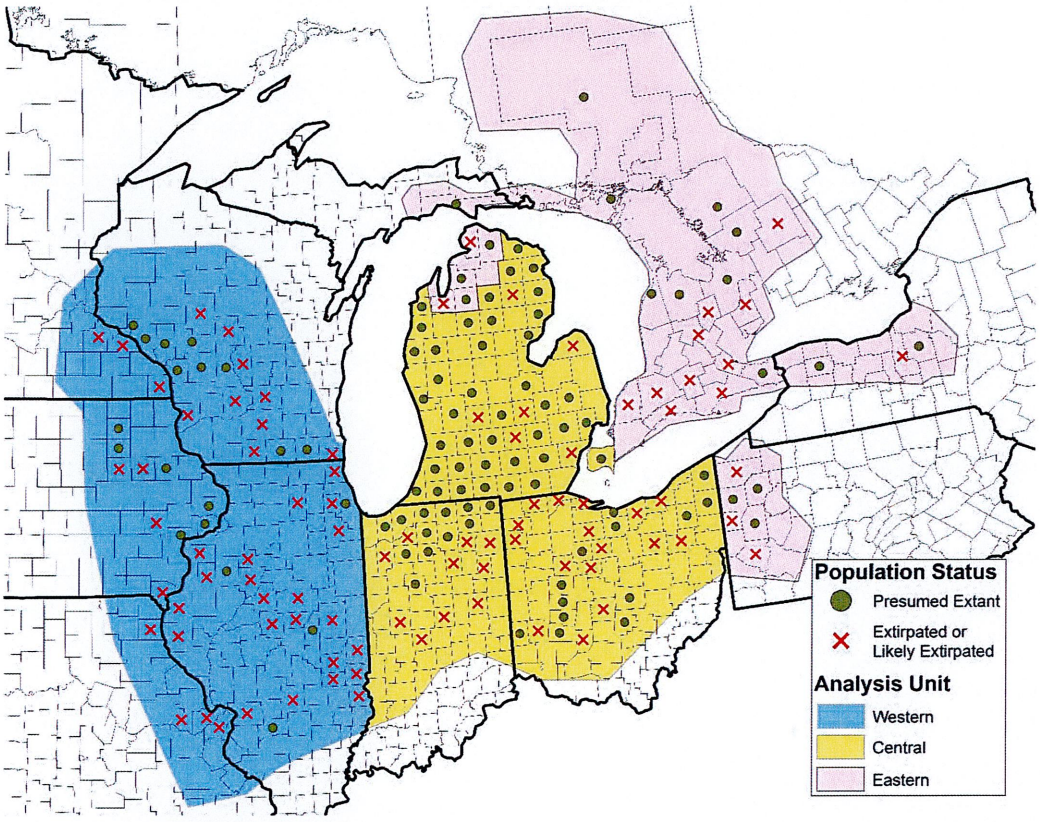


Figure 3: The geographical distribution of presumed extant (extant and unknown status) and extirpated EMR populations within each analysis unit (Adapted from Ray et al. 2013 and in Szymanski et al. 2016).

These three geographic "analysis units" correspond to broad scale genetic differences across the EMR range and represent areas of unique adaptive diversity. The EMR occupied spatial extent rangewide has declined by a northeasterly contraction in the range and by the loss of area occupied within each analysis unit. Overall, there has been more than 41% reduction in the extent of occurrence rangewide. This loss has not been uniform, with most of this decline occurring in the WAU (70% reduction in the extent of occurrence). However, losses of 33% and 26% in the CAU and EAU, respectively, are notable as well.

EMR has been extirpated from Minnesota and Missouri and from counties in every state across the range, including Ontario. Of those range wide populations presumed extant, 139 (40%) are presumed to be quasi-extirpated (Szymanski et al. 2016) while 105 (30%) are presumed to be demographically, genetically, and physiologically robust (Redford et al. 2011 in Szymanski et al. 2016). Of these 105 presumed robust populations, only 53 EMR populations range-wide are considered to be self-sustaining (Szymanski et al. 2016).

The greatest decline has occurred in the western analysis unit where only one population is considered to be self-sustaining out of 20 presumed extant populations (Szymanski et al. 2016). In the central analysis, only 47 populations are considered to be self-sustaining (Szymanski et al. 2016). The eastern analysis unit has only six self-sustaining populations (Szymanski et al. 2016).

Lee and Enander (2015) recently assessed the condition and estimated the viability of EMR populations in Michigan. Populations were delineated based on a population model using known element occurrences in Michigan's Natural Heritage Database and a cost-weighted distance analysis. A total of 187 EMR populations were delineated, with 42 populations located in the northern Lower Peninsula and 145 populations in the southern Lower Peninsula. A total of 110 populations (59%) were ranked as having excellent, good, or fair estimated viability. 35 populations (19%) were ranked as having fair to poor or poor viability. 42 populations (22%) were ranked as historical or extirpated (Lee and Enander, 2015).

Threats

The most prominent threats include habitat loss and fragmentation through development and vegetative succession, mortality of individuals as a result of roads, hydrologic alteration resulting in drought or flooding, persecution, collection, and post-emergent prescribed fire, mowing, and disking. Disease is a relatively recent threat with still unknown consequences. The effects of threats on extinction risk to EMR populations were included in model evaluations (Faust et al. 2011), while the Species Status Assessment (Szymanski et al. 2016) considered the total number of sites range wide where specific threats were reported.

Habitat Loss and Fragmentation

The effects of past, widespread wetland loss continue to impact EMR populations. Development and agricultural practices continue to cause habitat loss, although to a lesser degree than in the past. Habitat loss increases the distance between populations and can isolate seasonally used habitats within individual populations, can restrict gene flow, and other effects of small population dynamics, as well as increase exposure to sources of mortality.

In addition, urban encroachment has disrupted the natural disturbance processes (such as hydrological cycles and fire frequency), and subsequently, changes in habitat structure and vegetative composition have occurred. Prolonged flood conditions may make wetlands too deep for use by EMR, while prolonged drought conditions may affect crayfish populations and thus reduce the number of suitable hibernacula (crayfish burrows) available for EMR.

Vegetative Succession

Woody succession, especially by introduced species such as Eurasian buckthorn, that results in EMR's preferred graminoid (grasses, sedges, and rushes) dominated habitat becoming too shaded may reduce or eliminate these sites as suitable places for EMR to bask and

thermoregulate. Unmanaged succession is now the most common risk factor, with 75% of the sites being impacted range-wide (Szymanski et al. 2016).

Post-Emergent Land Management Practices (Prescribed Fire, Mowing, and Disking)

The dependence of EMR on early to mid-successional stage graminoid (grasses, sedges, and rushes) dominated plant communities necessitates that these communities be managed in a manner that prevents woody species from dominating them. One of the most commonly used management techniques for this is prescribed fire, since it is a relatively inexpensive technique and mimics the natural fire processes that would have regulated these plant communities prior to European settlement. However, although EMR likely evolved in these fire dependent communities, direct mortality of EMR can result from exposure to fire if burning occurs when the snakes are out of their hibernacula (post-emergent fire) (Dreslik 2005; Cross 2009; Dreslik et al. 2011; Cross et al. 2015). In Missouri, Durbian (2006) observed the mortality of eight massasaugas on a 16.6 ha (41 ac) prairie after a burn conducted on April 18, 2000.

Mowing is another strategy often used in conjunction with prescribed burning, to control woody vegetation and invasive species encroachment. Durbian and Lenhoff (2004) postulated that pre-burn mowing may potentially reduce fire related mortality of EMRs and other snake species by negatively modifying the occupied habitat forcing the snakes to leave the area or seek refuge below ground. Durbian (2006) subsequently found that pre-burn mowing at a height of 20 cm (eight in) resulted in the direct mortality of three of seven radio marked EMRs. After the burn, three unmarked individuals in the burned area were killed by the fire itself indicating that a number of EMRs did not leave the site after mowing as hypothesized by Durbian and Lenhoff (2004). Durbian (2006) concluded that mowing prior to burning results in additional direct mortality to EMRs beyond that incurred by prescribed burning and advises to conduct burns while EMRs are hibernating until methods that effectively reduce mortality while achieving the treatment objectives are identified (Durbian 2006).

Some work has also been done to look at the indirect effects of forestry practices on snake habitat use (MacGowan et al. 2010; Reinert et al. 2011; MacGowan and Walker 2013). Preliminary results of one study of timber rattlesnakes in Indiana demonstrate that timber harvest does not influence habitat use and home range size (MacGowan et al. 2010; MacGowan and Walker 2013). Reinert et al. (2011) also observed logging and associated habitat modifications did not change timber rattlesnake behavior or movement during or after operations.

Road Mortality

EMR are more sedentary and move more slowly than other snakes, which increases the probability of being killed while crossing roads (Andrews and Gibbons 2005). EMR road mortality follows a seasonal pattern with the highest mortality during the summer and fall (Shepard et al. 2008a; Baker et al. 2016). Habitat quality surrounding the road segment is more significant in affecting the level of road mortality as opposed to traffic intensity (Shepard et al. 2008a). Snake road mortality may also result when drivers intentionally hit snakes during road crossings (Ashley et al. 2007). However, installing barrier fences and ecopassages has shown to reduce road mortality (Colley et al. 2017).

Hydrologic Alteration Resulting in Drought or Artificial Flooding

Individual populations of EMR often occur in riparian areas, wet prairies, or other places that are prone to fluctuations in hydrology. While EMRs are, to a degree. adapted to natural hydrological fluctuation, altered flood and drought cycles or naturally occurring floods and droughts can have

effects on EMR or the burrowing crayfish they rely upon for hibernacula. Prolonged flood conditions in a Missouri population of the western massasauga (*Sistrurus tergeminus*) led to changes in population and reproductive characteristics as well as an immediate effect on body condition (Seigel 1986). Conversely, prolonged drought or drawdown conditions may affect water table and burrowing crayfish populations and thus reduce the number of suitable hibernacula (crayfish burrows) available for EMR.

Persecution / Collection

Persecution and collection of EMR are documented threats (Szymanski et al. 2016), with several populations having been collected beyond a recoverable threshold. Generally, people have a negative view of snakes and snake encounters, frequently result in snake mortality. Poaching and the illegal collection of snakes for the pet trade is also a factor that contributes to the species decline. In Wisconsin, illegal collecting has been documented despite many years of legal protection (Christiansen 1993, Wisconsin Department of Natural Resources 2013). An Indiana Department of Natural Resources law enforcement investigation in 1998 uncovered a well-organized, multi-state effort to launder State protected reptile species (including EMR). The investigation concluded with the indictment of 40 defendants.

Disease

Snake fungal disease (SFD) is an emerging and significant threat to EMR populations (Allender et al. 2011). Recently, a growing number of snakes have been found in the U.S. with severe and often fatal fungal infections. The number of species of snakes with documented or suspected cases of the disease, and the geographic area the disease has been found, continues to increase annually. A causative agent, *Ophidiomyces ophidiicola* (formerly *Chrysosporium ophidiicola*) was first described from an eastern rat snake (*Pantherophis obsoletus*) in Georgia (Rajeev et al. 2009). Five individuals from three sites in Michigan tested positive for SFD in 2013 and 2014 and two EMR were confirmed to be infected in 2015 in the Grayling area. (Mike Ravesi 2015, pers.comm.). Both died within a few weeks of capture. In the wake of the devastating impacts on amphibians due to Chytrid beginning in 1996 (caused by the fungus *Batrachochytrium dendrobatidis*) (Longcore et al. 1999), and White Nose Syndrome (caused by the fungus *Pseudogymnoascus destructans*) on bats beginning in 2005 (Gargas et al. 2009), there may be genuine cause for concern that the emerging fungal disease in snakes could have a significant impact on EMR populations.

Climate Change

Climate change is one of several factors believed to be actively leading to declines in reptile populations (Gibbons et al. 2000). As defined by the Intergovernmental Panel on Climate Change (IPCC), "climate" refers to average weather, typically measured in terms of the mean and variability of temperature, precipitation, or other relevant properties over time; thus "climate change" refers to a change in such a measure which persists for an extended period, typically decades or longer, due to natural conditions (e.g., solar cycles) or human-caused changes in the composition of the atmosphere or in land use (IPCC 2013). Detailed explanations of global climate change and examples of various observed and projected changes and associated effects and risks at the global level are provided in reports issued by the IPCC (2014 and citations therein). Information for the United States at national and regional levels is summarized in the National Climate Assessment (Melillo et al. 2014 entire and citations therein; see Melillo et al. 2014, pp.28-45 for an overview). EMR scored Highly Vulnerable to climate change in an analysis using the NatureServe Climate Change Vulnerability Index tool (Hoving et al. 2013).

