STANDARD SPECIFICATIONS AND DETAILS
FOR

WATER MAIN AND SANITARY SEWER

TITTABAWASSEE TOWNSHIP DPW
SAGINAW COUNTY, MICHIGAN

Prepared By:
SPICER GROUP, INC.
SAGINAW, MICHIGAN
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DRAWINGS

DS-1156-2A (STD)
DW-1556 (STD)

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DIVISION 33 - UTILITIES

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SUMMARY

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Contract description.
2. Contractor's use of Site
3. Work sequence.
4. Owner occupancy.
5. Permits.
6. Specification conventions.

1.2 CONTRACT DESCRIPTION

A. The Contractor shall furnish all the labor, material and construction equipment and perform all the work for the construction of the Utilities as shown on the Drawings and described in the specifications. Contractor shall be responsible for the entire work until completed and accepted by the Owner.

B. The Owner will obtain easements and rights-of-way needed for construction, as shown on the plans. Additional temporary easements beyond what is shown shall be the responsibility of the Contractor.

1.3 CONTRACTOR'S USE OF SITE

A. Limit use of Site to allow:
1. Cooperate with Land Owners to minimize conflict. If disputes arise, contact the Engineer immediately.

1.4 WORK SEQUENCE

A. Construct Work in an upstream direction during the construction period, coordinate construction schedule and operations with Engineer

1.5 OWNER OCCUPANCY

A. Schedule and substantially complete designated portions of the Work for occupancy before Substantial Completion of the entire Work.

B. Cooperate with Owner to minimize conflict and to facilitate Owner's operations.

1.6 PERMITS

A. Furnish necessary permits for construction of Work.

1.7 SPECIFICATION CONVENTIONS

A. These Specifications are written in imperative mood and streamlined form. This imperative language is directed to Contractor unless specifically noted otherwise. The words "shall be" are included by inference where a colon (:) is used within sentences or phrases.

PART 2 PRODUCTS - Not Used

PART 3 EXECUTION - Not Used

END OF SECTION

SECTION 01 25 00
SUBSTITUTION PROCEDURES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Quality assurance.

B. Product options.

C. Product substitution procedures.

1.2 QUALITY ASSURANCE

A. Products specified define standard of quality, type, function, dimension, appearance, and performance required.

B. Substitution Proposals: Permitted for specified products except where specified otherwise. Do not substitute products unless substitution has been accepted and approved in writing by Owner.

1.3 PRODUCT OPTIONS

A. See Section 01 60 00 - Product Requirements.

1.4 PRODUCT SUBSTITUTION PROCEDURES

A. The Township will consider requests for substitutions only within 15 days after the construction.

B. Substitutions may be considered when a product becomes unavailable through no fault of Contractor.

C. Document each request with complete data, substantiating compliance of proposed substitution with Township Standards, including:
   1. Manufacturer's name and address, product, trade name, model, or catalog number, performance and test data, and reference standards.
   2. Itemized point-by-point comparison of proposed substitution with specified product, listing variations in quality, performance, and other pertinent characteristics.
   3. Reference to Article and Paragraph numbers in Specification Section.
   4. Cost data comparing proposed substitution with specified product and amount of net change to Contract Sum.
   5. Changes required in other Work.
   6. Availability of maintenance service and source of replacement parts as applicable.
   7. Certified test data to show compliance with performance characteristics specified.
   8. Samples when applicable or requested.

D. A request constitutes a representation that Contractor:

1. Has investigated proposed product and determined that it meets or exceeds quality level of specified product.
2. Will provide same warranty for substitution as for specified product.
3. Will coordinate installation and make changes to other Work that may be required for the Work to be complete with no additional cost to Owner.
4. Waives claims for additional costs or time extension that may subsequently become apparent.
5. Will coordinate installation of the accepted substitute, making such changes as may be required for the Work to be complete in all respects.
6. Will reimburse Owner for review or redesign services associated with reapproval by authorities having jurisdiction.

E. Substitutions will not be considered when they are indicated or implied on Shop Drawing or Product Data submittals without separate written request or when acceptance will require revision to Township Standards.

F. Substitution Submittal Procedure:
1. Submit requests for substitutions.
2. Submit three copies of Request for Substitution for consideration. Limit each request to one proposed substitution.
3. Submit Shop Drawings, Product Data, and certified test results attesting to proposed product equivalence. Burden of proof is on proposer.
4. Engineer will notify Contractor in writing of decision to accept or reject request.

PART 2 PRODUCTS - Not Used

PART 3 EXECUTION - Not Used

END OF SECTION

SECTION 01 30 00
ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Coordination and Project conditions.

B. Field Engineering

C. Cutting and Patching

D. Preconstruction meeting.

E. Site mobilization meeting.

F. Progress meetings.

G. Preinstallation meetings.

H. Closeout meeting.

I. Alteration procedures.

1.2 COORDINATION AND PROJECT CONDITIONS

A. Coordinate scheduling, submittals, and Work of various Sections of Technical Specifications to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.

B. Verify that utility requirements and characteristics of operating equipment are compatible with building utilities. Coordinate Work of various Sections having interdependent responsibilities for installing, connecting to, and placing operating equipment in service.

C. Coordination Meetings: In addition to other meetings specified in this Section, hold coordination meetings with personnel and Subcontractors to ensure coordination of Work.

D. Coordinate completion and clean-up of Work of separate Sections in preparation for Substantial Completion and for portions of Work designated for Owner's partial occupancy.

E. After Owner's occupancy of premises, coordinate access to Site for correction of defective Work and Work not complying with Township Standards, to minimize disruption of Owner's activities.

1.3 FIELD ENGINEERING

A. Contractor to locate and protect survey control and reference points, land monuments, and property corner.

B. Control datum for survey is that established by Owner provided survey shown on Drawings.

C. Engineer will provide construction staking. Call the Engineer to request staking at least 3 working days in advance of the time needed for the work.

D. Construction stakes removed or damaged by Contractor shall be replaced at Contractor's expense.

E. When finished surfaces are cut so that a smoother transition and new work is not possible, terminate existing surface along a straight line at a natural line of division and make recommendation to Engineer.

F. Where a change of plane of 1/4 inch or more occurs, submit recommendation for providing a smooth transition for Engineer review and request instructions from Engineer.

G. Patch or replace portions of existing surfaces which are damaged, lifted, discolored, or showing other imperfections.

H. Finish surfaces as specified in individual product sections.

I. Where there are changes in open drain cross sections, excavate a 20-foot smooth transition between sections.

1.4 CUTTING AND PATCHING

A. Employ skilled and experienced installer to perform cutting and patching.

B. Submit written request in advance of cutting or altering elements which affects:
   1. Structural integrity of element.
   2. Integrity of weather-exposed or moisture-resistant elements.
   3. Efficiency, maintenance, or safety of element.
   4. Visual quantities of sight-exposed elements.
   5. Work of Owner or separate contractor.

C. Execute cutting, fitting, and patching including excavation and fill, to complete Work, and to:
   1. Fit the several parts together, to integrate with other Work.
   2. Uncover Work to install or correct ill-timed Work.
   3. Remove and replace defective and non-conforming Work.
   4. Remove samples of installed Work for testing.

D. Execute work by methods which will avoid damage to other Work, and provide proper surfaces to receive patching and finishing.

E. Cut rigid materials using masonry saw or core drill.

F. Restore Work with new products in accordance with requirements of the Township.

G. Fit Work tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

H. Refinish surfaces to match adjacent finishes. For continuous surfaces, refinish to nearest intersection; for an assembly, refinish entire unit.

I. Identify any hazardous substance or condition exposed during the Work to the Engineer for decision or remedy.

1.5 PRECONSTRUCTION MEETING

A. Engineer will schedule and preside over meeting after Notice of Award.

B. Attendance Required: Engineer, Owner, appropriate governmental agency representatives, applicable public and private utility companies and Contractor.

C. Minimum Agenda:
1. Submission of executed bonds and insurance certificates.
2. Submission of list of Subcontractors, list of products, schedule of values, and Progress Schedule.
3. Designation of personnel representing parties in Contract, along with contact phone number and Engineer.
4. Communication procedures.
5. Procedures and processing of requests for interpretations, field decisions field orders, submittals, substitutions, Applications for Payments, proposal request, Change Orders, and closeout procedures.
6. Scheduling.
7. Critical Work sequencing.
8. Scheduling activities.
9. Utility Representatives comments and requirements.

D. Engineer will record minutes and distribute copies to participants after meeting.

1.6 PROGRESS MEETINGS

A. Schedule and administer meetings throughout progress of the Work.

B. Engineer will make arrangements for meetings, prepare agenda with copies for participants, and preside over meetings.

C. Attendance Required: Job superintendent, major Subcontractors, Contractors and suppliers, and Engineer, Owner, as appropriate to agenda topics for each meeting.

D. Minimum Agenda:
1. Review minutes of previous meetings.
2. Review of Work progress.
3. Field observations, problems, and decisions.
4. Identification of problems impeding planned progress.
5. Review of submittal schedule and status of submittals.
6. Review of off-Site fabrication and delivery schedules.
7. Maintenance of Progress Schedule.
8. Corrective measures to regain projected schedules.

9. Planned progress during succeeding work period.
10. Coordination of projected progress.
11. Maintenance of quality and work standards.
12. Effect of proposed changes on Progress Schedule and coordination.
13. Other business relating to Work.

E. Contractor: Record minutes and distribute copies to participants within two days after meeting, with two copies each to Engineer, Owner, and those affected by decisions made.

1.7 PREINSTALLATION MEETINGS

A. When required in individual Specification Sections, convene preinstallation meetings at Project Site before starting Work of specific Section.

B. Require attendance of parties directly affecting, or affected by, Work of specific Section.

C. Notify Engineer four days in advance of meeting date.

D. Prepare agenda and preside over meeting:
1. Review conditions of installation, preparation, and installation procedures.
2. Review coordination with related Work.

E. Record minutes and distribute copies to participants within two days after meeting, with two copies each to Engineer, Owner, and those affected by decisions made.

1.8 CLOSEOUT MEETING

A. Schedule Project closeout meeting with sufficient time to prepare for requesting Substantial Completion. Preside over meeting and be responsible for minutes.

B. Attendance Required: Contractor, Subcontractors, Engineer, Owner, and others appropriate to agenda.

C. Notify Engineer four days in advance of meeting date.

D. Minimum Agenda:
1. Start-up of facilities and systems.
2. Operations and maintenance manuals.
3. Testing, adjusting, and balancing.
4. System demonstration and observation.
5. Operation and maintenance instructions for Owner's personnel.
6. Temporary indoor-air-quality plan and procedures.
7. Contractor's inspection of Work.
8. Contractor's preparation of an initial "punch list."
9. Procedure to request Engineer inspection to determine date of Substantial Completion.
10. Completion time for correcting deficiencies.
11. Inspections by authorities having jurisdiction.
12. Certificate of Occupancy and transfer of insurance responsibilities.
13. Partial release of retainage.

14. Final cleaning.
15. Preparation for final inspection.
16. Closeout Submittals:
    a. Project record documents.
    b. Operating and maintenance documents.
    c. Operating and maintenance materials.
    d. Affidavits.
17. Final Application for Payment.
18. Contractor's demobilization of Site.
19. Maintenance.

E. Record minutes and distribute copies to participants within two days after meeting, with two copies each to Engineer, Owner, and those affected by decisions made.

PART 2 PRODUCTS - Not Used

PART 3 EXECUTION

3.1 ALTERATION PROCEDURES

A. Entire facility will be occupied for normal operations during progress of construction. Cooperate with Owner in scheduling operations to minimize conflict and to permit continuous usage.
    1. Perform Work not to interfere with operations of occupied areas.
    2. Keep utility and service outages to a minimum and perform only after written approval of Owner.
    3. Clean Owner-occupied areas daily. Clean spillage, overspray, and heavy collection of dust in Owner-occupied areas immediately.

B. Materials: As specified in product Sections; match existing products with new and salvaged products for patching and extending Work.

C. Employ skilled and experienced installer to perform alteration and renovation Work.

D. Cut, move, or remove items as necessary for access to alterations and renovation Work. Replace and restore at completion. Comply with Section 01 70 00 - Execution and Closeout Requirements

E. Remove unsuitable material not marked for salvage, including rotted wood, corroded metals, and deteriorated masonry and concrete. Replace materials as specified for finished Work.

F. Remove debris and abandoned items from area and from concealed spaces.

G. Prepare surface and remove surface finishes to permit installation of new Work and finishes.

H. Close openings in exterior surfaces to protect existing Work from weather and extremes of temperature and humidity.

I. Remove, cut, and patch Work to minimize damage and to permit restoring products and finishes to original or specified condition.

J. Refinish existing visible surfaces to remain in renovated rooms and spaces, to specified or new condition for each material, with neat transition to adjacent finishes.

K. Where new Work abuts or aligns with existing Work, provide smooth and even transition. Patch Work to match existing adjacent Work in texture and appearance.

L. When finished surfaces are cut so that smooth transition with new Work is not possible, terminate existing surface along straight line at natural line of division and submit recommendation to Engineer for review.

M. Where change of plane of 1/4 inch or more occurs, submit recommendation for providing smooth transition to Engineer for review.

N. Trim existing doors to clear new floor finish. Refinish trim to original or specified condition.

O. Patch or replace portions of existing surfaces that are damaged, lifted, discolored, or showing other imperfections.

P. Finish surfaces as specified in individual product Sections.

END OF SECTION

SECTION 01 32 16
CONSTRUCTION PROGRESS SCHEDULE

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Submittals.

B. Review and evaluation.

C. Updating schedules.

D. Distribution.

1.2 SUBMITTALS

A. 5 days prior to the pre-construction meeting the Contractor shall submit a construction work schedule laying out the progress of the project for the Engineer's review.

B. Schedule Updates:
1. Overall percent complete, projected and actual.
2. Completion progress by listed activity and subactivity, to within five days prior to submittal.
3. Changes in Work scope and activities modified since submittal.
4. Delays in submittals or resubmittals, deliveries, or Work.
5. Adjusted or modified sequences of Work.
6. Other identifiable changes.
7. Revised projections of progress and completion.

1.3 REVIEW AND EVALUATION

A. Participate in joint review and evaluation of schedules with Engineer at each submittal.

B. Evaluate Project status to determine Work behind schedule and Work ahead of schedule.

C. After review, revise schedules incorporating results of review, and resubmit within 10 days.

1.4 UPDATING SCHEDULES

A. Maintain schedules to record actual start and finish dates of completed activities.

B. Indicate progress of each activity to date of revision, with projected completion date of each activity. Update schedules to depict current status of Work.

C. Identify activities modified since previous submittal, major changes in Work, and other identifiable changes.

D. Upon approval of a Change Order, include the change in the next schedule submittal.

E. Indicate changes required to maintain Date of Substantial and Total Completion.

F. Submit sorts as required to support recommended changes.

G. Prepare narrative report to define problem areas, anticipated delays, and impact on schedule. Report corrective action taken or proposed and its effect.

1.5 DISTRIBUTION

A. Following joint review, distribute copies of updated schedules to Contractor's Project site file, to Subcontractors, suppliers, Engineer, Owner, and other concerned parties.

B. Instruct recipients to promptly report, in writing, problems anticipated by projections shown in schedules.

PART 2 PRODUCTS - Not Used

PART 3 EXECUTION - Not Used

END OF SECTION

SECTION 01 33 00
SUBMITTAL PROCEDURES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Definitions.

B. Submittal procedures.

C. Construction progress schedules.

D. Proposed product list.

E. Product data.

F. Use of electronic CAD files of Project Drawings.

G. Shop Drawings.

H. Samples.

I. Other submittals.

J. Design data.

K. Test reports.

L. Certificates.

M. Manufacturer's instructions.

N. Manufacturer's field reports.

O. Erection Drawings.

P. Contractor review.

Q. Engineer review.

1.2 DEFINITIONS

A. Action Submittals: Written and graphic information and physical samples that require Engineer's responsive action.

B. Informational Submittals: Written and graphic information and physical Samples that do not require Engineer's responsive action. Submittals may be rejected for not complying with requirements.

1.3 SUBMITTAL PROCEDURES

A. Transmit each submittal with Engineer-accepted form.

B. Sequentially number transmittal forms. Mark revised submittals with original number and sequential alphabetic suffix.

C. Identify: Project, Contractor, Subcontractor and supplier, pertinent Drawing and detail number, and Specification Section number appropriate to submittal.

D. Apply Contractor's stamp, signed or initialed, certifying that review, approval, verification of products required, field dimensions, adjacent construction Work, and coordination of information is according to requirements of the Work.

E. Schedule submittals to expedite Project, and deliver to Engineer**.** Coordinate submission of related items.

F. For each submittal for review, allow **15** days excluding delivery time to and from Contractor.

G. Identify variations in Township Standards and product or system limitations that may be detrimental to successful performance of completed Work.

H. Allow space on submittals for Contractor and Engineer review stamps.

I. When revised for resubmission, identify changes made since previous submission.

J. Distribute copies of reviewed submittals as appropriate. Instruct parties to promptly report inability to comply with requirements.

K. Submittals not requested will not be recognized nor processed.

L. Incomplete Submittals: Engineer will not review. Complete submittals for each item are required. Delays resulting from incomplete submittals are not the responsibility of Engineer.

1.4 CONSTRUCTION PROGRESS SCHEDULES

A. Comply with Section 01 32 16 - Construction Progress Schedule

1.5 PROPOSED PRODUCT LIST

A. Submit list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.

B. For products specified only by reference standards, indicate manufacturer, trade name, model or catalog designation, and reference standards.

1.6 PRODUCT DATA

A. Product Data: Action Submittal: Submit to Engineer for review for assessing conformance with information given and design concept expressed.

B. Submit number of copies Contractor requires, plus three copies Engineer will retain.

C. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.

D. Indicate product utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

E. After review, produce copies and distribute according to "Submittal Procedures" Article and for record documents described in Section 01 70 00 - Execution and Closeout Requirements.

1.7 ELECTRONIC CAD FILES OF PROJECT DRAWINGS

A. Electronic CAD Files of Project Drawings: May only be used to expedite production of Shop Drawings for the Project. Use for other Projects or purposes is not allowed.

B. Electronic CAD Files of Project Drawings: Distributed only under the following conditions:
   1. Use of files is solely at receiver's risk. Engineer does not warrant accuracy of files. Receiving files in electronic form does not relieve receiver of responsibilities for measurements, dimensions, and quantities set forth in Contract Documents. In the event of ambiguity, discrepancy, or conflict between information on electronic media and that in Contract Documents, notify Engineer of discrepancy and use information in hard-copy Drawings and Specifications.
   2. CAD files do not necessarily represent the existing conditions, and as-built conditions. Receiver is responsible for determining and complying with these conditions and for incorporating addenda and modifications.
   3. User is responsible for removing information not normally provided on Shop Drawings. Shop Drawings submitted with information associated with other trades will not be reviewed and will be immediately returned.
   4. Receiver shall not hold Engineer responsible for data or file clean-up required to make files usable, nor for error or malfunction in translation, interpretation, or use of this electronic information.
   5. Receiver shall understand that even though Engineer has computer virus scanning software to detect presence of computer viruses, there is no guarantee that computer viruses are not present in files or in electronic media.
   6. Receiver shall not hold Engineer responsible for such viruses or their consequences, and shall hold Engineer harmless against costs, losses, or damage caused by presence of computer virus in files or media.

1.8 SHOP DRAWINGS

A. Shop Drawings: Action Submittal: Submit to Engineer for assessing conformance with information given and design concept.

B. Indicate special utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

C. When required by individual Specification Sections, provide Shop Drawings signed and sealed by a professional Engineer responsible for designing components shown on Shop Drawings.
   1. Include signed and sealed calculations to support design.
   2. Submit Shop Drawings and calculations in form suitable for submission to and approval by authorities having jurisdiction.
   3. Make revisions and provide additional information when required by authorities having jurisdiction.

D. Submit number of opaque reproductions Contractor requires, plus two copies Engineer will retain.

E. After review, produce copies and distribute according to "Submittal Procedures" Article and for record documents described in Section 01 70 00 - Execution and Closeout Requirements.

1.9 SAMPLES

A. Samples: Action Submittal: Submit to Engineer for assessing conformance with information given and design concept.

B. Samples for Selection as Specified in Product Sections:
   1. Submit to Engineer for aesthetic, color, and finish selection.
   2. Submit Samples of finishes, textures, and patterns for Engineer selection.

C. Submit Samples to illustrate functional and aesthetic characteristics of products, with integral parts and attachment devices. Coordinate Sample submittals for interfacing work.

D. Include identification on each Sample, with full Project information.

E. Submit number of Samples specified in individual Specification Sections; Engineer will retain **one** Sample.

F. Reviewed Samples that may be used in the Work are indicated in individual Specification Sections.

G. Samples will not be used for testing purposes unless specifically stated in Specification Section.

H. After review, produce copies and distribute according to "Submittal Procedures" Article and for record documents described in Section 01 70 00 - Execution and Closeout Requirements.

1.10 OTHER SUBMITTALS

A. Closeout Submittals: Comply with Section 01 70 00 - Execution and Closeout Requirements.

B. Informational Submittal: Submit data for Engineer's knowledge or for Owner.

C. Submit information for assessing conformance with information given and design concept.

1.11 TEST REPORTS

A. Informational Submittal: Submit reports for Engineer's knowledge or for Owner.

B. Submit test reports for information for assessing conformance with information given and design concept.

1.12 CERTIFICATES

A. Informational Submittal: Submit certification by manufacturer, installation/application Subcontractor, or Contractor to Engineer, in quantities specified for Product Data.

B. Indicate material or product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.

C. Certificates may be recent or previous test results on material or product but must be acceptable to Engineer.

1.13 MANUFACTURER'S INSTRUCTIONS

A. Informational Submittal: Submit manufacturer's installation instructions for Engineer's knowledge or Owner.

B. Submit printed instructions for delivery, storage, assembly, installation, startup, adjusting, and finishing, to Engineer in quantities specified for Product Data.

C. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.

1.14 MANUFACTURER'S FIELD REPORTS

A. Informational Submittal: Submit reports for Engineer's knowledge or Owner.

B. Submit report in duplicate within 5 days of observation to Engineer for information.

C. Submit reports for information for assessing conformance with information given and design concept expressed in Contract Documents.

1.15 ERECTION DRAWINGS

A. Informational Submittal: Submit Drawings for Engineer's knowledge or Owner.

B. Submit Drawings for information assessing conformance with information given and design concept expressed in Contract Documents.

C. Data indicating inappropriate or unacceptable Work may be subject to action by Engineer or Owner.

1.16 CONTRACTOR REVIEW

A. Review for compliance with Township Standards and approve submittals before transmitting to Engineer.

B. Contractor: Responsible for:
   1. Determination and verification of materials including manufacturer's catalog numbers.
   2. Determination and verification of field measurements and field construction criteria.
   3. Checking and coordinating information in submittal with requirements of Work and of the Township Standards.
   4. Determination of accuracy and completeness of dimensions and quantities.
   5. Confirmation and coordination of dimensions and field conditions at Site.
   6. Construction means, techniques, sequences, and procedures.
   7. Safety precautions.
   8. Coordination and performance of Work of all trades.

C. Stamp, sign or initial, and date each submittal to certify compliance with requirements of Contract Documents.

D. Do not fabricate products or begin Work for which submittals are required until approved submittals have been received from Engineer.

1.17 ENGINEER REVIEW

A. Do not make "mass submittals" to Engineer. "Mass submittals" are defined as six or more submittals or items in one day or 15 or more submittals or items in one week. If "mass submittals" are received, Engineer's review time stated above will be extended as necessary to perform proper review. Engineer will review "mass submittals" based on priority determined by Engineer after consultation with Owner and Contractor.

B. Informational submittals and other similar data are for Engineer's information, do not require Engineer's responsive action, and will not be reviewed or returned with comment.

C. Submittals made by Contractor that are not required may be returned without action.

D. Submittal approval does not authorize changes to Township requirements unless accompanied by Change Order.

PART 2 PRODUCTS - Not Used

PART 3 EXECUTION - Not Used

END OF SECTION

SECTION 01 40 00
QUALITY REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Quality control.

B. Tolerances.

C. References.

D. Labeling.

E. Mockup requirements.

F. Testing and inspection services.

G. Manufacturers' field services.

1.2 QUALITY CONTROL

A. Monitor quality control over suppliers, manufacturers, products, services, Site conditions, and workmanship, to produce Work of specified quality.

B. Comply with specified standards as the minimum quality for the Work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

C. Perform Work using persons qualified to produce required and specified quality.

D. Products, materials, and equipment may be subject to inspection by Engineer and Owner at place of manufacture or fabrication. Such inspections shall not relieve Contractor of complying with requirements of the Township.

E. Supervise performance of Work in such manner and by such means to ensure that Work, whether completed or in progress, will not be subjected to harmful, dangerous, damaging, or otherwise deleterious exposure during construction period.

1.3 TOLERANCES

A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.

B. Comply with manufacturers' recommended tolerances and tolerance requirements in reference standards. When such tolerances conflict, request clarification from Engineer before proceeding.

C. Adjust products to appropriate dimensions; position before securing products in place.

1.4 REFERENCES

A. For products or workmanship specified by association, trade, or other consensus standards, comply with requirements of standard except when more rigid requirements are specified or are required by applicable codes.

B. Obtain copies of standards and maintain on Site when required by product Specification Sections.

C. When requirements of indicated reference standards conflict with Township Standards, request clarification from Engineer before proceeding.

D. Neither contractual relationships, duties, or responsibilities of parties nor those of Engineer shall be altered from by mention or inference in reference documents.

1.5 LABELING

A. Attach label from agency approved by authorities having jurisdiction for products, assemblies, and systems required to be labeled by applicable code.

B. Label Information: Include manufacturer's or fabricator's identification, approved agency identification, and the following information, as applicable, on each label:
   1. Model number.
   2. Serial number.
   3. Performance characteristics.

C. Manufacturer's Nameplates, Trademarks, Logos, and Other Identifying Marks on Products: Not allowed on surfaces exposed to view in public areas, interior or exterior.

1.6 MOCK-UP REQUIREMENTS

A. Tests will be performed under provisions identified in this Section and identified in individual product Specification Sections.

B. Assemble and erect specified or indicated items with specified or indicated attachment and anchorage devices, flashings, seals, and finishes.

C. Accepted mockups shall be comparison standard for remaining Work.

D. Where mockup has been accepted by Engineer and is specified in product Specification Sections to be removed, remove mockup and clear area when directed to do so by Engineer.

1.7 TESTING AND INSPECTION SERVICES

A. Owner will appoint, employ, and pay for services of Engineer to perform materials inspection and testing including compaction.

B. Then Engineer will perform inspections, tests, and other services specified in individual specification sections and as required.

C. Reports will be submitted by Engineer, indicating observations and results of tests and indicating compliance or non-compliance with Township Standards.

D. Cooperate with the Engineer; furnish samples of materials, design mix, equipment, tools, storage and assistance as requested.
   1. Notify General Contractor 2 working days prior to expected time for operations requiring services.
   2. Make arrangements with the Engineer and pay for additional samples and tests required for Contractor’s use.

E. Retesting required because of non-conformance to specified requirements shall be performed by the Engineer.

1.8 MANUFACTURER'S FIELD SERVICES

A. When specified in individual Specification Sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe Site conditions, conditions of surfaces and installation, quality of workmanship, startup of equipment, testing, adjusting, and balancing of equipment commissioning and as applicable, and to initiate instructions when necessary.

B. Submit qualifications of observer to Engineer 30 days in advance of required observations. Observer is subject to approval of Engineer.

C. Report observations and Site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturer's written instructions.

D. Refer to Section 01 33 00 - Submittal Procedures, "Manufacturer's Field Reports" Article.

PART 2 PRODUCTS - Not Used

PART 3 EXECUTION - Not Used

END OF SECTION

SECTION 01 50 00
TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Temporary Utilities:
   1. Temporary electricity.
   2. Temporary lighting for construction purposes.
   3. Temporary heating.
   4. Temporary cooling.
   5. Temporary ventilation.
   6. Temporary water service.
   7. Temporary sanitary facilities.
   8. Temporary driveways.

B. Construction Facilities:
   1. Vehicular access.
   2. Parking.
   3. Progress cleaning and waste removal.
   4. Fire-prevention facilities.

C. Temporary Controls:
   1. Barriers.
   2. Enclosures and fencing.
   3. Security.
   4. Water control.
   5. Dust control.
   6. Erosion and sediment control.
   7. Noise control.
   8. Pest and rodent control.
   9. Pollution control.

D. Removal of utilities, facilities, and controls.

E. Protection of Installed Work.

F. Protection of Existing.

G. Progress Cleaning.

H. Traffic Regulations:
   1. Traffic Control
   2. Signs, signals, and devices
   3. Flag persons
   4. Flares and lights
   5. Haul routes

6. Traffic signs and signals
7. Removal

1.2 TEMPORARY ELECTRICITY

A. Provide and pay for power service required from utility source as needed for construction operation.

B. Complement existing power service capacity and characteristics as required for construction operations.

C. Provide power outlets with branch wiring and distribution boxes located as required for construction operations. Provide suitable, flexible power cords as required for portable construction tools and equipment.

D. Provide main service disconnect and overcurrent protection at convenient location switch at source distribution equipment meter.

E. Permanent convenience receptacles may be used during construction.

1.3 TEMPORARY LIGHTING FOR CONSTRUCTION PURPOSES

A. Provide and maintain lighting for construction operations.

B. Provide and maintain lighting to exterior staging and storage areas after dark for security purposes.

C. Provide and maintain lighting to interior work areas after dark for security purposes.

D. Provide branch wiring from power source to distribution boxes with lighting conductors, pigtails, lamps, and the like, for specified lighting levels.

E. Maintain lighting and provide routine repairs.

F. Permanent building lighting may be used during construction.

1.4 TEMPORARY HEATING

A. Provide and pay for heating devices and heat as needed to maintain specified conditions for construction operations.

B. Before operating permanent equipment for temporary heating purposes, verify installation is approved for operation, equipment is lubricated, and filters are in place. Provide and pay for operation, maintenance, and regular replacement of filters and worn or consumed parts. Replace filters at Substantial Completion.

C. Maintain minimum ambient temperature of 50 degrees F in areas where construction is in progress unless indicated otherwise in individual product Sections.

1.5 TEMPORARY COOLING

A. Provide and pay for cooling devices and cooling as needed to maintain specified conditions for construction operations.

B. Before operating permanent equipment for temporary cooling purposes, verify installation is approved for operation, equipment is lubricated, and filters are in place. Provide and pay for operation, maintenance, and regular replacement of filters and worn or consumed parts. Replace filters at Substantial Completion.

C. Maintain maximum ambient temperature of 80 degrees F in areas where construction is in progress unless indicated otherwise in individual product Sections.

1.6 TEMPORARY VENTILATION

A. Ventilate enclosed areas to achieve curing of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.

1.7 TEMPORARY WATER SERVICE

A. Provide and pay for suitable quality water service as needed to maintain specified conditions for construction operations.

1.8 TEMPORARY SANITARY FACILITIES

A. Provide and maintain required facilities and enclosures. Existing facility use is not permitted. Provide facilities at time of Project mobilization.

1.9 TEMPORARY DRIVEWAY

A. Temporary driveways shall be constructed to provide safe, stable, and smooth access.

B. Driveways shall be finished and accepted by Owner before 100% completion of Work is accepted.

1.10 VEHICULAR ACCESS

A. Construct temporary access roads from public thoroughfares to serve construction area, of width and load-bearing capacity to accommodate unimpeded traffic for construction purposes.

B. Construct temporary bridges and culverts to span low areas and allow unimpeded drainage.

C. Extend and relocate vehicular access as Work progress requires and provide detours as necessary for unimpeded traffic flow.

D. Locate as approved by Architect/Engineer.

E. Provide unimpeded access for emergency vehicles. Maintain 20-foot-wide driveways with turning space between and around combustible materials.

F. Provide and maintain access to fire hydrants and control valves free of obstructions.

G. Provide means of removing mud from vehicle wheels before entering streets.

H. Use designated existing on-Site roads for construction traffic.

1.11 PARKING

A. Arrange for temporary parking areas to accommodate construction personnel.

B. Locate as approved by Architect/Engineer.

C. If Site space is not adequate, provide additional off-Site parking.

D. Use of designated areas of existing on-Site streets and driveways used for construction traffic is permitted. Tracked vehicles are not allowed on paved areas.

E. Use of designated areas of existing parking facilities used by construction personnel is permitted.

F. Do not allow heavy vehicles or construction equipment in parking areas.

G. Do not allow vehicle parking on existing pavement.

H. Permanent Pavements and Parking Facilities:
   1. Before Substantial Completion, bases for permanent roads and parking areas may be used for construction traffic.
   2. Avoid traffic loading beyond paving design capacity. Tracked vehicles are not allowed.
   3. Use of permanent parking structures is permitted.

I. Maintenance:
   1. Maintain traffic and parking areas in sound condition free of excavated material, construction equipment, products, mud, snow, ice, and the like.
   2. Maintain existing and permanent paved areas used for construction; promptly repair breaks, potholes, low areas, standing water, and other deficiencies, to maintain paving and drainage in original condition.

J. Removal, Repair:
   1. Remove temporary materials and construction at Substantial Completion.
   2. Remove underground Work and compacted materials to depth of 2 feet fill and grade Site as indicated.
   3. Repair existing and permanent facilities damaged by use, to original condition.

K. Mud from Site vehicles: Provide means of removing mud from vehicle wheels before entering streets.

1.12 PROGRESS CLEANING AND WASTE REMOVAL

A. Maintain areas free of waste materials, debris, and rubbish. Maintain Site in clean and orderly condition.

B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, before enclosing spaces.

C. Broom and vacuum clean interior areas before starting surface finishing and continue cleaning to eliminate dust.

D. Collect and remove waste materials, debris, and rubbish from Site and dispose of off-Site.

E. Open free-fall chutes are not permitted. Terminate closed chutes into appropriate containers with lids.

1.13 FIRE-PREVENTION FACILITIES

A. Prohibit smoking within buildings under construction and demolition. Designate area on Site where smoking is permitted. Provide approved ashtrays in designated smoking areas.

B. Establish fire watch for cutting, welding, and other hazardous operations capable of starting fires. Maintain fire watch before, during, and after hazardous operations until threat of fire does not exist.

C. Standpipes: Maintain existing standpipes in usable condition to height within one floor of floor being demolished.

D. Portable Fire Extinguishers: NFPA 10; 10-pound capacity, 4A-60B: C UL rating.
   1. Provide one fire extinguisher at each stairway on each floor of buildings under construction and demolition.
   2. Provide minimum of one fire extinguisher in every construction trailer and storage shed.
   3. Provide minimum of one fire extinguisher on roof during roofing operations using heat-producing equipment.