Poor dispersal ability, landscape barriers, and drought sensitivity all contributed to the highly vulnerable score (Hoving, unpublished).

Summary

In assessing the occurrence of these threats or risk factors, Szymanski et al. (2016) found that 94% of EMR populations have at least one risk factor currently affecting the site. Habitat loss or modification is the most common risk factor occurring at 55% of the sites with 3% of these sites at risk of total habitat loss. The second most common risk factor is fragmentation which occurs at 49% of the sites. Unmanaged vegetative succession is the third most common factor occurring at 31% of sites.

Among the other factors considered, road mortality occurs at 20 %, collection of persecution occurs at 17%, water fluctuation at 7%, and pre- or post-emergent fire at less than 1% of sites (Szymanski et al. 2016).

The risk factors most likely to push a population to quasi-extirpation within 25 years (high magnitude risk factors) are late-stage vegetative succession, high habitat fragmentation, moderate habitat fragmentation, total habitat loss, and moderate habitat loss or modification.

STATUS OF CRITICAL HABITAT

No critical habitat has been designated for this species; thus, none would be affected. In the September 20, 2016, final rule listing EMR as a threatened species, it was determined that designating critical habitat was not prudent due to the potential for increased persecution and unauthorized collection.

ENVIRONMENTAL BASELINE

Regulations implementing the ESA (50 CFR 402.02) define the environmental baseline as the past and present impacts of all Federal, State, or private actions and other human activities in the action area. Also included in the environmental baseline are the anticipated impacts of all proposed federal projects in the action area that have undergone section 7 consultation, and the impacts of state and private actions which are contemporaneous with the consultation in process.

Status of the Species in the Action Area

In Michigan, the decline of EMR has been less severe than in other states. Michigan has the greatest number of extant EMR populations and the greatest amount of suitable habitat (Szymanski 1998). Thus, conservation and recovery efforts in Michigan are particularly crucial for ensuring the long-term viability of this species.

Michigan has many populations of EMR, and they persist throughout most of the species' historical range in Michigan. However, the number of populations has declined (Legge and Rabe 1996). Although the general distribution of populations in the state has been well documented, less is known about population size, demographics, and long-term viability. Given the highly cryptic nature, several factors impacting detection, and potentially low abundance of EMR, it is difficult to estimate population size for this species (Szymanski 1998; Crawford et al. 2020).

In Michigan, we use a tiered approach to determining the likelihood of EMR being present based on known element occurrence records, suitable habitat, and predictive modeling. Tier 1 habitat includes areas known to be occupied or highly likely to be occupied by the EMR. Tier 2 habitat

includes areas with a high potential for habitat that may be occupied. Throughout the Lower Peninsula of Michigan, we have identified 658,975 and 1,387,873 acres of Tier 1 and Tier 2 habitats, respectively.

The proposed action area is in Oakland County, Michigan, an area with 50,786 and 43,659 acres of Tier 1 and Tier 2 habitats, respectively. EMR are known to occur with 0.5 mile of the proposed action area. In 2018, an EMR was observed less than 0.5 mi southeast of the location of the proposed park on the front lawn of a neighborhood home that borders a natural wetland area. This wetland continues from this location south to Brendel Lake and east to the location of the proposed park. This population has been ranked "extant" by Michigan Natural Features Inventory, and no further information is known about the population. No surveys for EMR have been done in the action area.

The proposed park is located in modeled Tier 1 and Tier 2 EMR habitat. On May 17, 2022, a site visit was conducted to assess on the ground habitat conditions at the site. Much of the Tier 2 modeled habitat in the action area is marginal in quality, due to being heavily forested. If the area had less tree cover, it would likely be highly suitable for EMR. Tier 1 habitat within the action area is of higher quality, with less tree cover, though vegetative succession poses a threat to EMR habitat in the area. Tier 1 habitat adjacent to the boundaries of the proposed park, particularly southeast around the tributaries of the Huron River and Mud Lake appears to be the highest quality habitat is the immediate area and is very suitable for EMR.

Factors Affecting the Species within the Action Area

Vegetative succession is a major contributor of EMR habitat loss (Reinert and Buskar 1992, Johnson and Breisch 1993). EMR prefer sites dominated by graminoid species which provide the necessary thermoregulatory areas as well as retreat sites. Fire suppression has led to the widespread loss of open canopy habitats through succession (Kingsbury 2002). Woody vegetation encroachment and the introduction on non-native species, such as Eurasian buckthorn, can cause these open vegetative areas to become shaded and eliminate thermoregulatory and retreat areas. Alteration in habitat structure and quality can also reduce EMR prey availability by reducing the forage for its prey base (Kingsbury 2002). The area within and immediately around the boundary of the proposed park is subject to fire suppression, and much of the area is dominated by woody vegetation, though patches of open canopy area with higher quality EMR habitat do still exist.

Roads are a necessary part of the landscape enabling access for land management, safety purposes, public recreation, construction and maintenance, and general transit. However, roads are a source of direct mortality to EMR and have the potential to cause habitat fragmentation. Shepard et al. (2008b) found a seasonal pattern to EMR road mortality with the greatest mortality among males during the mating season (August and September). Neonate/juvenile mortality was also greatest in August when they move away from their birthing site to forage before overwintering. The quality of habitat surrounding the road segment has a significant effect on the level of road mortality (Shepard et al. 2008b, Choquette and Valliant 2016). Snake road mortality may also result when drivers intentionally hit snakes during road crossings (Ashley et al. 2007). The proposed park was historically used as a campground, which closed in 2017. Prior to the campground's closure, a gravel two track was used to allow vehicular access into the park from Elizabeth Lake Road.

Most people are fearful of snakes, and human snake encounters frequently result in the death of the snake (Whitaker and Shine 2000). The action area is currently open to the public as a

recreation area, is surrounded by residential areas, and was previously used as a campground. Evidence of human persecution of EMR on both public and private lands is well documented in the literature (Szymanski et al. 2016) and may have occurred in and around the action area.

Mowing has resulted in mortality of EMR throughout the range of the species (Durbian 2006, Baker et al. 2016, Szymanski et al. 2016). Before 2017, when the action area was used as a campground, mowing was used to maintain the open areas of the property as lawn, and mowing has continued since White Lake Township acquired the property.

Climate change may affect EMR, as the species is sensitive to changes in temperature and precipitation. Pomara et al. (2014) modeled demographic rates under past and future climate scenarios. They found that past climate change explained the observed recent EMR range contraction and suggested that the range contraction would continue. Only populations in northern Michigan and Ontario were likely to persist to mid-century (Pomara et al. 2014). While these studies suggest that EMR populations in southern Michigan are not viable, there is some uncertainty about this prediction. Although additional models suggest drying in southern Michigan, nearly as many models suggest a wetter climate. In our analysis, we use our expert judgment to weigh the best scientific and commercial data available in our consideration of relevant aspects of climate change and related effects.

Previous Section 7 Consultations in the Action Area

- Federal Highway Administration Programmatic on Eastern Massasauga Rattlesnake
    - On November 5, 2018, USFWS issued a Biological Opinion to the Federal Highway Administration and Michigan Department of Transportation analyzing the effects of road construction and maintenance over a 5-year period on state trunkline roads and MDOT maintained road rights-of-way (USFWS 2018).
    - Projects with combined impacts of more than 20 acres of EMR habitat, wetland fills exceeding one acre, projects that effect known hibernaculum, and projects that permanently alter hydrology were outside the scope of the consultation and were not considered part of the proposed action.
    - Additionally, the proposed action included providing conservation programs (i.e., conservation banks, local conservation (mitigation) projects, an in-lieu fee program) for projects that included impacts to EMR habitat greater than three acres of Tier 1 habitat or five acres of Tier 2 habitat.
    - Due to the secretive and cryptic nature of the species, the degree to which individuals may be able to move and avoid impacts during project activities, and the difficulty of finding injured or dead specimens during or following project implementation, USFWS used the areal extent of occupied and potentially occupied EMR habitat as a surrogate to monitor the level of take. Therefore, it was anticipated that activities occurring on 6,561 acres of EMR habitat are expected to rise to the level of take of EMR over five years. To date, no take associated with this project has occurred within the Project area.
- USFWS Programmatic Consultation on Issuance of Section 10(a)(1)(A) Scientific Take Permits and Providing Funding Pursuant to Endangered Species Grants

- On March 28, 2017, USFWS analyzed the effects of issuing Section 10(a)(1)(A) permits for scientific studies and field surveys, granting of funds for recovery and enhancement of survival, and controlled propagation and management of EMR over a five-year period. These actions, as described in the programmatic Biological Opinion, may impact a maximum of 2,000 individuals and were determined to not likely jeopardize the continued existence of EMR (USFWS 2017).

EFFECTS OF THE ACTION

The effects of the action refers to the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated or interdependent with that action, that will be added to the environmental baseline (50 CFR 402.02). Indirect effects are those that are caused by the proposed action and are later in time, but still are reasonably certain to occur. Interrelated actions are those that are part of a larger action and depend on the larger action for their justification. Interdependent actions are those that have no independent utility apart from the action under consideration. Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the action (50 CFR 402.02).

Construction and Ground Disturbing Activities

Construction activities in EMR habitat will include road widening and realignment, curb and gutter installation, bioswale construction, trail construction, vegetation removal, culvert replacement, boat ramp removal, fishing pier installation, installation of park amenities, and associated activities. Construction activities can result in harm, injury, or death of EMR, as well as habitat alteration and fragmentation. All ground disturbing activities will take place well within the active season of EMR, to prevent impacts to EMR within hibernacula when they are more vulnerable. During construction, silt fence will be used to exclude EMR from the action area. All fill materials will be sourced on site to avoid the potential spread of invasive plant species. In addition, the applicant will continue or increase their current efforts to control invasive species at the site. Only wildlife-safe erosion and sedimentation control materials will be used, to prevent EMR or other snake from becoming entangled in plastic mesh netting. All construction personnel will be educated about EMR identification, conservation, and protected status before work begins. However, adverse effects to EMR are still possible from construction activities.

Maintenance Activities

Mowing has been documented to result in mortality of EMR throughout the range of the species (Durbian 2006, Baker et al. 2016, Szymanski et al. 2016). Mortality from mowing occurs both from individuals being crushed by mower tires as well as being struck by the blades. In a study by Durbian (2006), three EMR of seven individuals known to be occupying a mowing unit were killed by mowing (two females, one male). The open areas of the proposed park will be mowed so they can be maintained as a lawn area to facilitate public use. To reduce potential conflicts with EMR, mowing will be structured so that during the EMR active season (April 15 – October 15), vegetation will be kept short (less than six inches) to reduce the suitability of the open areas for EMR. This mowing schedule will alter habitat in such a way to reduce quality and availability of potential basking and foraging sites for EMR within the action area. Despite this

precaution, EMR may still be accidently struck with a mower, leading to injury or death. During the inactive season, mowing can occur at any time and to any length because EMR will be underground in hibernacula.

Park Use

Increased Human Presence

EMR are known to respond to human disturbance, although not all snakes respond in a consistent manner. EMR usually respond to disturbance by remaining motionless (Prior and Weatherhead 1994), and human disturbance causes both male and female adult EMR to move shorter distances and move less frequently (Parent and Weatherhead 2000). In addition, gravid females become more cryptic when exposed to moderate levels of human disturbance, though males and non-gravid females do not respond the same way (Parent and Weatherhead 2000). A study by Parent and Weatherhead (2000) at a park in Ontario found that despite these behavioral changes, EMR in a heavily used area of the park had similar health when compared to EMR from areas of the park with lower human disturbance. They found that a moderate level of human disturbance had no effect on condition, growth rates, or brood size of EMR, though they were unable to evaluate factors such as gene flow or age structure of the population. Increased human activity has the potential to result in more human-snake conflicts due to fear of snakes (particularly venomous species) and persecution. To inform park users about the potential presence of EMR, their protected status, and conservation actions, an interpretive sign will be placed in the park.

Roads and Trails

EMR are more sedentary than other snakes and move more slowly, which increases the probability of being killed while crossing roads (Andrews and Gibbons 2005). Mortality from bicycles has also been observed (Bailey et al. 2011) and from drivers intentionally hitting snakes (Ashley et al. 2007). A study over 11 years in Indiana found automobiles were the leading cause of mortality for EMR, likely because they are using roads to thermoregulate or crossing roads to reach other habitats (Baker et al. 2016). To reduce the potential for EMR strikes on roads or trails, motor vehicle speeds will be limited to 15 mph and an educational sign will be installed in the park informing visitors about the potential presence of EMR and its protected status. Despite this, EMR in the action area may still be injured or killed by being struck by a motor vehicle or bike on roads or trails. The population size of EMR in the action area is unknown, and trail and road encounters with EMR are expected to be infrequent and sporadic. To account for this uncertainty, we anticipate no more than two adult or juvenile EMR will be injured or killed each year, not to exceed five EMR over a 10 calendar-year rolling average.

In addition to the risk of mortality, construction of a paved trail and a partially paved road will fragment portions of EMR habitat in the action area. In addition to the threat of mortality from crossing a road or trail (Shepard et al. 2008b), EMR have demonstrated behavioral avoidance of roads (Shepard et al. 2008a). It is believed that paved roads are a greater barrier to EMR than unpaved roads and wide roads are a greater barrier than narrow roads (Kingsbury 2002; Szymanski et al. 2016). Roads in the park will mainly be gravel, except where pavement is necessary due to steep grades and legal requirements (Figure 1). Trails will be wooden boardwalk or paved for accessibility. Trails will closely follow the road in many areas to minimize the extent of disturbance. To minimize the risk of mortality and the effects of fragmentation, open-bottom culverts will be used in three locations to connect existing wetlands and facilitate unobstructed wildlife passage beneath roadways and trails. To encourage wildlife use, particularly use by snakes, culvert length will be minimized, culverts will be broken into

separate segments for the roads and pathways, and native vegetation will be restored at the ends of the culverts to provide continuity with adjacent wetlands. Despite the availability of these crossings, up to 28.5 acres of Tier 1 habitat and 10.5 acres of Tier 2 habitat may be impacted by fragmentation.

Cumulative Effects

Cumulative effects are those "effects of future State or private activities, not involving federal activities, that are reasonably certain to occur within the Action Area" considered in this Opinion (50 CFR 402.02). Future federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA.

White Lake Township does plan to add additional public recreation amenities to the park in the future. Potential future amenities include picnic shelters, restrooms, playground equipment, kayak launch, pickleball courts, splash pad, small amphitheater, and an additional 1.3 miles of trail/boardwalk (Figure 4). These plans do not have allocated budgets or defined timelines. Much of the planned construction would take place in the open areas of the park, where mowing is scheduled to reduce the suitability of habitat for EMR. The additional 1.3 miles of trails is planned to take place in modeled Tier 1 and Tier 2 EMR habitat. EMR exposed to these trails would face similar effects to those discussed in the construction and ground disturbing activities and roads and trails sections above.

USFWS is not aware of any additional future state, tribal, local, or private actions that are reasonably certain to occur within the Action Area at this time; therefore, no other cumulative effects are anticipated.

JEOPARDY ANALYSIS

Section 7(a)(2) of the ESA requires that federal agencies ensure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of designated critical habitat.

Jeopardy Analysis Framework

"Jeopardize the continued existence of" means to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species (50 CFR 402.02). The following analysis relies on four components: (1) Status of the Species, (2) Environmental Baseline, (3) Effects of the Action, and (4) Cumulative Effects. The jeopardy analysis in this Opinion emphasizes the range-wide survival and recovery needs of the listed species and the role of the Action Area in providing for those needs. It is within this context that we evaluate the significance of the proposed federal action, taken together with cumulative effects, for purposes of making the jeopardy determination.

Figure 4. Future Plans for Stanley Park, prepared by Beckett&Raeder

Analysis for Jeopardy

Given the known occurrence of EMR within 0.5 mile of the action area and the lack of surveys conducted at the site, we assume EMR are present within suitable habitat within the proposed action area. The population size of EMR in the action area is unknown. Construction, on-going park use, and maintenance activities have the potential to harm, injure, or kill EMR present in the action area. We anticipate adverse effects to occur to EMR on up to, but no more than, 39 acres within the proposed park, including two adult or juvenile EMR taken per year, not to exceed five EMR over a 10 calendar-year rolling average. Impacts from construction activities are expected to be temporary, but on-going park use and maintenance activities may have permanent impacts for as long as the park is operational. Permanent impacts are expected to mainly occur within the approximately 12.5 acres open area of the proposed park, where mowing, road use, and trail use will occur.

Currently, there are 263 populations of EMR known to be extant, rangewide (Szymanski et al. 2016). In Michigan, where EMR are more widely distributed than in other states, we use a tiered approach to determining the likelihood of EMR being present based on known element occurrence records, suitable habitat, and predictive modeling. Tier 1 habitat includes areas known to be occupied or highly likely to be occupied by EMR. Tier 2 habitat includes areas with a high potential for habitat that may be occupied. Throughout the Lower Peninsula of Michigan, we have identified 658,975 and 1,387,873 acres of Tier 1 and Tier 2 habitats, respectively. In Oakland County, where the proposed park will be located, we have identified 50,786 and 43,659 acres of Tier 1 and Tier 2 habitats, respectively. The total action area of this project is approximately 39 acres, less than 0.002% of the 2,046,848 acres of EMR habitat that has been modeled for the Lower Peninsula of Michigan and less than 0.05% of the 94,445 acres of EMR habitat that has been modeled in Oakland County.

We acknowledge that our analysis of effects is likely an over-estimate of effects that are reasonably certain to occur. The effect to EMRs may not rise to the level of take for each individual within the action area, as some snakes occurring within the proposed park will be able to avoid project activities and adverse impacts. As a result, we do not expect that take resulting from the Stanley Park Development Project will exceed more than a small proportion of individual EMRs within the action area. Therefore, it is unlikely that populations of EMR will experience reductions in fitness, and there will be no harmful effects on the species as a whole.

CONCLUSION

We considered the current overall stable range-wide status of EMR and the condition of the species within the action area (environmental baseline). We then assessed the effects of the proposed action and the potential for cumulative effects in the action area on individuals, populations, and the species as a whole. As stated in the Jeopardy Analysis, we do not anticipate any long-term reductions in the overall reproduction, numbers, and distribution of EMR. It is USFWS's Opinion that the Stanley Park Development Project, as proposed, is not likely to jeopardize the continued existence of EMR.

INCIDENTAL TAKE STATEMENT

Section 9 of the ESA and federal regulation pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without a special exemption. Take is defined in section 3 of the ESA as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or

collect, or to attempt to engage in any such conduct. Harm is further defined by the USFWS to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns including breeding, feeding, or sheltering (50 CFR § 17.3). Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the ESA provided that such taking is in compliance with the terms and conditions of this incidental take statement.

The measures described below are nondiscretionary and must be undertaken by NPS so that they become binding conditions of any grant or permit issued to DNR, White Lake Township, and Beckett&Raeder, as appropriate, for the exemption in section 7(o)(2) to apply. NPS has a continuing duty to regulate the activity covered by this incidental take statement. If NPS: (1) fails to assume and implement the terms and conditions or (2) fails to require DNR, White Lake Township, and Beckett&Raeder adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, the protective coverage of Section 7(o)(2) may lapse. To monitor the impact of incidental take, NPS must require the award recipient to report the progress of the action and its impact on the species to USFWS as specified in the incidental take statement [50 CFR 402.14(i)(3)].

AMOUNT OR EXTENT OF TAKE

Incidental take may occur as a result of construction, mowing, and park use. Adult and juvenile EMR may be killed or injured during contact with mowers, construction equipment, motor vehicles, bikes, or park visitors. EMR may also be harmed by the loss, alteration, or fragmentation of basking and foraging habitat. Although the implementation of conservation measures is intended to avoid and minimize the sources of incidental take from these activities and reduce threats to EMR, all take may not be avoidable.

Estimate of Incidental Take

No baseline data exists for the EMR population within the proposed action area, the frequency that EMR may encounter the road and trails, or the number of visitors expected to use the park. At larger parks (302 - 1,286 acres) that contain EMR habitat in Oakland County, park visitors and staff have reported as many as nine EMR sightings a year, but most frequently report zero to two EMR sightings a year (Appendix A in Bird and Lavender 2016). It is expected that EMR that are present in the action area may be injured or killed due to contact with motor vehicles, bikes, or park visitors. We further expect that these encounters will be infrequent and sporadic. To account for this uncertainty, we anticipate that no more than two adult or juvenile EMR will be taken per year, not to exceed five EMR over a 10 calendar-year rolling average.

Any take that occurs due to illegal activities is outside the jurisdiction and authority of the NPS and not covered by this ITS. Although we are not covering incidental take associated with illegal actions, it is necessary to monitor the occurrence and extent of such activity to ensure that the impact of such take is commensurate with the anticipated impact analyzed in this Opinion. Thus, NPS is required to monitor the frequency and extent of impact that occurs from illegal activities, as specified in the terms and conditions. If, through monitoring, it is determined that the impact associated with illegal activity exceeds what we have anticipated, NPS must consult with the Service to determine if reinitiation of consultation is necessary.

Surrogates for take

50 CFR 402.14(i)(1)(i) states that surrogates may be used to express the amount or extent of anticipated take provided the Opinion or incidental take statement: (1) describes the causal link between the surrogate and take of the listed species; (2) describes why it is not practical to express the amount of anticipated take or to monitor take-related impacts in terms of individuals of the listed species; and (3) sets a clear standard for determining when the amount or extent of the taking has been exceeded.

For impacts to EMR due to habitat alteration, habitat fragmentation, construction, and mowing, it is not practical to express the amount of anticipated take in terms of individuals. No surveys for EMR have been conducted and there is no estimate of a population size within the action area. As a result, predicting the precise number of individuals that will be taken is not possible. Additionally, it is not practical to monitor take-related impacts in terms of individual EMR for the following reasons: (1) the individuals are secretive and cryptic; (2) there is a low probability of EMR detection during surveys; (3) EMR is able to move and avoid impacts during project activities; (4) finding dead or injured specimens during or following project implementation is unlikely; (5) the extent and density of the species within its habitat in the action area is unknown; and (6) in many cases incidental take will be non-lethal and undetectable.

However, because suitable EMR habitat can be readily identified, measured, and monitored, this surrogate is the most reasonable means for detecting when take may be exceeded. We anticipate that habitat alteration, habitat fragmentation, construction, and mowing as a result of the proposed action will cause incidental take on EMR on up to, but no more than, 39 acres of Tier 1 and Tier 2 EMR habitat.

REASONABLE AND PRUDENT MEASURES

USFWS believes that the following reasonable and prudent measures are necessary and appropriate to minimize the incidental take of EMR during the proposed action:

- EMR observed to be in eminent danger of injury or death from proposed actions should be moved away from the project activity, provided handling or moving the snake does not jeopardize human health or safety.
- Report on the progress of project activities on the Forest and the impact on the species as required pursuant to 50 CFR 402.14(i)(3).

Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the Act, USFWS must comply with the following terms and conditions which implement the reasonable and prudent measures described above. These terms and conditions are non-discretionary.

The following terms and conditions implement the first RPM:

- EMR should only be handled by qualified individuals and at no point should human health or safety be compromised. For more information on how to safely move snakes, watch DNR's "60-Second Snakes: Snake Removal" video.
- EMR should be moved less than 500 meters and into similar adjacent habitat, but not across barriers (e.g., roads). Snakes should be monitored until project activities have been

completed to ascertain the project's impact on the individual snake. Personnel are not authorized to possess EMR for longer than is needed to relocate the snake to a safe area.

- Personnel shall notify USFWS upon moving a snake as a result of project activities (517-351-2555; eastlansing@fws.gov). A report shall be provided to the Michigan Ecological Services Field Office within 30 days that documents the project activity and the circumstances requiring relocation, including the project location, the habitat the snake was found in and relocated to, and behavior of the snake.