1.14 BARRIERS

A. Provide barriers to prevent unauthorized entry to construction areas and to protect existing facilities and adjacent properties from damage from construction operations and demolition.

B. Provide barricades and covered walkways required by authorities having jurisdiction for public rights-of-way and for public access to existing building.
   1. Barricade Construction: As indicated on Drawings.
   2. Covered Walkway Construction: As indicated on Drawings.

C. Tree and Plant Protection: Preserve and protect existing trees and plants designated to remain.
   1. Protect areas within drip lines from traffic, parking, storage, dumping, chemically injurious materials and liquids, ponding, and continuous running water.
   2. Provide 6-foot-high barriers around drip line, with access for maintenance.
   3. Replace trees and plants damaged by construction operations.

D. Protect non-owned vehicular traffic, stored materials, Site, and structures from damage.

E. Provide access to all adjacent buildings for use during construction.

1.15 ENCLOSURES AND FENCING

A. Construction: Commercial-grade chain-link fence.

B. Provide 6-foot-high fence around construction Site; equip with vehicular and pedestrian gates with locks.

C. Exterior Enclosures:
   1. Provide temporary insulated weathertight closure of exterior openings to accommodate acceptable working conditions and protection for products, to allow for temporary heating and maintenance of required ambient temperatures identified in individual Specification Sections, and to prevent entry of unauthorized persons. Provide access doors with self-closing hardware and locks.

D. Interior Enclosures:
   1. Provide temporary partitions and ceilings as indicated on Drawings to separate work areas from Owner-occupied areas, to prevent penetration of dust and moisture into Owner-occupied areas, and to prevent damage to existing materials and equipment.
   2. Construction: Framing and plywood sheet materials with closed joints and sealed edges at intersections with existing surfaces.
      a. Insulated to R-19.
      b. STC rating of 35 according to ASTM E 90.
      c. Surface-Burning Characteristics: Maximum 200/450 flame-spread/smoke-developed index when tested according to ASTM E 84.
   3. Paint surfaces exposed to view from Owner-occupied areas.

1.16 SECURITY

A. Security Program:
   1. Protect Work on existing premises and Owner's operations from theft, vandalism, and unauthorized entry.
   2. Initiate program in coordination with Owner's existing security system at Project mobilization.
   3. Maintain program throughout construction period until directed by Engineer.

1.17 WATER CONTROL

A. Grade Site to drain. Maintain excavations free of water. Provide, operate, and maintain necessary pumping equipment.

B. Protect Site from puddles or running water. Provide water barriers as required to protect Site from soil erosion.

C. Trenches shall be dewatered to provide a stable base for structures and piping.

1.18 DUST CONTROL

A. Execute Work by methods that minimize raising dust from construction operations.

B. Provide positive means to prevent airborne dust from dispersing into atmosphere and into Owner-occupied areas.

1.19 EROSION AND SEDIMENT CONTROL

A. Conform to Part 91 of Public Act 451 of 1994, relative to Soil Erosion and Sedimentation Control for the life of the project.

B. Plan and execute construction by methods to control surface drainage from cuts and fills from borrow and waste disposal areas. Prevent erosion and sedimentation.

C. Minimize surface area of bare soil exposed at one time.

D. Provide temporary measures including berms, dikes, drains, and other devices to prevent water from entering adjacent water ways.

E. Construct fill and waste areas by selective placement to avoid erosive surface silts and clays.

F. Periodically inspect earthwork to detect evidence of erosion and sedimentation. Promptly apply corrective measures.

G. Do not deposit trash, debris or sediment in tile or open drains.

H. Immediately repair trenches located within the traveled surface of roadways.

I. Landscape construction areas as soon as practical after work is complete according to Section 32 91 19 Landscape Grading and 32 92 19 Seeding.

J. Comply with sediment and erosion control plan indicated on Drawings.

1.20 NOISE CONTROL

A. Provide methods, means, and facilities to minimize noise produced by construction operations.

1.21 PEST AND RODENT CONTROL

A. Provide methods, means, and facilities to prevent pests and insects from damaging the Work and entering facility.

B. Provide methods, means, and facilities to prevent rodents from accessing or invading premises.

1.22 POLLUTION CONTROL

A. Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances and pollutants produced by construction operations.

B. Comply with pollution and environmental control requirements of authorities having jurisdiction.

1.23 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

A. Remove temporary utilities, equipment, facilities, and materials before Substantial Completion inspection.

B. Remove underground installations to minimum depth of 4 feet. Grade Site as indicated on Drawings.

C. Clean and repair damage caused by installation or use of temporary Work.

D. Restore existing and permanent facilities used during construction to original condition. Restore permanent facilities used during construction to specified condition.

E. A sufficient sum of money to remove and replace or repair any utilities damaged or relocated during the construction of the project shall be included in total contract amount.

1.24 PROTECTION OF INSTALLED WORK

A. Protect installed work and provide special protection where specified in individual specification Sections.

B. Provide temporary and removable protection for installed Products. Control activity in immediate work area to minimize damage.

C. Prohibit traffic from landscaped areas.

1.25 PROTECTION OF EXISTING

A. CALL “MISS DIG” 811 or (1-800-482-7171) A MINIMUM OF THREE WORKING DAYS PRIOR TO CONSTRUCTION.

B. Obtain a copy of Positive Response. Contact Miss Dig for additional assistance if there are any utilities not marked or cleared through the Positive Response System.

C. Contact Miss Dig for additional assistance if there is a discrepancy in the field from the Positive Response System.

D. Contact Miss Dig for additional assistance if utility is not found within the applicable “approximate locations” marked in the field.

E. Protect landscaped areas. Damaged areas shall be replaced in kind.

F. Protect utilities and farm tiles encountered during the work. Replace or repair damaged utilities and farm tiles.

G. Protect drives, roadways, and sidewalks. Repair as required in following sections.

H. Protect mailboxes. Relocate temporarily until mailboxes can be returned to original location. All mailboxes and posts must be returned to their original condition or better at no additional cost to the project.

I. Protect trees, shrubs, and bushes:
   1. Where trees, shrubs, and bushes are too large to be replaced in kind, the proposed utility shall be installed in a boring or tunneling operation unless written consent is given by the property owner for removal. Owner and Engineer shall each be given one copy of consent letters.
   2. Where requested by the Property Owner, timber from removed trees shall be cut into 6-foot lengths and stockpiled along the work or as specified in the consent letter.
   3. Proper disposal of removed trees or sections of removed trees not wanted by the property owner shall become the responsibility of the Contractor.
   4. Trees, shrubs, and bushes that are removed and replaced shall be transplanted by an established nursery.

J. Utilities must remain in service. If it becomes necessary to interrupt a utility service, the utility authority must be notified immediately, and steps taken to restore temporary or permanent service as soon as possible.

K. Maintain outlets for drains. Provide temporary pumping if necessary.

L. Expose utility mains and services by hand in the trench.

M. Where utility and drainage piping cross the trench, support the piping according to the utility authority's standards and backfill to the top with compacted sand.

1.26 PROGRESS CLEANING

A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.

B. Clean road surface daily to the Owner's and/or Engineer's satisfaction.

C. Complete leveling, remove excess material and debris and restore drainage not more than 1000 feet behind construction.

D. A sufficient sum of money to remove and replace or repair any utilities damaged or relocated during the construction of the project shall be included in total contract amount.

PART 2 PRODUCTS - Not Used

PART 3 EXECUTION - Not Used

END OF SECTION

SECTION 01 55 26
TRAFFIC CONTROL

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Traffic Regulations:
   1. Traffic Control
   2. Sign, signals, and devices
   3. Flag persons
   4. Flares and Lights
   5. Haul Routes
   6. Traffic Signs and Signals
   7. Removal

B. Related Sections:
   1. Section 01 10 00 – Summary.
   2. Section 01 30 00 – Administrative Requirements.
   3. Section 01 50 00 – Temporary Facilities and Controls.

1.2 TRAFFIC REGULATON

A. Traffic Control:
   1. CONTRACTOR shall obtain all permits and pay all fees for plan review and inspection as required by applicable enforcing agency having jurisdiction.
   2. Comply with the rules and regulations of the County, City, Township, Village, Michigan Manual of Uniform Traffic Control Devices, or current MDOT Standard Specifications for Construction having jurisdiction over the road.
   3. Maintain traffic control devices.
   4. Control devices shall conform to Michigan Manual of Uniform Traffic Control Devices and the current MDOT Standard Specification for Construction.
   5. Maintain through traffic unless written permission to do otherwise is obtained from the authority having jurisdiction over the road.
   6. Contractor shall submit the Traffic Control Plan no later than the pre-construction meeting.

B. Sign, Signals, and Devices:
   1. Post-Mounted and Wall-mounted Traffic Control and Informational Signs: As approved by authorities having jurisdiction.
   2. Traffic Control Signals: As approved by local jurisdictions.
   3. Traffic Cones, Drums, Flares, and Lights: As approved by authorities having jurisdiction.
   4. Flag Person Equipment: As required by authorities having jurisdiction.

C. Flag Persons: Provide trained and equipped flag persons to regulate traffic when construction operations or traffic encroach on public traffic lanes.

D. Flares and Lights: Use flares and lights during hours of low visibility to delineate traffic lanes and to guide traffic.

E. Haul Routes:
   1. Consult with authorities having jurisdiction and establish public thoroughfares to be used for haul routes and site access.
   2. Confine construction traffic to designated hail routes.
   3. Provide traffic control at critical areas of haul routes to regulate traffic and to minimize interference with public traffic.

F. Traffic Signs and Signals:
   1. Provide signs at approaches to Site and on Site, at crossroads, detours, parking areas, and elsewhere as needed to direct construction and affected public traffic.
   2. Provide, operate, and maintain automatic traffic controls signals to direct and maintain orderly flow of traffic in areas under Contractor's control and areas affected by Contractor's operations.
   3. Relocate signs and signals as Work progresses, to maintain effective traffic control/
   4. At approaches to site and on site, install at crossroads, detours, parking areas, and elsewhere as needed to direct construction and affected public traffic.
   5. All temporary signs used on this project shall be fabricated utilizing prismatic retro-reflective sheeting.
   6. All diamond shaped warning signs shall be 48"x48". All temporary signs shall be mounted at a minimum seven-foot bottom height. All temporary signs used for detour, except those at Type II Barricades, shall be installed on temporary sign supports shall conform to MDOT special detail WZD-125-E.
   7. Temporary signs which are to remain in place for fourteen (14) days or more shall be installed on driven posts as directed by the Engineer. All other temporary signs (excluding detour signs) may be installed on portable supports. See W2D-100-A, and W2-125E for means and methods of sign support.

G. Removal:
   1. Remove equipment and devices when no longer required.
   2. Repair damage caused by installation.
   3. Remove post settings to depth of 2 feet.

END OF SECTION

SECTION 01 60 00
PRODUCT REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Products.

B. Product delivery requirements.

C. Product storage and handling requirements.

D. Product options.

E. Equipment electrical characteristics and components.

1.2 PRODUCTS

A. At minimum, comply with specified requirements and reference standards.

B. Specified products define standard of quality, type, function, dimension, appearance, and performance required.

C. Furnish products of qualified manufacturers that are suitable for intended use. Furnish products of each type by single manufacturer unless specified otherwise. Confirm that manufacturer's production capacity can provide sufficient product, on time, to meet Project requirements.

D. Domestic Products: Except where specified otherwise, domestic products are required and interpreted to mean products mined, manufactured, fabricated, or produced in United States or its territories.

E. Do not use materials and equipment removed from existing premises except as specifically permitted by Township Standards.

F. Furnish interchangeable components from same manufacturer for components being replaced.

1.3 PRODUCT DELIVERY REQUIREMENTS

A. Comply with delivery requirements.

B. Transport and handle products according to manufacturer's instructions.

C. Promptly inspect shipments to ensure products comply with requirements, quantities are correct, and products are undamaged.

D. Provide equipment and personnel to handle products; use methods to prevent soiling, disfigurement, or damage.

1.4 PRODUCT STORAGE AND HANDLING REQUIREMENTS

A. Store and protect products according to manufacturer's instructions.

B. Store products with seals and labels intact and legible.

C. Store sensitive products in weathertight, climate-controlled enclosures in an environment suitable to product.

D. For exterior storage of fabricated products, place products on sloped supports aboveground.

E. Provide off-Site storage and protection when Site does not permit on-Site storage or protection.

F. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.

G. Store loose granular materials on solid flat surfaces in well-drained area. Prevent mixing with foreign matter.

H. Provide equipment and personnel to store products; use methods to prevent soiling, disfigurement, or damage.

I. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

1.5 PRODUCT OPTIONS

A. Products Specified by Reference Standards or by Description Only: Products complying with specified reference standards or description.

B. Products Specified by Naming One or More Manufacturers: Products of one of manufacturers named and complying with Specifications; no options or substitutions allowed.

C. Products Specified by Naming One or More Manufacturers with Provision for Substitutions: Submit Request for Substitution for any manufacturer not named, according to Section 01 25 00 - Substitution Procedures.

PART 2 PRODUCTS

2.1 EQUIPMENT ELECTRICAL CHARACTERISTICS AND COMPONENTS

A. Wiring Terminations: Furnish terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Include lugs for terminal box.

B. Cord and Plug: Furnish minimum 6-foot long cord and plug including grounding connector for connection to electric wiring system. Cord of longer length may be specified in individual Specification Sections.

PART 3 EXECUTION - Not Used

END OF SECTION

SECTION 01 70 00
EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Field engineering.

B. Closeout procedures.

C. Demonstration and instructions.

D. Testing, adjusting, and balancing.

E. Project record documents.

F. Product warranties and product bonds.

G. Maintenance service.

H. Warranties.

I. Progress Payments.

J. Examination.

K. Preparation.

L. Execution.

M. Cutting and patching.

N. Protecting installed construction.

O. Final cleaning.

1.2 FIELD ENGINEERING

A. Owner will locate and Contractor shall protect survey control and reference points. Promptly notify Engineer of discrepancies discovered.

B. Control datum for survey is established by Owner-provided survey indicated on Drawings.

C. Prior to beginning Work, verify and establish floor elevations of existing facilities to ensure that new Work will meet existing elevations in smooth and level alignment except where specifically detailed or indicated otherwise.

D. Verify setbacks and easements; confirm Drawing dimensions and elevations.

E. Field engineering services provided by Engineer includes: Establish elevations, lines, and levels using recognized engineering survey practices.

F. Maintain complete and accurate log of control and survey Work as Work progresses.

G. Protect survey control points prior to starting Site Work; preserve permanent reference points during construction.

H. Promptly report to Engineer loss or destruction of reference point or relocation required because of changes in grades or other reasons.

I. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to Engineer.

1.3 CLOSEOUT PROCEDURES

A. Prerequisites to Substantial Completion: Complete following items before requesting Certification of Substantial Completion, either for entire Work or for portions of Work:
   1. Submit maintenance manuals, Project record documents, digital images of construction photographs**,** and other similar final record data in compliance with this Section.
   2. Complete facility startup, testing, adjusting, balancing of systems and equipment, demonstrations, and instructions to Owner's operating and maintenance personnel as specified in compliance with this Section.
   3. Conduct inspection to establish basis for request that Work is substantially complete. Create comprehensive list (initial punch list) indicating items to be completed or corrected, value of incomplete or nonconforming Work, reason for being incomplete, and date of anticipated completion for each item. Include copy of list with request for Certificate of Substantial Completion.
   4. Obtain and submit releases enabling Owner's full, unrestricted use of Project and access to services and utilities. Include certificate of occupancy, operating certificates, and similar releases from authorities having jurisdiction and utility companies.
   5. Deliver tools, spare parts, extra stocks of material, and similar physical items to Owner.
   6. Make final change-over of locks eliminating construction master-key system and transmit keys directly to Owner. Advise Owner's personnel of change-over in security provisions.
   7. Discontinue or change over and remove temporary facilities and services from Project Site, along with construction tools, mockups, and similar elements.
   8. Perform final cleaning according to this Section.

B. Substantial Completion Inspection:
   1. When Contractor considers Work to be substantially complete, submit to Engineer
      a. Written certificate that Work, or designated portion, is substantially complete.
      b. List of items to be completed or corrected (initial punch list).
   2. Within seven days after receipt of request for Substantial Completion, Engineer will make inspection to determine whether Work or designated portion is substantially complete.
   3. Should Engineer determine that Work is not substantially complete:
      a. Engineer will promptly notify Contractor in writing, stating reasons for its opinion.
      b. Contractor shall remedy deficiencies in Work and send second written request for Substantial Completion to Engineer.
      c. Engineer will reinspect Work.

d. Redo and Inspection of Deficient Work: Repeated until Work passes Engineer's inspection.

4. When Engineer finds that Work is substantially complete, Engineer will:
   a. Prepare Certificate of Substantial Completion on AIA G704 - Certificate of Substantial Completion or EJCDC C-625 - Certificate of Substantial Completion, accompanied by Contractor's list of items to be completed or corrected as verified and amended by Engineer and Owner (final punch list).
   b. Submit Certificate to Owner and Contractor for their written acceptance of responsibilities assigned to them in Certificate.
5. After Work is substantially complete, Contractor shall:
   a. Allow Owner occupancy of Project under provisions stated in Certificate of Substantial Completion.
   b. Complete Work listed for completion or correction within time period stipulated.
6. Owner will occupy portions of building as specified in Section 01 10 00 - Summary.

C. Prerequisites for Final Completion: Complete following items before requesting final acceptance and final payment.
   1. When Contractor considers Work to be complete, submit written certification that:
      a. Contract Documents have been reviewed.
      b. Work has been examined for compliance with Contract Documents.
      c. Work has been completed according to Contract Documents.
      d. Work is completed and ready for final inspection.
   2. Submittals: Submit following:
      a. Final punch list indicating all items have been completed or corrected.
      b. Final payment request with final releases and supporting documentation not previously submitted and accepted. Include certificates of insurance for products and completed operations where required.
      c. Specified warranties, workmanship/maintenance bonds, maintenance agreements, and other similar documents.
      d. Accounting statement for final changes to Contract Sum.
      e. Contractor's affidavit of payment of debts and claims.
      f. Contractor affidavit of release of liens on AIA G706A - Contractor's Affidavit of Release of Liens.
      g. Consent of surety to final payment.
   3. Perform final cleaning for Contractor-soiled areas according to this Section.

D. Final Completion Inspection:
   1. Within seven days after receipt of request for final inspection, Engineer will make inspection to determine whether Work or designated portion is complete.
   2. Should Engineer consider Work to be incomplete or defective:
      a. Engineer will promptly notify Contractor in writing, listing incomplete or defective Work.
      b. Contractor shall remedy stated deficiencies and send second written request to Engineer that Work is complete.
      c. Engineer will reinspect Work.
      d. Redo and Inspection of Deficient Work: Repeated until Work passes Engineer's inspection.

1.4 FINAL CLEANING

A. Execute final cleaning prior to final inspection.

B. Remove sediment from storm sewers, and catch basins.

C. Clean site; sweep paved areas, rake clean landscaped surfaces.

D. Remove waste and surplus materials, rubbish, and construction facilities from the site.

E. Landscape areas as required in documents.

F. Restore roads, driveways, parking areas, lawns, drainage, and other items disturbed during construction to original condition or as required.

1.5 DEMONSTRATION AND INSTRUCTIONS

A. Demonstrate operation and maintenance of products to Owner's personnel two weeks prior to date of Substantial Completion.

B. Video Recordings: Provide high-quality color video recordings of demonstration and instructional sessions. Engage commercial videographer to record sessions. Include classroom instructions, demonstrations, board diagrams, and other visual aids. Include menu navigation.

C. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.

D. Use operation and maintenance manuals as basis for instruction. Review contents of manual with Owner's personnel in detail to explain all aspects of operation and maintenance.

E. Demonstrate startup, operation, control, adjustment, troubleshooting, servicing, maintenance, and shutdown of each item of equipment at agreed time, at equipment location.

F. Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instruction.

G. Required instruction time for each item of equipment and system is specified in individual Specification Sections.

1.6 TESTING, ADJUSTING, AND BALANCING

A. Owner will appoint and employ services of independent firm to perform testing, adjusting, and balancing. Contractor shall pay for services from cash allowance specified in Section 01 20 00 - Price and Payment Procedures.

B. Reports will be submitted by independent firm to Engineer indicating observations and results of tests and indicating compliance or noncompliance with requirements of the Township.

1.7 PROJECT RECORD DOCUMENTS

A. Maintain on Site one set of the following record documents; record actual revisions to the Work:
   1. Drawings.
   2. Specifications.
   3. Addenda.
   4. Change Orders and other modifications to the project.
   5. Reviewed Shop Drawings, product data, and Samples.
   6. Manufacturer's instruction for assembly, installation, and adjusting.

B. Ensure entries are complete and accurate, enabling future reference by Owner.

C. Store record documents separate from documents used for construction.

D. Record information concurrent with construction progress, not less than weekly.

E. Specifications: Legibly mark and record, at each product Section, description of actual products installed, including the following:
   1. Manufacturer's name and product model and number.
   2. Product substitutions or alternates used.
   3. Changes made by Addenda and modifications.

F. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction as follows:
   1. Include modifications such as Addenda, supplementary instructions, change directives, field orders, minor changes in the Work, and change orders.
   2. Include locations of concealed elements of the Work.
   3. Identify depth of buried utility lines and provide dimensions showing distances from permanent facility components that are parallel to utilities.
   4. Dimension ends, corners, and junctions of buried utilities to permanent facility components using triangulation.
   5. Identify and locate existing buried or concealed items encountered during Project.
   6. Measured depths of foundations in relation to finish first floor datum.
   7. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
   8. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
   9. Field changes of dimension and detail.
   10. Details not on original Drawings.

G. Submit marked-up paper copy documents to Engineer before Substantial Completion.

1.8 PRODUCT WARRANTIES AND PRODUCT BONDS

A. Obtain warranties and bonds executed in duplicate by responsible Subcontractors, suppliers, and manufacturers within ten days after completion of applicable item of Work.

B. Execute and assemble transferable warranty documents and bonds from Subcontractors, suppliers, and manufacturers.

C. Verify documents are in proper form, contain full information, and are notarized.

D. Co-execute submittals when required.

E. Include table of contents and assemble in three D side ring binder with durable plastic cover.

F. Submit prior to final Application for Payment.

G. Time of Submittals:
   1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within ten days after acceptance.
   2. Make other submittals within ten days after date of Substantial Completion, prior to final Application for Payment.
   3. For items of Work for which acceptance is delayed beyond Substantial Completion, submit within ten days after acceptance, listing date of acceptance as beginning of warranty or bond period.

1.9 MAINTENANCE SERVICE

A. Furnish service and maintenance of components indicated in Specification Sections for 1 year from date of Substantial Completion.

B. Examine system components at frequency consistent with reliable operation. Clean, adjust, and lubricate as required.

C. Include systematic examination, adjustment, and lubrication of components. Repair or replace parts whenever required. Use parts produced by manufacturer of original component.

D. Do not assign or transfer maintenance service to agent or Subcontractor without prior written consent of Owner.

1.10 WARRANTIES

A. Execute and assemble documents from Sub-contractors, suppliers, and manufacturers.

B. Provide Table of Contents and assemble in three D size ring three ring binder with durable plastic cloth cover.

C. Warranty all work for a period of one year from the date of the final progress payment.

1.11 PROGRESS PAYMENTS

A. The Owner may request from the Contractor waivers for proof of payment to all sub-contractors and suppliers utilized on this project prior to issuing payments.

B. The Owner may request from the Contractor a Sworn Statement listing all sub-contractors and suppliers, their involvement with the project, their subcontracted amount, amount paid to date, and balance due prior to issuing payment.

C. Failure to provide this information may result in not receiving payments or payments not being issued in a timely manner.

PART 2 PRODUCTS - Not Used

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that existing Site conditions and substrate surfaces are acceptable for subsequent Work. Beginning new Work means acceptance of existing conditions.

B. Verify that existing substrate is capable of structural support or attachment of new Work being applied or attached.

C. Examine and verify specific conditions described in individual Specification Sections.

D. Verify that utility services are available with correct characteristics and in correct locations.

3.2 PREPARATION

A. Clean substrate surfaces prior to applying next material or substance according to manufacturer's instructions.

B. Seal cracks or openings of substrate prior to applying next material or substance.

C. Apply manufacturer-required or -recommended substrate primer, sealer, or conditioner prior to applying new material or substance in contact or bond.

3.3 EXECUTION

A. Comply with manufacturer's installation instructions, performing each step in sequence. Maintain one set of manufacturer's installation instructions at Project Site during installation and until completion of construction.

B. When manufacturer's installation instructions conflict with Contract Documents, request clarification from Engineer before proceeding.

C. Verify that field measurements are as indicated on approved Shop Drawings or as instructed by manufacturer.

D. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, or disfigurement.
   1. Secure Work true to line and level and within specified tolerances, or if not specified, industry-recognized tolerances.
   2. Physically separate products in place, provide electrical insulation, or provide protective coatings to prevent galvanic action or corrosion between dissimilar metals.

3. Exposed Joints: Provide uniform joint width and arrange to obtain best visual effect. Refer questionable visual-effect choices to Engineer for final decision.

E. Allow for expansion of materials and building movement.

F. Climatic Conditions and Project Status: Install each unit of Work under conditions to ensure best possible results in coordination with entire Project.
   1. Isolate each unit of Work from incompatible Work as necessary to prevent deterioration.
   2. Coordinate enclosure of Work with required inspections and tests to minimize necessity of uncovering Work for those purposes.

G. Mounting Heights: Where not indicated, mount individual units of Work at industry recognized standard mounting heights for particular application indicated.
   1. Refer questionable mounting heights choices to Engineer for final decision.
   2. Elements Identified as Accessible to Handicapped: Comply with applicable codes and regulations.

H. Adjust operating products and equipment to ensure smooth and unhindered operation.

I. Clean and perform maintenance on installed Work as frequently as necessary through remainder of construction period. Lubricate operable components as recommended by manufacturer.

3.4 CUTTING AND PATCHING

A. Employ skilled and experienced installers to perform cutting and patching.

B. Submit written request in advance of cutting or altering elements affecting:
   1. Structural integrity of element.
   2. Integrity of weather-exposed or moisture-resistant elements.
   3. Efficiency, maintenance, or safety of element.
   4. Visual qualities of sight-exposed elements.
   5. Work of Owner or separate contractor.

C. Execute cutting, fitting, and patching including excavation and fill to complete Work and to:
   1. Fit the several parts together, to integrate with other Work.
   2. Uncover Work to install or correct ill-timed Work.
   3. Remove and replace defective and nonconforming Work.
   4. Remove samples of installed Work for testing.
   5. Provide openings in elements of Work for penetrations of mechanical and electrical Work.

D. Execute Work by methods to avoid damage to other Work and to provide proper surfaces to receive patching and finishing.

E. Cut masonry and concrete materials using masonry saw or core drill.

F. Restore Work with new products according to requirements of Contract Documents.

G. Fit Work tight to pipes, sleeves, ducts, conduits, and other penetrations through surfaces.

H. Maintain integrity of wall, ceiling, or floor construction; completely seal voids.

I. Refinish surfaces to match adjacent finishes. For continuous surfaces, refinish to nearest intersection; for assembly, refinish entire unit.

J. Identify hazardous substances or conditions exposed during the Work to Engineer for decision or remedy.

3.5 PROTECTING INSTALLED CONSTRUCTION

A. Protect installed Work and provide special protection where specified in individual Specification Sections.

B. Provide temporary and removable protection for installed products. Control activity in immediate Work area to prevent damage.

C. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.

D. Use durable sheet materials to protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects.

E. Prohibit traffic or storage upon waterproofed or roofed surfaces. When traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.

F. Prohibit traffic from landscaped areas.

3.6 FINAL CLEANING

A. Execute final cleaning prior to final Project assessment.
   1. Employ experienced personnel or professional cleaning firm.

B. Clean interior and exterior glass and surfaces exposed to view; remove temporary labels, stains, and foreign substances; polish transparent and glossy surfaces; and vacuum carpeted and soft surfaces.

C. Clean equipment and fixtures to sanitary condition with appropriate cleaning materials.

D. Replace filters of operating equipment.

E. Clean debris from roofs, gutters, downspouts, and drainage systems.

F. Clean Site; sweep paved areas, rake clean landscaped surfaces.

G. Remove waste and surplus materials, rubbish, and construction facilities from Site.

END OF SECTION

SECTION 03 10 00

CONCRETE FORMING AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Formwork for cast-in place concrete.
   2. Shoring, bracing, and anchorage.
   3. Form accessories.
   4. Form stripping.

B. Related Sections:
   1. Section 03 30 00 - Cast-In-Place Concrete.

1.2 REFERENCES

A. American Concrete Institute:
   1. ACI 117 - Standard Specifications for Tolerances for Concrete Construction and Materials.
   2. ACI 301 - Specifications for Structural Concrete.
   3. ACI 318 - Building Code Requirements for Structural Concrete.
   4. ACI 347 - Guide to Formwork for Concrete.

B. American Forest and Paper Association:
   1. AF&PA - National Design Specifications for Wood Construction.

C. The Engineered Wood Association:
   1. APA/EWA PS 1 - Voluntary Product Standard for Construction and Industrial Plywood.

D. ASTM International:
   1. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
   2. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials.

E. West Coast Lumber Inspection Bureau:
   1. WCLIB - Standard Grading Rules for West Coast Lumber.
   2. MDOT Standard Specifications for Construction.

1.3 QUALITY ASSURANCE

A. Perform Work in accordance with ACI 347.

B. For wood products furnished for work of this Section, comply with AF&PA.

C. Perform Work in accordance with MDOT Standard Specifications for Construction.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Products storage and handling requirements.

B. Deliver void forms and installation instructions in manufacturer's packaging.

C. Store off ground in ventilated and protected manner to prevent deterioration from moisture.

1.5 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Coordinate this Section with other sections of work, requiring attachment of components to formwork.

PART 2 - PRODUCTS

2.1 WOOD FORM MATERIALS

A. Plywood: Douglas Fir 5 ply species; solid one side grade; sound undamaged sheets with clean, true edges.

B. Lumber Forms:
1. Application: Use for edge forms and unexposed finish concrete.
2. Boards: 6 inches or 8 inches in width, shiplapped or tongue and groove, “Pine species no. 2 grade with grade stamps clearly visible.

C. Plywood Forms:
1. Application: Use for exposed finish concrete.
2. Forms: Conform to PS 1; full size 4 x 8 feet panels; each panel labeled with grade trademark of APA/EWA.
3. Plywood for Surfaces to Receive Membrane Waterproofing: Minimum of 5/8 inch thick; APA/EWA “B-B Plyform Structural I Exterior” grade.
4. Plywood where “Smooth Finish” is required, as indicated on Drawings: APA/EWA “HD Overlay Plyform Structural I Exterior” grade, minimum of 3/4 inch thick.

2.2 PREFABRICATED FORMS

A. Furnish materials in accordance with MDOT Standard Specifications for Construction.

B. Glass Fiber Fabric Reinforced Plastic Forms: Matched, tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished concrete surfaces.

C. Tubular Column Type: Round, spirally wound laminated fiber material, surface treated with release agent, non-reusable, sizes as indicated on Drawings.

D. Steel Forms: Sheet steel, suitably reinforced, and designed for particular use indicated on Drawings.

E. Form Liners: Smooth, durable, grain less and non-staining hardboard, unless otherwise indicated on Drawings.

F. Framing, Studding and Bracing: Stud or No. 3 structural light framing grade.

2.3 FORMWORK ACCESSORIES

A. Form Release Agent: Colorless material which will not stain concrete, absorb moisture or impair natural bonding or color characteristics of coating intended for use on concrete; manufactured by W.R. Meadows, or equal.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify lines, levels, and centers before proceeding with formwork. Verify dimensions agree with Drawings.

C. When formwork is placed after reinforcement resulting in insufficient concrete cover over reinforcement before proceeding, request instructions from Architect/Engineer.

3.2 INSTALLATION

A. Earth Forms:
1. Trench earth forms neatly, accurately, and at least 2 inches wider than standard detail widths indicated on Drawings.
2. Trim sides and bottom of earth forms.
3. Construct wood edge strips at top of each side of trench to secure reinforcing and prevent trench from sloughing.
4. Form sides of footings where earth sloughs.
5. Tamp earth forms firm and clean forms of debris and loose material before depositing concrete.

B. Formwork - General:
1. Provide top form for sloped surfaces steeper than 1.5 horizontal to 1 vertical to hold shape of concrete during placement, unless it can be demonstrated that top forms can be omitted.
2. Construct forms to correct shape and dimensions, mortar-tight, braced, and of sufficient strength to maintain shape and position under imposed loads from construction operations.
3. Camber forms where necessary to produce level finished soffits unless otherwise shown on Drawings.
4. Carefully verify horizontal and vertical positions of forms. Correct misaligned or misplaced forms before placing concrete.
5. Complete wedging and bracing before placing concrete.

C. Forms for Smooth Finish Concrete:
   1. Use steel, plywood or lined board forms.
   2. Use clean and smooth plywood and form liners, uniform in size, and free from surface and edge damage capable of affecting resulting concrete finish.
   3. Install form lining with close-fitting square joints between separate sheets without springing into place.
   4. Use full size sheets of form lines and plywood wherever possible.
   5. Tape joints to prevent protrusions in concrete.
   6. Use care in forming and stripping wood forms to protect corners and edges.
   7. Level and continue horizontal joints.
   8. Keep wood forms wet until stripped.

D. Framing, Studding and Bracing:
   1. Space studs at 16 inches on center maximum for boards and 12 inches on center maximum for plywood.
   2. Size framing, bracing, centering, and supporting members with sufficient strength to maintain shape and position under imposed loads from construction operations.
   3. Construct beam soffits of material minimum of 2 inches thick.
   4. Distribute bracing loads over base area on which bracing is erected.
   5. When placed on ground, protect against undermining, settlement or accidental impact.

E. Erect formwork, shoring, and bracing to achieve design requirements, in accordance with requirements of ACI 301 and MDOT Standard Specifications for Construction.

F. Arrange and assemble formwork to permit dismantling and stripping. Do not damage concrete during stripping. Permit removal of remaining principal shores.

G. Obtain Architect/Engineer’s approval before framing openings in structural members not indicated on Drawings.

H. Install void forms in accordance with manufacturer's recommendations.

3.3 APPLICATION - FORM RELEASE AGENT

A. Apply form release agent on formwork in accordance with manufacturer's recommendations.

B. Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.

C. Do not apply form release agent where concrete surfaces are indicated to receive special finishes that are affected by agent. Soak inside surfaces of untreated forms with clean water. Keep surfaces coated prior to placement of concrete.

D. Reuse and Coating of Forms: Thoroughly clean forms and reapply form coating before each reuse. For exposed work, do not reuse forms with damaged faces or edges. Apply form coating to forms in accordance with manufacturer’s specifications. Do not coat forms for concrete indicated to receive “scored finish”. Apply form coatings before placing reinforcing steel.

3.4 INSTALLATION - INSERTS, EMBEDDED PARTS, AND OPENINGS

A. Install formed openings for items to be embedded in or passing through concrete work.

B. Locate and set in place items required to be cast directly into concrete.

C. Coordinate with Work of other sections in forming and placing openings, slots, reglets, recesses, sleeves, bolts, anchors, other inserts, and components of other Work.

D. Install accessories straight, level, and plumb. Ensure items are not disturbed during concrete placement.

E. Install water stops continuous without displacing reinforcement.

F. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water to drain.

G. Close temporary openings with tight fitting panels, flush with inside face of forms, and neatly fitted so joints will not be apparent in exposed concrete surfaces.

H. Form Ties:
   1. Use sufficient strength and sufficient quantity to prevent spreading of forms.
   2. Place ties at least 1 inch away from finished surface of concrete.
   3. Leave inner rods in concrete when forms are stripped.
   4. Space form ties equidistant, symmetrical and aligned vertically and horizontally unless otherwise shown on Drawings.

I. Arrangement: Arrange formwork to allow proper erection sequence and to permit form removal without damage to concrete.

J. Construction Joints:
   1. Install surfaced pouring strip where construction joints intersect exposed surfaces to provide straight line at joints.
   2. Just prior to subsequent concrete placement, remove strip and tighten forms to conceal shrinkage.
   3. Show no overlapping of construction joints. Construct joints to present same appearance as butted plywood joints.
   4. Arrange joints in continuous line straight, true and sharp.

K. Embedded Items:
   1. Make provisions for pipes, sleeves, anchors, inserts, reglets, anchor slots, nailers, water stops, and other features.
   2. Do not embed wood or uncoated aluminum in concrete.
   3. Obtain installation and setting information for embedded items furnished under other Specification sections.
   4. Securely anchor embedded items in correct location and alignment prior to placing concrete.
   5. Verify conduits and pipes, including those made of coated aluminum, meet requirements of ACI 318 for size and location limitations.

L. Openings for Items Passing Through Concrete:
   1. Frame openings in concrete where indicated on Drawings. Establish exact locations, sizes, and other conditions required for openings and attachment of work specified under other sections.
   2. Coordinate work to avoid cutting and patching of concrete after placement.
   3. Perform cutting and repairing of concrete required as result of failure to provide required openings.

M. Screeds:
   1. Set screeds and establish levels for tops of concrete slabs and levels for finish on slabs.
   2. Slope slabs to drain where required or as shown on Drawings.
   3. Before depositing concrete, remove debris from space to be occupied by concrete and thoroughly wet forms. Remove freestanding water.

N. Screed Supports:
   1. For concrete over waterproof membranes and vapor retarder membranes, use cradle, pad or base type screed supports which will not puncture membrane.
   2. Staking through membrane is not be permitted.

O. Cleanouts and Access Panels:
   1. Provide removable cleanout sections or access panels at bottoms of forms to permit inspection and effective cleaning of loose dirt, debris and waste material.
   2. Clean forms and surfaces against which concrete is to be placed. Remove chips, saw dust and other debris. Thoroughly blow out forms with compressed air just before concrete is placed.

3.5 FORM CLEANING

A. Clean forms as erection proceeds, to remove foreign matter within forms.

B. Clean formed cavities of debris prior to placing concrete.

C. Flush with water or use compressed air to remove remaining foreign matter. Ensure that water and debris drain to exterior through clean-out ports.

D. During cold weather, remove ice and snow from within forms. Do not use de-icing salts. Do not use water to clean out forms, unless formwork and concrete construction proceed within heated enclosure. Use compressed air or other means to remove foreign matter.

3.6 FORM REMOVAL

A. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads and removal has been approved by Engineer.

B. Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.

C. Store removed forms in manner that surfaces to be in contact with fresh concrete will not be damaged. Discard damaged forms.

D. Leave forms in place for minimum number of days as specified in ACI 347.

3.7 ERECTION TOLERANCES

A. Construct formwork to maintain tolerances required by ACI 301 and MDOT Standard Specifications for Construction.

B. Tolerances: Construct formwork to produce completed concrete surfaces within construction tolerances specified in ACI 117.

3.8 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements and 01 70 00 - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.

B. Inspect erected formwork, shoring, and bracing to ensure that work is in accordance with formwork design, and that supports, fastenings, wedges, ties, and items are secure.

C. Notify Architect/Engineer after placement of reinforcing steel in forms, but prior to placing concrete.

D. Schedule concrete placement to permit formwork inspection before placing concrete.

END OF SECTION

SECTION 03 20 00
CONCRETE REINFORCING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Reinforcing bars.
   2. Welded wire fabric.
   3. Reinforcement accessories.

B. Related Requirements:
   1. Section 03 10 00 - Concrete Forming and Accessories

1.2 REFERENCE STANDARDS

A. American Concrete Institute:
   1. ACI 301 - Specifications for Structural Concrete.

B. American Welding Society:
   1. AWS D1.4 - Structural Welding Code - Reinforcing Steel. ASTM International:
   2. ASTM A615 - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement. ASTM A706 - Standard Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement. ASTM A775 - Standard Specification for Epoxy-Coated Steel Reinforcing Bars. ASTM A934 - Standard Specification for Epoxy-Coated Prefabricated Steel Reinforcing Bars. Concrete Reinforcing Steel Institute:
   3. CRSI 10-MSP - Manual of Standard Practice.
   4. CRSI 10PLACE - Placing Reinforcing Bars.

1.3 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Requirements for coordination.

B. Coordinate Work of this Section with placement of formwork, formed openings, and other Work.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Certify products meet or exceed specified requirements for MDOT Standard Specifications for Construction.

1.5 QUALITY ASSURANCE

A. Perform Work according to MDOT Standard Specifications for Construction.

B. Prepare Shop Drawings according to ACI SP-66.

C. Maintain one copy of each standard affecting Work of this Section on Site.

1.6 QUALIFICATIONS

A. Welders: AWS qualified within previous 12 months for employed weld types.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

C. Store materials according to manufacturer instructions.

D. Protection:
   1. Protect materials from moisture by storing in clean, dry location remote from construction operations areas.
   2. Provide additional protection according to manufacturer instructions.

1.8 EXISTING CONDITIONS

A. Field Measurements:
   1. Verify field measurements prior to fabrication.
   2. Indicate field measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 REINFORCEMENT

A. Reinforcing Steel:
   1. Comply with ASTM A615.
   2. Yield Strength: In accordance to the requirements of MDOT Standard Specifications for Construction.
   3. Billet Bars: In accordance to the requirements of MDOT Standard Specifications for Construction
   4. Finish: In accordance to the requirements of MDOT Standard Specifications for Construction

B. Deformed and Plain Reinforcement:
   1. Material: Steel bars.
   2. Comply with ASTM A706.
   3. Yield Strength: In accordance to the requirements of MDOT Standard Specifications for Construction
   4. Finish: In accordance to the requirements of MDOT Standard Specifications for Construction

2.2 FABRICATION

A. Fabricate concrete reinforcement according to MDOT Standard Specifications for Construction.

B. Form standard hooks according to MDOT Standard Specifications for Construction.

C. Form reinforcement bends with minimum diameters according to MDOT Standard Specifications for Construction.

D. Fabricate column reinforcement with offset bends at reinforcement splices.

E. Form spiral column reinforcement from minimum 3/8-inch-diameter continuous deformed bar or wire.

F. Form ties and stirrups from following:
   1. Bars No. 10 and Smaller: In accordance to MDOT Standard Specifications for Construction.
   2. Bars No. 11 (36) and Larger: In accordance to MDOT Standard Specifications for Construction.
   3. Weld reinforcement: In accordance to MDOT Standard Specifications for Construction.

G. Reinforcement: Clean surfaces, weld, and re-protect welded joint according to MDOT Standard Specifications for Construction.

H. Splicing:
   1. If not indicated on Drawings, locate reinforcement splices at point of minimum stress.

2.3 SHOP FINISHING

A. Epoxy-Coated Finish for Steel Bars: Comply with ASTM A775 A934 and MDOT Standard Specifications for Construction.

2.4 ACCESSORY MATERIALS

A. Tie Wire: In accordance to MDOT Standard Specifications for Construction.

B. Chairs, Bolsters, Bar Supports, and Spacers:
   1. Size and Shape: To strengthen and support reinforcement during concrete placement conditions.

C. Special Chairs, Bolsters, Bar Supports, and Spacers Adjacent to Weather-Exposed Concrete Surfaces:
   1. Material: In accordance to MDOT Standard Specifications for Construction.
   2. Size and Shape: To meet Project conditions.

D. Reinforcing Splicing Devices:
   1. Type: Exothermic welding type; In accordance to MDOT Standard Specifications for Construction.

E. Epoxy Coating Patching Material: Type as recommended by coating manufacturer.

2.5 SOURCE QUALITY CONTROL

A. Provide shop inspection and testing of completed assembly.

B. Section 01 40 00 - Quality Requirements: Requirements for testing, inspection, and analysis.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Place, support, and secure reinforcement against displacement.

B. Do not deviate from required position beyond specified tolerance.

C. Do not weld crossing reinforcement bars for assembly engineer.

D. Do not displace or damage vapor retarder.

E. Accommodate placement of formed openings.

F. Spacing:
   1. Space reinforcement bars with minimum clear spacing in accordance with MDOT Standard Specifications for Construction.
   2. If bars are indicated in multiple layers, place upper bars directly above lower bars.

G. Maintain concrete cover around reinforcement according to MDOT Standard Specifications for Construction

3.2 TOLERANCES

A. Section 01 40 00 - Quality Requirements: Requirements for tolerances.

B. Install reinforcement in accordance with MDOT Standard Specifications for Construction.

C. Foundation Walls: In accordance with MDOT Standard Specifications for Construction.

3.3 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Requirements for inspecting and testing.

END OF SECTION

SECTION 03 30 00
CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.1 SUMMARY

A. Section includes cast-in-place concrete for the following:
   1. Slabs on grade.
   2. Equipment pads.
   3. Thrust blocks.
   4. Manholes.

B. Related Sections:
   1. Section 03 10 00 - Concrete Forming and Accessories

1.2 REFERENCES

A. American Concrete Institute:
   1. ACI 301 - Specifications for Structural Concrete.
   2. ACI 305 - Hot Weather Concreting.
   3. ACI 306.1 - Standard Specification for Cold Weather Concreting.
   4. ACI 308.1 - Standard Specification for Curing Concrete.
   5. ACI 318 - Building Code Requirements for Structural Concrete.

B. ASTM International:
   1. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
   2. ASTM C31/C31M - Standard Practice for Making and Curing Concrete Test Specimens in the Field.
   3. ASTM C33 - Standard Specification for Concrete Aggregates.
   4. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
   5. ASTM C42/C42M - Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
   6. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete.
   7. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic Cement Concrete.
   8. ASTM C150 - Standard Specification for Portland Cement.
   9. ASTM C172 - Standard Practice for Sampling Freshly Mixed Concrete.
   10. ASTM C173/C173M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
   11. ASTM C231 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
   12. ASTM C260 - Standard Specification for Air-Entraining Admixtures for Concrete.
   13. ASTM C330 - Standard Specification for Lightweight Aggregates for Structural Concrete.
   14. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete.
   15. ASTM C595 - Standard Specification for Blended Hydraulic Cements.

16. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete.
17. ASTM C685/C685M - Standard Specification for Concrete Made By Volumetric Batching and Continuous Mixing.
18. ASTM C845 - Standard Specification for Expansive Hydraulic Cement.
19. ASTM C989 - Standard Specification for Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars.
20. ASTM C1017/C1017M - Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.
21. ASTM C1064/C1064M - Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete.
22. ASTM C1107/C1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).
23. ASTM C1116 - Standard Specification for Fiber-Reinforced Concrete and Shotcrete.
24. ASTM C1157 - Standard Performance Specification for Hydraulic Cement.
25. ASTM C1218/C1218M - Standard Test Method for Water-Soluble Chloride in Mortar and Concrete.
26. ASTM C1240 - Standard Specification for Silica Fume Used in Cementitious Mixtures.
27. ASTM D994 - Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type).
28. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
29. ASTM D1752 - Standard Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.
30. ASTM D6690 - Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements.
31. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials.
32. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
33. ASTM E1643 - Standard Practice for Installation of Water Vapor Retarders Used in Contact with Earth or Granular Fill under Concrete Slabs.
34. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs.

C. Michigan Department of Transportation:
   1. MDOT Standard Specifications for Construction, current edition.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Design Data:
   1. Submit concrete mix design for each concrete strength. Submit separate mix designs when admixtures are required for the following:
      a. Hot and cold weather concrete work.
      b. Air entrained concrete work.
   2. Identify mix ingredients and proportions, including admixtures.
   3. Identify chloride content of admixtures and whether or not chloride was added during manufacture.

1.4 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Accurately record actual locations of embedded utilities and components concealed from view in finished construction.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with ACI 301.

B. Conform to ACI 305 when concreting during hot weather.

C. Conform to ACI 306.1 when concreting during cold weather.

D. Acquire cement and aggregate from one source for Work.

E. Perform Work in accordance with MDOT Standard Specifications for Construction.

F. Maintain one copy of each document on site.

1.6 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements: Environmental conditions affecting products on site.

B. Maintain concrete temperature after installation at minimum 50 degrees F for minimum 7 days.

C. Maintain high early strength concrete temperature after installation at minimum 50 degrees F for minimum 3 days.

1.7 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Coordinate placement of joint devices with erection of concrete formwork and placement of form accessories.

PART 2 PRODUCTS

2.1 CONCRETE MATERIALS

A. Cement: ASTM C150, Type IA - Air Entraining Portland type; manufactured by.

B. Expansive Hydraulic Cement: ASTM C845.

C. Coarse Aggregates: ASTM C33.
   1. In accordance with MDOT 6AA.

D. Fine Aggregate: ASTM C33.

1. In accordance with MDOT 2NS.

E. Water: ACI 318; potable, without deleterious amounts of chloride ions.

2.2 ADMIXTURES

A. Furnish materials according to State of Michigan Department of Transportation standard specification for construction.

B. Air Entrainment: ASTM C260.

C. Chemical: ASTM C494/C494M.
1. Type A - Water Reducing.
2. Type B - Retarding.
3. Type C - Accelerating.
4. Type F - Water Reducing, High Range.

D. Fly Ash: ASTM C618 Class C.

E. Plasticizing: ASTM C1017/C1017M Type I, plasticizing.

2.3 ACCESSORIES

A. Bonding Agent: Two component modified epoxy resin.
1. Manufacturers:
a. Sikadur 32, Hi-Mod LV manufactured by Sika Corp; concessive 1001 LPL, 3007.
b. Substitutions: Or equal manufactured by structural bonding company.

B. Non-Shrink Grout: ASTM C1107/C1107M; premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents; capable of developing minimum compressive strength of 2,400 psi in 48 hours and 7,000 psi in 28 days.
1. Manufacturers:
a. Five Star Grout as manufactured by U.S. Grout Company.
b. Or equal.

C. Epoxy Adhesive: Two components epoxy resin adhesive; Sikadur 35, Hi-Mod LV manufactured by Sika Corporation, Glendale Hts., IL 708-924-7900.

D. Adhesive Anchors: Hilti HVA adhesive anchoring system. Hilti adhesive anchors shall be comprised on an HEA capsule with an ASTM A193, Grade B & HAS stainless steel rod assembly with stainless steel ASTM F594 nuts and ANSI B 18.221 (1965), Type A, plain washers under the turned element. Install per manufacturer's specifications.

2.4 JOINT DEVICES AND FILLER MATERIALS

A. Joint Filler Type A: ASTM D1751; Asphalt impregnated fiberboard or felt, 1/4 to 1 inch thick; tongue and groove profile; manufactured by A.C.D. International or equal.

B. Construction Joint Devices: ANSI/ASTM D1751 type; 1/4 inch to 1 inch thick, manufactured by A.C.D. International or equal.

C. Expansion and Contraction Joint Devices: Supply materials in accordance with MDOT 2012 standard specifications for construction.

D. Sealant: ASTM D6690, Type I; Son-No-Mar, manufactured by Sonneborn Building Products or equal.

2.5 CONCRETE MIX

A. Select proportions for normal weight concrete in accordance with ACI 301 Method 2.

B. Select proportions for concrete in accordance with ACI 318 without trial mixtures or field experience when approved by Engineer.

C. Provide concrete to the following criteria:

Concrete Grade: MDOT 3500

Material and Property	Measurement
Flexural Strength (7 day)	550 psi
Flexural Strength (28 day)	650 psi
Compressive Strength (7 day)	2,600 psi
Compressive Strength (28 day)	3,500 psi
Cement Type	Type A or IA
Cement Content (minimum)	6.0 sacks
Coarse Aggregate Type	6AA
Coarse Aggregate	72 percent by bulk volume (Dry, loose)
Fine Aggregate	2NS
Air Content	6.5 percent plus or minus 1.5 percent
Slump	4 inches plus or minus 1 inch

D. Admixtures: Include admixture types and quantities indicated in concrete mix designs only when approved by Engineer.
1. Use accelerating admixtures in cold weather. Use of admixtures will not relax cold weather placement requirements.
2. Do not use calcium chloride nor admixtures containing calcium chloride.
3. Use set retarding admixtures during hot weather.
4. Add air entrainment admixture to concrete mix for work exposed to freezing and thawing.
5. For concrete exposed to deicing chemicals, limit fly ash, pozzolans, silica fume, and slag content as required by applicable ACI code.

E. Average Compressive Strength Reduction: Permitted in accordance with ACI 318.

F. Ready Mixed Concrete: Mix and deliver concrete in accordance with ASTM C94/C94M.

G. Site Mixed Concrete: Mix concrete in accordance with ACI 318.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify requirements for concrete cover over reinforcement.

C. Verify anchors, seats, plates, reinforcement and other items to be cast into concrete are accurately placed, positioned securely, and will not interfere with placing concrete.

3.2 PREPARATION

A. Prepare previously placed concrete by cleaning with steel brush and applying bonding agent. Remove laitance, coatings, and unsound materials.

B. In locations where new concrete is doweled to existing work, drill holes in existing concrete, insert steel dowels and pack solid with non-shrink grout.

C. Remove debris and ice from formwork, reinforcement, and concrete substrates.

D. Remove water from areas receiving concrete before concrete is placed.

3.3 PLACING CONCRETE

A. Place concrete in accordance with ACI 301 and MDOT Standard Specifications for Construction.

B. Notify testing laboratory and Engineer minimum 24 hours prior to commencement of operations.

C. Ensure reinforcement, inserts, embedded parts, formed expansion and contraction joints are not disturbed during concrete placement.

D. Deposit concrete at final position. Prevent segregation of mix.

E. Place concrete in continuous operation for each panel or section determined by predetermined joints.

F. Consolidate concrete after placing by means of mechanical vibrators or other suitable tools approved by the Engineer.

G. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.

H. Place concrete continuously between predetermined expansion, control, and construction joints.

I. Do not interrupt successive placement; do not permit cold joints to occur.

J. Saw cut joints within 24 hours after placing. Use 3/16 inch thick blade, cut into 1/4 depth of slab thickness.

K. Concrete transported in a truck mixer, agitator or other transportation device shall be discharged at the job within 1 1/2 hours after the cement has been added to the water or aggregates.

L. When hand mixing is authorized, it shall be done on a watertight platform and in such a manner as to ensure a uniform distribution of the materials throughout the mass. Mixing shall continue until a homogeneous mixture of the required consistency is obtained.

M. Retempering of partially hardened concrete or mortar will not be permitted.

3.4 CONCRETE FINISHING

A. Formed Surfaces:
   1. As a minimum of formed surfaces shall receive a plain finish and rubbed finish.
   2. Plain Finish: Immediately after removal of forms, all fins and loose material shall be removed and all holes, voids, aggregate pockets and depressions shall be cut out to solid concrete. All such defective areas shall be cleaned and wetted thoroughly and immediately be brushed and net cement and filled with Portland Cement grout finished, flush with the adjacent surfaces. Patch work shall be damp cured for a period of 48 hours and, when exposed, it shall be finished to match adjacent surfaces.
   3. Rubbed Finish: All form marks and other such irregularities shall be removed by rubbing the surface with a Carborundum stone and water as soon as practical after form removal.
   4. Bagged Finish: All formed surfaces which are not earth backfilled shall receive a bagged finish. All air and water voids shall be finished flush with the wall surface. The wall shall first be moistened with water. Portland cement grout matching the color of the base concrete shall be worked into the voids using burlap or sponge rubber finishing pads.

B. Unformed Surface Finishes
   1. Troweled Finish: After a floated finish, provide a smooth surface, free of defects with a steel trowel. Follow the first troweling with a second troweling after the concrete has hardened sufficiently to produce a ringing sound as the towel is moved over the surface. The finish surface shall be essentially free of trowel marks, uniform in texture and appearance and shall be plane to 1/8” in 10 ft. tolerance.
   2. Broomed Finish: After receiving the floated and troweled finishes, apply a broomed finish with a fiber-bristle brush in a direction transverse to the line of traffic.
   3. Floated Finish: Place, consolidate, strike off and level concrete. After the concrete has stiffened sufficiently, floating shall begin using a hard float, power trowel and float shoes or powered disc float. Cut down high spots and fill low spots to 1/4” in 10 ft. tolerance. Float to a uniform sandy texture.
   4. Scratched Finish: After the concrete has been placed consolidated, struck off and leveled to a 1/4” in 2 ft. tolerance, roughen with stiff brushes or rakes before the final set.

C. Finish concrete floor surface in accordance with ACI 301.

D. Provide a troweled finish for base slabs.

E. Provide a floated finish for slabs as directed by the Engineer.

F. Provide a broom finish for exterior slabs, sidewalks, pavements and where directed by the Engineer.

G. Provide a scratched finish where concrete is specified to receive a subsequent concrete topping.

H. In areas with floor drains, maintain floor elevation at walls; pitch surfaces uniformly to drains at one inch per 10 feet unless otherwise indicated on drawings.

I. Maximum variation of surface flatness for exposed concrete floors 1/8 inch in 10 feet.

3.5 CURING AND PROTECTION

A. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.

B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.

C. Cure concrete in accordance with MDOT Standard Specification for Construction.

D. Membrane Curing Compound: Apply curing compound in accordance with manufacturer's instructions. Curing compound shall not contain any ingredients which might stain or otherwise injure the concrete or prevent a good bond for subsequent coatings or finishing's.

3.6 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.

B. Field inspection and testing will be performed by Owner's testing laboratory in accordance with MDOT Standard Specification for Construction.

C. Provide free access to Work and cooperate with appointed firm.

D. Submit proposed mix design of each class of concrete to Engineer for review prior to commencement of Work.

E. Concrete Inspections:
   1. Continuous Placement Inspection: Inspect for proper installation procedures.
   2. Periodic Curing Inspection: Inspect for specified curing temperature and procedures.

F. Strength Test Samples:
   1. Sampling Procedures: ASTM C172.
   2. Cylinder Molding and Curing Procedures: ASTM C31/C31M, cylinder specimens, standard cured.
   3. Sample concrete and make one set of three cylinders for every 75 cu yds or less of each class of concrete placed each day and for every 5,000 sf of surface area for slabs and walls.

4. When volume of concrete for any class of concrete would provide less than 5 sets of cylinders, take samples from five randomly selected batches, or from every batch when less than 5 batches are used.
5. Make one additional cylinder during cold weather concreting, and field cure.

G. Field Testing:
1. Slump Test Method: ASTM C143/C143M.
2. Air Content Test Method: ASTM C231.
3. Temperature Test Method: ASTM C1064/C1064M.
4. Measure slump and temperature for each compressive strength concrete sample.
5. Measure air content in air entrained concrete for each compressive strength concrete sample.

H. Cylinder Compressive Strength Testing:
1. Test Method: ASTM C39/C39M.
2. Test Acceptance: In accordance with MDOT Standard Specification for Construction.
3. Test one cylinder at 7 days.
4. Test two cylinders at 28 days.
5. Dispose remaining cylinders when testing is not required.

I. Core Compressive Strength Testing:
1. Sampling and Testing Procedures: ASTM C42/C42M.
2. Test Acceptance: In accordance with MDOT Standard Specification for Construction.
3. Drill three cores for each failed strength test from concrete represented by failed strength test.

J. Maintain records of concrete placement. Record date, location, quantity, air temperature and test samples taken.

3.7 PATCHING

A. Allow Engineer to inspect concrete surfaces immediately upon removal of forms.

B. Excessive honeycomb or embedded debris in concrete is not acceptable. Notify Engineer upon discovery.

C. Patch imperfections as directed by Engineer in accordance with MDOT Standard Specification for Construction.

3.8 DEFECTIVE CONCRETE

A. Defective Concrete: Concrete not conforming to required lines, details, dimensions, tolerances or specified requirements.

B. Repair or replacement of defective concrete will be determined by Engineer.

C. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Engineer for each individual area.

END OF SECTION

SECTION 03 60 00
GROUTING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Portland cement grout.
2. Rapid curing epoxy grout.
3. Non-shrink cementitious grout.

B. Related Sections:
1. Section 03 10 00 – Concrete Forming and Accessories.
2. Section 03 30 00 - Cast-In-Place Concrete.
3. Section 03 05 13.16 – Public Manholes & Structures

1.2 REFERENCES

A. American Concrete Institute:
1. ACI 301 - Specifications for Structural Concrete.
2. ACI 318 - Building Code Requirements for Structural Concrete.

B. American Society of Testing and Materials:
1. ASTM C33 - Standard Specification for Concrete Aggregates.
2. ASTM C40 - Test Method for Organic Impurities in Fine Aggregates for Concrete.
3. ASTM C150 - Standard Specification for Portland Cement.
4. ASTM C191 - Test Method for Time of Setting of Hydraulic Cement by Vicat Needle.
5. ASTM C307 - Test Method for Tensile Strength of Chemical-Resistant Mortar, Grouts, and Monolithic Surfacings.
6. ASTM C531 - Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes.
7. ASTM C579 - Test Method for Compressive Strength of Chemical-Resistant Mortars, Grouts, monolithic Surfacings and Polymer Concretes.
8. ASTM C827 - Test Method for Change in Height at Early Ages of Cylindrical Specimens from Cementitious Mixtures.

C. U. S. Army Corps of Engineers Concrete Research Division (CRD):
1. CRD C621 - Non-Shrink Grout.

D. Michigan Department of Transportation
1. MDOT Standard Specifications for Construction, current edition

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit product data on grout and bonding agent.

C. Manufacturer's Installation Instructions: Submit manufacturer’s instructions for mixing, handling, surface preparation and placing epoxy type and non-shrink type grouts.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with the MDOT Standard Specifications for Construction.

B. Maintain one copy of each document on site.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Deliver grout in manufacturer's unopened containers with proper labels intact.

C. Store grout in a dry shelter, protect from moisture.

1.6 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements: Environmental conditions affecting products on site.

B. Do not perform grouting if temperatures exceed 90 degrees F.

C. Maintain minimum temperature of 40 degrees F before, during, and after grouting, until grout has set.

PART 2 PRODUCTS

2.1 PORTLAND CEMENT GROUT MATERIALS

A. Portland Cement: ASTM C150, Type I and II.

B. Water:
   1. Potable; containing no impurities, suspended particles, algae or dissolved natural salts in quantities capable of causing:
      a. Corrosion of steel.
      b. Volume change increasing shrinkage cracking.
      c. Efflorescence.
      d. Excess air entraining.

C. Fine Aggregate:
   1. Washed natural sand.
   2. Gradation in accordance with ASTM C33 and represented by smooth granulometric curve within required limits.
   3. Free from injurious amounts of organic impurities as determined by ASTM C40.

D. Mix:

1. Portland cement, sand and water. Do not use ferrous aggregate or staining ingredients in grout mixes.

2.2 RAPID CURING EPOXY GROUT

A. Manufacturers:
   1. BASF MasterEmaco T 1060 Rapid Cement.
   2. Or equal.

B. Furnish materials in accordance with State of Michigan Department of Transportation Standard Specification for Construction.

C. Rapid Curing Epoxy Grout: High strength, three component epoxy grout formulated with thermosetting resins and inert fillers. Rapid-curing, high adhesion, and resistant to ordinary chemicals, acids and alkalies.

Property	Test	Result
Compressive Strength	ASTM C579	12,000 psi at 7 days
Tensile Strength	ASTM C307	2,000 psi minimum
Coefficient of Expansion	ASTM C531	$30x10^{-6}$ in per degree F
Shrinkage	ASTM C827	None

2.3 NON-SHRINK CEMENTITIOUS GROUT

A. Furnish materials in accordance with the MDOT Standard Specifications for Construction.

B. Non-shrink Cementitious Grout: Pre-mixed ready for use formulation requiring only addition of water; non-shrink, non-corrosive, non-metallic, non-gas forming, no chlorides.

C. Properties: Certified to maintain initial placement volume or expand after set and meet the following minimum properties when tested in accordance with CRD-C621, for Type D non-shrink grout:

Property	Test	Time	Result
Setting Time	ASTM C191	Initial	2 hours (Approx)
		Final	3 hours (Approx)
Expansion			0.10% - 0.4% Maximum
Compressive Strength	CRD-C621	1 day	4,000 psi
		7 days	7,000 psi
		28 days	10,000 psi to 10,800 psi

2.4 FORMWORK

A. Refer to Section 03 10 00 for formwork requirements.

2.5 CURING

A. Prevent rapid loss of water from grout during first 48 hours by use of approved membrane curing compound or with use of wet burlap method.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify areas to receive grout.

3.2 PREPARATION

A. Remove defective concrete, laitance, dirt, oil, grease and other foreign material from concrete surfaces by brushing, hammering, chipping or other similar means until sound, clean concrete surface is achieved.

B. Rough concrete lightly, but not enough to interfere with placement of grout.

C. Remove foreign materials from metal surfaces in contact with grout.

D. Align, level and maintain final positioning of components to be grouted.

E. Saturate concrete surfaces with clean water; remove excess water, leave none standing.

3.3 INSTALLATION - FORMWORK

A. Construct leakproof forms anchored and shored to withstand grout pressures.

B. Install formwork with clearances to permit proper placement of grout.

3.4 MIXING

A. Portland Cement Grout:
   1. Use proportions of 2 parts sand and 1 part cement, measured by volume.
   2. Prepare grout with water to obtain consistency to permit placing and packing.
   3. Mix water and grout in two steps; pre-mix using approximately 2/3 of water; after partial mixing, add remaining water to bring mix to desired placement consistency and continue mixing 2 to 3 minutes.
   4. Mix only quantities of grout capable of being placed within 30 minutes after mixing.
   5. Do not add additional water after grout has been mixed.

B. Mix and prepare rapid curing epoxy grout in accordance with manufacturer's instructions.
   1. Capable of developing minimum compressive strength of 2400 psi in 48 hours and 7000 psi in 28 days.

C. Mix and prepare non-shrink cementitious grout in accordance with manufacturer's instructions.
   1. Capable of developing minimum compressive strength of 2400 psi in 48 hours and 7000 psi in 28 days.

D. Mix grout components in proximity to work area and transport mixture quickly and in manner not permitting segregation of materials.

3.5 PLACING GROUT

A. Place grout material quickly and continuously.

B. Do not use pneumatic-pressure or dry-packing methods.

C. Apply grout from one side only to avoid entrapping air.

D. Do not vibrate placed grout mixture, or permit placement when area is being vibrated by nearby equipment.

E. Thoroughly compact final installation and eliminate air pockets.

F. Do not remove leveling shims for at least 48 hours after grout has been placed.

3.6 CURING

A. Immediately after placement, protect grout from premature drying, excessively hot or cold temperatures, and mechanical injury.

B. After grout has attained its initial set, keep damp for minimum of 3 days.

3.7 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.

B. Field inspection and testing will be performed in accordance with MDOT Standard Specifications for Construction with and under provisions of Section 01 40 00 - Quality Requirements.

C. Submit proposed mix design of each class of grout to the Engineer for review prior to commencement of Work.

D. Tests of grout components may be performed to ensure conformance with specified requirements.

END OF SECTION

SECTION 31 05 13
SOILS FOR EARTHWORK

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Subsoil materials.
   2. Topsoil materials.

B. Related Sections:
   1. Section 31 05 16 - Aggregates for Earthwork.
   2. Section 31 22 13 - Rough Grading.
   3. Section 31 23 17 - Trenching.
   4. Section 32 91 19 - Landscape Grading.
   5. Section 32 92 19 – Seeding.
   6. Section 31 25 00 - Erosion and Sedimentation Controls.

1.2 REFERENCES

A. American Association of State Highway and Transportation Officials:
   1. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. ASTM International:
   1. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).
   2. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3)).
   3. ASTM D2487 - Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System).

C. Michigan Department of Transportation
   1. MDOT Standard Specifications for Construction, current edition

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Samples: Maybe requested for submittal by the Engineer for testing. Submit, in air-tight containers, 10 lb sample of each type of fill to testing laboratory.

C. Materials Source: Submit name of imported materials source.

D. Manufacturer's Certificate: Certify soils meet or exceed specified requirements.

1.4 QUALITY ASSURANCE

A. Furnish each subsoil and topsoil material from single source throughout the Work. A second source maybe requested for approval by the Engineer.

B. Perform Work in accordance with the MDOT Standard Specifications for Construction.

PART 2 PRODUCTS

2.1 SUBSOIL MATERIALS

A. Subsoil MDOT Subsoil: Native material conforming to the MDOT Standard Specifications for Construction.

B. Subsoil Type Municipal Subsoil:
   1. Native material.
   2. Graded.
   3. Free of lumps larger than 3 inches, rocks larger than 2 inches, and debris.

2.2 TOPSOIL MATERIALS

A. Topsoil Type MDOT Topsoil: Native material conforming to MDOT Standard Specifications for Construction.

B. Topsoil Type Municipal Native Topsoil:
   1. Native Topsoil.
   2. Graded.
   3. Free of roots, rocks larger than 1/2 inch, subsoil, debris, large weeds and foreign matter.
      a. Screening: Double screened.

C. Topsoil Type Municipal Imported Borrow Topsoil:
   1. Imported borrow.
   2. Friable loam.
   3. Reasonably free of roots, rocks larger than 1/2 inch, subsoil, debris, large weeds, and foreign matter.
      a. Screening: Double screened.
   4. Acidity range (pH) of 5.5 to 7.5.
   5. Containing minimum of 4 percent and maximum of 25 percent inorganic matter.