The following terms and conditions implement the second RPM:

- Report on the installation of educational signs along the trail, including the content and location of the signs.
- As early as practicable, prior to construction, obtain concurrence from USFWS for the final layout and construction materials for the additional 1.3 miles of trails anticipated in modeled Tier 1 and Tier 2 EMR habitat.
- Due to the difficulty to detect and quantify the actual incidental take of EMR due to ground disturbing activities and mowing, the areal extent of occupied and potential habitat affected will be used as surrogate to monitor the level of take.
- To track the amount of take that occurred during the year and cumulatively to date due to ground disturbing activities, mowing, and trail maintenance, report to USFWS the status and number of acres of trail construction implemented within EMR Tier 1 and Tier 2 habitat. The report will also include a summary of maintenance activities including the area mowed, type of mower used and deck height, any trail maintenance that involved more than routine vegetation removal, and the time of year the activity occurred. Finally, the report will include the number of live or dead EMR encountered and the results of any EMR surveys conducted. This information will be provided to the Service annually by December 1.

Upon locating a dead, injured, or sick individual of an endangered or threatened species, initial notification must be made to the USFWS Law Enforcement Office in Ann Arbor, MI (734-995-0387). Additional notification must be made to the USFWS Michigan Ecological Services Field Office at East Lansing, MI (517-351-2555; eastlansing@fws.gov). Care should be taken in handling sick or injured individuals and in the preservation of specimens in the best possible state for later analysis of cause of death or injury. Any reports of potential illegal taking must also be immediately reported to the USFWS Law Enforcement Office (734-995-0387).

MONITORING AND REPORTING REQUIREMENTS

Federal agencies have a continuing duty to monitor the impacts of incidental take resulting from their activities [50 CFR 402.14(i)(3)]. In doing so, NPS must report the progress of the action and its impact on the species to USFWS as specified below.

- Supply the Michigan Ecological Services Field Office with a report, due once a year by Dec. 31, that includes:
    - A summary of maintenance activities including:
        - The extent of the area mowed
        - Type of mower used and deck height
        - Any trail maintenance that involved more than routine vegetation removal
        - The time of year maintenance activities took place

- Information about any live EMR reported at the park, including number, behavior, photos, and GPS location (if available).
- Information about any dead EMR found in the park, including number, possible cause of mortality, photos, and GPS location.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the ESA directs federal agencies to utilize their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information. USFWS has identified the following additional actions that, if undertaken by NPS or its non-federal representative, would further the conservation and assist in the recovery of EMR. We recognize that limited resources and other agency priorities may affect the ability of NPS to conduct these activities at any given time.

- Continue to gather information on the EMR's distribution by conducting EMR surveys in Tier 1 and Tier 2 habitat, including the proposed park.
- Provide additional educational outreach to the public, such as informational talks or brochures, including information like:
  - The importance of maintaining a safe distance from EMR,
  - Reasons why EMR is protected and that the snakes should not be harmed,
  - Information about emerging threats, such as snake fungal disease and climate change,
  - Conservation actions and best management practices taken to protect EMR, and
  - To report all sightings to the USFWS.
- Enhance EMR habitat in or near the park where feasible by removing encroaching woody vegetation and controlling non-native invasive species.

In order to be kept informed of actions minimizing or avoiding adverse effects, or benefitting listed species or their habitats, USFWS requests notification if any of these additional conservation actions are carried out or if additional measures consistent with these conservation recommendations are implemented.

REINITIATION NOTICE

USFWS believes that no more than two EMR a year, and no more than five EMR over a 10 calendar-year rolling average, will be incidentally taken in the form of harm, injury, or death as a result of the proposed action. If more EMR are taken, this would represent new information, requiring reinitiation of consultation. Likewise, if greater than 39 total acres of Tier 1 or Tier 2 EMR habitat is impacted as a result of this project, this would also represent new information, requiring reinitiation of consultation.

This concludes formal consultation on the actions outlined in your request dated July 29, 2022. As provided in 50 CFR 402.16, reinitiation of formal consultation is required where discretionary federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this Opinion; (3) the agency action is subsequently

modified in a manner that causes an effect to the listed species or critical habitat not considered in this Opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such a take must cease pending reinitiation.

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APPENDIX C
for
GEOTECHNICAL REPORT

STANLEY PARK IMPROVEMENTS

B R i
Beckett&Raeder

CONSULTING GROUP

Report on Geotechnical Investigation

Proposed Stanley Park Improvements Elizabeth Lake Road White Lake Township, Michigan

Latitude 42.643456˚ N
Longitude -83.499054˚ W

Prepared for:

Beckett & Raeder, Inc.
535 West William Street, Suite 101
Ann Arbor, Michigan 48103

G2 Project No. 213917
March 28, 2023

g2consultinggroup.com

Headquarters	1866 Woodslee St	Troy, MI 48083	P 248.680.0400	F 248.680.9745
Ann Arbor	1350 Eisenhower Pl	Ann Arbor, MI 48108	P 734.390.9330	F 734.390.9331
Chicagoland	1186 Heather Dr	Lake Zurich, IL 60047	P 847.353.8740	F 847.353.8742

CONSULTING GROUP

March 28, 2023

Mr. Brian Barrick, PLA, ASLA
Principal
Becket & Raeder, Inc.
535 West William Street, Suite 101
Ann Arbor, Michigan 48103

Re: Report on Geotechnical Investigation
Proposed Stanley Park Improvements
Elizabeth Lake Road
White Lake Township, Michigan
G2 Project No. 213917

Dear Mr. Barrick:

We have completed the geotechnical investigation for construction of the proposed improvements within the existing Stanley Park located along Elizabeth Lake Road in White Lake Township, Michigan. This report presents the results of our observations and analysis and our recommendations for earthwork and subgrade preparation, foundation construction, and pavement design, as well as related construction considerations.

We appreciate the opportunity to be of service to you and look forward to discussing the recommendations presented herein. In the meantime, if you have any questions regarding the report or any other matter pertaining to the project, please call us.

Sincerely,

G2 Consulting Group, LLC

Tyler Hesse

Tyler S. Hesse, P.E.
Project Engineer

Jason B. Stoops

Jason B. Stoops, P.E.
Office Manager / Project Manager

TSH/JBS/jbs

Enclosures

EXECUTIVE SUMMARY

We understand that the project consists of constructing several improvements within the existing Stanley Park development located along Elizabeth Lake Road in White Lake Township, Michigan. Based on the provided drawings, the proposed improvements consist of a new bituminous and gravel roadway, a bituminous pedestrian path with associated boardwalks, and a fishing dock.

Approximately 2 to 9 inches of sand and clay topsoil is present at the ground surface within the soil boring locations. Loose granular and medium cohesive fill soils consisting of clayey sand, sandy clay, and silty clay underlie the topsoil within soil borings B-05 and B-08 extending to approximate depths ranging from 1-1/2 to 6 feet. The fill soils contain intermixed peat and have organic matter contents ranging from 15.2 to 21.7 percent. Organic peat underlies the fill soils within B-05 and B-08 extending to depths ranging from 3 to 8-1/2 feet. The peat soils have organic matter contents ranging from 42.9 to 64.3 percent. Very soft to soft clayey silt underlies the peat within soil borings B-05 and B-08 extending to depths ranging from 8 feet to the explored depth of 10 feet. The clayey silt soils have an organic matter content of 13.3 percent. Stiff silty clay underlies the clayey silt soils within soil boring B-08 extending to the explored depth of 10 feet. Native very loose to medium compact sand and clayey sand underlie the topsoil within soil borings B-03 and B-07 extending to the explored depth of 10 feet. Alternating strata of native very loose to very compact granular and medium to hard cohesive soils consisting of sand, gravelly sand, sandy clay, and silty clay underlie the topsoil within soil borings B-01, B-02, B-04, and B-06 extending to the explored depths ranging from 10 to 25 feet.

Groundwater measurements were performed during and upon completion of drilling operations. During drilling operations, groundwater was generally encountered at depths ranging from 2 to 9 feet below existing grades (Elevation 925-1/4 feet to 949 feet). Upon completion of drilling operations, groundwater was generally measured at depths ranging from 2 to 8-1/2 feet below existing grades (Elevation 925-3/4 feet to 948 feet). No groundwater was encountered during or upon completion of drilling operations within soil borings B-01 and B-02.

Based on the provided grading plan, existing grades will be raised as much as two (2) feet to four (4) feet within the vicinity of the northern and southern boardwalks, respectively, and as much as five (5) feet within portions of the proposed service road. We anticipate that a large volume of imported fill will be required to achieve final site grades, which will significantly affect overall project costs. Peat and organic clayey silt soils were encountered in these areas extending as deep as 8-1/2 feet. We understand that it is desired to leave these soils in place. As grades will be raised by as much as five feet in these areas, consolidation of the peat/organic clayey silt will occur over time. In order to allow for construction of utilities, pavements, and boardwalks in these areas with a couple months after placement of engineered fill, surcharging of the unsuitable soils would be required. Surcharging would consist of raising grades to the design subgrade elevation, then placing a mound of soil within the peat/organic clayey silt areas. The surcharge would be monitored with settlement plates to determined when settlement rates have subsided so that the surcharge can be removed, and utility and site work can commence.

Due to unsuitable peat and organic clayey silt soils, we anticipate that the boardwalk abutment foundations, and the fishing dock headwall foundation system will be required to be supported by helical piles. The helical piles will extend through the unsuitable soils and are designed to have an allowable capacity of 15 kips. It should be noted that additional soil borings will be required in order to finalize helical pile design.

Do not consider this summary separate from the entire text of this report, with all the conclusions and qualifications mentioned herein. Details of our analysis and recommendations are discussed in the following sections and in the Appendix of this report.

PROJECT DESCRIPTION

We understand that the project consists of constructing several improvements within the existing Stanley Park development located along Elizabeth Lake Road in White Lake Township, Michigan. Based on the provided drawings, the proposed improvements consist of a new bituminous and gravel roadway, a bituminous pedestrian path with associated boardwalks, and a fishing dock.

Based on the provided topographical survey, existing site grades within Stanley Park range from elevation 933 feet to 973 feet. Based on the provided grading plan, final site grades will be within 4 to 5 feet of existing grades. Furthermore, based on the provided grading plan, existing grades on the north side of the park will generally be lowered by as much as two (2) feet. Grades within the vicinity of the southern boardwalk and adjacent proposed roadway will be raised by approximately three (3) to five (5) feet.

Based on the provided drawings, a new service road will be constructed, providing access to Brendel Lake from Elizabeth Lake Road. It was reported to us that the aforementioned access road will consist of both bituminous and gravel pavement sections. At the time of this report, information related to anticipated traffic frequencies was not available; however, it was reported to us that traffic will primarily consist of passenger-car vehicles (PCVs) with occasional emergency response vehicles.

A bituminous pedestrian path will be constructed starting at the north end of Stanley Park and extending south to Brendel Lake. Based on the provided drawings, the pedestrian path will include two (2) boardwalk structures. At the time of this report, information related to anticipated structural loading conditions of the boardwalk structures was unavailable. However, we understand that the boardwalks will be lightly loaded and will primarily be used for pedestrian travel with occasional maintenance vehicles.

Based on the provided drawings, a fishing dock will be constructed at the southern end of the aforementioned service road overlooking Brendel Lake. It was reported to us that the fishing dock will be a floating structure supported by a headwall foundation system. It is our understanding that the headwall foundation system will be constructed at the edge of Brendel Lake and will require a temporary earth retention cofferdam system in order to construct foundations in a dry condition.

If information related to existing and final site grades or anticipated traffic frequencies becomes available or changes, G2 Consulting Group, LLC (G2) should be notified in order to re-evaluate the recommendations provided herein. The purpose of our exploration is to determine and evaluate the general subsurface conditions at the site and to develop recommendations for the subgrade preparation, foundation design, bituminous pavement design, and construction considerations as they relate to the geotechnical conditions on site.