2.3 SOURCE QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Testing and Inspection Services Testing and analysis of soil material.

B. Testing and Analysis of Subsoil Material: Perform in accordance with AASHTO T180.

C. Testing and Analysis of Topsoil Material: Perform in accordance with AASHTO T180.

D. When tests indicate materials do not meet specified requirements, change material and retest.

E. Furnish materials of each type from same source throughout the Work.

PART 3 EXECUTION

3.1 EXCAVATION

A. Excavate subsoil and topsoil as required for utility and/or road installation. Strip topsoil to full depth of topsoil for complete installation.

B. Stockpile excavated material meeting requirements for subsoil materials and topsoil materials.

C. Remove excess excavated materials subsoil and topsoil not intended for reuse, from site.

D. Remove excavated materials not meeting requirements for subsoil materials and topsoil materials from site.

3.2 STOCKPILING

A. Stockpile materials on site at locations approved by the Engineer.

B. Stockpile in sufficient quantities to meet Project schedule and requirements.

C. Separate differing materials with dividers or stockpile apart to prevent mixing.

D. Stockpile topsoil 8 feet high maximum.

E. Prevent intermixing of soil types or contamination.

F. Direct surface water away from stockpile site to prevent erosion or deterioration of materials.

G. Stockpile unsuitable or hazardous materials on impervious material and cover to prevent erosion and leaching, until disposed of.

3.3 STOCKPILE CLEANUP

A. Remove stockpile, leave area in clean and neat condition. Grade site surface to prevent free standing surface water.

END OF SECTION

SECTION 31 05 16
AGGREGATES FOR EARTHWORK

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Coarse aggregate materials.
   2. Fine aggregate materials.

B. Related Sections:
   1. Section 31 05 13 - Soils for Earthwork.
   2. Section 31 22 13 - Rough Grading.
   3. Section 31 23 17 - Trenching.
   4. Section 32 11 23 - Aggregate Base Courses.
   5. Section 32 91 19 - Landscape Grading.

1.2 REFERENCES

A. American Association of State Highway and Transportation Officials:
   1. AASHTO M147 - Standard Specification for Materials for Aggregate and Soil-Aggregate Subbase, Base and Surface Courses.
   2. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. ASTM International:
   1. ANSI/ASTM C117 – Test Method for Materials finer than 75 mm (No. 200) Sieve in Mineral Aggregates by Washing.
   2. ASTM C136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
   3. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).
   4. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3)).
   5. ASTM D2487 - Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System).
   6. ASTM D2992 – Test Methods of Density of Soil and Soil – Aggregate in Place by the Nuclear Method (Shallow Depth).
   7. ASTM D4318 - Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
   8. Test method for density of soil in place with loss by wash less than 15% - One Point Michigan Cone Test.
   9. Test method for density of soil in place with loss by was greater than 15% - One Point T-99 Test.

C. Michigan Department of Transportation
   1. MDOT Standard Specifications for Construction, current edition

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Samples: May be requested for submittal by the Engineer for testing.

C. Materials Source: Submit name of imported materials suppliers.

D. Manufacturer's Certificate: Certify Products meet or exceed MDOT 22A crushed limestone specification or MDOT 6A crushed limestone.

1.4 QUALITY ASSURANCE

A. Furnish each aggregate material from single source throughout the Work.

B. Perform Work in accordance with MDOT Standard Specifications for Construction.

C. Maintain one copy of each document on site.

PART 2 PRODUCTS

2.1 COARSE AGGREGATE MATERIALS

A. Coarse Aggregate MDOT 6A compacted crushed limestone: Conforming to MDOT Standard Specifications for Construction.

B. Coarse Aggregate MDOT 22A crushed limestone: Conforming to MDOT Standard Specifications for Construction.

2.2 FINE AGGREGATE MATERIALS

A. Fine Aggregate Type MDOT Class II (Sand): Conforming to MDOT Standard Specifications for Construction.

B. Fine Aggregate Type MDOT Class III A: Conforming MDOT Standard Specifications for Construction (used for sanitary sewer backfill – 1’ over top of pipe only).

2.3 SOURCE QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Testing and inspection services.

B. Coarse Aggregate Material - Testing and Analysis: Perform in accordance with MTM 109 and MTM 108 and other applicable MDOT testing standards.

C. Fine Aggregate Material - Testing and Analysis: Perform in accordance with MTM 109 and MTM 108 and other applicable MDOT testing standards.

D. When tests indicate materials do not meet specified requirements, change material and retest.

PART 3 EXECUTION

3.1 STOCKPILING

A. Stockpile materials on site at locations approved by the Engineer.

B. Stockpile in sufficient quantities to meet Project schedule and requirements.

C. Separate different aggregate materials with dividers or stockpile individually to prevent mixing.

D. Direct surface water away from stockpile site to prevent erosion or deterioration of materials.

E. Stockpile hazardous materials on impervious material and cover to prevent erosion and leaching, until disposed of.

3.2 STOCKPILE CLEANUP

A. Remove stockpile, leave area in clean and neat condition. Grade site surface to prevent free standing surface water.

END OF SECTION

SECTION 31 10 00
SITE CLEARING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Removing surface debris.
   2. Removing designated paving, curbs, and sidewalk.
   3. Removing designated trees, shrubs, and other plant life.
   4. Removing abandoned utilities.
   5. Excavating topsoil.

B. Related Sections:
   1. Section 31 22 13 - Rough Grading.
   2. Section 31 23 18 - Rock Removal.

1.2 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit data for herbicide. Indicate compliance with applicable codes for environmental protection.

1.3 QUALITY ASSURANCE

A. Conform to applicable code for environmental requirements, disposal of debris.

B. Perform Work in accordance with the MDOT Standard Specifications for Construction, current edition.

C. Coordinate clearing work with utility companies.

PART 2 PRODUCTS

A. NOT USED

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify existing plant life designated to remain is tagged or identified.

C. Identify waste area for placing removed materials.

3.2 PREPARATION

A. Call Miss Dig (Local Utility Line) Information service at 1-800-482-7171 not less than three working days before performing Work.
   1. Request underground utilities to be located and marked within and surrounding construction areas.

3.3 PROTECTION

A. Locate, identify, and protect utilities indicated to remain, from damage.

B. Protect trees, plant growth, and features designated to remain, as final landscaping as specified in Section 01 50 00 - Temporary Facilities and Controls.

C. Protect bench marks, survey stakes, survey control points, and existing structures from damage or displacement.

D. All trees, shrubs, and bushes which are too large to be replaced in kind, shall be let undisturbed, with the utility being installed in a boring and/or tunneling operation, unless written consent form the property owner to remove the tree is obtained.

E. The boring or tunneling operation shall be constructed in accordance with these specifications.

F. The Contractor shall locate the boring or tunneling pit at a sufficient distance to insure no damage will occur to the tree.

3.4 CLEARING

A. Clear areas required for access to site and execution of Work.

B. Remove trees and shrubs indicated. Remove stumps, main root ball, surface rock, and as indicated on the plans.

C. Clear undergrowth and deadwood, without disturbing subsoil.

D. Apply herbicide to remaining stumps to inhibit growth.

3.5 REMOVAL

A. Remove debris, rock, and extracted plant life from site.

B. Partially remove paving, curbs, and, sidewalk as indicated on Drawings. Neatly saw cut edges at right angle to surface.

C. Remove abandoned utilities. Indicated removal termination point for underground utilities on Record Documents.

D. Continuously clean-up and remove waste materials from site. Do not allow materials to accumulate on site.

E. Trees, shrubs, and bushes which are removed and which are to be replaced shall be done so by an established nursery.

F. Trees, shrubs, and bushes to be removed shall be done by falling the tree in sections, beginning from the top down and removing the stump and debris from the site.

G. The property owner, at his option, may elect to claim the usable timber.

H. Is so, the Contractor shall be responsible for cutting the tree into manageable lengths and stockpiling same along the line of the work.

I. If the property owner does not want the timber, it shall become the property of the Contractor.

J. The cost of removing trees, brush, and bushes and the cutting of timber and removing debris from the site shall be included in the unit price for cleanup of the project.

K. Continuously clean-up and remove waste materials from site. Do not allow materials to accumulate on site.

L. Do not burn or bury materials on site. Leave site in clean condition.

3.6 TOPSOIL EXCAVATION

A. Excavate topsoil from areas to be further excavated, relandscaped, or regraded, without mixing with foreign materials for use in finish grading.

B. Do not excavate wet topsoil.

C. Stockpile in area designated on site approved by the Engineer to depth not exceeding 8 feet and protect from erosion.

END OF SECTION

SECTION 31 22 13
ROUGH GRADING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Excavating topsoil.
2. Excavating subsoil.
3. Cutting, grading, filling, rough contouring, and compacting the site for site structures.

B. Related Sections:
1. Section 31 05 13 - Soils for Earthwork
2. Section 31 05 16 - Aggregates for Earthwork
3. Section 31 10 00 - Site Clearing
4. Section 31 23 16 - Excavation
5. Section 31 23 17 - Trenching
6. Section 31 23 18 - Rock Removal
7. Section 32 91 19 - Landscape Grading

1.2 REFERENCES

A. American Association of State Highway and Transportation Officials:
1. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. ASTM International:
1. ASTM C136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
2. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).
3. ASTM D1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.
4. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3)).
5. ASTM D2419 - Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate.
6. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
7. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

C. Michigan Department of Transportation
1. MDOT Standard Specifications for Construction, current edition

1.3 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for submittals.

B. Project Record Documents: Accurately record actual locations of utilities remaining by horizontal dimensions, elevations or inverts, and slope gradients.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with the MDOT Standard Specifications for Construction.

PART 2 PRODUCTS

2.1 MATERIALS

A. Topsoil: Municipal Topsoil as specified in Section 31 05 13.

B. Subsoil Fill: Municipal Subsoil as specified in Section 31 05 13.

C. Structural Fill: MDOT 22A Compacted Crushed Limestone as specified in Section 31 05 16.

D. Granular Fill: MDOT Class II Sand as specified in Section 31 05 16.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify site conditions under provisions of Section 01 30 00.

C. Verify survey bench mark and intended elevations for the Work are as indicated on Drawings.

D. Verify fill materials are acceptable.

3.2 PREPARATION

A. Call Miss Dig at 811 not less than three working days before performing Work.
   1. Request underground utilities to be located and marked within and surrounding construction areas.

B. Identify required lines, levels, contours, and datum.

C. Notify utility company to remove and relocate utilities.

D. Protect utilities indicated to remain from damage.

E. Protect plant life, lawns, rock outcropping and other features remaining as portion of final landscaping.

F. Protect bench marks, survey control point, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

3.3 FILLING

A. Fill areas to contours and elevations with unfrozen materials.

B. Place fill material in continuous layers and compact in accordance with schedule at end of this section.

C. Maintain optimum moisture content of fill materials to attain required compaction density.

D. Slope grade away from building minimum 2 percent slope for minimum distance of 10 ft, unless noted otherwise.

E. Make grade changes gradual. Blend slope into level areas.

F. Repair or replace items indicated to remain damaged by excavation or filling.

G. The Owner may have a use for the surplus excess excavated material. If they do it shall be their property and the Contractor's responsibility to transport said material to the Owner's stockyard. All cost associated with transporting, hauling, and loading said material shall be included in other pay items of this project.

3.4 TOLERANCES

A. Section 01 40 00 - Quality Requirements: Tolerances.

B. Top Surface of Subgrade: Plus or minus 1/10 foot from required elevation.

3.5 SPOIL LEVELING

A. As indicated on Drawings, or as directed by Engineer.

B. Contractor shall be responsible for loading, hauling and spreading of all excess excavated material generated from this project.

C. Place no excavated materials on roads without written permission of the authorities having jurisdiction of said road.

D. Remove excavation in areas adjacent to yards where there is not suitable place to deposit spoils and dispose of as indicated on the drawings or off site as directed by the Engineer.

E. Place no spoils in a watercourse or drain.

3.6 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.

B. Test and analysis of fill material will be performed in accordance with MDOT Standards and with Section 01 40 00.

C. Compaction testing will be performed in accordance with MDOT Standards and with Section 01 40 00.

D. If testes indicate Work does not meet specified requirement, remove Work, replace and retest at no cost to the Owner.

E. Frequency of Tests: As directed by the Engineer.

3.7 SCHEDULES

A. Structural Fill:
   1. Fill Type MDOT 6A Compacted Crushed Limestone: To subgrade elevation.
   2. Compact uniformly to minimum 98 percent of maximum density.

B. Subsoil Fill:
   1. Fill Type MDOT Class II Sand within the 1 on 1 influence of the road: To subgrade elevation.
   2. Fill Type Native Fill within the green belt outside the road influence.
   3. Compact uniformly to minimum 95 percent of maximum density.

C. Topsoil Fill:
   1. Fill Type Municipal Topsoil: Proposed elevation, 4 inches thick.
   2. Compact uniformly to minimum 95 percent of maximum density.

END OF SECTION

SECTION 31 23 16
EXCAVATION

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Soil densification.
2. Excavating for paving, roads, and parking areas.
3. Excavating for slabs-on-grade.
4. Excavating for structures.

B. Related Sections:
1. Section 31 05 13 - Soils for Earthwork
2. Section 31 05 16 - Aggregates for Earthwork
3. Section 31 22 13 - Rough Grading
4. Section 31 23 17 - Trenching
5. Section 31 23 18 - Rock Removal
6. Section 33 14 13 – Public Water Utility Distribution Piping
7. Section 33 05 13 - Public Manholes and Structures.

1.2 REFERENCES

A. MISS DIG System, Inc.

B. Act No. 174, Public Acts of 2013, latest revision.

C. Special provisions made by local utility having jurisdiction.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Excavation Protection Plan: Describe sheeting, shoring, and bracing materials and installation required to protect excavations and adjacent structures and property; include structural calculations to support plan.

C. Shop Drawings: Indicate soil densification grid for each size and configuration footing requiring soils densification.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with the MDOT Standard Specifications for Construction, current edition.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.1 PREPARATION

A. Call MISS DIG at 811 not less than three working days before performing Work.
   1. Request underground utilities to be located and marked within and surrounding construction areas.

B. Identify required lines, levels, contours, and datum.

C. Notify utility company when specified to remove and relocate utilities.

D. Identify known underground, above ground, and aerial utilities, stake, and flag locations.

E. Protect above and below ground utilities indicated to remain from damage.

F. Protect plant life, lawns, rock outcroppings and other features remaining as portion of final landscaping.

G. Protect bench marks, survey control points, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

H. Protect grade and slope stakes.

3.2 OPEN CHANNEL RELOCATION AND RESTORATION

A. Clear site in accordance with Section 31 10 00 – Site Clearing.

B. Excavation drain to dimensions and cross sections specified on drawings.

C. Contractor shall check flow line elevations every 100 ft. (grade stakes will be provided by Engineer). Over excavation of 0.3 ft or greater will be filled with Type MDOT 6A compacted crushed limestone to the proposed flow line as incidental cost to the Contractor.

D. Contractor shall remove all sediment from existing culverts to remain.

E. When drain parallels a road, all excavation will be on field side slope unless stated on drawing or required by Engineer.

F. Underpin adjacent structures which may be damaged by excavation work, including utilities and pipe chases.

G. Machine slope banks to required slopes.

H. Notify Engineer of unexpected subsurface conditions and discontinue affected Work in area until notified to resume work.

I. Correct unauthorized excavation at no extra cost to Owner.

J. Seed excavated areas daily in accordance with Section 32 92 19 – Seeding.

K. Repair and replace field tile outlets as directed by Engineer.

L. Match existing side slopes in reaches identified channel cleanout.

M. Excess spoils on road sides and lawn areas are to be hauled away.

N. When excavating one side slope of drain. The opposite ditch bank shall be cleared in accordance with Section 31 10 00 – Site Clearing. Grass vegetation should not be removed on opposite side slopes.

3.3 SPOIL LEVELING

A. Seed spoils in accordance with Section 32 92 19 – Seeding.

B. Place soil erosion and sedimentation control measures per SESC plan.

C. Spoils placed on tillable land shall be spread evenly to allow for tilling.

D. Spoils in wooded areas shall be stockpiled as shown on plans.

E. Spoils are to be kept a minimum 3 feet from excavation area.

F. No excavated materials shall be placed on roads without written permission of the authorities having jurisdiction of said road.

G. Spoils excavated in areas adjacent to residential or lawn areas are to be removed from the area unless directed by the Engineer, shown on plans, or Contractor receives written permission from Landowner to level in area.

H. No spoils are to be placed in any watercourse or drain.

I. Side grade outs for watercourse and ditches shall be done at the time of open drain excavation or channel cleanout.

J. Non-combustible items (i.e. roots and stumps), brush, or debris shall not be mixed with leveled spoil material.

K. Shape leveled spoils to prevent the ponding of water behind spoil pile.

L. Level spoils on the same side of the drain which excavation occurs. If excavation occurs from both sides of drain then made even spoil piles on both sides of drain unless otherwise directed by the Engineer.

M. In agricultural areas, root rake and hand pick sticks and rocks so that foreign debris 1’ in length and/or 6” in diameter is disposed of.

3.4 ROAD SHOULDER CONSTRUCTION

A. Construct road shoulder and construct 2 horizontal to 1 vertical side slope to drain and valley shaped ditches.

B. Prior to filling for shoulder construction, remove existing sediment, top soil, and vegetation from area to be filled.

C. Fill and compact native material for road shoulder. Fill material shall be placed in 12”-24” lifts. Contractor will be responsible for the construction of stable side slopes.

D. Fill materials must be dry and must be approved by Engineer. Fill materials will be native excavated material.

3.5 EXCAVATION

A. Underpin adjacent structures which may be damaged by excavation work.

B. Excavate subsoil to accommodate building foundations, paving and site structures, construction operations, and utility trenches.

C. Slope banks with machine to angle of repose or less until shored.

D. Grade top perimeter of excavation to prevent surface water from draining into excavation.

E. Trim excavation. Remove loose matter.

F. Remove lumped subsoil, boulders, and rock up to 0.5 cu ft measured by volume. Remove larger material as specified in Section 31 23 18.

G. Notify Engineer of unexpected subsurface conditions.

H. Correct areas over excavated with structural fill Type MDOT 6A Compacted Crushed Limestone as directed by Engineer.

I. Remove excess and unsuitable material from site.

3.6 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.

B. Request visual inspection of bearing surfaces by Engineer before installing subsequent work.

3.7 PROTECTION

A. Prevent displacement or loose soil from falling into excavation; maintain soil stability.

B. Protect bottom of excavations and soil adjacent to and beneath foundation from freezing.

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

3.8 DUST CONTROL

A. The Contractor shall implement measures to minimize dust, especially near residents, upon the Engineers request.

END OF SECTION

SECTION 31 23 17
TRENCHING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Excavating trenches for utilities within municipal right-of-way or easement.
2. Compacted fill from top of utility bedding to subgrade elevations.
3. Backfilling and compaction.

B. Related Sections:
1. Section 03 30 00 - Cast-In-Place Concrete
2. Section 31 05 13 - Soils for Earthwork
3. Section 31 05 16 - Aggregates for Earthwork
4. Section 31 22 13 - Rough Grading
5. Section 31 23 16 - Excavation
6. Section 31 23 18 - Rock Removal
7. Section 32 91 19 - Landscape Grading

1.2 REFERENCES

A. American Association of State Highway and Transportation Officials:
1. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. ASTM International:
1. ASTM A-328 – Standard Specifications for Sheet Piling.
2. ASTM A-572 – Grades 60, High Strength.
3. ASTM A-690 – High Strength Corrosion Resistant.
4. ASTM C117 – Test Method for Materials Finer than 75mm (No. 200) Sieve in Mineral Aggregates by Washing.
5. ASTM C12 – Standard Practice for Installing Vitrified Clay Pipe Lines.
6. ASTM D-245-62T – Timber and lumber requirement.
7. ASTM C136 – Method for Sieve Analysis of Fine and Coarse Aggregates.
8. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).
9. ASTM D1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.
10. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3)).
11. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
12. ASTM D2321 – Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity – Flow Applications.
13. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

14. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

1.3 DEFINITIONS

A. Utility: Any buried pipe, duct, conduit, or cable.

1.4 REGULATORY REQUIREMENTS

A. Conform to applicable OSHA regulations.

1.5 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Excavation Protection Plan: Describe sheeting, shoring, and bracing materials and installation required to protect excavations and adjacent structures and property; include structural calculations to support plan.

C. Product Data: Submit data for geotextile fabric indicating fabric and construction.

D. Samples: Submit, in air-tight containers, 10 lb sample of each type of fill to testing laboratory.

E. Materials Source: Submit name of imported fill materials suppliers.

F. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.6 QUALITY ASSURANCE

A. Perform Work in accordance with Municipal standards.

1.7 QUALIFICATIONS

A. Prepare excavation protection plan under direct supervision of Professional Engineer experienced in design of this Work and licensed in State of Michigan.

1.8 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.9 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify Work associated with lower elevation utilities is complete before placing higher elevation utilities.

PART 2 PRODUCTS

2.1 FILL MATERIALS

A. Subsoil Fill: Native Fill as specified in Section 31 05 13 - Soils for Earthwork.

B. Structural Fill: MDOT 6A crushed limestone and MDOT 22A crushed limestone as specified in Section 31 05 16 - Aggregates for Earthwork.

C. Granular Fill: MDOT Class II Sand as specified in Section 31 05 16 - Aggregates for Earthwork.

D. Concrete: Structural concrete as specified in Section 03 30 00 - Cast-in-Place Concrete with compressive strength of 3500 psi.

2.2 EXCAVATION SUPPORT MATERIALS

A. Timber and lumber for shoring and bracing shall be new, merchantable pine. Douglas Fir or Spruce, unless otherwise shown or specified. Secondhand timber or lumber shall not be used where strength and/or appearance are important considerations.

B. Steel for sheeting, shoring, and bracing shall be as per the referenced ASTM specifications.

C. Temporary Sheeting: Select section modulus, embedment depth and bracing required to complete the work.

PART 3 EXECUTION

3.1 LINES AND GRADES

A. Lay pipes to lines and grades indicated on Drawings.
   1. Engineer and Owner reserves right to make changes in lines, grades, and depths of utilities when changes are required for Project conditions.

B. Use laser-beam instrument with qualified operator to establish lines and grades.

3.2 PREPARATION

A. Call MISS DIG at 811 not less than three working days before performing Work.
   1. Request underground utilities to be located and marked within and surrounding construction areas.

B. Identify required lines, levels, contours, and datum locations.

C. Protect plant life, lawns, rock outcropping and other features remaining as portion of final landscaping.

D. Protect bench marks, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

E. Maintain and protect above and below grade utilities indicated to remain.

F. Establish temporary traffic control and detours when trenching is performed in public right-of-way. Relocate controls and reroute traffic as required during progress of Work.

3.3 TRENCHING

A. Excavate subsoil required for utilities as shown on the plan, and as stated in the proposal.

B. Excavate subsoil for utility piping and accessories as indicated on the drawings.

C. Excavate on the required line to the depth required below the pipe grade for bedding thickness required.

D. Remove lumped subsoil, boulders, and rock up of 1/6 cubic yard, measured by volume. Remove larger material as specified in Section 31 23 18 – Rock Removal.

E. Do not advance open trench more than one pipe length ahead of installed pipe.

F. Cut trenches to width indicated on Drawings. Remove water or materials that interfere with Work.

G. Excavate bottom of trenches in accordance with trench details or specifications.

H. Excavate trenches to depth indicated on Drawings. Provide uniform and continuous bearing and support for bedding material and utilities being installed.

I. Excavate trench widths exceed the maximum specified above, the Owner's representative may require special bedding or the use of extra strength pipe at the Contractor's expense.

J. Do not interfere with 45 degree bearing splay of foundations.

K. When Project conditions permit, slope side walls of excavation starting 1 feet above top of pipe. When side walls can not be sloped, provide sheeting and shoring to protect excavation as specified in this section.

L. When subsurface materials at bottom of trench are loose or soft, excavate to greater depth as directed by Engineer until suitable material is encountered.

M. Cut out soft areas of subgrade not capable of compaction in place. Backfill with Fill Type MDOT 6A Compacted Crushed Limestone and compact to density equal to or greater than requirements for subsequent backfill material.

N. Trim excavation. Hand trim for bell and spigot pipe joints. Remove loose matter.

O. Correct areas over excavated areas with compacted backfill as specified for authorized excavation or replace with fill concrete as directed by Engineer.

P. Remove excess subsoil not intended for reuse, from site.

Q. Grade top perimeter of excavation to prevent surface water from draining into excavation.

R. Notify Owner's representative of unexpected subsurface conditions and discontinue affected work in area until notified to resume work.

S. Protect excavation by methods required to prevent cave-in or loose soil from failing into excavation.

T. Provide, operate, and maintain pumping equipment to keep trench free of water.

U. Use trench boxes or other form of temporary protection when required by OSHA Standards or when protection of existing utilities is necessary.

V. Stockpile excavated material in area designated on site in accordance with Section 31 05 13 – Aggregates for Earthwork.

3.4 SHEETING AND SHORING

A. Sheet, shore, and brace excavations to prevent danger to persons, structures and adjacent properties and to prevent caving, erosion, and loss of surrounding subsoil.

B. Support trenches more than 5 feet deep excavated through unstable, loose, or soft material. Provide sheeting, shoring, bracing, or other protection to maintain stability of excavation.

C. Design sheeting and shoring to be removed at completion of excavation work.

D. The Contractor is responsible for the design and location of all sheeting, shoring, and bracing.

E. When required to properly support the surfaces of excavations and to protect the construction work and workmen, sheeting, bracing and shoring shall be provided.

F. If the Owner's representative is of the opinion that at any point sufficient or proper supports have not been provided, he may order additional supports at the expense of the Contractor, but neither the placing of such additional supports by the order of the Owner's representative nor the failure of the Owner's representative to order such additional supports placed shall release the Contractor from his responsibility for the sufficiency of such supports and the integrity of the work.

G. Damage to new or existing structures occurring through settlements due to failure or lack of sheeting or bracing shall be repaired by the Contractor at his own expense.

H. Conflict of opinion as to whether the settlement is due to the work of the Contractor or to any other cause will be determined by the Owner's representative.

I. In general, the sheeting and bracing shall be removed, as the trench or excavation is refilled, in such a manner as to avoid the caving in of the work.

J. Fill voids left by the withdrawal of the sheeting by ramming, or otherwise as directed.

K. Obtain permission of the Owner's representative prior to the removal of any shoring, sheeting or bracing.

L. When sheeting and bracing is removed, the Contractor shall assume full responsibility for injury to structures or to other property or persons arising from failure to leave in place such sheeting or bracing.

M. For the purpose of preventing injury to the structures, or to other property or to persons, the Contractor shall leave in place any sheeting or bracing shown on the plans or ordered in writing by the Owner's representative.

N. Cutoff sheeting left in place at the elevation ordered but not be less than 18" below the final ground surface.

O. Bracing remaining in place shall be driven up tight.

P. Measurements and payment for sheeting and bracing ordered left in place will be made as extra work, unless noted otherwise.

Q. The right of the Owner's representative to order sheeting and bracing left in place shall not be construed as creating any obligation on his part to issue such orders.

R. Repair damage caused by failure of the sheeting, shoring, or bracing and for settlement of filled excavations or adjacent soil.

S. Repair damage to new and existing Work from settlement, water or earth pressure or other causes resulting from inadequate sheeting, shoring, or bracing.

3.5 BACKFILLING

A. Verify all materials to be reused as acceptable.

B. Backfill trenches to proposed contours and elevations with unfrozen fill materials.

C. Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen, or spongy subgrade surfaces.

D. Place material in continuous layers as follows:
   1. Subsoil Fill: Maximum 8 inches compacted depth.
   2. Structural Fill: Maximum 6 inches compacted depth.
   3. Granular Fill: Maximum 8 inches compacted depth.

E. Place geotextile fabric over Type MDOT 6A Compacted Crushed Limestone fill bedding prior to placing last lift of bedding.

F. Employ placement method that does not disturb or damage, utilities in trench, pavement, sidewalk, and driveways.

G. Maintain optimum moisture content of fill materials to attain required compaction density.

H. Do not leave more than 20 feet of trench open at end of working day.

I. Protect open trench to prevent danger to Owner.

J. Backfill against supported foundation walls.

K. Make grade changes gradual. Blend slope into level areas.

L. Slope fill away from structures a minimum 2 inches in 10 feet.

M. Leave fill material stockpile areas completely free of excess fill materials.

N. Employ a compaction method for trench backfill that does not disturb or damage installed utilities and existing utilities in the trench. Compact backfill to specified density. If required compaction is not achieved and verified using mechanical methods, settling or spiking the trench with water may be used as a compaction method in conformance with ASTM C13 and D2321, as approved by the Engineer.

O. Backfill simultaneously around all sides of structures, manholes and catch basins.

3.6 TOLERANCES

A. Top Surface of Backfilling under Paved Areas: Plus or minus 1/2 inch from required elevations.

B. Top surface of fill for building pads plus or minus 1/4 inch form required elevations.

C. Top Surface of General Backfilling: Plus or minus 1 inch from required elevations.

3.7 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed under provisions of Section 01 40 00.

B. Tests and analysis of fill material will be performed in accordance with MDOT Standard Requirements and with Section 01 40 00.

C. Compaction testing will be performed in accordance with MDOT Standard Requirements and with Section 01 40 00.

D. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to Owner.

E. Frequency of Tests: As directed by Soils Engineer.

F. Proof roll compacted fill surfaces under paving.

3.8 PROTECTION OF FINISHED WORK

A. Protect finished Work under provisions of Section 01 50 00 Temporary Facilities and Controls and Section 01 70 00 - Execution and Closeout Requirements.

B. Reshape and re-compact fills subjected to vehicular traffic during construction.

3.9 SCHEDULE

A. Fill Under Grass Area:
   1. Subsoil Type Municipal Subsoil, to 4 inches below finish grade, compacted to 95 percent maximum dry density as determined by MDOT Standard Requirements.

B. Fill Under Asphalt Paving:
   1. MDOT Class II Sand to underside of aggregate base course elevation, compacted to 95 percent maximum dry density as determined by MDOT Standard Requirements.

C. Fill Under Concrete Building Pads, Concrete Pads, Concrete Curb and Gutter and Sidewalks:
   1. MDOT Class II Sand to within 4" of underside of concrete slab. All fill to be compacted to 95 percent maximum dry density as determined by MDOT Standard Requirements.

D. Backfill for Utility Trenches:
   1. As specified in individual water and sewer utility standard detail sheets.

E. Fill for Subgrade and Undercutting:
   1. MDOT Class II Sand fill to proposed subgrade elevation, compacted to 95 percent maximum dry density as determined by MDOT Standard Requirements.

END OF SECTION

SECTION 31 23 18
ROCK REMOVAL

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Removing identified and discovered rock during excavation.
   2. Expansive tools to assist rock removal.

B. Related Sections:
   1. Section 31 22 13 - Rough Grading
   2. Section 31 23 16 - Excavation
   3. Section 31 23 17 - Trenching

1.2 DEFINITIONS

A. Trench Rock: Solid mineral material with volume in excess of 0.5 cu ft or solid material that cannot be removed with 1/2 cu yd capacity excavator without drilling or blasting.

1.3 SCHEDULING

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Schedule Work to avoid disruption to occupied buildings nearby.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify site conditions and note subsurface irregularities affecting Work of this section.

3.2 PREPARATION

A. Identify required lines, levels, contours, and datum.

3.3 ROCK REMOVAL BY MECHANICAL METHOD

A. Excavate and remove rock by mechanical method.
   1. Drill holes and use wedges or mechanical disintegration compound to fracture rock.

B. Cut away rock at bottom of excavation to form level bearing.

C. Remove all lumped subsoil, boulders, and rocks 6 inches below bottom of pipe.

D. In utility trenches, excavate to 6 inches below invert elevation of pipe and 18 inches wider than pipe diameter.

E. Remove excavated materials from site.

F. Correct unauthorized rock removal in accordance with backfilling and compacting requirements of Section 31 23 17.

3.4 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.

B. Request visual inspection of utility bearing surfaces by Engineer before bedding, install, and backfilling utility.

END OF SECTION

SECTION 31 23 19
DEWATERING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Dewatering system.
2. System operation and maintenance.
3. Water disposal.

B. Related Sections:
1. Section 31 05 16 - Aggregates for Earthwork
2. Section 31 23 16 - Excavation
3. Section 31 23 17 - Trenching
4. Section 31 25 00 - Erosion and Sedimentation Controls

1.2 REFERENCES

A. ASTM International:
1. ASTM C33 - Standard Specification for Concrete Aggregates.

1.3 DEFINITIONS

A. Dewatering includes the following:
1. Lowering of ground water table, intercepting horizontal water seepage, and water from utilities to prevent water from entering excavations trenches.
2. Disposing of removed water.

B. Surface Water Control: Removal of surface water within open excavations.

1.4 SYSTEM DESCRIPTION

A. Provide dewatering and surface water control systems to permit Work to be completed on dry and stable subgrade.

1.5 PERFORMANCE REQUIREMENTS

A. Design dewatering systems to:
1. Lower water table within areas of excavation to below bottom of excavation to permit Work to be completed on dry and stable subgrade.
2. Relieve hydrostatic pressures in confined water bearing strata below excavation to eliminate risk of uplift or other instability of excavation.
3. Prevent damage to adjacent properties, buildings, structures, utilities, and facilities from construction operations.
4. Prevent loss of fines, quick condition, or softening of foundation subgrade.
5. Maintain stability of sides and bottoms of excavations and trenches.

B. Design surface water control systems to:
   1. Collect and remove surface water and seepage entering excavation.

1.6 QUALITY ASSURANCE

A. Comply with authorities having jurisdiction for the following:
   1. Water discharge and disposal from pumping operations.

B. Obtain permit from EPA under National Pollutant Discharge Elimination System (NPDES), for storm water discharge from construction sites.

C. Perform Work in accordance with Municipal, State and Federal Standards.

1.7 QUALIFICATIONS

A. Installer: Company specializing in performing work of this section with minimum 3 years' experience and responsible for design, operation, and maintenance of dewatering system.
   1. Assume sole responsibility for dewatering and surface water control systems and for loss or damage resulting from partial or complete failure of protective measures and settlement or resultant damage caused by ground water control operations.

1.8 SEQUENCING

A. Section 01 10 00 - Summary: Requirements for sequencing.

B. Sequence work to obtain required permits before start of dewatering operations.

C. Sequence work to install and test dewatering and surface water control systems minimum 1 day before starting excavation trenching.