SCOPE OF SERVICES

The field operations, laboratory testing, and engineering report preparation were performed under direction and supervision of a licensed professional engineer. Our services were performed according to generally accepted standards and procedures in the practice of geotechnical engineering in this area. Our scope of services for this project is as follows:

1. We drilled a total of eight (8) soil borings within the existing Stanley Park development. Soil borings B-01 through B-03, B-06, and B-07 were performed along the proposed bituminous/gravel service road extending to depths ranging from 10 to 25 feet. Soil borings B-04 and B-05 were performed within the influence of the proposed northern and southern boardwalks, respectively, extending to a depth of 10 feet each. Soil boring B-08 was performed within the vicinity of the proposed fishing dock extending to a depth of 10 feet.

2. We performed laboratory testing on representative samples obtained from the soil borings. Laboratory testing included visual engineering classification, natural moisture content, organic

matter content, and determination of unconfined compressive strength.

3. We prepared this engineering report. The report includes recommendations regarding the soil bearing capacity, estimated settlement, bituminous pavement cross-sections, gravel road cross-sections, and related construction considerations related to foundation and pavement constructions.

FIELD OPERATIONS

Becket & Raeder selected the number, depth, and location of the soil borings. The soil boring locations were located in the field by a G2 representative using conventional taping methods from known surface features prior to our field operations. The approximate soil boring locations are shown on the Soil Boring Location Plan, Plate No. 1. Ground surface elevations at the soil boring locations were estimated based on the provided topographical survey. The resulting elevations are presented on the Soil Boring Logs, Figure Nos. 1 through 8.

The soil borings were drilled using a truck mounted rotary drilling rig. Continuous flight 3-1/4 inch inside diameter hollow-stem augers were used to advance the borehole to the explored depths. Soil samples were obtained at intervals of 2-1/2 feet within the upper 10 feet and at intervals of 5 feet thereafter. The samples were obtained by the Standard Penetration Test method (ASTM D 1586), which involves driving a 2-inch diameter split-spoon sampler into the soil with a 140-pound weight falling 30 inches. The sampler is generally driven three successive 6-inch increments with the number of blows for each increment recorded. The number of blows required to advance the sampler the last 12 inches is termed the Standard Penetration Resistance (N). The blow counts for each 6-inch increment and the resulting N-value are presented on the soil boring logs.

The soil samples were placed in sealed containers and brought to our laboratory for testing and classification. During field operations, the driller maintained logs of the subsurface conditions, including changes in stratigraphy and observed groundwater levels. The final boring logs are based on the field boring logs supplemented by laboratory soil classification and test results. The boreholes were backfilled with auger cuttings upon completion of drilling operations.

LABORATORY TESTING

Representative soil samples were subjected to laboratory testing to determine soil parameters pertinent to site preparation, as well as foundation and pavement design. An experienced geotechnical engineer classified the samples in general conformance with the Unified Soil Classification System. Laboratory testing was conducted in general conformance with the following ASTM test methods:

- "Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass" (ASTM D2216); and
- "Standard Test Methods for Moisture, Ash, and Organic Matter of Peat and Other Organic Soils" (ASTM D2974).

The unconfined compressive strengths were determined using a spring-loaded hand penetrometer and a Torvane Shear device. The hand penetrometer estimates the unconfined compressive strength to a maximum of 4-1/2 tons per square foot (tsf) by measuring the resistance of the soil sample to the penetration of a calibrated spring-loaded cylinder. The hand-held Torvane estimates the shear strength to a maximum of 1 tsf by measuring the resistance of the soil sample to the applied torque of a vane seated in the soil sample.

The results of the moisture contents, organic matter contents, and unconfined compressive strengths are indicated on the Soil Boring Logs, Figure Nos. 1 through 8, at the depths the samples were collected. We will hold the soil samples for 60 days from the date of this report, after which time they will be discarded. If you would like the samples, please let us know.

SITE DESCRIPTION

The existing Stanley Park development is located south of Elizabeth Lake Road in White Lake Township, Michigan. The park is bounded by Elizabeth Lake Road to the north, a residential development to the east, and by wooded areas and Brendel Lake to the south and west. The park currently consists of a gravel parking area, two (2) single-story, slab-on-grade structures, and a gravel access road spanning from Elizabeth Lake Road to Brendel Lake. The remainder of the site is grass covered and contains numerous mature trees and vegetation.

Based on the provided topographical survey, existing site grades within Stanley Park range from elevation 933 feet to 973 feet. Similarly, based on the provided survey, existing grades generally slope downward from north to south.

SOIL CONDITIONS

Approximately 2 to 9 inches of sand and clay topsoil is present at the ground surface within the soil boring locations. Clayey sand, sandy clay, and silty clay fill soils underlie the topsoil within soil borings B-05 and B-08 extending to approximate depths ranging from 1-1/2 to 6 feet. Organic peat underlies the fill soils within B-05 and B-08 extending to depths ranging from 3 to 8-1/2 feet. Clayey silt underlies the peat within soil borings B-05 and B-08 extending to depths ranging from 8 feet to the explored depth of 10 feet. Silty clay underlies the clayey silt soils within soil boring B-08 extending to the explored depth of 10 feet. Native sand and clayey sand underlie the topsoil within soil borings B-03 and B-07 extending to the explored depth of 10 feet. Alternating strata of native granular and cohesive soils consisting of sand, gravelly sand, sandy clay, and silty clay underlie the topsoil within soil borings B-01, B-02, B-04, and B-06 extending to the explored depths ranging from 10 to 25 feet.

The clayey sand fill soils are loose in relative density, contains intermixed peat, has an organic matter content of 21.7 percent, and a Standard Penetration Test (SPT) N-value of 8 blows per foot (bpf). The cohesive fill soils are medium in consistency, contain intermixed peat, have an organic matter content of 15.2 percent, have a moisture content of 23 percent, and have an unconfined compressive strength of 1,000 pounds per square foot (psf). The organic peat soils have moisture contents ranging from 98 to 380 percent and organic matter contents ranging from 42.9 to 64.3 percent. The native clayey silt soils are very soft to soft in consistency, with natural moisture contents ranging from 55 to 71 percent, an organic matter content of 13.3 percent, and unconfined compressive strengths ranging from 250 to 500 psf. In general, the native granular soils are very loose to medium compact in relative density, with SPT N-values ranging from 4 to 19 bpf. However, the native gravelly sand soils within soil boring B-01 are very compact in relative density, with an SPT N-value of 53 bpf. The upper native cohesive soils are medium to stiff in consistency, with natural moisture contents ranging from 10 to 18 percent, and unconfined compressive strengths ranging from 1,000 to 3,500 psf. The deeper native silty clay soils within B-01 are hard in consistency, with natural moisture contents ranging from 10 to 11 percent, and unconfined compressive strengths in excess of 9,000 psf.

The stratification depths shown on the soil boring logs represent the soil conditions at the specified locations. Variations may occur between and away from the soil boring locations. Additionally, the stratigraphic lines represent the approximate boundaries between soil types. The transition may be more gradual than indicated. We have prepared the soil boring logs on the basis of the field logs of the soil conditions encountered supplemented by laboratory classification and testing.

The Soil Boring Location Plan, Plate No. 1, and Soil Boring Logs, Figure Nos. 1 through 8, are presented in the Appendix. The soil profiles described above are generalized descriptions of the conditions encountered at the soil boring locations. General Notes Terminology defining the nomenclature used on the soil boring logs and elsewhere in this report are presented on Figure No. 9.

GROUNDWATER CONDITIONS

Groundwater measurements were performed during and upon completion of drilling operations. During

drilling operations, groundwater was generally encountered at depths ranging from 2 to 9 feet below existing grades (Elevation 925-1/4 feet to 949 feet). Upon completion of drilling operations, groundwater was generally measured at depths ranging from 2 to 8-1/2 feet below existing grades (Elevation 925-3/4 feet to 948 feet). No groundwater was encountered during or upon completion of drilling operations within soil borings B-01 and B-02.

An estimate in the historical groundwater levels may be made based on the soil color change from browns (aerobic condition where free oxygen is available) to grays (anaerobic condition where free oxygen is not available). This color change occurs at approximate depths ranging from 3 to 23 feet below existing grades (Elevation 931 feet to 948-1/2 feet).

Fluctuations in perched and long-term groundwater levels should be anticipated due to seasonal variations and following periods of prolonged precipitation. It should also be noted that groundwater observations made during drilling operations in predominantly cohesive soils are not necessarily indicative of the static groundwater level. This is due to the low permeability of such soils and the tendency of drilling operations to seal off the natural paths of groundwater flow.

SITE PREPARATION

We anticipate earthwork operations will consist of complete removal of topsoil, trees, and vegetation within the proposed service road and pedestrian path alignment(s), proof-rolling/proof-compacting the exposed subgrade, placing engineered fill to raise site grades, stockpiling soils in order to expedite primary consolidation of the peat and organic clayey silt soils, excavating for utilities and foundations, and preparing subgrade for pavement support. We recommend all earthwork operations be performed in accordance with comprehensive specifications and be properly monitored in the field by qualified personnel under the direction of a licensed professional engineer.

At the start of earthwork operations, any existing topsoil, trees, or vegetation within the footprint of the proposed service road and pedestrian pathway should be removed in their entirety. After site stripping, the exposed subgrade will consist of native granular and cohesive soils and/or granular and cohesive fill soils. Where cohesive soils are encountered, soils should be proof-rolled with a fully loaded tandem-axle dump truck and be evaluated for stability. Unsuitable soils exhibiting excessive instability, such as severe rutting, should be improved with additional compaction or undercut to expose stable soils. Where granular soils are encountered, soils should be proof-compacted with a heavy smooth-drum vibratory roller and should be visually evaluated for instability and/or unsuitable soil conditions by a qualified geotechnical engineer or technician. We recommend 10 passes in two perpendicular directions during the proof-compaction operations. Any resulting undercut excavations should be backfilled with engineered fill.

Based on the provided grading plan, existing grades will be raised as much as two (2) feet to four (4) feet within the vicinity of the northern and southern boardwalks, respectively, and as much as five (5) feet within portions of the proposed service road. As previously stated, fill soils with intermixed peat, organic peat, and organic clayey silt soils were encountered within soil borings B-05 and B-08. These soils have organic matter contents ranging from 13.3 to 64.3 percent. Soil boring B-05 is within the vicinity of the proposed southern boardwalk and the portion of the proposed service road where grades will be raised as much as five (5) feet. Soil boring B-08 is within the vicinity of the proposed fishing dock and southern portion of the proposed service road.

We understand it is desired to leave the existing fill soils/peat/organic silt in place. The practicality of leaving these soils in place for support of pavements and the proposed boardwalks is a function of the amount of fill placed in these areas. The placement of more than 2 to 3 feet of engineered fill will apply a global load and consolidate the underlying peat/organic silt soils. We recommend that grades be raised minimally within the vicinity of soil boring B-05 and B-08 to mitigate the potential for significant settlement. If more than 2 to 3 feet of fill must be placed, consolidation of the peat/organic clayey silt will occur over time. In order to allow for construction of utilities, pavements, and boardwalks in these

areas with a couple months after placement of engineered fill, surcharging of the unsuitable soils would be required. Surcharging would consist of raising grades to the design subgrade elevation, then placing a mound of soil within the peat/organic clayey silt areas. The surcharge would be monitored with settlement plates to determine when settlement rates have subsided so that the surcharge can be removed, and utility and site work can commence. G2 can provide supplemental design services for the surcharge design if desired.

The moisture content of the surficial native silty clay soils within the vicinity of soil boring B-02 are relatively high and likely approaching their respective plastic limit. Therefore, these soils may become unstable under repeated loading from construction equipment. The subgrade should not be exposed to prolonged periods of precipitation to prevent the subgrade from becoming unstable. We recommend earthwork operations be performed during the predominantly drier summer months.

Engineered fill should be free of organic matter, frozen soil, clods, or harmful material. The fill should be placed in uniform horizontal layers not more than 9 inches in loose thickness. The engineered fill should be compacted to achieve a dry density corresponding with 95 percent of the maximum dry density as determined by the Modified Proctor Compaction test (ASTM D1557).

We anticipate significant volumes of imported fill will be required to adjust grades at the site and will significantly impact the overall project costs. In order to economically conduct earthwork operations at the site, imported fill, adhering to the aforementioned requirements, should consist of low plasticity clays or well-graded aggregates. Low plasticity clays, having a plasticity index less than 20 percent, should be placed within +3 or -1 percent of the optimum moisture content as determined by the Modified Proctor Test (ASTM D1557). For well-graded aggregates, such as MDOT Class II Sand, we recommend the engineered fill be placed at ±2 percent of the optimum moisture content as determined by ASTM D1557.

We recommend the use of free-draining granular soils, such as MDOT Class II sand, within utility trenches. We recommend the use of engineered fill with a sufficient amount of fines (material passing the No. 200 sieve) in order to facilitate trenching and excavation techniques for strip and spread footing foundations.

BOARDWALK DISCUSSION

It was reported to us that the proposed boardwalks will be modular structures supported by pan feet. Based on typical manufacturer details, this boardwalk system consists of a galvanized steel frame with wooden planks. The boardwalk is supported by square pan feet, which vary in size, depending on the manufacturer's recommendations based on the encountered soil conditions.

These modular boardwalk systems are designed to facilitate construction within typical wetland soils. The pan feet are intended to bear directly on grade and are connected to the galvanized steel frame with adjustable steel rods. The steel rods can be manually adjusted in order to facilitate any settlement or heave due to freeze/thaw cycles.

As these boardwalk systems are intended for wetland areas with similar soil conditions, we anticipate that the underlying fill soils and/or organic soils may be left in place and the system may bear directly on grade.

FOUNDATION RECOMMENDATIONS

Northern Boardwalk

We understand that the proposed boardwalk will generally be supported by pan feet bearing directly on grade. However, based on the provided drawings, the boardwalk system will be supported by concrete abutments at each end of the proposed boardwalks.

Soil boring B-04 was performed within the vicinity of the northern boardwalk. Within soil boring B-04, native clayey sand and sandy clay soils with low strength characteristics are present to a depth of 6 feet. Native medium compact sand soils underlie the aforementioned soils. As the upper soils have low strength characteristics, we recommend that the proposed abutment be supported by helical piles extending to the medium compact sand soils.

We performed a static pile analysis for 12"-14" double helix anchor. Our analyses shows that the 12"-14" double helix will have an allowable pile capacity of 15 kips when all helixes are bearing within the native medium compact sand soils with a tip bearing approximately 15-1/2 feet below existing grades. Helical piers should have a minimum center-to-center spacing of 3 times the diameter of the largest helix plate to avoid reduction in capacity due to group interaction. Once the pier installation is complete, grade beams and/or pier caps will be required to transfer the boardwalk loads to the foundation system.

Southern Boardwalk

Soil boring B-05 was performed within the vicinity of the southern boardwalk. Within soil boring B-05, fill soils with intermixed peat, peat, and very soft clayey silt are present to the explored depth of 10 feet. These soils are not suitable for support of foundations, as such, we recommend that the boardwalk abutments within this area be supported by helical piles extending through the unsuitable soils. As soil boring B-05 was terminated within the very soft clayey silt, we have made the assumption that native stiff cohesive soils are present at an approximate depth of 15 feet.

We performed a static pile analysis for a 12-inch/14-inch double helix configuration. Our analysis indicates n allowable pile capacity of 15 kips when all helixes are bearing within the native stiff silty clay soil with a tip bearing approximately 25 feet below existing grades. Helical piers should have a minimum center-to-center spacing of 3 times the diameter of the largest helix plate to avoid reduction in capacity due to group interaction. Once the pier installation is complete, grade beams and/or pier caps will be required to transfer the building loads to the foundation system.

Fishing Dock

It is our understanding that the proposed fishing dock will be a floating structure and will include a headwall foundation system. It was reported to us that the proposed headwall foundation system will be constructed at the edge of Brendel Lake. As such, we anticipate that a temporary earth retention system cofferdam will be required in order to construct foundations in a dry condition. If required, G2 can provide design services for the cofferdam system under a separate cover.

As previously stated, soil boring B-08 was performed within the vicinity of the proposed fishing dock. Within soil boring B-08, peat and organic clayey silt soils were encountered and extend to an approximate depth of 8 feet. These soils have organic matter contents ranging from 13.3 to 42.9 percent. Native stiff silty clay underlies the organic soils and extended to the explored depth of 10 feet. The peat and organic clayey silt soils are not suitable for foundations and extending foundations to a depth of 8 feet is not feasible. As such, we recommend that helical piles with an associated pile cap be utilized in order to support the proposed headwall foundation.

We performed a static pile analysis for 12-inch"/14-inch double helix system and determined an allowable pile capacity of 15 kips when all helixes are bearing within the native stiff silty clay soil with a tip bearing approximately 18 feet below existing grades. Helical piers should have a minimum center-to-center spacing of 3 times the diameter of the largest helix plate to avoid reduction in capacity due to group interaction. Once the pier installation is complete, grade beams and/or pier caps will be required to transfer the superstructure loads to the foundation system.

General

It should be noted that several assumptions were made during the static pile analysis for soil conditions below a depth of 10 feet. Prior to helical pier installation, we recommend deeper soil borings be

performed within the vicinity of the two (2) boardwalks, as well as within the vicinity of the proposed fishing dock. Once further soil information is obtained, G2 should be notified in order to re-evaluate the recommendations provided herein.

Continuous wall or strip footings should be at least 12 inches in width and isolated spread footings should be at least 30 inches in their least dimension. We recommend G2 be on site during construction to observe the foundations excavations and verify the adequacy of the bearing soils.

If the recommendations outlined in this report are adhered to, total and differential settlements for the completed structure(s) should be within 1 inch and 1/2 inch, respectively. We expect settlements of these magnitudes are within tolerable limits for the type of structures proposed. We recommend all foundations be suitably reinforced to minimize the effects of differential settlements associated with local variations in subsoil conditions.

PAVEMENT RECOMMENDATIONS

Based on the provided drawings, a service road will be constructed connecting Elizabeth Lake Road to Brendel Lake. It was reported to us that the service road will consist of both bituminous and gravel sections. At the time of this report, information related to anticipated traffic frequencies was not available; however, it was reported to us that traffic will primarily consist of passenger car vehicles and occasional emergency response vehicles. Once traffic conditions become available, G2 should be notified in order to re-evaluate the recommendations provided herein. Furthermore, we understand that a bituminous pedestrian path will be constructed beginning at the north end of Stanley Park and ending near Brendel Lake.

If grades are raised more than two (2) feet within pavement areas where fill soils/peat/organic clayey silt are present, consolidation of the organic soils will occur. We recommend that pavement operations not occur until the settlement rate of the proposed grade has slowed significantly. Even after settlement rates have slowed significantly, some differential settlement will occur over time due to variability in the thickness and location of the peat. Considerations should be given to placing a Tensar Tri-Ax geogrid within the areas where peat and organic clayey silt soils were encountered to minimize the effects of differential settlement. The geogrid should be placed directly atop the subgrade prior to aggregate base installation.

Provided the recommendations presented in the Site Preparation section of this report are followed, we recommend a subgrade modulus of 6,000 pounds per square inch (psi) be used for the anticipated subgrade soils. Based on the anticipated traffic frequencies, we have designed a standard-duty pavement section(s).

For the service bituminous service road, the standard duty section is based on an estimated 50,000 Equivalent Single Axle Loads (ESALs) over a 20-year design life. For evaluation purposes, we estimated a serviceability loss of 2.0, a standard deviation of 0.49, and a reliability of 95 percent.

Based on the results of our analyses, we recommend a minimum standard-duty bituminous pavement section consisting of 1-1/2 inches of MDOT 5EML bituminous concrete wearing course and 2 inches of MDOT 3C bituminous concrete leveling course supported on a minimum of 8 inches of MDOT 21AA dense-graded aggregate base material. All pavement materials are specified within the 2020 Standard Specifications for Construction from the Michigan Department of Transportation (MDOT). The bituminous pavement materials are described in Section 501 and can be assigned a structural coefficient number of 0.42. Any new imported aggregate base course material can be assigned a structural coefficient number of 0.14.

Typical Standard-Duty Asphalt Flexible Pavement Section For Service Road		
Material	**Thickness**	**Structural Coefficient**
MDOT 5EML Bituminous Wearing Course	1-1/2 inches	0.42
MDOT 3C Bituminous Leveling Course	2 inches	0.42
MDOT 21AA Aggregate Base Course (dense-graded)	8 inches	0.14
		Total SN = 2.59

We understand that the proposed bituminous pedestrian pathway will be lightly loaded, with occasional maintenance vehicles. Due to the encountered soil conditions, we recommend that the bituminous pathway be placed in compacted in one (1) lift. It should be noted that over time, small depressions may form on the pavement surface. For evaluation purposes, we estimated a serviceability loss of 2.0, a standard deviation of 0.49, and a reliability of 95 percent.

Based on the results of our analyses, we recommend the pedestrian pathway consists of 2-1/2 inches of MDOT 13A bituminous wearing course supported on a minimum of 8 inches of MDOT 21AA dense-graded aggregate base material. All pavement materials are specified within the 2020 Standard Specifications for Construction from the Michigan Department of Transportation (MDOT). The bituminous pavement materials are described in Section 501 and can be assigned a structural coefficient number of 0.42. Any new imported aggregate base course material can be assigned a structural coefficient number of 0.14.

Typical Standard-Duty Asphalt Flexible Pavement Section For Pedestrian Pathway		
Material	**Thickness**	**Structural Coefficient**
MDOT 13A Bituminous Wearing Course	2-1/2 inches	0.42
MDOT 21AA Aggregate Base Course (dense-graded)	8 inches	0.14
		Total SN = 2.59

Proper pavement drainage is essential given the predominantly cohesive soils within the site. We recommend “stub” or “finger” drains be provided around catch basins to minimize the accumulation of water above and within any frost susceptible subgrade soils. The pavement and subgrade should be properly sloped to promote effective surface and subsurface drainage and prevent water from ponding. We also recommend pavement subbase materials consist of non-frost susceptible aggregates where possible.

Regular timely maintenance should be performed on the pavement to reduce the potential deterioration associated with moisture infiltration through surface cracks. The owner should be prepared to seal the cracks with hot-applied elastic crack filler as soon as possible after cracking develops and as often as necessary to block the passage of water to the subgrade soils.

As previously stated, a portion of the aforementioned service road will be an aggregate surfaced roadway. Based on the variability of the encountered subgrade soils, we recommend a subgrade reaction (k-value) of 100 pounds per cubic inch (pci).

According to AASHTO design criteria for low volume aggregate-surfaced roads, the project is located within the climatic region III, which is characterized as wet, hard freeze, and spring thaw. Due to the encountered organic soils, we recommend that a Tensar Triax 140 be placed directly atop of the exposed subgrade prior to placement of the aggregate surfaced roadway. The minimum aggregate thickness for aggregate-surfaced roadways bearing on the reinforced subgrade should be 12 inches. Aggregate base should consist of MDOT 22A or equivalent material.

CONSTRUCTION CONSIDERATIONS

At the time of this report, information related to proposed utility inverts were not available; however, it will be assumed that approximate utility inverts will range from 5 to 6 feet below existing grades. We anticipate that the foundation excavations will extend approximately 3-1/2 to 5 feet below existing grades.

We anticipate caving and/or sloughing of the surficial granular soils will occur during excavation operations, and as such, the contractor should be prepared to over excavate and form foundations. The sides of the spread and/or strip footings should be constructed straight and vertical to reduce the risk of frozen soil adhering to the concrete and raising foundations. We recommend that foundation excavation and concrete placement operations be conducted on the same day to minimize potential for cave-ins or stormwater run-off into the open excavations.

Within the vicinity of the proposed boardwalks, we anticipate that groundwater will be encountered within excavation extending below a depth of 6 feet. Within the vicinity of the proposed fishing dock headwall foundation system, we anticipate that groundwater will be encountered within excavation extending below a depth of 2 feet.

In general, we do not anticipate significant accumulations of groundwater within construction excavations near the proposed boardwalks. However, we do anticipate significant groundwater accumulations within the vicinity of the proposed fishing dock. Within the vicinity of the proposed boardwalks, we anticipate surface water runoff and groundwater intrusion can generally be controlled with sumps and pumps. Within the vicinity of the proposed fishing dock, we anticipate that a cofferdam earth retention system will be required in order to construct the headwall foundation system in dry conditions.