1.9 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Requirements for coordination.

B. Coordinate work to permit the following construction operations to be completed on dry stable substrate.
   1. Excavation for structures specified in Section 31 23 16.
   2. Trenching for utilities specified in Section 31 23 17.
   3. Drilled piers and shafts specified in Section 31 63 29.

PART 2 PRODUCTS

2.1 DEWATERING EQUIPMENT

A. Select dewatering equipment to meet specified performance requirements.

2.2 ACCESSORIES

A. Filter Sand: Fine aggregate Type MDOT Class II Sand as specified in Section 31 05 16.

B. Filter Aggregates: Course aggregate type MDOT 6A Compacted Crushed Limestone as specified in Section 31 05 16.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.

B. Conduct additional borings and investigations to supplement subsurface investigations identified in Section 00 31 00 as required to complete dewatering system design.

C. Call Local Utility Line Information service at 811 not less than three working days before performing Work.
   1. Request underground utilities to be located and marked within and surrounding construction areas.

3.2 PREPARATION

A. Protect existing adjacent buildings, structures, and improvements from damage caused by dewatering operations.

B. Maintain monitoring wells until groundwater is allowed to return to normal level.

3.3 DEWATERING SYSTEM

A. Install dewatering system as required to complete work stated in the proposal.

B. Locate system components to allow continuous dewatering operations without interfering with installation of permanent Work and existing public rights-of-way, sidewalks, and adjacent buildings, structures, and improvements.

C. Install sand filter and aggregate surrounding the pump as required for dewatering.

D. Use pumps in accordance with manufacturer’s instructions.

E. Connect pumps to discharge header. Install valves to permit pump isolation.

3.4 SURFACE WATER CONTROL SYSTEM

A. Provide ditches, berms, and other devices to divert and drain surface water from excavation area as specified in Section 31 25 00.

B. Divert surface water and seepage water within excavation areas into sumps and pump water into drainage channels storm drains settling basins in accordance with requirements of agencies having jurisdiction.

C. Control and remove unanticipated water seepage into excavation.

3.5 SYSTEM OPERATION AND MAINTENANCE

A. Operate dewatering system continuously until backfill is minimum 2 feet above normal ground water table elevation.

B. Provide 24-hour supervision of dewatering system by personnel skilled in operation, maintenance, and replacement of system components.

C. Conduct daily observation of dewatering system and monitoring system. Make required repairs and perform scheduled maintenance.

D. Fill fuel tanks before tanks reach 25 percent capacity.

E. Start emergency generators at least twice each week to check operating condition.

F. When dewatering system cannot control water within excavation, notify Architect/Engineer and stop excavation work.
   1. Supplement or modify dewatering system and provide other remedial measures to control water within excavation.
   2. Demonstrate dewatering system operation complies with performance requirements before resuming excavation operations.

G. Modify dewatering and surface water control systems when operation causes or threatens to cause damage to new construction, existing site improvements, adjacent property, or adjacent water wells.

H. Correct unanticipated pressure conditions affecting dewatering system performance.

I. Do not discontinue dewatering operations without Engineer’s approval.

3.6 WATER DISPOSAL

A. Discharge water into existing storm sewer system drainage channels settling basins specified in Section 31 25 00.

3.7 SYSTEM REMOVAL

A. Remove dewatering and surface water control systems after dewatering operations are discontinued.

B. Repair damage caused by dewatering and surface water control systems or resulting from failure of systems to protect property.

3.8 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.

B. After dewatering system is installed, perform pumping test to determine when selected pumping rate lowers water level in well below pump intake. Adjust pump speed, discharge volume, or both to ensure proper operation of each pump.

C. Submit weekly monitoring reports including the following:
   1. Dewatering flow rates.
   2. Piezometer readings.
   3. Test reports of discharge water analysis.
   4. Maintenance records for dewatering and surface water control systems.

END OF SECTION

SECTION 31 23 23.33

FLOWABLE FILL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Flowable fill for:
      a. Structure backfill.
      b. Filling abandoned utilities.

B. Related Requirements:
   1. Section 31 23 16 - Excavations
   2. Section 31 23 17 - Trenching
   3. Section 32 91 19 - Landscape Grading
   4. Section 33 11 13 - Public Water Utility Distribution Piping

1.2 DEFINITIONS

A. Utility: Any buried pipe, duct, conduit, manhole, tank, or cable.

B. Excavatable Flowable Fill: Lean cement concrete fill used where future excavation may be required, such as fill for utility trenches, bridge abutments, and culverts.

C. Non-excavatable Flowable Fill: Lean cement concrete fill used where future excavation is not anticipated, such as fill below structure foundations and filling abandoned utilities.

1.3 REFERENCE STANDARDS

A. ASTM International:
   1. ASTM C33 - Standard Specification for Concrete Aggregates.
   2. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete.
   3. ASTM C150 - Standard Specification for Portland Cement.
   4. ASTM C260 - Standard Specification for Air-Entraining Admixtures for Concrete.
   5. ASTM C403/C403M - Standard Test Method for Time of Setting of Concrete Mixtures by Penetration Resistance.
   6. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete.
   7. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete.
   8. ASTM C1017/C1017M - Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.
   9. ASTM C1040 - Standard Test Methods for Density of Unhardened and Hardened Concrete in Place By Nuclear Methods.
   10. ASTM D4832 - Standard Test Method for Preparation and Testing of Controlled Low Strength Material (CLSM) Test Cylinders.

B. Michigan Department of Transportation:
   1. Standard Specifications for Construction.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

C. Field Quality-Control Submittals:
   1. Mix Design:
      a. Furnish flowable fill mix design for each specified strength.
      b. Furnish separate mix designs when admixtures are required for the following:
         1) Flowable fill Work during hot and cold weather.
         2) Air entrained flowable fill Work.
      c. Identify design mix ingredients, proportions, properties, admixtures, and tests.
   2. Furnish test results to certify flowable fill mix design properties meet or exceed specified requirements.

D. Delivery Tickets:
   1. Furnish duplicate delivery tickets indicating actual materials delivered to Project Site.

E. Qualifications Statements:
   1. Submit qualifications for supplier.

1.5 QUALITY ASSURANCE

A. Perform Work according to Municipal standards.

1.6 QUALIFICATIONS

A. Supplier:
   1. Company specializing in supplying products specified in this Section with minimum three years' documented experience.
   2. Product source approved by authority having jurisdiction.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Section 01 50 00 - Temporary Facilities and Controls specifies ambient condition control facilities for product storage and installation.

B. Minimum Conditions: Do not install flowable fill during inclement weather or when ambient temperature is less than 40 degrees F.

1.8 FIELD MEASUREMENTS

A. Verify field measurements before installing flowable fill to establish quantities required to complete the Work.

PART 2 - PRODUCTS

2.1 FLOWABLE FILL

A. Furnish materials according to Municipal standards.

B. Flowable Fill: Excavatable type.

2.2 MATERIALS

A. Portland Cement: ASTM C150 Type I - Normal; Type IA - Air Entraining; Portland Type.

B. Fine Aggregates: ASTM C33**.**

C. Water: Clean and not detrimental to concrete.

2.3 ADMIXTURES

A. Furnish materials according to MDOT Standard Specifications for Construction.

B. Air Entrainment: ASTM C260.

C. Chemical Admixture: ASTM C494/C494M.
   1. Type B - Retarding.
   2. Type C - Accelerating.
   3. Type F - Water Reducing, High Range.

D. Fly Ash: ASTM C618 Class C.

E. Plasticizing: ASTM C1017/C1017M Type I, plasticizing.

2.4 MIXES

A. Mix and deliver flowable fill according to ASTM C94/C94M, Option C.

B. Flowable Fill Design Mix:
   1. Cement Content:
      a. Excavatable: 75 to 100 lb/cu yd
   2. Fly Ash Content:
      a. Excavatable: None.
   3. Water Content:
      a. Excavatable: As specified.
   4. Air Entrainment:
      a. Excavatable:5 to 35 percent.
   5. 28-Day Compressive Strength:
      a. Excavatable: Maximum 100 psi.
   6. Unit Mass (Wet):
      a. Excavatable: 80 to 110 pcf

7. Temperature, Minimum, at Point of Delivery:
    a. Excavatable: 50 degrees F

C. Provide water content in design mix to produce self-leveling, flowable fill material at time of placement.

D. Design mix air entrainment and unit mass are for laboratory design mix and source quality control only.

2.5 SOURCE QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Testing, inspection and analysis requirements.

B. Test properties of flowable fill design mix and certify results for the following:
1. Design mix proportions by weight of each material.
2. Aggregate: ASTM C33 for material properties and gradation.
3. Properties of plastic flowable fill design mix including:
    a. Temperature.
    b. Slump.
    c. Air entrainment.
    d. Wet unit mass.
    e. Yield.
    f. Cement factor.
4. Properties of hardened flowable fill design mix including:
    a. Compressive strength at 1 day, 7 days, and 28 days. Report compressive strength of each specimen and average specimen compressive strength.
    b. Unit mass for each specimen and average specimen unit mass at time of compressive strength testing.

C. Prepare delivery tickets containing the following information:
1. Project designation.
2. Date.
3. Time.
4. Class and quantity of flowable fill.
5. Actual batch proportions.
6. Free moisture content of aggregate.
7. Quantity of water withheld.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting Work.

B. Verify trenching specified in Section 31 23 17 is complete.

C. Verify utility installation as specified in Section 33 14 13 Public Water Utility Distribution Piping is complete and tested before placing flowable fill.

D. Verify excavation is dry and dewatering system if required is operating.

3.2 PREPARATION

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for installation preparation.

B. Support and restrain utilities to prevent movement and flotation during installation of flowable fill.

C. Protect structures and utilities from damage caused by hydraulic pressure of flowable fill before fill hardens.

D. Protect utilities and foundation drains to prevent intrusion of flowable fill.

3.3 INSTALLATION - FILL, BEDDING, AND BACKFILL

A. Place flowable fill by chute, pumping or other methods approved by Engineer.
   1. When required, place flowable fill under water using tremie procedure.
   2. Do not place flowable fill through flowing water.

B. Place flowable fill in lifts to prevent lateral pressures from exceeding structural capacity of structures and utilities.

C. Place flowable fill evenly on both sides of utilities to maintain alignment.

D. Place flowable fill to elevations indicated on Drawings without vibration or other means of compaction.

3.4 INSTALLATION - FILLING ABANDONED UTILITIES

A. Verify pipes and conduits are not clogged and are sufficiently empty to permit gravity installation of flowable fill for entire length indicated to be filled.

B. Seal lower end of pipes and conduits by method to contain flowable fill and to vent trapped air caused by filling operations.

C. Place flowable fill using method to ensure there are no voids.
   1. Fill pipes and conduits from high end.
   2. Fill manholes, tanks, and other structures from grade level access points.

D. After filling pipes and conduits seal both ends.

3.5 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Requirements for inspecting and testing.

B. Section 01 70 00 - Execution and Closeout Requirements: Requirements for testing, adjusting, and balancing.

C. Perform inspection and testing according to ASTM C94/C94M.
   1. Take samples for tests for every 150 cu yd of flowable fill, or fraction thereof, installed each day.
   2. Sample, prepare and test four compressive strength test cylinders according to ASTM D4832. Test one specimen at 3 days, one at 7 days, and two at 28 days.
   3. Measure temperature at point of delivery when samples are prepared.

D. Perform in place penetration (density) tests using hand held penetrometer to measure penetration resistance of hardened flowable fill according to ASTM C403.
   1. Perform tests at locations as directed by Engineer**.**

E. Defective Flowable Fill: Fill failing to meet the following test requirements or fill delivered without the following documentation.
   1. Test Requirements:
      a. Minimum temperature at point of delivery.
      b. Compressive strength requirements for each type of fill.
   2. Documentation: Duplicate delivery tickets.

3.6 CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for cleaning.

B. Remove spilled and excess flowable fill from Project Site.

C. Restore facilities and Site areas damaged or contaminated by flowable fill installation to existing condition before installation.

END OF SECTION

SECTION 31 25 00
EROSION AND SEDIMENTATION CONTROLS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Erosion Control Blanket.
   2. Sediment Ponds.
   3. Sediment Traps.
   4. Silt Stabilization.
   5. Silt Fence.

B. Related Sections:
   1. Section 31 05 13 - Soils for Earthwork.
   2. Section 31 05 16 - Aggregates for Earthwork.
   3. Section 31 10 00 - Site Clearing.
   4. Section 31 23 16 - Excavation.
   5. Section 32 91 19 - Landscape Grading.

1.2 REFERENCES

A. American Association of State Highway and Transportation Officials:
   1. AASHTO T88 - Standard Specification for Particle Size Analysis of Soils.
   2. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. ASTM International:
   1. ASTM C127 - Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Coarse Aggregate.
   2. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).
   3. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3)).
   4. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
   5. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).
   6. ASTM D-4632 – Test Method for Tensile Strength and Elongation.
   7. ASTM D-3786 – Test Method for Mullen Burst.
   8. ASTM D-4533 – Test Method for Puncture Strength.
   9. ASTM D-4751 – Test Method for Apparent Opening Size.
   10. ASTM D-4491 – Test Method for Coefficient of Permeability.

1.3 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for submittals.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with the Soil Erosion and Sedimentation Control, Part 91 of Act 451 of 1994, and corresponding rules of the Michigan Department of Environment, Great Lakes and Energy.

B. CONTRACTOR shall obtain Act 451 Permit.

C. CONTRACTOR shall obtain soil erosion permit.

D. Maintain one copy of each document on site.

1.5 REGULATORY REQUIREMENTS

A. Contractor shall obtain all permits and pay all fees for plan review and inspection as required by applicable enforcing agency having jurisdiction.

B. Submit installation time schedule for temporary and permanent soil erosion and sedimentation control measures to applicable enforcing agency having jurisdiction, as well as to Engineer. Make submittals prior to start of construction.

1.6 METHOD OF PAYMENT

A. All fees required by applicable enforcing agency shall be paid by the Contractor.

PART 2 PRODUCTS

2.1 SOIL EROSION AND SEDIMENT CONTROLS

A. Permanent Measures: In accordance with applicable Section for specified materials.

B. Temporary Measures: In accordance with standards and specifications for soil erosion and sediment control with approved plans and requirements of applicable enforcing agency.

2.2 PLANTING MATERIALS

A. Seeding and Soil Supplements: Material, as specified in Section 32 92 19 Seeding.

B. Mulch: Material, as specified in Section 32 92 19 Seeding.

2.3 SOURCE QUALITY CONTROL (AND TESTS)

A. Section 01 40 00 - Quality Requirements: Testing, inspection, and analysis requirements.

B. Perform tests as required to ensure conformance with specified requirements.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify compacted subgrade is acceptable and ready to support devices and imposed loads.

C. Verify gradients and elevations of required lines, levels, contours, and datum are correct.

D. Field locate known utilities locations. Notify Engineer of conflicts and attain removal or relocation instructions prior to continuing installation activities.

E. Maintain and protect existing utilities to remain.

F. Verify the correct fabric is specified for the specific site.

G. Beginning of installation means acceptance of existing conditions.

H. Remove large stones or other debris which could damage the filter fabric and other erosion control material.

3.2 PROTECTION OF ADJACENT WORK

A. Protect adjacent structures, and property, which may be damaged by execution of work.

B. Protect existing trees, shrubs, landscaping, and lawn areas designated to remain.

3.3 STORAGE

A. All geotextile material shall be stored in a wrap that protects it from ultraviolet radiation and abrasion.

3.4 SOIL EROSION AND SEDIMENTATION CONTROL INSTALLATION AND MAINTENANCE

A. Construct soil erosion and sedimentation control measures in accordance with approved plans and requirements of applicable enforcing agency.

B. Schedule planned control measures with construction operations to limit the area of any disturbed land to the shortest possible period of exposure.

C. Permanent and minimum temporary control measures as scheduled on Drawings.

D. Additional temporary measures (over and above those scheduled on Drawings) due to site grading/construction activities that any way differs from that shown-on drawings.

E. Conduct all earth changes to effectively reduce accelerated soil erosion and resulting sedimentation.

F. Remove all sediment from runoff water before it leaves the site.

G. Inspect, maintain, and repair temporary control measures until permanent control measures are implemented.

3.5 EROSION CONTROL BLANKET

A. Repair washouts in area to be seeded.

B. Prepare side slopes as shown on plans.

C. Over excavate area equal to thickness of required topsoil and protection.

D. Place topsoil as shown on plans.

E. Rake in fertilizer; apply at the rate of 15 lbs per 1,000 sq. ft.

F. Seed topsoil with ditch bank seeding mix at a rate of 6 lbs per 1,000 sq. ft.

G. Place erosion control blanket over seeded areas.

H. Place metal pins over seeded areas 2.0 ft on centers. As approved by Engineer.

3.6 SEDIMENTATION POND

A. Clear and grub storage area and embankment foundation area site as specified in Section 31 10 00.

B. Excavate key trench for full length of dam. Excavate emergency spillway in natural ground.

C. Install pipe spillway, with anti-seep collar attached, at location indicated.

D. Place forms and reinforcing for concrete footing at bottom of riser pipe with trash rack and anti-vortex device, as specified in Section 03 10 00, and Section 03 20 00. Construction of embankment and trench prior to placing pipe is not required.

E. Mix, place, finish, and cure concrete, as specified in Section 03 30 00.

F. Do not use coarse aggregate as backfill material around pipe. Backfill pipe with suitable embankment material to prevent dam leakage along pipe.

G. Construct rock basin at outlet end of pipe, as specified in this Section. Place embankment material, as specified in Section 31 23 17. When required, obtain borrow excavation for formation of embankment, as specified in Section 31 23 17.

H. On entire sedimentation pond area, apply soil supplements and sow seed as specified in Section 32 92 19.

I. Mulch seeded areas with hay as specified in Section 32 92 19 Seeding.

3.7 SEDIMENT TRAPS

A. Clear site, as specified in Section 31 10 00.

B. Construct trap by excavating and forming embankments as specified in Section 31 23 16, and Section 31 23 17.

C. Place coarse aggregate or rock at outlet as indicated on Drawings.

D. Place geotextile fabric, as specified for rock energy dissipater.

E. When required, obtain borrow excavation for formation of embankment, as specified in Section 31 23 16.

F. On entire sediment trap area, apply soil supplements and sow seed as specified in Section 32 92 19.

G. Mulch seeded areas with straw as specified in Section 32 92 19.

3.8 SITE STABILIZATION

A. Incorporate erosion control devices indicated on the Drawings into the Project at the earliest practicable time.

B. Construct, stabilize and activate erosion controls before site disturbance within tributary areas of those controls.

C. Stockpile and waste pile heights shall not exceed 35 feet. Slope stockpile sides at 2: 1 or flatter.

D. Stabilize any disturbed area of affected erosion control devices on which activity has ceased and which will remain exposed for more than 20 days.
   1. During non-germinating periods, apply mulch at recommended rates.
   2. Stabilize disturbed areas which are not at finished grade, and which will be disturbed within one year in accordance with Section 32 92 19.
   3. Stabilize disturbed areas which are either at finished grade or will not be disturbed within one year in accordance with Section 32 92 19 permanent seeding specifications.

E. Stabilize diversion channels, sediment traps, and stockpiles immediately.

3.9 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.

B. Inspect erosion control devices on a weekly basis and after each runoff event. Make necessary repairs to ensure erosion and sediment controls are in good working order.

C. Field test concrete in accordance with Section 03 30 00.

D. Compaction Testing: As specified in Section 31 23 17.

E. When tests indicate Work does not meet specified requirements, remove Work, replace, and retest.

3.10 CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for cleaning.

B. When sediment accumulation in sedimentation structures has reached a point one-third depth of sediment structure or device, remove, and dispose of sediment.

C. Do not damage structure or device during cleaning operations.

D. Do not permit sediment to erode into construction or site areas or natural waterways.

E. Clean channels when depth of sediment reaches approximately one-half channel depth.

3.11 PROTECTION

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for protecting finished Work.

B. Protect temporary soil erosion control from elements, flowing water, or other disturbance until construction is complete.

3.12 SCHEDULES

A. Erosion Control Schedule Example:

Erosion Control Element	Location	Size
Diversion Channel		
Rock Energy Dissipator		
Paved Energy Dissipator		
Rock Basin		
Sediment Pond		
Rock Barrier		
Sediment Trap		

END OF SECTION

SECTION 31 32 21
FILTER FABRIC

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Filter Fabric for Groundwater Infiltration Applications.
2. Filter Fabric for Cobblestone Applications.
3. Filter Fabric for Plain Riprap Applications and Concrete Box Culvert Joints.
4. Filter Fabric for Heavy Riprap Applications.
5. Filter Fabric for Articulated Concrete Mat Applications.

B. Related Sections:
1. Section 31 22 13 – Rough Grading
2. Section 31 25 00 – Erosion and Sedimentation Controls.
3. Section 31 23 17 – Trenching

1.2 REFERENCES

A. ASTM International:
1. ASTM D-4632 - Test method for Tensile Strength and Elongation
2. ASTM D-3786 - Test method for Mullen Burst.
3. ASTM D-4533 - Test method for Trapezoidal Tear Strength.
4. ASTM D-3787 - Test method for Puncture Strength.
5. ASTM D-4751 - Test method for Apparent Opening Size.
6. ASTM D-4491 - Test method for Coefficient of Permeability

1.3 SUBMITTALS

A. Section 01 70 00 – Execution and Closeout Requirements: Requirements for Submittals.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Mechanically bonded, non-woven, long-chain polymeric fibers or yarns.
1. Filter fabric for groundwater infiltration (french drains, trench drains, pipe joint wrap, etc.) and embankment filter fabric is to have, at minimum, the following properties:

Tensile Strength	100 lbs
Tensile Elongation (max)	100%
Mullen Burst	200 psi
Trapezoidal Tear Strength	40 lbs
Puncture Strength	65 lbs
Apparent Opening Size (max)	0.210 mm
Coef. Of Permeability	0.15 cm/sec

2. Filter fabric for cobblestone grade and bank protection shall have, at minimum the following properties:

Tensile Strength	120 lbs
Tensile Elongation (max)	100%
Mullen Burst	230 psi
Trapezoidal Tear Strength	45 lbs
Puncture Strength	70 lbs
Apparent Opening Size (max)	0.210 mm
Coef. Of Permeability	0.15 cm/sec

3. Filter fabric for plain riprap grade and bank protection shall have, a minimum, the following properties:

Tensile Strength	155 lbs
Tensile Elongation (max)	100%
Mullen Burst	315 psi
Trapezoidal Tear Strength	65 lbs
Puncture Strength	90 lbs
Apparent Opening Size (max)	0.210 mm
Coef. Of Permeability	0.15 cm/sec
Open Area	

4. Filter fabric for heavy rip-rap grade and bank protection to have, at minimum, the following properties:

Tensile Strength	200lbs
Tensile Elongation (max)	100%
Mullen Burst	350 psi
Trapezoidal Tear Strength	75 lbs
Puncture Strength	100 lbs
Apparent Opening Size (max)	0.210 mm
Coef. Of Permeability	0.15 cm/sec
Open Area	

5. Filter fabric for rock ford crossings to have, at minimum, the following properties:

Tensile Strength	265 lbs
Tensile Elongation (max)	120%
Mullen Burst	470 psi
Trapezoidal Tear Strength	130 lbs
Puncture Strength	160 lbs
Apparent Opening Size (max)	0.149 mm
Coef. Of Permeability	0.25 cm/sec
Open Area	

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 10 13 00 – Administrative Requirements: Verification of Existing Conditions before Starting Work.

B. Verify compacted subgrade is acceptable and ready to support devices and imposed loads.

C. Verify gradients and elevations of required lines, levels, contours, and datum are correct.

D. Verify the correct fabric is specified for the specific use.

E. At the time of installation, the filter fabric may be rejected at the discretion of the Engineer if it has been removed from its protective cover for over 72 hours or has defects, tears, punctures, flow deterioration, or damage incurred during manufacture, transportation or storage.

F. No torn, punctured, or otherwise damaged fabric shall be installed.

3.2 PREPARATION

A. Section 01 70 00 - Execution and Closeout Requirements specifies requirements for installation preparation.

B. Remove large stones or other debris, which could damage the filter fabric.

C. Adjacent Surfaces: Protect adjacent surfaces.

3.3 STORAGE

A. During all periods of shipment and storage, the filter fabric shall be protected from abrasion, direct sunlight, ultraviolet rays, and temperatures greater than 140 degrees Fahrenheit (or as directed by the manufacturer). To the extent possible, the fabric shall be maintained wrapped in its protective covering.

3.4 INSTALLATION

A. Install according to manufacturer’s instructions.

B. All joints/overlaps in material shall be a minimum of 2 feet.

C. Any damaged material shall be repaired by placing a piece of fabric that is sufficiently large to cover the damaged area plus 2 feet of adjacent undamaged geotextile in all directions.

D. Finish according to specific use requirements.

E. Edges of filter fabric shall be toed in 12 inches unless specified otherwise. Work will not pass inspection if filter fabric is not "toed in.”

F. Maintain permanent control measures until final acceptance by Owner.

G. Install silt fences around all catchbasin inlets, to be removed after final inspection of the project.

H. Construct trap by excavating and forming embankments as specified in Section 31 23 16, and Section 31 23 17.

I. Place coarse aggregate or rock at outlet as indicated on Drawings.

J. Place geotextile fabric, as specified for rock energy dissipater.

K. When required, obtain borrow excavation for formation of embankment, as specified in Section 31 23 16.

L. On entire sediment trap area, apply soil supplements and sow seed as specified in Section 32 92 19.

M. Mulch seeded areas with hay as specified in section 32 92 19.

3.5 PROTECTION

A. Section 01 70 00 - Execution and Closeout Requirements specifies requirements for protecting finished Work.

B. Do not permit Traffic over unprotected surface.

C. Take care placing material over filter fabric so as not to damage the material.

END OF SECTION

SECTION 31 41 16.20

UTILITIES INSTALLED IN BORING OR TUNNELING OPERATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Tunneling, boring and jacking installations of utilities placed in casings, including installations beneath railroad crossings, roadways and trees.

B. Related Sections:
   1. Section 31 23 16 – Excavation
   2. Section 31 23 23 – Fill
   3. Section 33 11 13 – Public Water Utility Distribution Piping.

1.2 REFERENCES

A. AWWA C200 - Standards for Steel Water Pipe 6" and Larger.

B. ASTM A36 - Standard Specifications for Structural Steel.

1.3 COORDINATION

A. Coordinate work and traffic with MDOT or County Road Commission for work beneath active roadways.

1.4 SUBMITTALS

A. Submit shop drawings and product data for all items to be installed and/or constructed within this Section

1.5 REGULATORY REQUIRMENTS

A. Perform work within public or private rights-of-way in accordance with the authority having jurisdiction. Obtain construction permits as required.

1.6 PREPARATION AND FIELD MEASUREMENTS

A. See drawings for locations where pipe is required.

B. Verify alignment of proposed utility, required grades, and location and depths of end points. Verify alignment and depths comply with applicable permits for crossings in public or private right-of-way.

C. Verify location of existing utilities and structures that my cause interference.

PART 2 - PRODUCTS

2.1 PIPE

A. ASTM C-76, Class V - R.C.P. jack pipe with premium joints.

B. Welded Steel Pipe Sleeve.

PART 3 - EXECUTION

3.1 JACKING/BORING INSTALLATION

A. Construct and maintain jacking/boring pits as required. Adequately clear site required for pits as needed to perform the work. Size pits for boring machine, frames, reaction blocks, minimum 2 sections of pipe and with sufficient room for working. Provide steel safety ladder, meeting OSHA and MIOSHA standards.

B. Locate pits such that no damage occurs to trees, poles (not specified for removal) or structures in the immediate area.

C. Construct pits with sheeting and bracing as required for proper support. In accordance with O.S.H.A. Standards and as needed to sufficiently support reaction blocks.

D. Place crushed rock or approved bedding to sufficiently support equipment and protect pit floor.

E. Employ guide timbers and rails for maintaining pipe line and grade.

F. Place reaction blocks perpendicular to axis of pipe.

G. Employ hydraulic jacks of sufficient power to apply jacking pressure.

H. Jacking frames shall be built to match end of pipe and evenly distribute pressure over pipe end. Apply jacking pressure such that pipe is not broken or forced out of alignment.

I. Jack pipe upgrade unless approved by the Engineer.

J. Jacking operation shall be continuous 24 hours without stopping.

K. Adjoining sections of pipe sleeve shall be attached with a continuous weld, if using a sleeve.

L. Excavation/boring shall be done from inside of pipe not to exceed 6" ahead of pipe. Minimize voids and disturbances to surrounding material and use pressure grouting or sand to repair excessive voids.

M. After the pipe sleeve has been jacked and augured, it shall be checked by pouring water through the pipe. Pipe sleeve not meeting the line and grade requirements shall be rejected.

N. The pipe shall be pushed in the pipe sleeve, supported on a minimum of 3 each 1”x2” (minimum) hardwood continuous slats banded to the utility pipe. The banding shall be 5/8” stainless steel.

O. The annular spaces of the pipe sleeve shall be tested as shown on the drawing detail.

P. Cut the bottom of the excavation accurately to line and grade. Pipe not meeting line and grade shall be rejected.

Q. MDOT may require to completely fill annular space around pipe with MDOT standard flowable fill.

R. Restore pits upon completion and approval of installation. Backfill per Section 31 23 17 - Trenching. Provide support for trench requirements as specified and/or as on drawings.

3.2 FIELD QUALITY CONROL

A. Field inspection and testing will be performed under provisions of Section 01 40 00 - Quality Requirements.

B. Accurately record location of casing ends and inverts.

3.3 PROTECTION

A. Protect installation after placement prior to completion of backfilling and restoration of pit site.

B. Meet all the requirements of MDOT and County Road Commission to protect traffic and the public from hazardous conditions that may exist.

END OF SECTION

SECTION 32 11 23
AGGREGATE BASE COURSES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Aggregate subbase.
   2. Aggregate base course.

B. Related Sections:
   1. Section 31 05 16 – Aggregates for Earth Work.
   2. Section 31 22 13 - Rough Grading
   3. Section 31 23 17 - Trenching
   4. Section 32 12 16 - Asphalt Paving
   5. Section 32 13 13 - Concrete Paving
   6. Section 32 91 19 - Landscape Grading
   7. Section 33 05 13 - Manholes and Structures

1.2 REFERENCES

A. American Association of State Highway and Transportation Officials:
   1. AASHTO M288 - Standard Specification for Geotextile Specification for Highway Applications.

B. ASTM International:
   1. ANSI/ASTM C117 – Test Method for Materials Finer than 75 mm (No. 200) Sieve in Mineral Aggregates by Washing.
   2. ANSI/ASTM C136 – Method for Sieve Analysis of Fine and Coarse Aggregates.
   3. Test method for density of soil in place with loss by wash less than 15% - One Point Michigan Cone Test.
   4. Test method for density of soil in place with loss by wash greater than 15% - One Point T-99 Test.
   5. ASTM D1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.
   6. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
   7. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
   8. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).
   9. MDOT Standard Specifications for Construction.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Product Data:
   1. Submit data for geotextile fabric and herbicide.

C. Samples may be requested by the Engineer: Submit, in air-tight containers, 10 lb sample of each type of aggregate fill to testing laboratory.

D. Materials Source: Submit name of aggregate materials suppliers.

E. Manufacturer's Certificate: Certify Products meet or exceed specified requirements for MDOT 22A Crushed Limestone.

1.4 QUALITY ASSURANCE

A. Furnish each aggregate material from single source throughout the Work.

B. Perform Work in accordance with Saginaw County Road Commission standards.

PART 2 PRODUCTS

2.1 AGGREGATE MATERIALS

A. Coarse Aggregate: Fill Type MDOT 22A crushed limestone as specified in Section 31 05 16 – Aggregates for Earthwork compacted to 98 percent density.

B. Fine Aggregate: Fill Type MDOT Class II Sand as specified in Section 31 05 16 – Aggregates for Earthwork.

2.2 ACCESSORIES

A. Geotextile Fabric: AASHTO M288; non-woven, polypropylene. Maybe required for winter construction.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify compacted substrate is dry and ready to support paving and imposed loads.
   1. Proof roll substrate with 3 ton in minimum two perpendicular passes to identify soft spots.
   2. Remove soft substrate and replace with compacted fill as specified in Section 31 05 16 – Aggregates for Earthwork and Section 31 23 17 - Trenching.

C. Verify substrate has been inspected, gradients and elevations are correct.

3.2 PREPARATION

A. Correct irregularities in substrate gradient and elevation by scarifying, reshaping, and re-compacting.

B. Do not place fill on soft, muddy, or frozen surfaces.

3.3 AGGREGATE PLACEMENT

A. Install geotextile fabric over subgrade in accordance with manufacturer's instructions.
   1. Lap ends and edges minimum 12 inches.
   2. Anchor fabric to subgrade when required to prevent displacement until aggregate is installed.

B. Gradation of Aggregate: In accordance with ASTM C136.

C. Spread aggregate over prepared substrate to total compacted thickness as indicated on drawings and stated in the proposal.

D. Roller compact aggregate to 98 percent maximum density.

E. Level and contour surfaces to elevations, profiles, and gradients indicated.

F. Add small quantities of fine aggregate to coarse aggregate when required to assist compaction.

G. Maintain optimum moisture content of fill materials to attain specified compaction density. Add water to assist compaction. If excess water is apparent, remove aggregate and aerate to reduce moisture content.

H. Use mechanical tamping equipment in areas inaccessible to compaction equipment.

3.4 TOLERANCES

A. Section 01 40 00 - Quality Requirements: Tolerances.

B. Maximum Variation From Flat Surface: 1/4 inch measured with 10 foot straight edge.

C. Maximum Variation From Thickness: 1/4 inch.

D. Maximum Variation From Elevation: 1/2 inch.

3.5 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.

B. Compaction testing will be performed in accordance with ASTM D2922.

C. When tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to the Owner.

D. Frequency of Tests: As determined by the Engineer in the field with a minimum of one test for every 500 square yards of each layer compacted aggregate.

3.6 COMPACTION

A. Compact materials to 98 percent of maximum density as determined from test strip, in accordance with ASTM D2940.

3.7 SCHEDULES

A. Asphalt Paving Base Course: Thickness varies as stated in the proposal, placed in one or two equal layers.

B. Concrete Paving Base Course: Thickness varies as stated in the proposal, placed in single layer.

END OF SECTION

SECTION 32 12 16
ASPHALT PAVING

1.1 SUMMARY

A. Section Includes:
1. Asphalt materials.
2. Asphalt paving base course, binder course, and wearing course.
3. Asphalt paving overlay for existing paving.

B. Related Requirement:
1. Section 31 22 13 - Rough Grading
2. Section 31 23 17 – Trenching
3. Section 32 11 23 - Aggregate Base Courses
4. Section 33 12 16 – Water Utility Distribution Valves

1.2 REFERENCE STANDARDS

A. American Association of State Highway and Transportation Officials:
1. AASHTO M17 - Standard Specification for Mineral Filler for Bituminous Paving Mixtures.
2. AASHTO M29 - Standard Specification for Fine Aggregate for Bituminous Paving Mixtures.
3. AASHTO M140 - Standard Specification for Emulsified Asphalt.
4. AASHTO M208 - Standard Specification for Cationic Emulsified Asphalt.
5. AASHTO M288 - Standard Specification for Geotextile Specification for Highway Applications.
6. AASHTO M320 - Standard Specification for Performance-Graded Asphalt Binder.
7. AASHTO M324 - Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements.
8. AASHTO MP1a - Standard Specification for Performance-Graded Asphalt Binder.

B. Asphalt Institute:
1. AI MS-2 - Mix Design Methods for Asphalt Concrete and Other Hot- Mix Types.
2. AI MS-19 - Basic Asphalt Emulsion Manual.
3. AI SP-2 - Superpave Mix Design.

C. ASTM International:
1. ASTM C1371 - Standard Test Method for Determination of Emittance of Materials Near Room Temperature Using Portable Emissometers.
2. ASTM C1549 - Standard Test Method for Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer.
3. ASTM D242 - Standard Specification for Mineral Filler For Bituminous Paving Mixtures.
4. ASTM D692 - Standard Specification for Coarse Aggregate for Bituminous Paving Mixtures.
5. ASTM D946 - Standard Specification for Penetration-Graded Asphalt Cement for Use in Pavement Construction.
6. ASTM D977 - Standard Specification for Emulsified Asphalt.
7. ASTM D1073 - Standard Specification for Fine Aggregate for Bituminous Paving Mixtures.

8. ASTM D1188 - Standard Test Method for Bulk Specific Gravity and Density of Compacted Bituminous Mixtures Using Coated Samples
9. ASTM D2027 - Standard Specification for Cutback Asphalt (Medium-Curing Type).
10. ASTM D2397 - Standard Specification for Cationic Emulsified Asphalt.
11. ASTM D2726 - Standard Test Method for Bulk Specific Gravity and Density of Non-Absorptive Compacted Bituminous Mixtures.
12. ASTM D2950 - Standard Test Method for Density of Bituminous Concrete in Place by Nuclear Methods.
13. ASTM D3381 - Standard Specification for Viscosity-Graded Asphalt Cement for Use in Pavement Construction.
14. ASTM D3515 - Standard Specification for Hot-Mixed, Hot-Laid Bituminous Paving Mixtures.
15. ASTM D3549 - Standard Test Method for Thickness or Height of Compacted Bituminous Paving Mixture Specimens.
16. ASTM D3910 - Standard Practices for Design, Testing, and Construction of Slurry Seal.
17. ASTM D6690 - Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements.
18. ASTM E408 - Standard Test Methods for Total Normal Emittance of Surfaces Using Inspection-Meter Techniques.
19. ASTM E903 - Standard Test Method for Solar Absorptance, Reflectance, and Transmittance of Materials Using Integrating Spheres.
20. ASTM E1918 - Standard Test Method for Measuring Solar Reflectance of Horizontal and Low-Sloped Surfaces in the Field.
21. ASTM E1980 - Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces.
22. MDOT 2012 Standard Specifications for Construction.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Product Data:
   1. Submit product information for asphalt and aggregate materials.
   2. Submit mix design with laboratory test results supporting design.

C. Manufacturer's Certificate: Certify Products meet or exceed specified requirements for MDOT Standard Construction Specifications.

1.4 QUALITY ASSURANCE

A. Mixing Plant: Conform to State of Michigan Department of Transportation Standard.

B. Obtain materials from same source throughout.

C. Perform Work in accordance with State of Michigan Department of Transportation standard.

D. Maintain one copy of each document on site.

1.5 REGULATORY REQUIREMENTS

A. Conform to applicable local codes for paving work.

1.6 QUALIFICATIONS

A. Installer: Company specializing in performing work of this section with minimum 3 years documented experience.

1.7 AMBIENT CONDITIONS

A. Section 01 50 00 - Temporary Facilities and Controls: Ambient conditions control facilities for product storage and installation.

B. Do not place asphalt mixture when ambient air or base surface temperature is less than 40 degrees F, or surface is wet or frozen.

C. Place asphalt mixture when temperature is not more than 15 degrees F less than initial mixing temperature.

PART 2 PRODUCTS

2.1 MATERIALS

A. Asphalt Cement: In accordance with MDOT standards.

B. Aggregate for Leveling Course Mix: In accordance with MDOT standards.

C. Aggregate for Wearing Course Mix: In accordance with MDOT standards.

D. Fine Aggregate: In accordance with MDOT standards.

E. Mineral Filler: In accordance with MDOT standards.

2.2 ACCESSORIES

A. Primer: Homogeneous, medium curing, liquid asphalt in accordance with MDOT standards.

B. Tack Coat: Homogeneous, medium curing, liquid asphalt in accordance with MDOT standards.

2.3 ASPHALT PAVING MIX

A. Use dry material to avoid foaming. Mix uniformly.

B. Base Course: provide mix in accordance with MDOT uniformity tolerances for bituminous mixtures.

C. Leveling Course: provide mix in accordance with MDOT uniformity tolerances for bituminous mixtures.

D. Wearing Course: provide mix in accordance with MDOT uniformity tolerances for bituminous mixtures.

2.4 SOURCE QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Testing, inspection and analysis requirements.

B. Submit proposed mix design of each class of mix for review prior to beginning of Work.

C. Submit MDOT approved job mix formula (JMF) of each mix for review 14 days prior to commencement of work.

D. Test samples in accordance with AI MS-2 and MDOT standards.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for installation examination.

B. Verify utilities indicated under paving are installed with excavations and trenches backfilled and compacted.

C. Verify compacted subgrade and subbase is dry and ready to support paving and imposed loads.
1. Proof roll subbase with 7 ton in minimum two perpendicular passes to identify soft spots.
2. Remove soft subbase and replace with compacted fill as specified in Section 31 23 17 - Trenching.

D. Verify gradients and elevations of base are correct.

E. Verify gutter drainage grilles and frames manhole frames and valve boxes are installed in correct position and elevation.

3.2 PREPARATION

A. Prepare subbase in accordance with MDOT Standard Specifications for Construction, current edition.

3.3 DEMOLITION

A. Saw cut and notch existing paving, saw cutting shall be paid for as part of pavement removal.

B. Clean existing paving to remove foreign material, excess joint sealant and crack filler from paving surface.

C. Repair surface defects in existing paving to provide uniform surface to receive new paving.

3.4 INSTALLATION

A. Subbase:
   1. Aggregate Subbase: Install as specified in Section 31 05 16 – Aggregates for Earthwork.

B. Primer:
   1. Apply primer in accordance with AI MS-2. MDOT Standard Specifications for Construction, current edition.
   2. Use clean sand to blot excess primer.

C. Tack Coat:
   1. Apply bond coat on existing, abutting asphalt and concrete surfaces according to manufacturer's instructions and MDOT standards.
   2. Apply bond coat to contact surfaces of curbs, gutters, building walls and sidewalks. Prevent overspray from reaching adjacent surfaces.
   3. Coat surfaces of manhole and catch basin frames with oil to prevent bond with asphalt pavement. Do not bond coat these surfaces.
   4. Use clean sand to blot excess primer.

D. Single Course Asphalt Paving:
   1. Install Work in accordance with MDOT Standard Specifications for Construction, current edition.
   2. Place asphalt within 24 hours of applying primer or tack coat.
   3. Place asphalt wearing course to compacted thickness as indicated on the drawings and stated in the proposal.
   4. Compact paving by rolling to specified density. Do not displace or extrude paving from position. Hand compact in areas inaccessible to rolling equipment.
   5. Perform rolling with consecutive passes to achieve even and smooth finish without roller marks.

E. Double Course Asphalt Paving:
   1. Place asphalt binder course within 24 hours of applying primer or tack coat.
   2. Place binder course to compacted thickness indicated on drawings and as stated in the proposal.
   3. Place wearing course within 24 hours of placing and compacting binder course. When binder course is placed more than 24 hours before placing wearing course, clean surface and apply tack coat before placing wearing course.
   4. Place wearing course to compacted thickness indicated on drawings and as stated in the proposal.
   5. Install gutter drainage grilles and frames, manhole frames, valve and monument boxes in correct position and elevation.
   6. Compact each course by rolling to specified density. Do not displace or extrude paving from position. Hand compact in areas inaccessible to rolling equipment.
   7. Perform rolling with consecutive passes to achieve even and smooth finish, without roller marks.

F. Asphalt Paving Overlay
   1. Apply asphalt cement tack coat to existing paving surface at rate recommended by geotextile fabric manufacturer.

2. Install geotextile fabric in accordance with manufacturer's instructions to permit asphalt saturation of fabric. Lap fabric edge and end joints 4 inches.
3. Place wearing course to compacted thickness indicated on drawings and as stated in the proposal.
4. Compact overlay by rolling to specified density. Do not displace or extrude paving from position. Hand compact in areas inaccessible to rolling equipment.
5. Perform rolling with consecutive passes to achieve even and smooth finish, without roller marks.

G. Hand Patching
1. Install uniform thickness surface slurry over existing paving in accordance with ASTM Install work according to current MDOT standards.
2. Place to compacted thickness as specified on plans.
3. Compact in maximum lifts by use of a machine vibrator or approved roller according to current MDOT standards.

H. Curbs
1. Install extruded asphalt curbs of profile as indicated on Drawings.

3.5 TOLERANCES

A. Section 01 40 00 - Quality Requirements: Tolerances.

B. Flatness: Maximum variation of 1/4 inch measured with 10 foot straight edge.

C. Scheduled Compacted Thickness: Within 1/4 inch.

D. Variation from Indicated Elevation: Within 1/4 inch.

3.6 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Requirements for inspecting, testing.

B. Take samples and perform tests in accordance with State of Michigan Department of Transportation Standards.

C. Asphalt Paving Mix Temperature: Measure temperature at time of placement.

D. Asphalt Paving Thickness: ASTM D3549; test one core sample from every 1000 square yards compacted paving.

E. Asphalt Paving Density: ASTM D2950 nuclear method; density testing shall be performed at the discretion of the Engineer.

3.7 PROTECTION

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for protecting finished Work.

B. Immediately after placement, protect paving from mechanical injury for 3 days.

END OF SECTION

SECTION 32 13 13
CONCRETE PAVING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Concrete paving for:
      a. Concrete sidewalks.
      b. Concrete curbs and gutters.
      c. Concrete parking areas and roads.

B. Related Requirements:
   1. Section 31 22 13 - Rough Grading
   2. Section 32 11 23 - Aggregate Base Courses
   3. Section 32 91 19 - Landscape Grading
   4. Section 33 05 13 - Manholes and Structures

1.2 REFERENCE STANDARDS

A. American Association of State Highway and Transportation Officials:
   1. AASHTO M324 - Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements.

B. American Concrete Institute:
   1. ACI 301 - Specifications for Structural Concrete.
   2. ACI 304 - Guide for Measuring, Mixing, Transporting, and Placing Concrete.

C. ASTM International:
   1. ASTM A184/A184M - Standard Specification for Fabricated Deformed Steel Bar Mats for Concrete Reinforcement.
   2. ASTM A185/A185M - Standard Specification for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement.
   3. ASTM A497/A497M - Standard Specification for Steel Welded Wire Fabric, Deformed, for Concrete Reinforcement.
   4. ASTM A615/A615M - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
   5. ASTM A706/A706M - Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement.
   6. ASTM A767/A767M - Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement.
   7. ASTM A775/A775M - S Standard Specification for Epoxy-Coated Steel Reinforcing Bars.
   8. ASTM A884/A884M - Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Reinforcement.
   9. ASTM A934/A934M - Standard Specification for Epoxy-Coated Prefabricated Steel Reinforcing Bars.

10. ASTM C31/C31M - Standard Practice for Making and Curing Concrete Test Specimens in the Field.
11. ASTM C33 - Standard Specification for Concrete Aggregates.
12. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
13. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete.
14. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic Cement Concrete.
15. ASTM C150 - Standard Specification for Portland Cement.
16. ASTM C172 - Standard Practice for Sampling Freshly Mixed Concrete.
17. ASTM C173/C173M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
18. ASTM C231 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
19. ASTM C260 - Standard Specification for Air-Entraining Admixtures for Concrete.
20. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
21. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete.
22. ASTM C595 - Standard Specification for Blended Hydraulic Cements.
23. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete.
24. ASTM C979 - Standard Specification for Pigments for Integrally Colored Concrete.
25. ASTM C989 - Standard Specification for Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars.
26. ASTM C1017/C1017M - Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.
27. ASTM C1064/C1064M - Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete.
28. ASTM C1116 - Standard Specification for Fiber-Reinforced Concrete and Shotcrete.
29. ASTM C1315 - Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete.
30. ASTM C1371 - Standard Test Method for Determination of Emittance of Materials Near Room Temperature Using Portable Emissometers.
31. ASTM C1549 - Standard Test Method for Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer.
32. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
33. ASTM D1752 - Standard Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.
34. ASTM D6690 - Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements.
35. ASTM E408 - Standard Test Methods for Total Normal Emittance of Surfaces Using Inspection-Meter Techniques.
36. ASTM E903 - Standard Test Method for Solar Absorptance, Reflectance, and Transmittance of Materials Using Integrating Spheres.
37. ASTM E1918 - Standard Test Method for Measuring Solar Reflectance of Horizontal and Low-Sloped Surfaces in the Field.
38. ASTM E1980 - Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Product Data:
   1. Submit data on concrete materials, joint filler and admixtures curing compounds.

C. Design Data:
   1. Submit concrete mix design for each concrete strength. Submit separate mix designs when admixtures are required for the following:
      a. Hot and cold weather concrete work.
   2. Identify mix ingredients and proportions, including admixtures.
   3. Identify chloride content of admixtures and whether or not chloride was added during manufacture.

D. Source Quality Control Submittals: Indicate results of shop tests and inspections.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with ACI 301.

B. Obtain cementitious materials from same source throughout.

C. Perform Work in accordance with MDOT Standard Specification for Construction, current edition.

D. Maintain one copy of each document on site.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing work of this section with minimum 3 years documented experience.

1.6 AMBIENT CONDITIONS

A. Section 01 50 00 - Temporary Facilities and Controls: Ambient conditions control facilities for product storage and installation.

B. Do not place concrete when base surface temperature is less than 40 degrees F, or surface is wet or frozen.

PART 2 PRODUCTS

2.1 AGGREGATE BASE COURSE

A. Aggregate Base Course: As specified in Section 32 11 23.

2.2 CONCRETE PAVING

A. Performance / Design Criteria:
   1. In accordance with Municipal, State, and Federal standards.

B. Form Materials:
   1. Form Materials: As specified in Section 03 10 00.
   2. Wood or Steel form material, profiled to suit conditions.
   3. Joint Filler: ASTM D1751; Asphalt impregnated fiberboard or felt, 1/2 inch thick.
   4. ANSI/ASTM D1751, performed type; 1/2 inch thick, full depth of concrete manufactured by ACD International, W.R. Meadows or equal.

C. Reinforcement:
   1. Reinforcing Steel and Wire Fabric: Conform to Municipal, State and Federal Standards. All reinforcement steel shall be epoxy coated.

D. Concrete Materials:
   1. Concrete Materials: As specified in Section 03 30 00.

2.3 MIXES

A. Concrete Mix - By Performance Criteria:
   1. Mix concrete in accordance with ACI 304. Deliver concrete in accordance with ASTM C94/C94M.
   2. Select proportions for normal weight concrete in accordance with ACI 301 Method 2.
   3. Provide concrete to the following criteria:
      a. As specified in 03 30 00 Concrete Cast in Place.
   4. Limit the following cementitious materials to maximum percentage by mass of all cementitious materials:
      a. As specified in 03 30 00.
   5. Use accelerating admixtures in cold weather only when approved by the Architect/Engineer in writing. Use of admixtures will not relax cold weather placement requirements.
   6. Use calcium chloride only when approved by the Engineer in writing.
   7. Use set retarding admixtures during hot weather only when approved by the Engineer in writing.

2.4 FINISHES

A. Shop Finishing - Reinforcement:
   1. Galvanized Finish for Steel Bars: ASTM A767/A767M, Class I, hot dip galvanized after fabrication.
   2. Epoxy Coated Finish for Steel Bars: ASTM A775/A775M.

B. Epoxy Coated Finish for Steel Wire: ASTM A884/A884M; Class A, using ASTM A775/A775M.

2.5 ACCESSORIES

A. Curing Compound: ASTM C309, Type 1, FS TT-C-800, 30 percent solids manufactured by ACD International or equal.

B. Liquid Surface Sealer: Son-No-Mar manufactured by Sonneborn Building Products or equal.

C. Joint Sealers: Type II or Type III; hot applied type.

2.6 SOURCE QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Testing and Inspection Services.

B. Submit proposed mix design of each class of concrete to appointed firm for review prior to commencement of work. Engineer will then submit to governing jurisdiction in accordance with Section 01 30 00.

C. Tests on cement, aggregates, and mixes will be performed to ensure conformance with specified requirements.

D. Test samples in accordance with ACI 301.

E. Provide certification that materials conform with specified requirements.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for installation examination.

B. Verify compacted subgrade and granular subbase is dry and ready to support paving and imposed loads.
   1. Remove soft subbase and replace with compacted fill as specified in Section 32 11 23.

C. Verify gradients and elevations of base are correct.

3.2 PREPARATION

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for installation preparation.

B. Moisten substrate to minimize absorption of water from fresh concrete.

C. Coat surfaces of manhole and catch basin frames with oil to prevent bond with concrete paving.

D. Verify correct line and grade of base.

E. Firmly stake forms to the required line and grade and provide for a finish transverse slope of 1/4 inch per foot towards the center of the road.

F. Notify Engineer minimum 48 hours prior to commencement of concreting operations.

G. Form sub-grade by excavating or filling to the required line and grade for bottom of concrete.

H. Make fills with granular material.

I. Remove unstable material from sub-grade.

J. Compact sub-grade to insure stability.

3.3 INSTALLATION

A. Subbase:
   1. Aggregate Subbase: Install as specified in Section 32 11 23.

B. Forms:
   1. Place and secure forms and screeds to correct location, dimension, profile, and gradient.
   2. Assemble formwork to permit easy stripping and dismantling without damaging concrete.

C. Removal:
   1. Provide curb cut by saw-cutting and removing the full curb section and gutter pan at locations where the proposed sidewalk adjoins existing curb and gutter at roadways and drives.
   2. Remove concrete curb full depth as shown on the drawings.
   3. Remove rubble, place compacted granular fill to correct line and grade.
   4. Leave existing reinforcement to extend 6 inches into proposed gutter pan.

D. Reinforcement:
   1. Place two #4 bars the entire length of the proposed concrete, lapped and tied to the existing reinforcement, or as shown on the plans.
   2. Dowel proposed #4 bars 12 inches into existing concrete where existing bars were cut off or are absent.
   3. Place reinforcing at mid-height of paving.
   4. Interrupt reinforcing at contraction expansion joints.
   5. Place dowels to achieve paving and curb alignment as detailed.
   6. Provide doweled joints as specified in MDOT Standard Specifications for Construction.
   7. Repair damaged galvanizing or epoxy coating to match shop finish.

E. Placing Concrete:
   1. Place concrete using the slip form technique.
   2. Ensure reinforcing, inserts, embedded parts, and formed joints are not disturbed during concrete placement.
   3. Place concrete continuously over the full width of the panel and between predetermined construction joints. Do not break or interrupt successive pours such that cold joints occur.
   4. Thickness:
      a. Sidewalks: 4 inches normal and 6 inches at driveways, ramps, and parking areas.

b. Curb cut and Gutter: Match existing.

5. Width:
   a. Sidewalks: Match existing (minimum of 4').
   b. Cut curb and Gutter: As shown on the drawings.
6. Place concrete in accordance with the Township, County, and MDOT standard specifications for construction.

F. Joints
1. Place expansion joints at 20 foot intervals. Align curb, gutter, and sidewalk joints.
2. Place joint filler between paving components and building or other appurtenances.
3. Cut joints shall be not less than 1/8 inch nor more than 1/4 inch in width and shall be finished smooth and true to line. Cut 1/4 minimum into depth of slab.
4. Seal joints as in accordance with MDOT Standard Specification for Construction.
5. Place expansion joints between sidewalk and back of abutting parallel curb or gutter and between sidewalk and buildings or other rigid structures.
6. Place expansion joints between sidewalk approaches and back of curb or gutter or edge of pavement.
7. Place expansion joint filler the full length of the sidewalk with the top flush with the finished surface of the sidewalk.
8. Contraction Joints: Divide sidewalk into square unit areas of nor more than 36 square feet nor less than 16 square feet.
9. Place joint over culvert.

G. Finishing:
1. After concrete has been struck off to finish grade, float surface with a steel float to produce a smooth surface.
2. Area Paving: Light broom.
3. Sidewalk Paving: Light broom.
4. Median Barrier: Light broom.
5. Curbs and Gutters: Light broom.
6. Direction of Texturing: Lightly broom transversely across the surface to create a slightly rough surface. Round edges and joint to a radius of 1/4 inch with an approved finishing tool.
7. Place curing compound on exposed concrete surfaces immediately after finishing. Apply in accordance with manufacturer's instructions.

H. Curing and Protection
1. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.
2. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.
3. During cold weather, protect concrete from freezing for a period of 3 days.
4. Protect concrete from traffic for a minimum of 7 days.

I. Finish Grading
1. Place surplus excavation in outlawn and level to existing contours.
2. Remove excess excavation unable to be used in outlawn.
3. Spread 4 inches minimum topsoil over entire disturbed area.
4. Furnish and install embankment in accordance with MDOT Standard Specifications, Section 2.08.11.

3.4 TOLERANCES

A. Section 01 40 00 - Quality Requirements: Tolerances.

B. Maximum Variation of Surface Flatness: 1/4 inch in 10 ft.

C. Maximum Variation From True Position: 1/4 inch.

3.5 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Requirements for inspecting, testing.

B. Engineer will take cylinders and perform slump and air entrainment tests in accordance with ACI 301. The frequency the tests are taken, shall be at the Engineer's discretion.

C. Strength Test Samples:
   1. Sampling Procedures: ASTM C172.
   2. Cylinder Molding and Curing Procedures: ASTM C31/C31M, cylinder specimens, standard cured.
   3. Sample concrete and make one set of three cylinders for every 75 cu yds or less of each class of concrete placed each day.
   4. Make one additional cylinder during cold weather concreting, and field cure.

D. Field Testing:
   1. Slump Test Method: ASTM C143/C143M.
   2. Air Content Test Method: ASTM C173/C173M.
   3. Temperature Test Method: ASTM C1064/C1064M.
   4. Measure slump and temperature for each compressive strength concrete sample.
   5. Measure air content in air entrained concrete for each compressive strength concrete sample.

E. Cylinder Compressive Strength Testing:
   1. Test Method: ASTM C39/C39M.
   2. Test Acceptance: In accordance with MDOT Standard Specifications for Construction.
   3. Test one cylinder at 7 days.
   4. Test two cylinders at 28 days.
   5. Dispose remaining cylinders when testing is not required.

F. Maintain records of placed concrete items. Record date, location of pour, quantity, air temperature, and test samples taken.

3.6 PROTECTION

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for protecting finished Work.

B. Immediately after placement, protect paving from premature drying, excessive hot or cold temperatures, and mechanical injury.

C. Do not permit pedestrian vehicular traffic over paving for 7 days minimum after finishing.

END OF SECTION

SECTION 32 91 13
SOIL PREPARATION

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Preparation of subsoil.
   2. Soil testing.
   3. Placing topsoil.

B. Related Sections:
   1. Section 31 05 13 – Soils for Earthwork
   2. Section 31 22 13 - Rough Grading
   3. Section 31 23 17 - Trenching
   4. Section 32 91 19 - Landscape Grading
   5. Section 32 92 19 – Seeding

1.2 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Submit minimum 10 lb sample of topsoil proposed. Forward sample to approved testing laboratory in sealed containers to prevent contamination.

C. Test Reports: Indicate topsoil nutrient and pH levels with recommended soil supplements and application rates.

D. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

E. Disregard sample submission of recent test results are available for type of fill.

1.3 QUALITY ASSURANCE

A. Perform Work in accordance with MDOT Standard Specifications for Construction, current edition.

B. Maintain one copy of each document on site.

PART 2 PRODUCTS

2.1 PROTECTION

A. Protect landscaping and other features remaining as final work.

B. Protect existing structures, fences, roads, sidewalks, paving, mailboxes, and curbs.

2.2 SOIL MATERIALS

A. Topsoil Minimum 4” Compacted Depth: As specified in Section 32 05 13 – Soils for Earthwork.

B. Topsoil: Imported, fabric loam; free of subsoil, roots, grass, excessive amount of weeds, stone, and foreign matter; acidity range (pH) of 5.5 to 7.5; containing a minimum of 4 percent and a maximum of 25 percent organic matter.

C. Topsoil: Fertile, agricultural soil, typical for locality, capable of sustaining vigorous plant growth, taken from drained site; free of subsoil, clay or impurities, plants, weeds and roots; pH value of minimum 5.5 and maximum 7.5.

2.3 ACCESSORIES

A. Mulching Material: Conwed Verdoyl #2000.

B. Fertilizer: FS O-F-241, Commercial Grade with 12-12-12 analysis.

C. Water: Clean, fresh and free of substances or matter which could inhibit vigorous growth of grass.

D. Erosion Fabric: Jute matting, open weave.

E. Stakes: softwood lumber, chisel pointed.

2.4 SOURCE QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Testing, inspection and analysis requirements.

B. Analyze to ascertain percentage of nitrogen, phosphorus, potash, soluble salt content, organic matter content, and pH value.

C. Provide recommendation for fertilizer and lime application rates for specified seed mix as result of testing.

D. Testing is not required when recent tests and certificates are available for imported topsoil. Submit these test results to testing laboratory. Indicate, by test results, information necessary to determine suitability.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify prepared soil base is ready to receive the Work of this section.

3.2 PREPARATION OF SUBSOIL

A. Prepare sub-soil to eliminate uneven areas and low spots. Maintain lines, levels, profiles and contours. Make changes in grade gradual. Blend slopes into level areas.

B. Remove foreign materials, weeds and undesirable plants and their roots. Remove contaminated sub-soil.

C. Eliminate uneven areas and low spots. Remove debris, roots, branches, stones, in excess of 1/2 inch in size. Remove subsoil contaminated with petroleum products.

D. Scarify subsoil to depth of 3 inches where topsoil is to be placed. Repeat cultivation in areas where equipment, used for hauling and spreading topsoil, has compacted sub-soil.

3.3 PLACING TOPSOIL

A. Spread topsoil to minimum compacted depth of 4 inches over area to be seeded. Rake until smooth.

B. Place topsoil during dry weather and on dry unfrozen subgrade.

C. Remove vegetable matter and foreign non-organic material from topsoil while spreading.

D. Fine grade topsoil to eliminate rough, low or soft areas, and to ensure positive drainage.

E. Install edging at periphery of seeded areas in straight lines to consistent depth.

F. Remove stone, roots, grass, weeds, debris, and foreign material while spreading.

G. Manually spread topsoil around trees and plants to prevent damage.

H. Lightly compact. Roll placed topsoil.

I. Remove surplus subsoil and topsoil from site.

J. Leave stockpile area and site clean and raked, ready to receive landscaping.

K. Place required trees shrubs, fences, and mail boxes in their proper locations.

L. Reconstruct and place guard rails in proper locations to meet MDOT and Municipal specifications.

END OF SECTION

SECTION 32 91 19
LANDSCAPE GRADING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Final grade topsoil for finish landscaping.

B. Related Sections:
   1. Section 31 05 13 – Soils for Earthwork
   2. Section 31 22 13 - Rough Grading
   3. Section 31 23 17 - Trenching
   4. Section 32 92 19 - Seeding

SUBMITTALS

C. Section 01 33 00 - Submittal Procedures: Submittal procedures

D. Samples: If necessary by the Engineer, submit, in air-tight containers, 10 lb sample of each type of fill to testing laboratory.

E. Materials Source: Submit name of imported materials source.

F. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.2 QUALITY ASSURANCE

A. Furnish each topsoil material from single source throughout the Work.

B. Perform Work in accordance with MDOT Standard Specifications for Construction, current edition.

C. Maintain one copy on site.

PART 2 PRODUCTS

2.1 MATERIAL

A. Topsoil as specified in Section 31 05 13 – Soils for Earthwork.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify building and trench backfilling have been inspected.

C. Verify substrate base has been contoured and compacted.

3.2 PREPARATION

A. Protect landscaping and other features remaining as final Work.

B. Protect existing structures, fences, sidewalks, utilities, paving, and curbs.

3.3 SUBSTRATE PREPARATION

A. Eliminate uneven areas and low spots.

B. Remove debris, roots, branches, stones, in excess of 1/2 inch in size. Remove contaminated subsoil.

C. Scarify surface to depth of 3 inches where topsoil is scheduled. Scarify in areas where equipment used for hauling and spreading topsoil has compacted subsoil.

3.4 PLACING TOPSOIL

A. Place topsoil in areas where seeding, sodding or planting, is required to minimum depth of 4 inches. Place topsoil during dry weather.

B. Fine grade topsoil to eliminate rough or low areas. Maintain profiles and contour of subgrade.

C. Remove roots, weeds, rocks, and foreign material while spreading.

D. Manually spread topsoil close to plant material, building, utilities and curbs to prevent damage.

E. Roll placed topsoil.

F. Remove surplus subsoil and topsoil from site.

G. Leave stockpile area and site clean and raked, ready to receive landscaping.

3.5 TOLERANCES

A. Section 01 40 00 - Quality Requirements: Tolerances.

B. Top of Topsoil: Plus or minus 1/2 inch.

3.6 PROTECTION OF INSTALLED WORK

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for protecting finished Work.

B. Prohibit construction traffic over topsoil.

3.7 SCHEDULES

A. Compacted topsoil thicknesses:
   1. Seeded Grass: 6 inches.
   2. Sod: 4 inches.
   3. Shrub Beds: 18 inches.
   4. Flower Beds: 12 inches.
   5. Planter Boxes: To within 3 inches of box rim.

END OF SECTION

SECTION 32 92 19
SEEDING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Fertilizing.
2. Seeding.
3. Hydroseeding.
4. Mulching.
5. Maintenance.

B. Related Sections:
1. Section 31 05 13 – Soils for Earthwork
2. Section 31 22 13 - Rough Grading
3. Section 31 23 17 - Trenching
4. Section 32 91 13 - Soil Preparation
5. Section 32 91 19 - Landscape Grading
6. Section 32 93 00 - Plants

1.2 REFERENCES

A. ASTM International:
1. ASTM C602 - Standard Specification for Agricultural Liming Materials.

B. FS 0-F-241 – Fertilizers, Mixed, Commercial.

1.3 DEFINITIONS

A. Weeds: Include Dandelion, Jimsonweed, Quackgrass, Horsetail, Morning Glory, Rush Grass, Mustard, Lambsquarter, Chickweed, Cress, Crabgrass, Canadian Thistle, Nutgrass, Poison Oak, Blackberry, Tansy Ragwort, Bermuda Grass, Johnson Grass, Poison Ivy, Nut Sedge, Nimble Will, Bindweed, Bent Grass, Wild Garlic, Perennial Sorrel, and Brome Grass.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit data for seed mix, fertilizer, mulch, and other accessories.

C. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.5 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for submittals.

B. Operation and Maintenance Data: Include maintenance instructions, cutting method and maximum grass height; types, application frequency, and recommended coverage of fertilizer.

1.6 QUALITY ASSURANCE

A. Provide seed mixture in containers showing percentage of seed mix, germination percentage, inert matter percentage, weed percentage, year of production, net weight, date of packaging, and location of packaging.

B. Perform Work in accordance with State of Michigan Department of Transportation Standards.

C. Provide signed affidavit stating the amount and type of seed, fertilizer, and mulch applied per acre.

D. Maintain one copy of each document on site.

1.7 REGULATOR REQUIREMENTS

A. Comply with regulatory agencies for fertilizer and herbicide composition.

1.8 QUALIFICATIONS

A. Seed Supplier: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing work of this section with minimum 3 years documented experience.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Deliver grass seed mixture in sealed containers. Seed in damaged packaging is not acceptable.

C. Deliver fertilizer in waterproof bags showing weight, chemical analysis, and name of manufacturer.

1.10 MAINTENANCE SERVICE

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for maintenance service.

B. Maintain seeded and sodded areas immediately after placement until grass is well established, exhibits a vigorous growing condition and is accepted by Owner. Guarantee replacement of dead material for one year from date of substantial completion.

C. Contractor shall be responsible for maintaining adequate seedbed moisture until the sodbed is established.

PART 2 PRODUCTS

2.1 SEED MIXTURE

A. Furnish materials in accordance with Municipal, Federal and State Standards.

B. Seed Mixture:

Kentucky Blue Grass	30 percent
Creeping Red Fescue Grass	40 percent
Perennial Rye Grass (Manhattan)	30 percent

2.2 ACCESSORIES

A. Mulching Material: Conwed Verdoyl #2000.

B. Fertilizer: FS 0-F-241, Commercial Grade A with 12 12 12 analysis.

C. Water: Clean, fresh and free of substances or matter which could inhibit vigorous growth of grass.

D. Lime: ASTM C602, Class T agricultural limestone containing a minimum 80 percent calcium carbonate equivalent.

E. Erosion Fabric: Jute matting, open weave.

F. Stakes: Softwood lumber, chisel pointed.

G. String: Inorganic fiber.

2.3 SOURCE QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Testing, inspection and analysis requirements.

B. Analyze to ascertain percentage of nitrogen, phosphorus, potash, soluble salt content, organic matter content, and pH value.

C. Provide recommendation for fertilizer and lime application rates for specified seed mix as result of testing.

D. Testing is not required when recent tests and certificates are available for imported topsoil. Submit these test results to testing laboratory. Indicate, by test results, information necessary to determine suitability.

E. Notify Engineer 72 hours prior to hydroseeding and fertilizing for approval to proceed.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify prepared soil base is ready to receive the Work of this section.

C. Landscape Seeding: Verify that prepared soil base is read to receive the work of this section. See Section 32 91 19 – Landscape Grading.