We recommend maximum slope inclinations of 2 horizontal unit to 1 vertical unit (2H:1V) within the very soft to soft cohesive soils and very loose to loose granular soils, 1-1/2H:1V within the medium cohesive soils and medium compact granular soils, 1H:1V within the stiff cohesive soils, and 3/4H:1V within the very stiff to hard native cohesive soils for temporary excavations extending below a depth of 5 feet. Where seepage from excavation cuts is observed, the slopes will need to be flattened sufficiently to achieve stability, but in no case left steeper than 3H:1V at and below the seepage level.

All excavations should be safely sheeted, shored, sloped, or braced in accordance with MI-OSHA requirements. If material is stored or equipment is operated near an excavation, lower angle slopes or stronger shoring must be used to resist the extra pressure due to the superimposed loads.

GENERAL COMMENTS

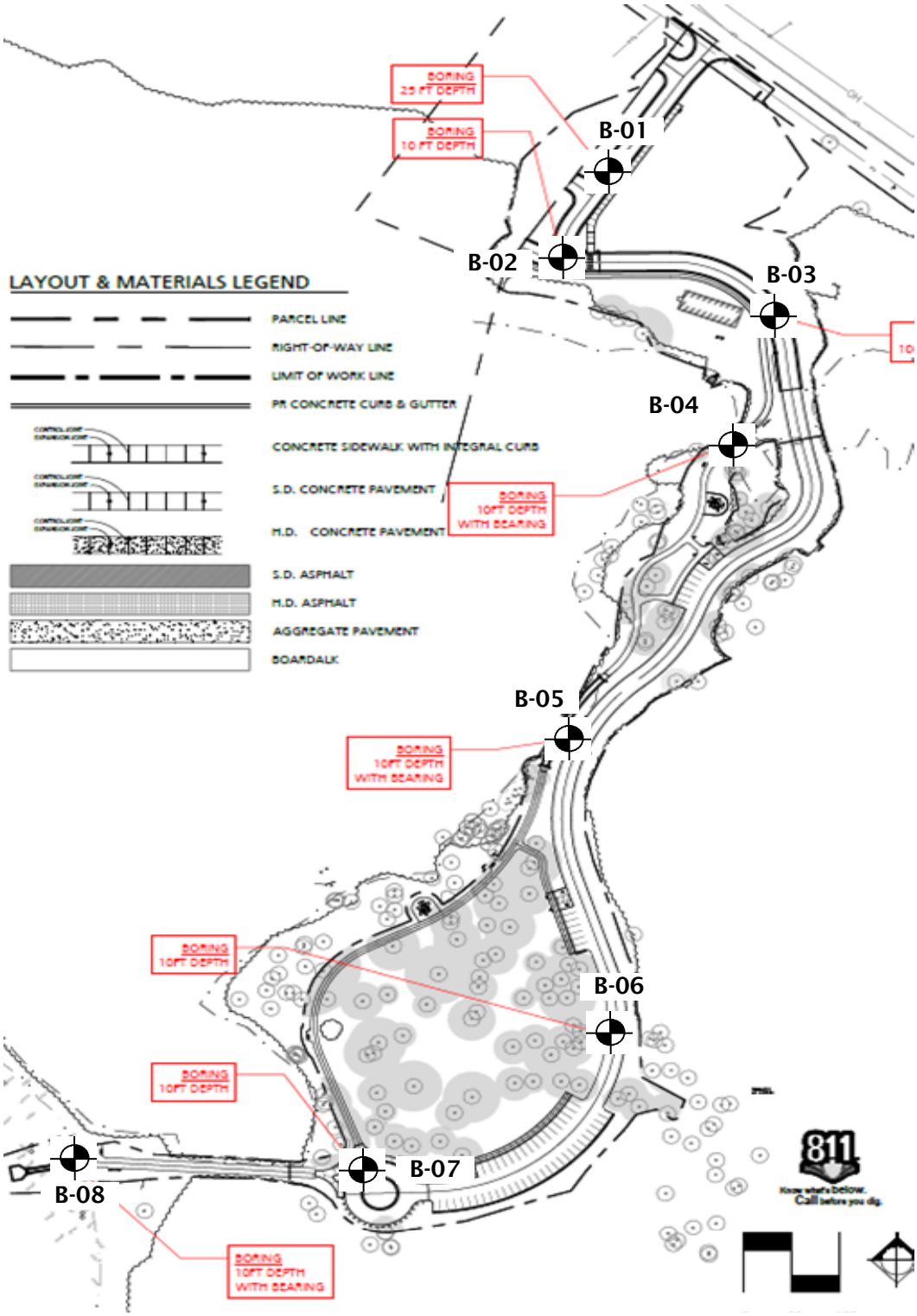
We have formulated the evaluations and recommendations presented in this report relative to site preparation and foundations on the basis of data provided to us relating to the project location, type of structure(s), and surface grade for the proposed site. Any significant change in this data should be brought to our attention for review and evaluation with respect to prevailing subsurface conditions. Furthermore, if changes occur in the design, location, or concept of the project, conclusions and recommendations contained in this report are not valid unless G2 Consulting Group, LLC reviews the changes. G2 Consulting Group, LLC will then confirm the recommendations presented herein or make changes in writing.

The scope of the present investigation was limited to evaluation of subsurface conditions for the support of proposed structure(s) and other related aspects of the development. No chemical, environmental, or hydrogeological testing or analyses were included in the scope of this investigation. We base the analyses and recommendations submitted in this report upon the data from the soil borings performed at the approximate location shown on the Soil Boring Location Plan, Plate No. 1. This report does not reflect variations that may occur between and away from the actual boring locations and the actual structure location(s). The nature and extent of any such variations may not become clear until the time

of construction. If significant variations then become evident, it may be necessary for us to re-evaluate our report recommendations.

We recommend G2 Consulting Group, LLC observe all geotechnical related work, including foundation construction, subgrade preparation, and engineered fill placement. G2 Consulting Group, LLC will perform the appropriate testing to confirm the geotechnical conditions given in the report are found during construction

APPENDIX



Legend

Soil borings drilled by DLZ Drilling on March 11, 2023

Notes

1. Soil boring B-01 drilled to a depth of 25 feet.

2. Soil borings B-02 through B-08 drilled to a depth of 10 feet each.

Soil Boring Location Plan

Proposed Stanley Park Improvements
Elizabeth Lake Road
White Lake Township, Michigan

CONSULTING GROUP	Project No. 213917
	Drawn by: TSH
	Date: 3-16-2023
	Scale: NTS
	Plate No. 1

Project Name: Proposed Stanley Park Improvements

Project Location: Elizabeth Lake Road
White Lake Township, Michigan

G2 Project No. 213917

Latitude: 42.643456° Longitude: -83.499054°

Soil Boring No. B-01

CONSULTING GROUP

SUBSURFACE PROFILE				SOIL SAMPLE DATA					
ELEV. (ft)	PRO-FILE	GROUND SURFACE ELEVATION: 970.0 ft	DEPTH (ft)	SAMPLE TYPE-NO.	BLOWS/ 6-INCHES	STD. PEN. RESISTANCE (N)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONF. COMP. STR. (PSF)
		Sand Topsoil (8 inches) 0.7							
		Very Loose Brown Sand with trace clay and gravel; occasional cobbles 3.0		S-01	3 2 2	4			
965.0		Medium Brown Sandy Clay with trace gravel	5	S-02	2 2 2	4	18.0		1500*
				S-03	1 WOH 1	---	16.2		1000*
		8.0							
960.0		Medium Compact Light Brown Sand with trace gravel	10	S-04	2 6 8	14			
		13.0							
955.0		Hard Brown Silty Clay with trace sand and gravel; frequent silt seams	15	S-05	8 9 13	22	10.9		9000*
		18.0							
950.0		Hard Mottled Brown and Gray Silty Clay with trace sand and gravel; frequent silt seams	20	S-06	13 10 15	25	10.6		9000*
		23.0							
945.0		Very Compact Gray Gravelly Sand; frequent cobbles 25.0	25	S-07	13 25 28	53			
		End of Boring @ 25 ft							
940.0			30						

Total Depth: 25 ft
Drilling Date: March 11, 2023
Inspector:
Contractor: DLZ Drilling
Driller: V. Dearing

Drilling Method:
3-1/4 inch inside-diameter hollow-stem auger

Water Level Observation:
Dry during and upon completion of drilling operations

Notes:
Borehole collapsed at 21 ft after auger removal
* Calibrated Hand Penetrometer

Excavation Backfilling Procedure:
Borehole backfilled with auger cuttings

Figure No. 1

SOIL / PAVEMENT BORING 213917.GPJ 20150116 G2 CONSULTING DATA TEMPLATE.GDT 3/22/23

Project Name: Proposed Stanley Park Improvements

Project Location: Elizabeth Lake Road
White Lake Township, Michigan

G2 Project No. 213917

Latitude: 42.643161° Longitude: -83.499252°

Soil Boring No. B-02

CONSULTING GROUP

SUBSURFACE PROFILE

GROUND SURFACE ELEVATION: 969.0 ft

Clay Topsoil (4 inches) — 0.3

Medium Brown Silty Clay with trace sand and gravel; frequent silt seams — 3.0

Medium Compact Brown Sand with trace gravel — 10.0

End of Boring @ 10 ft

SOIL SAMPLE DATA

ELEV. (ft)	DEPTH (ft)	SAMPLE TYPE-NO.	BLOWS/ 6-INCHES	STD. PEN. RESISTANCE (N)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONF. COMP. STR. (PSF)
		S-01	1 5 6	11	16.8		1000*
964.0	5	S-02	6 6 7	13			
		S-03	6 8 8	16			
959.0	10	S-04	3 5 7	12			
954.0	15						
949.0	20						
944.0	25						
939.0	30						

Total Depth: 10 ft
Drilling Date: March 11, 2023
Inspector:
Contractor: DLZ Drilling
Driller: V. Dearing

Drilling Method:
3-1/4 inch inside-diameter hollow-stem auger

Water Level Observation:
Dry during and upon completion of drilling operations

Notes:
Borehole collapsed at 7 ft after auger removal
* Calibrated Hand Penetrometer

Excavation Backfilling Procedure:
Borehole backfilled with auger cuttings

Figure No. 2

SOIL / PAVEMENT BORING 213917.GPJ 20150116 G2 CONSULTING DATA TEMPLATE.GDT 3/22/23

Project Name: Proposed Stanley Park Improvements

Project Location: Elizabeth Lake Road
White Lake Township, Michigan

G2 Project No. 213917

Latitude: 42.642879° Longitude: -83.498101°

Soil Boring No. B-03

CONSULTING GROUP

SUBSURFACE PROFILE

SOIL SAMPLE DATA

ELEV. (ft)	PRO-FILE	GROUND SURFACE ELEVATION: 955.0 ft	DEPTH (ft)	SAMPLE TYPE-NO.	BLOWS/ 6-INCHES	STD. PEN. RESISTANCE (N)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONF. COMP. STR. (PSF)
		Sand Topsoil (6 inches) 0.5							
		Loose Dark Brown Clayey Sand with trace gravel		S-01	2 2 3	5			
		3.0							
950.0		Loose Brown Sand with trace clay and gravel	5	S-02	WOH 3 3	6			
		6.5		S-03	WOH/18"	---			
		Very Loose to Loose Gray Sand with trace clay and gravel		S-04	3 4 3	7			
945.0		10.0	10						
		End of Boring @ 10 ft							
940.0			15						
935.0			20						
930.0			25						
925.0			30						

Total Depth: 10 ft
Drilling Date: March 11, 2023
Inspector:
Contractor: DLZ Drilling
Driller: V. Dearing

Drilling Method:
3-1/4 inch inside-diameter hollow-stem auger

Water Level Observation:
6 feet during drilling operations; 7 feet upon completion