3.2 FERTILIZING

A. Apply fertilizer at application rate 500 lbs per acre.

B. Apply after smooth raking of topsoil and prior to roller compaction.

C. Do not apply fertilizer at same time or with same machine used to apply seed.

D. Mix fertilizer thoroughly into upper 2 inches of topsoil.

E. Lightly water soil to aid dissipation of fertilizer. Irrigate top level of soil uniformly.

3.3 SEEDING

A. Apply seed at rate of 500 lbs per acre evenly in two intersecting directions. Rake in lightly.

B. Do not seed areas in excess of that which can be mulched on same day.

C. Planting Season: May 1 to October 10 unless otherwise approved by the Engineer.

D. Do not sow immediately following rain, when ground is too dry, or when winds are over 12 mph.

E. Roll seeded area with roller not exceeding 112 lbs/linear foot.

F. Immediately following seeding and compacting, apply mulch to thickness of 1/8 inches. Maintain clear of shrubs and trees.

G. Apply water with fine spray immediately after each area has been mulched. Saturate to 4 inches of soil.

3.4 HYDROSEEDING

A. Apply seed, fertilizer and mulch slurry with a hydraulic seeder at a rate of 200 lbs. per acre of seed, 500 lbs per acre of fertilizer and 14000 lbs per acre of mulch, evenly on prepared seedbed. Do not apply slurry on shrubs or trees.

B. Apply water with fine spray immediately after each area has been hydroseeded. Saturate to 3 inches of soil and maintain moisture levels two to four inches.

C. Planting Season: May 1, to October 10, unless otherwise approved by the Engineer.

3.5 SEED PROTECTION

A. Cover seeded slopes where grade is 6 inches per foot or greater with erosion fabric. Roll fabric onto slopes without stretching or pulling.

B. Lay fabric smoothly on surface, bury top end of each section in 6 inch deep excavated topsoil trench. Overlap edges and ends of adjacent rolls minimum 12 inches. Backfill trench and rake smooth, level with adjacent soil.

C. Secure outside edges and overlaps at 36 inch intervals with stakes.

D. Lightly dress slopes with topsoil to ensure close contact between fabric and soil.

E. At sides of ditches, lay fabric laps in direction of water flow. Lap ends and edges minimum 6 inches.

3.6 MAINTENANCE

A. Immediately reseed areas which show bare spots.

B. Repair any eroded areas and reseed immediately.

C. Contractor shall guarantee a uniform grass growth over the entire project and shall reseed bare and thin areas until this is accomplished at no additional cost to the project.

D. Water to prevent grass and soil from drying out.

E. Roll surface to remove minor depressions or irregularities.

F. Control growth of weeds. Apply herbicides. Remedy damage resulting from improper use of herbicides.

G. Immediately reseed areas showing bare spots.

H. Repair washouts or gullies.

I. Protect seeded areas with warning signs during maintenance period.

END OF SECTION

SECTION 33 01 30.13

SEWER AND MANHOLE TESTING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Testing of Gravity Sewer Piping:
      a. Low pressure air testing.
      b. Detection Test
      c. Infiltration testing.
   2. Testing of pressure piping.
   3. Deflection testing of plastic sewer piping.
   4. Testing of Manholes:
      a. Exfiltration testing.

B. Related Requirements:
   1. Section 33 31 00 - Sanitary Utility Sewerage Piping

1.2 REFERENCE STANDARDS

A. ASTM International:
   1. ASTM C-828 – Standard Test Method for Bulk Density of As-Manufactured Carbon and Graphite Shapes.
   2. ASTM C1244 - Standard Test Method for Concrete Sewer Manholes by the Negative Air Pressure (Vacuum) Test Prior to Backfill.
   3. ASTM D2122 - Standard Test Method for Determining Dimensions of Thermoplastic Pipe and Fittings.
   4. ASTM F1417 – Standard Practice for Installation Acceptance of Plastic Non-Pressure Sewer Lines Using Low-Pressure Air.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Submit following items prior to start of testing:
   1. Testing procedures.
   2. List of test equipment.
   3. Testing sequence schedule.
   4. Provisions for disposal of flushing and test water.
   5. Certification of test gage calibration.
   6. Deflection mandrel drawings and calculations.

C. Test and Evaluation Reports: Indicate results of manhole and piping tests.

PART 2 PRODUCTS

2.1 EXFILTRATION TESTING

A. Equipment:
   1. Plugs.
   2. Pump.
   3. Measuring device.

2.2 AIR TESTING

A. Equipment:
   1. Air compressor.
   2. Air supply line.
   3. Shutoff valves.
   4. Pressure regulator.
   5. Pressure relief valve.
   6. Stopwatch.
   7. Plugs.
   8. Pressure Gage: Calibrated to 0.1 psi.

2.3 INFILTRATION TESTING

A. Equipment: Weirs.

2.4 DEFLECTION TESTING

A. Equipment:
   1. "Go, no go" mandrels.
   2. Pull/retrieval ropes.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for installation examination.

B. Verify that manholes and piping are ready for testing.

C. Verify that trenches are backfilled.

D. Verify that pressure piping thrust restraint system is installed.

3.2 PREPARATION

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for preparation.

B. Plugs:
   1. Plug outlets, wye branches, and laterals.
   2. Brace plugs to resist test pressures.

3.3 FIELD QUALITY CONTROL

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for testing, adjusting, and balancing.

B. Low Pressure Air Testing:
   1. For areas that will be connected live Owner may elect to wave air testing requirements stated.
   2. Furnish Owner with acceptable air tests results or each 1,000 feet segment prior to further testing.
   3. Test in increments between manholes.
   4. Clean and plug pipe at each manhole.
   5. Plugs shall be designed to hold against the test pressure and provide an airtight seal.
   6. One plug shall have an orifice through which air can be pumped into the sewer.
   7. An air supply line fitted with control valves and pressure gage to measure the air pressure in the pipe shall be connected to the orifice.
   8. The air pressure gage shall have a minimum diameter of 3 1/2 inches, a range of 0 – 10 psig, increments of 0.10 psig and accuracy of ± 0.04 psig.
   9. Check water level over pipe by connecting a clear plastic tube to the 1/2 inch pipe nipple in each manhole.
   10. Increase test pressure by 0.433 psig for each foot of ground water above the top of the pipe.
   11. Pressurize the sewer pipe to 4 psig greater than the greatest back pressure caused by ground water over top of the sewer pipe.
   12. Allow two minutes for air pressure to stabilize between 3.5 and 4.0 psig.
   13. Add air to the pipe to begin the test at a pressure between 3.5 and 4.0 psig.
   14. Close valve at the end of the stabilization period so that nor more air enters the pipe.
   15. Record the gage pressure and begin timing for the test.
   16. Test will not begin if pressure is less than 3.5 psig or greater if required to compensate for ground water pressure.
   17. The time required for the air pressure to decrease 1.0 psig for rigid pipe during the test shall not be less than the time shown in the following table.
   18. Repair and retest failed sections.
   19. Follow Safety Procedures.
       a. Block plugs securely.
       b. Relieve air pressure completely before removing plugs.
       c. A 15” plug with 4.5 psig applied exerts almost 800 pounds of force.

PVC PIPE
SPECIFICATION TIME REQUIRED FOR A 0.5 PSIG PRESSURE DROP
FOR SIZE AND LENGTH OF PIPE INDICATED FOR Q = 0.0015

1 Pipe Diameter (in.)	2 Minimum Time (min: sec)	3 Length for Min. Time (ft.)	4 Time for Longer Length (sec)	SPECIFICATION TIME FOR LENGTH (L) SHOWN (MIN:SEC)							
				100 ft.	150 ft.	200 ft.	250 ft.	300 ft.	350 ft.	400 ft.	450 ft.
4	1:53	597	.190 L	1:53	1.53	1.53	1.53	1.53	1.53	1.53	1.53
6	2:50	398	.427 L	2:50	2:50	2:50	2:50	2:50	2:50	2:51	3:12
8	3:47	298	.760 L	3:47	3:47	3:47	3:48	4:26	5:04	5:04	5:42
10	4:43	239	1.187 L	4:43	4:43	4:43	4:57	5:56	6:55	7:54	8:54
12	5:40	199	1.709 L	5:40	5:40	5:42	7:08	8:33	9:58	11:24	12:50
15	7:05	159	2.671 L	7:05	7:05	8:54	11:08	13:21	15:35	17:48	20:02
18	8:30	133	3.846 L	8:30	9:37	12:49	16:01	19:14	22:26	25:38	28:51
21	9:55	114	5.235 L	9:55	13:05	17:27	21:49	26:11	30:32	34:54	39:16
24	11:20	99	6.837 L	11:24	17:57	22:48	28:30	34:11	39:53	45:35	51:17
27	12:45	88	8.653 L	14:25	21:38	28:51	36:04	43:16	50:30	57:42	46:54
30	14:10	80	10.683 L	17:48	26:43	35:37	44:31	53:25	62:19	71:13	80:07
33	15:35	72	12.926 L	21:33	32:19	43:56	53:52	64:38	75:24	86:10	96:57
36	17:00	66	15:384 L	25:39	38:28	51:17	64:06	76:55	89:44	102:34	115:23

C. Testing of Pressure Piping:
   1. Test system according to AWWA C600 and following:
      a. Hydrostatically test each portion of pressure piping, including valved section, at 1.5 times working pressure of piping, based on elevation of lowest point in piping corrected to elevation of test gage.
      b. Conduct hydrostatic testing for at least two hours.
      c. Slowly fill with water portion of piping to be tested, expelling air from piping at high points.
      d. Install corporation cocks at high points.
      e. Close air vents and corporation cocks after air is expelled.
      f. Raise pressure to specified test pressure.
      g. Observe joints, fittings, and valves undergoing testing.
      h. Remove and renew cracked pipes, joints, fittings, and valves that show visible leakage.
      i. Retest.
      j. Correct visible deficiencies and continue testing at same test pressure for additional two hours to determine leakage rate.
      k. Maintain pressure within plus or minus 5.0 psi of test pressure.
      l. Leakage is defined as quantity of water supplied to piping necessary to maintain test pressure during period of testing. Compute maximum allowable leakage using following formula:

L = [**SD x sqrt(P)**]/C
L = testing allowance, gph
S = length of pipe tested, feet
D = nominal diameter of pipe, inches
P = average test pressure during hydrostatic testing, psig
C = 148,000
Note: 1. When pipe undergoing testing contains sections of various diameters, calculate allowable leakage from sum of computed leakage for each pipe size.

D. Deflection Testing of Plastic Sewer Piping:
   1. Perform vertical ring deflection testing on PVC and acrylonitrile butadiene styrene sewer piping after backfilling has been in place for at least 60 days but not longer than 12 months.
   2. Allowable maximum deflection for installed plastic sewer pipe is no greater than five percent of original vertical internal diameter.
   3. Perform deflection testing using properly sized rigid ball or "go, no go" mandrel.
   4. Furnish rigid ball or mandrel with diameter not less than 95 percent of base or average inside diameter of pipe, as determined by ASTM standard to which pipe is manufactured; measure pipe diameter in compliance with ASTM D2122.
   5. Perform testing without mechanical pulling devices.
   6. Locate, excavate, replace, and retest piping that exceeds allowable deflection.

END OF SECTION

SECTION 33 05 13.16
PUBLIC MANHOLES AND STRUCTURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Cast-in-Place concrete manholes and structures with masonry transition to cover frame, covers, anchorage, and accessories.
2. Modular precast concrete manholes and structures with tongue-and-groove joints with masonry transition to cover frame, covers, anchorage, and accessories.
3. Masonry manhole and structure sections with masonry transition to cover frame, covers, anchorage, and accessories.
4. Doghouse manhole connections to existing sanitary and storm sewer lines.
5. Bedding and cover materials.
6. Pile support systems.

B. Related Sections:
1. Section 03 10 00 - Concrete Forming and Accessories.
2. Section 03 30 00 - Cast-In-Place Concrete
3. Section 03 60 00 - Grouting.
4. Section 31 05 13 - Soils for Earthwork
5. Section 31 05 16 - Aggregates for Earthwork
6. Section 31 23 16 - Excavation
7. Section 33 31 13 - Public Sanitary Utility Sewerage Piping
8. Section 33 41 13 - Public Storm Utility Drainage Piping

1.2 REFERENCES

A. American Association of State Highway Transportation Officials:
1. AASHTO M288 - Geotextiles.
2. AASHTO M306 - Drainage Structure Castings.
3. AASHTO M91 - Sewer and Manhole Brick (Made from Clay or Shale).

B. American Concrete Institute:
1. ACI 530/530.1 - Building Code Requirements for Masonry Structures and Specifications for Masonry Structures.

C. ASTM International:
1. ASTM A48/A48M - Standard Specification for Gray Iron Castings.
2. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
3. ASTM C32 - Standard Specification for Sewer and Manhole Brick (Made From Clay or Shale).
4. ASTM C55 - Standard Specification for Concrete Brick.
5. ASTM C361 - Standard Specification for Reinforced Concrete Low-Head Pressure Pipe.
6. ASTM C478 - Standard Specification for Precast Reinforced Concrete Manhole Sections.

7. ASTM C497 - Standard Test Methods for Concrete Pipe, Manhole Sections, or Tile.
8. ASTM C913 - Standard Specification for Precast Concrete Water and Wastewater Structures.
9. ASTM C923 - Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Shop Drawings: Indicate structure locations, elevations, piping, conduit, and sizes and elevations of penetrations.

C. Product Data: Submit manhole covers, component construction, features configuration and dimensions.

1.4 DEFINITIONS

A. Bedding: Fill placed under, beside and directly over pipe, prior to subsequent backfill operations.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with Local, State and Federal standards.

B. Maintain one copy of each document on site.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years documented experience.

B. Installer: Company specializing in performing work of this section with minimum 3 years documented experience.

1.7 DELIVERY, STORAGE AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Comply with precast concrete manufacturer’s instructions and ASTM C913 for unloading, storing and moving precast manholes and drainage structures.

C. Store precast concrete manholes and drainage structures to prevent damage to Owner’s property or other public or private property. Repair property damaged from materials storage.

D. Mark each precast structure by indentation or waterproof paint showing date of manufacture, manufacturer, and identifying symbols and numbers shown on Drawings to indicate its intended use.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements.

B. Maintain materials and surrounding air temperature to minimum 50 degrees F prior to, during, and 48 hours after completion of masonry work.

C. Cold Weather Requirements: ACI 530/530.1.

1.9 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Section 01 70 00.

B. Accurately record actual locations of pipe runs, connections, catch basins, cleanouts, and invert elevations and submit to Engineer prior to closeout.

C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.10 REGULATORY REQUIREMENTS

A. Conform to applicable code for materials and installation of the work of this section.

B. Conform to applicable standards for pipe and fitting identification and markings.

1.11 FIELD MEASUREMENTS

A. Verify that field measurements and elevations are indicated.

1.12 COORDINATION

A. Coordinate work under provisions of Section 01 30 00.

PART 2 - PRODUCTS

2.1 MANHOLES AND STRUCTURES

A. Manufacturers:
   1. Northern Concrete Pipe or equal.
   2. Substitutions: Section 01 60 00 - Product Requirements.

B. Manhole and Structure Sections: Reinforced precast concrete in accordance with ASTM C478 with gaskets in accordance with ASTM C923.
   1. Joints for Precast Manholes and Structures: In accordance with ASTM C913; maximum leakage of 0.025 gallons per hour per foot of joint at 3 feet of head.

2.2 FRAMES AND COVERS

A. Manufacturers:
   1. East Jordan Iron Works
   2. Substitutions: Approved equal.

2.3 COMPONENTS

A. Manhole and Structure Steps: Formed polypropylene rungs; 3/4 inch diameter. Formed integral with manhole sections.

B. Foundation Slab: Precast, leveled top surface.

2.4 CONFIGURATION

A. Shaft Construction and Eccentric Cone Top Section: Reinforced precast Concrete pipe sections, lipped male/female dry joints, sleeved to receive pipe conduit and sections.

B. Shape: Cylindrical.

C. Clear Inside Dimensions: As indicated on Drawings.

D. Design Depth: As indicated on Drawings.

E. Clear Cover Opening: As indicated on Drawings.

F. Pipe Entry: Furnish openings as indicated on Drawings.

G. Structure Joint Gaskets: ASTM C361; rubber.

H. Steps: 12 inches wide, 16 inches on center vertically, set into structure wall. As indicated on Drawings.

I. Steps: As required by code.

2.5 ACCESSORIES

A. Geotextile Filter Fabric: AASHTO M288 for Subsurface Drainage Non-biodegradable, non-woven.

B. Concrete: Specified in Section 03 30 00.

C. Grout: Specified in Section 03 60 00.

D. Expandable Pipe Plug:
   1. Substitutions: Section 01 60 00 - Product Requirements.

2.6 BEDDING AND COVER MATERIALS

A. Bedding: Fill Type 6A compacted crushed limestone as specified in Section 31 05 16.

B. Cover: Fill Type MDOT Class II, as specified in Section 31 05 16.

C. Soil Backfill from Above Pipe to Finish Grade: Soil Type Native Subsoil, in green belt areas and fill type MDOT Class II anywhere within the 1 on 1 influence of the road and as specified in Section 31 05 13.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify items provided by other sections of Work are properly sized and located.

C. Verify built-in items are in proper location, and ready for roughing into Work.

D. Verify correct size of manhole and structure excavation.

3.2 PREPARATION

A. Coordinate placement of inlet and outlet pipe or duct sleeves required by other sections.

B. Do not install manholes and structures where site conditions induce loads exceeding structural capacity of manholes or structures.

C. Inspect precast concrete manholes and structures immediately prior to placement in excavation to verify manholes and structures are internally clean and free from damage. Remove and replace damaged units.

D. Cut out soft areas of subgrade not capable of insitu compaction. Backfill with 6A compacted crushed limestone fill and compact to density equal to or greater than requirements for support of pipe or structure and subsequent backfill material.

3.3 INSTALLATION - GENERAL

A. Excavation and Backfill:
   1. Excavate for manholes and structures in accordance with Section 31 23 16 in location and to depth shown. Provide clearance around sidewalls of manhole or structure for construction operations, granular backfill and placement of geotextile filter fabric.
   2. When groundwater is encountered, prevent accumulation of water in excavations. Place manholes or structures in dry trench.
   3. Where possibility exists of watertight manhole or structure becoming buoyant in flooded excavation, anchor manhole or structure to avoid flotation.

4. Place foundation slab, trowel top surface level.
5. Place manhole sections plumb and level, trim to correct elevations, anchor to foundation slab.
6. Install manholes and structures supported at proper grade and alignment with crushed stone bedding as shown on Drawings.
7. Backfill excavations for manholes and structures in accordance with Section 31 23 10.
8. Form and place manhole or structure cylinder plumb and level, to correct dimensions and elevations.
9. Cut and fit for pipe and accessories.
10. Grout base of shaft sections to achieve slope to exit piping. Trowel smooth. Contour to form continuous drainage channel.
11. Paint interior with 2 coats of bituminous interior coating at rate of 120 square feet per gallon for each coat.
12. Set cover frames and covers level without tipping, to correct elevations.

3.4 PRECAST CONCRETE MANHOLE AND STRUCTURE INSTALLATION

A. Lift precast manholes and structures at lifting points designated by manufacturer.

B. When lowering manholes and structures into excavations and joining pipe to units, take precautions to ensure interior of pipeline and manhole or structure remains clean.

C. Set precast manholes and structures bearing firmly and fully on crushed stone bedding, compacted in accordance with provisions of Section 31 23 16 or on other support system shown on Drawings.

D. Assemble multi-section manholes and structures by lowering each section into excavation. Install rubber gasket joints between precast sections in accordance with manufacturer's recommendations. Lower, set level, and firmly position base section before placing additional sections.

E. Remove foreign materials from joint surfaces and verify sealing materials are placed properly. Maintain alignment between sections by using guide devices affixed to lower section.

F. Joint sealing materials may be installed on site or at manufacturer's plant.

G. Verify manholes and structures installed satisfy required alignment and grade.

H. Remove knockouts or cut structure to receive piping without creating openings larger than required to receive pipe. Fill annular space with mortar.

I. Cut pipe to finish flush with interior of manhole or structure.

J. Grout base of shaft sections to achieve slope to exit piping. Trowel smooth. Contour to form continuous drainage channel.

K. Install according to manufacturer's instructions.

L. Form bottom of excavation clean and smooth to correct elevation.

M. Place precast concrete base pad, tee sections, and sections with integral bottoms on 6 inches of MDOT 6A compacted crushed limestone bedding.

N. Level top surface of base pad or tee section to receive concrete shaft sections.

O. Establish elevations and pipe inverts for inlets and outlets as indicated.

P. Mount lid and frame level in grout, secured to top cone section or flat top to elevation indicated.

Q. Grout all joints between base pad, pipe connections, and top.

R. Install barrel sections, cone section, and frame and cover to elevation indicated.

S. Maximum height from top of cone to bottom of frame shall be 12 inches.

T. Install stubs and branch connections at locations and elevations. Close ends with approved plug.

U. Bed stubs and branch connections as indicated on the plan.

3.5 CASTINGS INSTALLATION

A. Set frames using mortar and masonry as indicated on Drawings. Install radially laid concrete brick with 1/4 inch thick vertical joints at inside perimeter. Lay concrete brick in full bed of mortar and completely fill joints. Where more than one course of concrete brick is required, stagger vertical joints.

B. Set frame and cover 2 inches above finished grade for manholes and other structures with covers located within unpaved areas to allow area to be graded away from cover beginning 1 inch below top surface of frame.

C. Core castings per the manhole cover adjustment (paved areas) detail as shown on the plans.

D. Adjust castings to final grade in areas to be paved using thermoplastic molding bolted to the manhole/catch basin top.

E. Cure concrete per section 32 13 13.

3.6 REMOVAL – EXISTING CATCHBASINS AND MANHOLES

A. Remove existing structures complete at locations indicated on the drawings.

B. Maintain continuous service in live lines.

C. Reconnect lines scheduled to remain in service, as indicated on the drawings.

3.7 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.

B. Test cast-in-place concrete in accordance with Section 03 30 00.

C. Test concrete manhole and structure sections in accordance with ASTM C497.

D. Vertical Adjustment of Existing Manholes and Structures:
   1. Where required, adjust top elevation of existing manholes and structures to finished grades shown on Drawings or determined in the field.
   2. Reset existing frames, grates and covers, carefully removed, cleaned of mortar fragments, to required elevation in accordance with requirements specified for installation of castings.
   3. Remove concrete without damaging existing vertical reinforcing bars when removal of existing concrete wall is required. Clean vertical bars of concrete and bend into new concrete top slab or splice to required vertical reinforcement, as indicated on Drawings.
   4. Clean and apply sand-cement bonding compound on existing concrete surfaces to receive cast-in-place concrete in accordance with Section 03 30 00.

3.8 INSTALLATION – END SECTIONS

A. Protect the ends of culvert by end section according to MDOT standards.

B. Use precast concrete end sections on concrete culverts.

C. Place them at the locations and elevations shown on the plans.

D. Fasten end section securely to the pipe as recommended by the manufacturer or as directed by the Engineer.

E. For concrete end sections, wrap the joint with a 36” wide geotextile blanket centered on the joint.

3.9 INSTALLATION STEEL GRATES

A. Fabricate end section grates from any grade of weldable hot-rolled steel bars, plain or deformed in accordance with MDOT Standard Specifications for Construction. Cut grate and mount to match slope of end section. Fasten grates securely to the concrete end sections.

3.10 PROTECTION

A. Protect finished work under provisions of Section 01 50 00 – Temporary Facilities and Controls.

B. Protect pipe and aggregate cover from damage or displacement until backfilling operation is in progress.

3.11 SCHEDULES

A. Manholes: Precast concrete sections, plastic coated steel steps, not less than 48 inches inside dimension, to depth indicated, with bolted lid.

END OF SECTION

SECTION 33 05 23
TRENCHLESS UTILITY INSTALLATION

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Casing and jacking pipe.
2. Steel tunnel liner.
3. Carrier pipe.
4. Excavation for approach trenches and pits.

B. Related Requirements:
1. Section 03 30 00 - Cast-in-Place Concrete
2. Section 31 05 16 - Aggregates for Earthwork
3. Section 31 23 16 - Excavation
4. Section 31 23 17 - Trenching
5. Section 33 11 13 - Public Water Utility Distribution Piping
6. Section 33 31 13 – Public Sanitary Utility Sewerage Piping

1.2 REFERENCE STANDARDS

A. American Association of State Highway and Transportation Officials:
1. AASHTO M 133 - Standard Specification for Preservatives and Pressure Treatment Processes for Timber.
2. AASHTO T 180 - Standard Method of Test for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. American Railway Engineering and Maintenance-of-Way Association:
1. AREMA - Manual for Railway Engineering.

C. ASTM International:
1. ASTM A36 - Standard Specification for Carbon Structural Steel.
2. ASTM A53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
3. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength.
4. ASTM A449 - Standard Specification for Hex Cap Screws, Bolts and Studs, Steel, Heat Treated, 120/105/90 ksi Minimum Tensile Strength, General Use.
5. ASTM A1011 - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength.
6. ASTM C33 - Standard Specification for Concrete Aggregates.
7. ASTM C76 - Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
8. ASTM C150 - Standard Specification for Portland Cement.
9. ASTM C361 - Standard Specification for Reinforced Concrete Low-Head Pressure Pipe.

10. ASTM C404 - Standard Specification for Aggregates for Masonry Grout.
11. ASTM C443 - Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.
12. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft3 (600 kN-m/m3)).
13. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3)).
14. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

D. American Welding Society:
   1. AWS D1.1 - Structural Welding Code - Steel.

E. American Wood Protection Association:
   1. AWPA C1 - All Timber Products - Preservative Treatment by Pressure Processes.

F. National Utility Contractors Association:
   1. NUCA - Guide to Pipe Jacking and Microtunneling.
   2. NUCA - Trenchless Assessment Guide.

1.3 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Requirements for coordination.

B. Coordinate Work of this Section with County Road Commission, Owner and utilities within construction area.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.5 QUALITY ASSURANCE

A. Perform Work according to NUCA Trenchless Assessment Guide, NUCA Guide to Pipe Jacking and Microtunneling, AREMA, and Association AASHTO guidelines.

B. When boring, jacking, or tunneling under MDOT and County Road Commission highways and railroads, obtain occupancy permit.

C. Perform Work according to County Road Commission standards.

D. Maintain one copy of each standard affecting Work of this Section on Site.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

C. Provide temporary end caps and closures on piping and fittings and maintain in place until installation.

D. Protect piping from entry of foreign materials and water by installing temporary covers, completing sections of Work, and isolating parts of completed system.

E. Use wooden shipping braces between layers of stacked pipe.

F. Stack piping lengths no more than three layers high.

G. Store field joint materials in original shipping containers in dry area indoors.

H. Support casing and carrier pipes with nylon slings during handling.

1.7 AMBIENT CONDITIONS

A. Section 01 50 00 - Temporary Facilities and Controls: Requirements for ambient condition control facilities for product storage and installation.

B. Maintain storage temperature of 60 to 85 degrees F.

1.8 EXISTING CONDITIONS

A. Field Measurements:
   1. Verify invert elevations of existing work prior to excavation and installation of casing.
   2. Indicate field measurements on Shop Drawings.

PART 2 PRODUCTS

2.1 CASING AND JACKING PIPE

A. Welded Steel Pipe Sleeve, ASTM, A53, Type S, Grade B.

2.2 ACCESSORIES

A. Supports and Insulators:
   1. Timber:
      a. Construction: Cross-sectional size to allow placement of carrier pipe in casing and to support barrel of carrier pipe. Provide notches to accommodate fastening. Treat notches at time of pipe installation.
      b. Wood Preservative or Pressure Treatment: AASHTO M133, creosote.
      c. 2”x2” Hardwood skids or Pressure Tested Lumber of the Contractor’s option.
   2. Steel: 5/8” wide stainless-steel band.

B. Steel Strapping: ASTM A36.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for installation examination.

B. Verify that connection to existing piping system, size, location, and invert elevations are according to Drawings.

3.2 PREPARATION

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for installation preparation.

B. Identify required lines, levels, contours, and datum locations.

C. Locate and identify utilities indicated to remain and protect from damage.

D. Notify utility company to remove and relocate utilities.

E. Protect plant life, lawns, rock outcroppings, and other features remaining as portion of final landscaping.

F. Protect bench marks, survey control points, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

G. Establish elevations at the depth shown on the plans.

H. Maintain required separation from existing utilities.

3.3 INSTALLATION

A. Dewatering:
   1. Intercept and divert surface drainage precipitation and groundwater away from excavation through use of dikes, curb walls, ditches, pipes, sumps, or other means.
   2. Develop substantially dry subgrade for prosecution of subsequent operations.
   3. Comply with of Michigan requirements for dewatering to any watercourse, prevention of stream degradation, and erosion and sediment control.

B. Pits or Approach Trenches:
   1. Excavate approach trenches or pits according to installation plan and as Site conditions require.
   2. Ensure casing entrance faces as near perpendicular to alignment as conditions permit.
   3. Establish vertical entrance face at least 1 foot above top of casing.
   4. Install dewatering measures and excavation supports as specified in Section 31 23 16 - Excavation.
   5. Construct and maintain jacking/boring pits as required. Adequately clear site required for pits as needed to perform the work. Size pits for boring machine, frames, reaction blocks,

minimum 2 sections of pipe and with sufficient room for working. Provide steel safety ladder.

6. Locate pits such that no damage occurs to trees, poles (not specified for removal) or structures in the immediate area.
7. Construct pits with sheeting and bracing as required for proper support in accordance with O.S.H.A. Standards and as needed to sufficiently support reaction blocks.
8. Place crushed rock or approved bedding to sufficiently support equipment and protect pit floor.

C. Casing Pipe:
   1. Boring:
      a. Push pipe into ground with boring auger, rotating within pipe to remove soil.
      b. Do not advance cutting head ahead of casing pipe, except for distance necessary to permit cutting teeth to cut clearance for pipe.
      c. Arrange machine bore and cutting head to be removable from within pipe.
      d. Arrange face of cutting head to provide barrier to free flow of soft material.
      e. If unstable soil is encountered during boring, retract cutting head into casing to permit balance between pushing pressure and ratio of pipe advancement to quantity of soil.
      f. Grout to fill voids if voids develop greater than outside diameter of pipe by approximately 1 inch.
      g. If boring is obstructed, relocate, jack, or tunnel as directed by Engineer.
      h. Employ guide timbers and rails for maintaining pipe line and grade.
      i. Push utility pipe through the bored opening leaving minimum annular space.
      j. On sanitary sewers the annular space between the pipe and opening shall be filled with pea stone the entire length. For water main the pea stone is not required.
      k. A pushing or jacking frame shall be built and furnished to fit or match the end of the pipe to be jacked so that the pressure of the jacks will be evenly distributed over the end of the pipe.
      l. The hydraulic jacks shall have sufficient power to apply a smooth and even pressure to move the pipe in place. Hammering or ramming of the pipe will not be allowed.
      m. The pipe shall be jacked upgrade where possible.
      n. The excavation shall be done within the inside of the pipe and shall not exceed 12" ahead of the pipe being jacked in place.
      o. After each pipe section is in place the pipe shall be check for correct grade and line. Pipe not meeting the correct grade and line shall be rejected and replaced.
      p. Excavation shall be done within the inside of the pipe sleeve not to exceed 6" ahead of the sleeve.
      q. Excavation at the top and sides may be approximately 1" greater than the outside periphery of the pipe.
      r. The bottom of the excavation shall be accurately cut to line and grade.
      s. Adjoining sections of pipe sleeve shall be attached with a continuous weld.
      t. After the pipe sleeve has been jacked and augured, it shall be checked by pouring water through the pipe. Pipe sleeve not meeting the line and grade requirements shall be rejected.
      u. After the pipe sleeve has been jacked and augured, it shall be checked by pouring water through the pipe. Pipe sleeve not meeting the line and grade requirements shall be rejected.
      v. The annular spaces at the ends of the pipe sleeve shall be sealed with Mirafi filter fabric and held in place with 6A stone.

w. The annular spaces at the ends of the pipe sleeve shall be sealed with Mirafi filter fabric and held in place with 6A stone.

2. Jacking:
   a. Construct adequate thrust wall normal to proposed line of thrust.
   b. Impart thrust load to pipe through suitable thrust ring sufficiently rigid to ensure uniform distribution of thrust load on full pipe circumference.
3. Drilling and Jacking:
   a. Use oil-field-type rock roller bit or plate bit made up of individual roller cutter units solidly welded to pipe, which is turned and pushed for its entire length by drilling machine to give bit necessary cutting action.
   b. Inject high-density slurry (oil field drilling mud) to head as cutter lubricant.
   c. Inject slurry at rear of cutter units to prevent jetting action ahead of pipe.
4. Mining and Jacking: Use manual hand-mining excavation from within casing pipe as casing is advanced with jacks, allowing minimum ground standup time ahead of casing pipe.

D. Carrier Pipe:
1. Clean, inspect, and handle pipe as specified.
2. Placement:
   a. Place carrier pipe as specified.
   b. Exercise care to prevent damage to pipe joints when carrier pipe is placed in casing.
3. Supports:
   a. Support pipeline within casing so no external loads are transmitted to carrier pipe.
   b. Attach supports to barrel of carrier pipe; do not rest carrier pipe on bells.
4. Grout ends of casing to seal.

3.4 TOLERANCES

A. Section 01 40 00 - Quality Requirements: Requirements for tolerances.

B. Do not overcut excavation by more than 1 inch greater than outside diameter of casing pipe.

C. Install casing pipe to vertical and horizontal alignment on Drawings within plus or minus 3 inches prior to installation of carrier pipe.

D. Install pipe bells with minimum 1/2 inch clearance to casing.

3.5 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Requirements for inspecting and testing.

3.6 CLEANING

A. Remove temporary facilities for casing installation and jacking operations as specified in Section 01 50 00 - Temporary Facilities and Controls.

END OF SECTION

SECTION 33 05 23.13
UTILITY HORIZONTAL DIRECTIONAL DRILLING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Excavation for approach trenches and pits.
2. Horizontal directional drilling.
3. Pipe.
4. Drilling fluid system.

B. Related Requirements:
1. Section 31 05 13 - Soils for Earthwork
2. Section 31 05 16 – Aggregates for Earthwork.
3. Section 31 23 16 - Excavation
4. Section 31 23 17 - Trenching
5. Section 33 11 13 - Public Water Utility Distribution Piping
6. Section 33 12 16 – Water Utility Distribution Valves.
7. Section 33 12 19 – Water Utility Distribution Fire Hydrants.
8. Section 33 13 00 – Disinfection.