Notes:
Borehole collapsed at 7 ft after auger removal

Excavation Backfilling Procedure:
Borehole backfilled with auger cuttings

Figure No. 3

SOIL / PAVEMENT BORING 213917.GPJ 20150116 G2 CONSULTING DATA TEMPLATE.GDT 3/22/23

Project Name: Proposed Stanley Park Improvements

Project Location: Elizabeth Lake Road
White Lake Township, Michigan

G2 Project No. 213917

Latitude: 42.642099° Longitude: -83.498307°

Soil Boring No. B-04

CONSULTING GROUP

SUBSURFACE PROFILE

SOIL SAMPLE DATA

ELEV. (ft)	PRO-FILE	GROUND SURFACE ELEVATION: 942.0 ft	DEPTH (ft)	SAMPLE TYPE-NO.	BLOWS/ 6-INCHES	STD. PEN. RESISTANCE (N)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONF. COMP. STR. (PSF)
		Sand Topsoil (9 inches) 0.8							
		Very Loose Brown Clayey Sand with trace gravel		S-01	WOH/18"	---			
		3.0							
937.0		Medium Mottled Brown and Gray Sandy Clay with trace gravel	5	S-02	WOH/12" 3	---	29.3		1000*
		6.0		S-03	8 9 10	19			
932.0		Medium Compact Brown and Gray Sand with trace gravel 10.0	10	S-04	8 8 9	17			
927.0		End of Boring @ 10 ft	15						
922.0			20						
917.0			25						
912.0			30						

Total Depth: 10 ft
Drilling Date: March 11, 2023
Inspector:
Contractor: DLZ Drilling
Driller: V. Dearing

Drilling Method:
3-1/4 inch inside-diameter hollow-stem auger

Water Level Observation:
6 feet during drilling operations; 6-1/2 feet upon completion

Notes:
Borehole collapsed at 7 ft after auger removal
* Calibrated Hand Penetrometer

Excavation Backfilling Procedure:
Borehole backfilled with auger cuttings

Figure No. 4

SOIL / PAVEMENT BORING 213917.GPJ 20150116 G2 CONSULTING DATA TEMPLATE.GDT 3/22/23

Project Name: Proposed Stanley Park Improvements

Project Location: Elizabeth Lake Road
White Lake Township, Michigan

G2 Project No. 213917

Latitude: 42.641394° Longitude: -83.499175°

Soil Boring No. B-05

CONSULTING GROUP

SUBSURFACE PROFILE

GROUND SURFACE ELEVATION: 936.5 ft

ELEV. (ft)	DEPTH (ft)	Description
	0.3	Sand Topsoil (3 inches)
	3.5	Fill: Loose Brown Clayey Sand with trace gravel; intermixed peat (Organic Matter Content = 21.7%)
931.5	5	Fill: Medium Mottled Brown and Black Sandy Clay with trace gravel; intermixed peat (Organic Matter Content = 15.2%)
	6.0	Black Peat (Organic Matter Content = 57.6%)
	7.0	Gray and Black Peat (Organic Matter Content = 64.3%)
	8.5	
926.5	10	Very Soft Gray Clayey Silt
	10.0	End of Boring @ 10 ft
921.5	15	
916.5	20	
911.5	25	
906.5	30	

SOIL SAMPLE DATA

SAMPLE TYPE-NO.	BLOWS/ 6-INCHES	STD. PEN. RESISTANCE (N)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONF. COMP. STR. (PSF)
S-01	3 4 4	8			
S-02	WOH 3 3	6	22.8		1000*
S-03	WOH/18"	---	98.7		
S-04	WOH/18"	---	55.3		250**

Total Depth: 10 ft
Drilling Date: March 11, 2023
Inspector:
Contractor: DLZ Drilling
Driller: V. Dearing

Drilling Method:
3-1/4 inch inside-diameter hollow-stem auger

Water Level Observation:
6 feet during and upon completion of drilling operations

Notes:
Borehole collapsed at 6 ft after auger removal
* Calibrated Hand Penetrometer
** Torvane

Excavation Backfilling Procedure:
Borehole backfilled with auger cuttings

Figure No. 5

SOIL / PAVEMENT BORING 213917.GPJ 20150116 G2 CONSULTING DATA TEMPLATE.GDT 3/22/23

Project Name: Proposed Stanley Park Improvements

Project Location: Elizabeth Lake Road
White Lake Township, Michigan

G2 Project No. 213917

Latitude: 42.640196° Longitude: -83.498855°

Soil Boring No. B-06

CONSULTING GROUP

SUBSURFACE PROFILE

SOIL SAMPLE DATA

ELEV. (ft)	PRO-FILE	GROUND SURFACE ELEVATION: 937.5 ft	DEPTH (ft)	SAMPLE TYPE-NO.	BLOWS/ 6-INCHES	STD. PEN. RESISTANCE (N)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONF. COMP. STR. (PSF)
		Sand Topsoil (3 inches) 0.3							
		Loose Brown Sand with trace clay and gravel		S-01	3 5 5	10			
		3.0							
932.5		Hard Mottled Brown and Gray Silty Clay with trace sand and gravel; frequent silt seams	5	S-02	6 7 11	18	13.9		9000*
		6.5		S-03	5 4 2	6			
		Loose Gray Clayey Sand with trace gravel							
		9.0							
927.5		Hard Gray Silty Clay with trace sand and gravel; frequent silt seams 10.0	10	S-04	2 5 9	14	7.6		9000*
		End of Boring @ 10 ft							
922.5			15						
917.5			20						
912.5			25						
907.5			30						

Total Depth: 10 ft
Drilling Date: March 11, 2023
Inspector:
Contractor: DLZ Drilling
Driller: V. Dearing

Drilling Method:
3-1/4 inch inside-diameter hollow-stem auger

Water Level Observation:
3 feet during and upon completion of drilling operations

Notes:
Borehole collapsed at 3 ft after auger removal
* Calibrated Hand Penetrometer

Excavation Backfilling Procedure:
Borehole backfilled with auger cuttings

Figure No. 6

SOIL / PAVEMENT BORING 213917.GPJ 20150116 G2 CONSULTING DATA TEMPLATE.GDT 3/22/23

Project Name: Proposed Stanley Park Improvements

Project Location: Elizabeth Lake Road
White Lake Township, Michigan

G2 Project No. 213917

Latitude: 42.639758° Longitude: -83.500162°

Soil Boring No. B-07

CONSULTING GROUP

SUBSURFACE PROFILE

SOIL SAMPLE DATA

ELEV. (ft)	PRO-FILE	GROUND SURFACE ELEVATION: 936.0 ft	DEPTH (ft)	SAMPLE TYPE-NO.	BLOWS/ 6-INCHES	STD. PEN. RESISTANCE (N)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONF. COMP. STR. (PSF)
		Sand Topsoil (2 inches) 0.2							
		Loose Brown Sand with trace gravel		S-01	3 5 3	8			
		3.0							
931.0			5	S-02	3 3 4	7			
		Very Loose to Loose Gray Sand with trace gravel		S-03	3 2 2	4			
926.0		10.0	10	S-04	2 3 4	7			
		End of Boring @ 10 ft							
921.0			15						
916.0			20						
911.0			25						
906.0			30						

Total Depth: 10 ft
Drilling Date: March 11, 2023
Inspector:
Contractor: DLZ Drilling
Driller: V. Dearing

Drilling Method:
3-1/4 inch inside-diameter hollow-stem auger

Water Level Observation:
2 feet during and upon completion of drilling operations

Notes:
Borehole collapsed at 2 ft after auger removal

Excavation Backfilling Procedure:
Borehole backfilled with auger cuttings

Figure No. 7

SOIL / PAVEMENT BORING 213917.GPJ 20150116 G2 CONSULTING DATA TEMPLATE.GDT 3/22/23

Project Name: Proposed Stanley Park Improvements

Project Location: Elizabeth Lake Road
White Lake Township, Michigan

G2 Project No. 213917

Latitude: 42.639651° Longitude: -83.501459°

Soil Boring No. B-08

CONSULTING GROUP

SUBSURFACE PROFILE

SOIL SAMPLE DATA

ELEV. (ft)	PRO-FILE	GROUND SURFACE ELEVATION: 934.3 ft	DEPTH (ft)	SAMPLE TYPE-NO.	BLOWS/ 6-INCHES	STD. PEN. RESISTANCE (N)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONF. COMP. STR. (PSF)
		Clay Topsoil (3 inches) 0.3							
		Fill: Mottled Brown and Gray Silty Clay with trace sand and gravel 1.5		S-01	1 1 WOH	---	380.0		
		Black Peat (Organic Matter Content = 42.9 %) 3.0							
929.3		Soft Gray Clayey Silt; intermixed shell fragments (Marl) (Organic Matter Content = 13.3%)	5	S-02	WOH/18"	---	70.9		500**
				S-03	WOH/18"	---	33.4		450**
		8.0							
924.3		Stiff Gray Silty Clay with trace sand and gravel; frequent silt seams 10.0	10	S-04	WOH 5 6	11	10.3		3500*
		End of Boring @ 10 ft							
919.3			15						
914.3			20						
909.3			25						
904.3			30						

Total Depth: 10 ft
Drilling Date: March 11, 2023
Inspector:
Contractor: DLZ Drilling
Driller: V. Dearing

Drilling Method:
3-1/4 inch inside-diameter hollow-stem auger

Water Level Observation:
9 feet during drilling operations; 8-1/2 feet upon completion

Notes:
Borehole collapsed at 9 ft after auger removal
* Calibrated Hand Penetrometer
** Torvane

Excavation Backfilling Procedure:
Borehole backfilled with auger cuttings

Figure No. 8

SOIL / PAVEMENT BORING 213917.GPJ 20150116 G2 CONSULTING DATA TEMPLATE.GDT 3/22/23

GENERAL NOTES TERMINOLOGY

Unless otherwise noted, all terms herein refer to the Standard Definitions presented in ASTM 653.

PARTICLE SIZE

Boulders		- greater than 12 inches
Cobbles		- 3 inches to 12 inches
Gravel	- Coarse	- 3/4 inches to 3 inches
	- Fine	- No. 4 to 3/4 inches
Sand	- Coarse	- No. 10 to No. 4
	- Medium	- No. 40 to No. 10
	- Fine	- No. 200 to No. 40
Silt		- 0.005mm to 0.074mm
Clay		- Less than 0.005mm

CLASSIFICATION

The major soil constituent is the principal noun, i.e. clay, silt, sand, gravel. The second major soil constituent and other minor constituents are reported as follows:

Second Major Constituent (percent by weight)	Minor Constituent (percent by weight)
Trace - 1 to 12%	Trace - 1 to 12%
Adjective - 12 to 35%	Little - 12 to 23%
And - over 35%	Some - 23 to 33%

COHESIVE SOILS

If clay content is sufficient so that clay dominates soil properties, clay becomes the principal noun with the other major soil constituent as modifier, i.e. sandy clay. Other minor soil constituents may be included in accordance with the classification breakdown for cohesionless soils, i.e. silty clay, trace sand, little gravel.

Consistency	Unconfined Compressive Strength (psf)	Approximate Range of (N)
Very Soft	Below 500	0 - 2
Soft	500 - 1,000	3 - 4
Medium	1,000 - 2,000	5 - 8
Stiff	2,000 - 4,000	9 - 15
Very Stiff	4,000 - 8,000	16 - 30
Hard	8,000 - 16,000	31 - 50
Very Hard	Over 16,000	Over 50

Consistency of cohesive soils is based upon an evaluation of the observed resistance to deformation under load and not upon the Standard Penetration Resistance (N).

COHESIONLESS SOILS

Density Classification	Relative Density %	Approximate Range of (N)
Very Loose	0 - 15	0 - 4
Loose	16 - 35	5 - 10
Medium Compact	36 - 65	11 - 30
Compact	66 - 85	31 - 50
Very Compact	86 - 100	Over 50

Relative Density of cohesionless soils is based upon the evaluation of the Standard Penetration Resistance (N), modified as required for depth effects, sampling effects, etc.

SAMPLE DESIGNATIONS

AS - Auger Sample – Cuttings directly from auger flight
BS - Bottle or Bag Samples
S - Split Spoon Sample - ASTM D 1586
LS - Liner Sample with liner insert 3 inches in length
ST - Shelby Tube sample - 3 inch diameter unless otherwise noted
PS - Piston Sample - 3 inch diameter unless otherwise noted
RC - Rock Core - NX core unless otherwise noted

STANDARD PENETRATION TEST (ASTM D 1586) - A 2.0 inch outside-diameter, 1-3/8 inch inside-diameter split barrel sampler is driven into undisturbed soil by means of a 140-pound weight falling freely through a vertical distance of 30 inches. The sampler is normally driven three successive 6-inch increments. The total number of blows required for the final 12 inches of penetration is the Standard Penetration Resistance (N).