1.2 REFERENCE STANDARDS

A. American Association of State Highway and Transportation Officials:
1. AASHTO T 180 - Standard Method of Test for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. ASTM International:
1. ASTM A126 – Gray Iron Casting for Valves, Flange and Pipe Fittings.
2. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft3 (600 kN-m/m3)).
3. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3)).
4. ASTM D1784 - Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds.
5. ASTM D1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
6. ASTM D2239 - Standard Specification for Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter.
7. ASTM D2241 - Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).
8. ASTM D2464 - Standard Specification for Threaded Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
9. ASTM D2466 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.

10. ASTM D2467 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
11. ASTM D2837 - Standard Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials or Pressure Design Basis for Thermoplastic Pipe Products.
12. ASTM D2855 - Standard Practice for Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings.
13. ASTM D3139 - Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.
14. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).
15. ASTM F1056 - Standard Specification for Socket Fusion Tools for Use in Socket Fusion Joining Polyethylene Pipe or Tubing and Fittings.
16. ASTM F1962 - Standard Guide for Use of Maxi-Horizontal Directional Drilling for Placement of Polyethylene Pipe or Conduit Under Obstacles, Including River Crossings.
17. ASTM F477 – Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
18. NSF 14 – Plastic Piping System Components and Related Materials.
19. NSF 61 – Drinking Water System Components.

C. American Water Works Association:
1. AWWA C105 – Polyethylene Easement for Ductile Iron Pipe Systems.
2. AWWA C111 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
3. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. Through 12 In. for Water Transmission and Distribution.
4. AWWA C605 – Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe
5. and Fittings for Water.

D. National Utility Contractors Association:
1. NUCA - Horizontal Directional Drilling Good Practices Guidelines.

E. Uni-Bell PVC Pipe:
1. Hand Book of PVC Pipe.

1.3 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Requirements for coordination.

B. Coordinate Work of this Section with Municipal, State and Federal entities having jurisdiction and existing utilities within construction area.

C. Coordinate work and traffic according to Section 01 50 00 Temporary Facilities and Controls.

1.4 PREPARATION AND FIELD MEASUREMENTS

A. See drawings for drilling locations.

B. Verify alignment of proposed utility, required grades, and location and depths of end points. Verify that alignment and depths comply with applicable permits for crossing in public or private right-of-ways.

C. Verify location of existing utilities and structures that may cause interference.

1.5 REGULATORY REQUIREMENTS

A. Perform work within public or private rights-of-way in accordance with the authority having jurisdiction. Obtain construction permits as required.

1.6 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Product Data:
   1. Identify source of water used for drilling.
   2. Submit copy of approvals and permits for use of water source.

C. Shop Drawings:
   1. Submit technical data for equipment, method of installation, and proposed sequence of construction.
   2. Include information pertaining to pits, dewatering, method of spoils removal, and equipment size, capacity, and capabilities, including installing pipe on radius, type of drill bit, drilling fluid, method of monitoring line and grade, detection of surface movement, name plate data for drilling equipment, and mobile spoils removal unit.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

E. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

F. Qualifications Statement:
   1. Submit qualifications for driller.

1.7 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements.

B. Project Record Documents: Record actual locations of pipe and invert elevations.

C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

D. Record actual depth of pipe at 25-foot intervals.

E. Record actual horizontal location of installed pipe.

F. Show depth and location of abandoned bores.

G. Record depth and location of drill bits and drill stems not removed from bore.

1.8 QUALITY ASSURANCE

A. Perform Work according to following:
   1. NUCA HDD Good Practices Guidelines.
   2. ASTM F1962.
   3. Uni-Bell Hand Book of PVC Pipe.

B. Perform Work according to Municipal, State and Federal standards.

1.9 QUALIFICATIONS

A. Driller: Company specializing in performing Work of this Section with minimum three years' documented experience.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Provide temporary end caps and closures on piping and fittings until pipe is installed.

C. Protect pipe from entry of foreign materials and water by installing temporary covers, completing sections of Work, and isolating parts of completed system.

D. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

E. Use shipping braces between layers of stacked pipe.

F. Stack piping lengths no more than three layers high.

G. Store field joint materials in original shipping containers in dry area indoors.

H. Support pipes with nylon slings during handling.

1.11 AMBIENT CONDITIONS

A. Section 01 50 00 - Temporary Facilities and Controls: Requirements for ambient condition control facilities for product storage and installation.

B. Maintain storage temperature of 60 to 85 degrees F.

1.12 EXISTING CONDITIONS

A. Field Measurements:
   1. Verify field measurements prior to fabrication.
   2. Indicate field measurements on Shop Drawings.

PART 2 PRODUCTS

2.1 HORIZONTAL DIRECTIONAL DRILLING

A. Performance and Design Criteria:
1. Drilling Steering System: Remote with continuous electronic monitoring of boring depth and location.
2. Directional Change Capability: 90 degrees with 35-foot radius curve.
3. Minimum distance for single bores and between boring pits:

PIPE SIZE	BORING DISTANCE
1 to 1-1/2 in.	400 ft.
2 to 2-1/2 in.	350 ft.
3 to 6 in.	300 ft.
8 in. and greater	205 ft.

4. Ratio of Reaming Diameter to Pipe Outside Diameter:
a. Nominal Pipe Diameter of 6 Inches and Smaller: Maximum of 1.5.
b. Nominal Pipe Diameter Larger than 6 Inches: Submit recommended ratio and reaming procedures for review.

2.2 WATER SOURCE

A. Water: Potable, shall be obtained at the Contractor's expense.

2.3 TRACER WIRE

A. Tracer wire as specified in Section 33 11 13.

2.4 MATERIALS

A. Drilling Fluid:
1. Liquid bentonite clay slurry; totally inert with no environmental risk.

B. Restrained Joint PVC Pipe: AWWA C900, SDR 18.
1. The pipe wall shall be marked with NSF-pw or shall otherwise indicate conformance with ANSI/NSF Standards 14 and 61.
2. Fittings: Meet or exceed AWWA/ANSI C153/A21.53 or C110/A21.1, latest revision shall be rubber gasket compression type. Joints shall conform to AWWA/ANSI C111/A21.11, latest revision. Fitting body material shall be ductile iron conforming to ASTM 536. Pressure rating shall be 350 psi for 4" – 20" diameter fittings. Fittings shall have an exterior bituminous coating. Potable water fittings shall be cement lined and seal coated in accordance with AWWA/ANSI C104/A21.4. latest revision.
3. Joints for PVC: Pipe shall be joined using non-metallic couplings to form an integral system for maximum reliability and interchangeability. High-strength. Flexible thermoplastic splines shall be inserted into mating, precision machines grooves in the pipe and coupling to provide full 360 degree restraint with evenly distributed loading.
Couplings shall be designed for use at or above the pressure class of pipe with which they are utilized, and shall incorporate twin elastomeric sealing gaskets meeting the requirements

of ASTM F477. Joints shall be designed to meet the zero leakage test requirements. ASTM D3139.

4. Standard Pipe Lengths: 20 feet with a maximum of 15 percent random lengths not less than 10 feet.
5. Certa-Lok as manufactured by Certain Teed.
6. Connecting collars shall be a separate entity from the pipe.

C. Subsoil Fill: Type Municipal Subsoil in green belt areas as specified in Section 31 05 13 – Soils for Earthwork. As indicated on plans and specifications.

D. Granular Fill: Type MDOT Class II Sand as specified in Section 31 05 16 – Aggregates for Earthwork. As indicated on the plans and specifications.

2.5 MIXES

A. Concrete: As specified in Section 03 30 00 – Cast-in-Place Concrete.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for installation examination.

B. Verify that connections to existing piping system, sizes, locations, and invert elevations are according to Drawings.

3.2 PREPARATION

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for installation preparation.

B. Call MISS DIG at 811 not less than three working days before performing Work.
1. Request underground utilities to be located and marked within and surrounding construction areas.

C. Maintain access to existing facilities services and indicated to remain; modify pipe installation indicated on Drawings to maintain access to existing facilities.

D. Locate and identify utilities indicated to remain and protect from damage.

E. Notify utility company to remove or relocate utilities.

F. Identify required lines, levels, contours, and data locations.

G. Protect plant life, lawns, rock outcroppings, and other features remaining as portion of final landscaping.

H. Protect benchmarks such as existing structures, fences, sidewalks, paving curbs, and survey control points from excavating equipment and vehicular traffic.

3.3 INSTALLATION

A. Dewatering:
   1. Intercept and divert surface drainage, precipitation, and groundwater away from excavation using dikes, curb walls, ditches, pipes, sumps, or other approved means.
   2. Develop and maintain substantially dry subgrade during drilling and pipe installation.
   3. Comply with Municipal, State and Federal requirements for discharging water to watercourse, preventing stream degradation, and controlling erosion and sediment.

B. Excavation:
   1. Excavate subsoil as specified in Section 31 23 17 - Trenching.
   2. Excavate approach trenches and pits according to Shop Drawings and as Site conditions require; minimize number of access pits.
   3. Provide sump areas to contain drilling fluids.
   4. Install excavation supports as specified in Section 31 23 17 - Trenching.
   5. Restore areas after completion of drilling and carrier pipe installation.

C. Drilling:
   1. Drill pilot bore with vertical and horizontal alignment as indicated on Drawings.
   2. Survey entire drill path and mark entry and exit locations with stakes. If a magnetic guidance system is used, survey drill path for surface geomagnetic variations or anomalies.
   3. Guide drill remotely from ground surface to maintain alignment by monitoring signals transmitted from drill bit.
      a. Monitor depth, pitch, and position.
      b. Adjust drill head orientation to maintain correct alignment.
   4. Inject drilling fluid into bore to stabilize hole, remove cuttings, and lubricate drill bit and pipe.
   5. Continuously monitor drilling fluid pumping rate, pressure, viscosity, and density while drilling pilot bore, back reaming, and installing pipe to ensure adequate removal of soil cuttings and stabilization of bore.
      a. Provide relief holes when required to relieve excess pressure.
      b. Minimize heaving during pullback.
   6. After completing pilot bore, remove drill bit.
   7. Contractor shall verify location, depth, and grade of directional bore a minimum of every 25 feet.
   8. Submit to Engineer a graphical profile of the directional bore showing ground elevation and as-constructed bore elevation a minimum of every 25’ over the length of the bore.

D. Drilling Obstructions:
   1. If obstructions are encountered during drilling, notify Engineer immediately. Do not proceed around obstruction without Engineer’s approval.
   2. For conditions requiring more than 3 feet of deviation in horizontal alignment, notify Engineer for approval before resuming Work.
   3. Maintain adjusted bore alignment within easement or right-of-way.

E. Pipe:
   1. Install pipe, fittings and accessories in accordance with manufacturer's instructions.
   2. Install to the line and elevations shown on the drawings.
   3. Install a minimum cover of 5' – 6".
   4. Restrain pipe and fittings as detailed on the drawings and as recommended by the manufacturer.
   5. Coat bolts, nuts, threaded road, and those ferrous parts used in flanged, mechanical and restrained joints that are directly buried, with a corrosion protection material.
   6. Install reamer and pipe pulling head; select reamer with minimum bore diameter required for pipe installation.
   7. Attach pipe to pipe pulling head, and pull reamer and pipe to entry pit along pilot bore.
   8. Inject drilling fluid through reamer to stabilize bore and lubricate pipe.
   9. Install piping with horizontal and vertical alignment as shown on Drawings.
   10. Protect and support pipe being pulled into bore such that pipe moves freely and is not damaged during installation.
   11. Do not exceed pipe manufacturer's recommended pullback forces.
   12. Trace Wire:
      a. Install trace wire continuous with each bore.
      b. Splice trace wire only at intermediate bore pits.
      c. Terminate trace wire for each pipe run at structures along pipe system.
      d. All joints shall be made using Snakebite locking connectors as manufactured by Copperhead Industries.
      e. Include slack for connections and bring to surface in snake pit magnetized tracer box. Neatly pack slack in valve box.
      f. Test trace wire for continuity for each bore before acceptance.
   13. Provide sufficient length of pipe to extend past termination point to allow connection to other pipe sections.
   14. Allow minimum of 24 hours for stabilization after installing pipe before making connections to pipe.
   15. Mark location and depth of bore with spray paint.

F. Slurry Removal and Disposal:
   1. Contain excess drilling fluids at entry and exit points until recycled or removed from Site; provide recovery system to remove drilling spoils from access pits.
   2. Drilling Spoils:
      a. Remove, transport, and legally dispose of drilling spoils.
      b. Do not discharge drilling spoils in sanitary sewers, storm sewers, or other drainage systems.
      c. When drilling in suspected contaminated soil, test drilling fluid for contamination before disposal.
   3. If drilling fluid leaks to surface, immediately contain leak and barricade area from vehicular and pedestrian travel before resuming drilling operations.
   4. Complete cleanup of drilling fluid at end of each working day.

G. Backfilling:
   1. Install backfill as specified in Section 31 23 17 - Trenching.
   2. Backfill approach trenches and pits with subsoil fill to contours and elevations as indicated on Drawings.

3. Compact subsoil fill as specified in Section 31 23 17 - Trenching.

3.4 TOLERANCES

A. Section 01 40 00 - Quality Requirements: Requirements for tolerances.

B. Maximum Variation from Horizontal Position: 12 inches.

C. Maximum Variation from Vertical Elevation: 2 inches.

D. Minimum Horizontal and Vertical Clearance from Other Utilities: 10’ Horizontal, 18” Vertical.

E. Deviation:
   1. When pipe installation deviates beyond specified tolerances, abandon bore, remove installed pipe, rebore, and reinstall pipe in correct alignment.
   2. Fill abandoned bores greater than 3 inches in diameter with grout or flowable fill material.

3.5 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Requirements for inspecting and testing.

B. Upon completion of pipe installation, fill, flush, test and inspect pipe according to following:
   1. Water Distribution Pipe Testing: As specified in Section 33 11 13 - Public Water Utility Distribution Piping.
   2. Water Distribution Main Filling and Flushing: As specified in Section 33 11 13 – Public Water Utility Distribution Piping.
   3. Water Distribution Disinfection: As specified in Section 33 13 00 – Disinfection of Water Utility Distribution.

C. Compaction Testing: As specified in Section 31 23 17 - Trenching.

D. If tests indicate Work does not meet specified requirements, remove Work, replace, and retest.

E. Certify that equipment for drilling has been properly set up and is ready for drilling.

3.6 PROTECTION

A. Protect installation after placement prior to final connection and restoration of site.

3.7 CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements.

B. Upon completion of drilling and pipe installation, remove drilling spoils, debris, and unacceptable material from approach trenches and pits. Clean up excess slurry from ground.

C. Restore approach trenches and pits to original condition.

D. Remove temporary facilities for drilling operations as specified in Section 01 50 00 - Temporary Facilities and Controls.

END OF SECTION

SECTION 33 12 13
WATER SERVICE CONNECTIONS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Pipe and fittings for domestic water service connections to buildings.
2. Corporation stop assembly.
3. Curb stop assembly.
4. Bedding and cover materials.

B. Related Requirements:
1. Section 03 30 00 - Cast-In-Place Concrete.
2. Section 31 05 13 - Soils for Earthwork.
3. Section 31 05 16 - Aggregates for Earthwork.
4. Section 31 23 16 - Excavation.
5. Section 31 23 17 - Trenching.
6. Section 33 13 00 - Disinfecting of Water Utility Distribution

1.2 REFERENCE STANDARDS

A. American Society of Mechanical Engineers:
1. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.
2. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings, Class 25, 125, 250 and 800.
3. ASME B16.1 – Cast Iron Pipe Flanges and Flanged Fittings Class 25, 125, 250 and 800.
4. ASME B16.26 – Cast Bronze Fittings for Flared Copper Tubes.

B. ASTM International:
1. ASTM A48/A48M - Standard Specification for Gray Iron Castings.
2. ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings.
3. ASTM B88 - Standard Specification for Seamless Copper Water Tube.
4. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
5. ASTM D6938- Standard Test Method for Water Content of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
6. ASTM F-477 – Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

C. American Water Works Association:
1. AWWA C153- Ductile Iron Compact fittings, 3 inch through 24 inch and 54 inch through 64 inch for water service.

D. NSF:
1. NSF/ANSI Standard 61 Drinking Water System Components.
2. Michigan Safe Drinking Water Act 1976 PA 399, as amended.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit data on pipe materials, pipe fittings, corporation stop assemblies, curb stop assemblies, meters, meter setting equipment, service saddles, backflow preventer, and accessories.

1.4 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for submittals.

B. Project Record Documents: Record actual locations of piping mains, curb stops, connections, thrust restraints, and invert elevations.

C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with Municipal, State, and Federal standards.

B. Maintain one copy of each document on site.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. During loading, transporting, and unloading of materials and products, exercise care to prevent any damage.

C. Store products and materials off ground and under protective coverings and custody, away from walls and in manner to keep these clean and in good condition until used.

D. Exercise care in handling precast concrete products to avoid chipping, cracking, and breakage.

PART 2 PRODUCTS

2.1 WATER PIPING AND FITTINGS

A. Copper Tubing: Type K, annealed
   1. Fittings: ASME B16.26, cast bronze.
   2. Joints: Compression.
   3. Unions: Mueller H-15403
   4. NSF 61-G

B. Service Tubing: Polyethylene (PE): CTS-OD PE4710 per ASTM D2737, SDR9, 200 psi.
   1. Joints: Polyethylene (PE) Mechanical or compression with stainless steel stiffener. Fused or coupled services will not be allowed. Entire service shall be one continuous piece.
   2. NSF 61-G

C. Tracer Wire: Shall be installed on all water services, see Section 33 14 13 for wire specification.

2.2 CORPORATION STOP ASSEMBLY

A. Manufacturers:
   1. Mueller Company.
   2. Ford.
   3. Substitutions: Approved Equal.
   4. NSF 61-G

B. Furnish materials in accordance with Municipal standards.

C. Corporation Stops:
   1. Mueller Company.
   2. Ford.
   3. Substitutions: Approved Equal
   4. AWWA taper thread (C.C.), compression fittings for 3/4 inch, 1 inch, 1 1/2 inch and 2 inch services.
   5. Outlet end suitable for service pipe specified.
   6. NSF 61-G

D. Service Saddles:
   1. Mueller Company.
   2. Ford.
   3. Substitutions: Approved Equal.
   4. AWWA taper thread (C.C.), single strap with stainless steel band for 3/4 inch, 1 inch, 1 1/2 inch and 2 inch services.

2.3 CURB STOP ASSEMBLY

A. Manufacturers:
   1. Mueller Company.
   2. Ford.
   3. Substitutions: Approved Equal.
   4. NSF 61-G

B. Furnish materials in accordance with Municipal standards.

C. Curb Stops:
   1. Mueller Company.
   2. Ford.
   3. Substitutions: Approved Equal.

D. Curb Boxes and Covers:

1. Mueller, H10314 5’ – 6” Depth Bury, 48” Stainless Steel Rod with Pin.
2. Cast Iron Body, 2” I.D. of upper section, 1 piece lid.
3. Extension type with Arch Pattern Base.
4. Foot piece required for 1 1/2" or larger curb box.
5. Substitutions: Approved Equal.

2.4 ACCESSORIES

A. Concrete for Thrust Restraints: Concrete type specified in Section 03 30 00.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for installation examination.

B. Verify building service connection and municipal utility water main size, location, and invert are as indicated on Drawings.

3.2 PREPARATION

A. Section 01 70 00 - Execution and Closeout Requirements.

B. Cut pipe ends square, ream pipe and tube ends to full pipe diameter, remove burrs.

C. Remove scale and dirt on inside and outside before assembly.

D. Prepare pipe connections to equipment with flanges or unions.

3.3 INSTALLATION - CORPORATION STOP ASSEMBLY

A. Make connection for each different kind of water main using suitable materials, equipment and methods approved by the Engineer.

B. Provide service clamps for mains other than ductile iron pipe.

C. Screw corporation stops directly into tapped and threaded water mains at 10 and 2 o'clock position on main's circumference; locate corporation stops at least 24 inches apart longitudinally and staggered.

D. For plastic pipe water mains, provide full support for service clamp for full circumference of pipe, with minimum 2 inches width of bearing area; exercise care against crushing or causing other damage to water mains at time of tapping or installing service clamp or corporation stop.

E. Use proper seals or other devices so no leaks are left in water mains at points of tapping; do not backfill and cover service connection until approved by the Engineer.

3.4 BEDDING

A. Excavate pipe trench in accordance with Section 31 23 17 for Work of this Section.

B. Place bedding material at trench bottom, level fill materials in one continuous layer of at least 4 inches compacted depth; compact to 95 percent.

C. Backfill around sides and to top of pipe in accordance with Section 31 23 23.

D. Place fill material in accordance with Section 31 23 23.

3.5 INSTALLATION - PIPE AND FITTINGS

A. Route pipe in straight line.

B. Install pipe to allow for expansion and contraction without stressing pipe or joints.

C. Install access fittings to permit disinfection of water system performed under Section 33 13 00.

D. Form and place concrete for thrust restraints at each elbow or change of direction of pipe main.

E. Establish elevations of buried piping with not less than 5.5 ft of cover.

F. Backfill trench in accordance with Section 31 23 23.

G. Install Work in accordance with Municipal standards.

3.6 INSTALLATION - CURB STOP ASSEMBLY

A. Set curb stops on 4” MDOT 6A compacted crushed limestone.

B. Center and plumb curb box over curb stops. Set box cover flush with finished grade.

3.7 MAINTAINING WATER SERVICE

A. The Contractor shall coordinate any proposed interruptions in the existing water system with both the Owner and Engineer.

B. If any portions of the existing water mains cannot remain in service due to construction of the proposed water mains, the Contractor shall extend a temporary 1-1/4” polyethylene service to each customer affected by the outage.

C. The cost of these temporary connections, if required, shall be included in all other items of the Contract.

D. Services shall be reconnected to the existing water main.

3.8 SERVICE CONNECTIONS

A. Work shall include all material for complete operation.

B. This work shall not begin until the proposed main has been tested, disinfected, accepted by the Engineer and is in operation.

C. Services shall pass visual inspection by the Engineer, under system pressure prior to backfilling.

D. Install water service to ROW line. Connect to existing water service, if one exists.

3.9 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A. Flush and disinfect system in accordance with Section 33 13 00.

3.10 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Requirements for inspecting, testing.

B. Compaction Testing for Bedding: In accordance with ASTM D2922 and ASTM D3017.

C. When tests indicate Work does not meet specified requirements, remove Work, replace and retest.

D. Frequency of Compaction Tests: Taken at the discretion of the Engineer.

END OF SECTION

SECTION 33 12 16
WATER UTILITY DISTRIBUTION VALVES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Valves.
   2. Valve boxes.

B. Related Sections:
   1. Section 03 30 00 - Cast-In-Place Concrete.
   2. Section 31 05 16 - Aggregates for Earthwork.
   3. Section 31 23 16 - Excavation.
   4. Section 33 12 13 - Water Service Connections.
   5. Section 33 12 19 - Water Utility Distribution Fire Hydrants.
   6. Section 33 13 00 - Disinfecting of Water Utility Distribution.

1.2 REFERENCES

A. American Water Works Association:
   1. AWWA C500 - Metal-Seated Gate Valves for Water Supply Service.
   2. AWWA C509 - Resilient-Seated Gate Valves for Water-Supply Service.
   3. AWWA C550 - Protecting Epoxy Interior Coating for Valves and Hydrants.
   4. AWWA C223 – Fabricated Steel and Stainless Steel Tapping Sleeves.
   5. ASTM D3139 – Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.
   6. ASTM A126 – Gray Iron Casting for Valves, Flange and Pipe Fittings.
   7. AWWA C105 – Polyethylene Easement for Ductile Iron Pipe Systems.
   8. AWWA C111 – Rubber Gasket Joints for Ductile Iron Pressure Fittings.
   9. AWWA C116 – Protective Fusion Bonded Epoxy Coatings for the Interior and Exterior Surfaces for Ductile Iron and Gray Iron Fittings for Water Supply Service.
   10. AWWA C153 – Ductile Iron Compact fittings, 3 inch through 24 inch and 54 inch through 64 inch for water service.
   11. AWWA C104 – Cement-Mortar Lining for Ductile-Iron Pipe and Fitting for Water.
   12. AWWA C550 – Protective Interior Coatings for Valves and Hydrants.
   13. Michigan Safe Drinking Water Act 1976 PA 399, as amended.

B. National Sanitation Foundation:
   1. NSF14 – Plastic Piping System Components and Related Materials.
   2. NSF 61 - Drinking Water System Components - Health Effects

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Shop Drawing:
   1. Installation Plan: Submit description of proposed installation.

C. Design Data: Submit manufacturer's latest published literature include illustrations, installation instructions, maintenance instructions and parts lists.

D. Manufacturer’s Certificates: Submit Statement of Compliance, supporting data, from material suppliers attesting that valves and accessory provided meet or exceed AWWA Standards and specification requirements.

1.4 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for submittals.

B. Project Record Documents: Record actual locations of valves.

C. Provide Operation and Maintenance Data for valves.

1.5 QUALITY ASSURANCE

A. Perform work in accordance with Municipal, State and federal standards.

B. Valves: Mark valve body with manufacturer's name and pressure rating.

1.6 QUALIFICATIONS

A. Manufacturer: company specializing in manufacturing Products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing work of this section with minimum 3 years documented.

1.7 DELIVERY, STORAGE AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing and protecting products.

B. Prepare valves and accessories for shipment according to AWWA Standards and seal valve and ends to prevent entry of foreign matter into product body.

C. Store products in areas protected from weather, moisture, or possible damage; do not store products directly on ground; handle products to prevent damage to interior or exterior surfaces.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements: Environmental conditions affecting products on site.

B. Conduct operations not to interfere with, interrupt, damage, destroy, or endanger integrity of surface or subsurface structures or utilities, and landscape in immediate or adjacent areas.

1.9 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Requirements for coordination.

B. Coordinate work with the Township and utilities within construction area.

1.10 MAINTENANCE MATERIALS

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for maintenance materials.

PART 2 PRODUCTS

2.1 RESILIENT WEDGE GATE VALVES

A. Manufacturers:
   1. EJIW
   2. Mueller
   3. Substitutions: Approved Equal.

B. Resilient Wedge Gate Valves: AWWA C509; iron body, bronze or ductile iron; including the manufacturer's name, pressure rating, and year of fabrication cast into valve body.
   1. Resilient seats.
   2. Single Wedge
   3. Stem: Non-rising bronze stem, bronze trim.
   4. Operating Nut: 2 inch Square; open LEFT (counter clockwise) unless otherwise indicated, painted black.
   5. Ends: Mechanical joint.
   6. Coating: AWWA C550; interior/exterior.
   7. Sizes 12 inch diameter and smaller: 200 psig.
   8. Sizes 16 inch diameter and larger: 150 psig.
   9. Direction of Opening: Indicated by an arrow cast on the operating nut skirt.

2.2 VALVE BOXES

A. Manufacturers:
   1. Mueller
   2. EJIW
   3. Substitutions: Approved Equal.

B. Valve Boxes:
   1. Cast Iron 5 1/2-inch diameter, three piece adjustable screw type, for installation of a 6 foot trench.
   2. Valve box extensions for trench depths greater than 6’-6”.
   3. No. 6 round base for gate valves up to 8”.

4. No. 160 oval base for valves 10” and greater.
5. Cast iron lid, marked “Water”.

2.3 ACCESSORIES

A. Concrete for Thrust Restraints: Concrete type specified in Section 03 30 00

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.

B. Determine exact location and size of valves from Drawings; obtain clarification and directions from Engineer prior to execution of work.
   1. A minimum of two (2) valves must be placed at a mainline tee within a minimum distance as approved by the Department of Public Works Director.
   2. A minimum of three (3) valves must be placed a cross within a minimum distance as approved by the Department of Public Works Director.
   3. The maximum distance between valves shall be 500’ unless otherwise approved by the Department of Public Works Director.

C. Verify invert elevations of existing utilities prior to excavation and installation of valves.

3.2 PREPARATION

A. Identify required lines, levels, contours and datum locations.

B. Locate, identify, and protect utilities to remain from damage.

C. Do not interrupt existing utilities without permission and without making arrangements to provide temporary utility services.
   1. Notify Engineer not less than 3 days in advance of proposed utility interruption.
   2. Do not proceed without written permission from the Engineer.

D. Perform trench excavation, backfilling and compaction in accordance with Section 31 23 17.

3.3 INSTALLATION VALVES

A. Install valves in conjunction with pipe laying; set valves plumb.

B. Tighten nuts on valve body.

C. Set plumb on 4” x 8”x 16” concrete block. Use larger blocks for larger valves.

D. Backfill with MDOT 6A Crushed Limestone material to a minimum of 2 inches above the flange of the valve dome.

E. Leave valves in the open position except for the valves that connect to the existing water main.

3.4 INSTALLATION – VALVE BOXES

A. Set base on MDOT 6A Crushed Limestone material a minimum of 2 inches above the flange on the valve dome and centered over the operating nut. Backfill to finish subgrade according to Section 31 23 17 Trenching.

B. Set box plumb and centered over the valve operating nut.

C. Adjust the top valve box to match proposed finish grade.

D. Install extensions for trench depth greater than 6'-6".

3.5 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A. Flush and disinfect system in accordance with Section 33 13 00.

3.6 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements Field inspecting, testing, adjusting, and balancing.

B. Perform pressure test on domestic water distribution system in accordance with AWWA C600.

3.7 POLYETHYLENE ENCASEMENT

A. Install in accordance with manufacturer's instructions and AWWA C105.

B. Install to prevent contact between ductile iron pipe, fittings, valves and hydrants and the surrounding backfill and bedding material.

C. Encasement is not intended to be a completely air tight nor water tight enclosure.

D. Overlap joints a minimum of 18 inches and secure with adhesive tape or plastic string for the purpose of holding polyethylene in place until backfilling operations are complete.

E. Encase valves up to the operating nut without interfering with valve operation.

F. Repair rips, punctures and other damage with adhesive tape or with a piece of polyethylene secured in place.

END OF SECTION

SECTION 33 12 19
WATER UTILITY DISTRIBUTION FIRE HYDRANTS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Fire hydrants.

B. Related Sections:
   1. Section 03 30 00 - Cast-In-Place Concrete.
   2. Section 33 12 13 - Water Service Connections.
   3. Section 33 12 16 - Water Utility Distribution Valves.
   4. Section 33 13 00 - Disinfecting of Water Utility Distribution.

1.2 REFERENCES

A. American Water Works Association:
   1. AWWA C502 - Dry-Barrel Fire Hydrants.
   2. AWWA C550 - Protecting Epoxy Interior Coating for Valves and Hydrants.
   3. AWWA C600 - Installation of Ductile-Iron Water Mains and Their Appurtenances.

B. National Sanitation Foundation:
   1. NSF 61 - Drinking Water System Components - Health Effects

C. National Fire Protection Association:
   1. NFPA 281 - Recommended Practice for Fire Flow Testing and Marking of Hydrants

D. Michigan Safe Drinking Water Act 1976 PA 399, as amended.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Shop Drawing:
   1. Installation Plan: Submit description of proposed installation.

C. Design Data: Submit manufacturer's latest published literature include illustrations, installation instructions, maintenance instructions and parts lists.

D. Manufacturer’s Certificates: Submit Statement of Compliance, supporting data, from material suppliers attesting that hydrants and accessories provided meet or exceed AWWA Standards and specification requirements.

1.4 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for submittals.

B. Project Record Documents: Record actual locations of fire hydrants.

C. Provide Operation and Maintenance Data for fire hydrants.

1.5 QUALITY ASSURANCE

A. Provide uniform color scheme for fire hydrants in accordance with Municipal standards.

B. Perform work in accordance with Municipal standards.

1.6 QUALIFICATIONS

A. Manufacturer: company specializing in manufacturing Products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing work of this section with minimum 3 years documented.

1.7 DELIVERY, STORAGE AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing and protecting products.

B. Prepare hydrants and accessories for shipment according to AWWA Standards and seal hydrant and ends to prevent entry of foreign matter into product body.

C. Store products in areas protected from weather, moisture, or possible damage; do not store products directly on ground; handle products to prevent damage to interior or exterior surfaces.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements: Environmental conditions affecting products on site.

B. Conduct operations not to interfere with, interrupt, damage, destroy, or endanger integrity of surface or subsurface structures or utilities, and landscape in immediate or adjacent areas.

1.9 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Requirements for coordination.

B. Coordinate work with the Township and utilities within construction area.

PART 2 PRODUCTS

2.1 FIRE HYDRANTS

A. Manufacturers:
   1. EJIW 5BR250 WaterMaster
   2. Substitutions: Not Permitted.

B. Furnish materials in accordance with Municipal, State, and Federal standards.

C. Dry-barrel Break-away Type: AWWA C502; for 150 pounds working pressure, opening with the line pressure, mechanical joints, cast-iron body, compression type valve.
   1. Comply with AWWA C502
   2. Bury Depth: As indicated on the Drawings.
   3. Inlet Connection: 6 inches.
   4. Valve Opening: 5-1/4 inches diameter.
   5. Ends: Mechanical Joint.
   6. Bolts and Nuts: Stainless steel
   7. Coating: AWWA C550; interior.
   8. Direction of Opening: Left (counter clockwise) turn opening accordance with Municipal standards unless otherwise indicated and shall be plainly marked with an arrow near the operating nut showing the opening direction.
   9. Operating Nut: 3/4" square.
   10. Bronze mounted throughout with no iron to iron or steel contacts or threads.
   11. Operating stem in base and valve seat shall be bronze.
   12. Iron parts of high strength gray iron conforming ASTM Designation A-126 Class B.
   13. Minimum inside barrel dimension of 8 inches.
   14. Completely assembled at factory with drain opening sealed with threaded plug.

D. Residential: 5-inch size with 6-inch inlet connection 2- 2-1/2 inch hose nozzles and 1 – 5 inch pumper nozzle with a Harrington Storz C x X Dome fitting.

E. One pumper, two hose nozzles.
   1. Connection with American National Fire Hose. Thread in accordance with municipal standards.

F. Finish: Primer and two coats of enamel painted red above grade line and black below, color in accordance with the Municipal standards.

G. Hydrant Leads: PVC pipe with restrained joints.

H. Tested to 300 pounds hydrostatic pressure from inlet side with valve in both open and closed position.

I. Designed so one man can easily remove or replace the working parts without removing the main valve seat.

J. Provide hydrant flag – 3/8" Ultimate Junior Hydrant Marker by Vait products or equal.

K. Tracer wire access point mounted to hydrant flange.

2.2 ACCESSORIES

A. Concrete for Thrust Restraints: Concrete type specified in Section 03 30 00 Cast in Place Concrete.

B. Aggregate: Aggregate for hydrant drainage specified in Section 31 05 16 Aggregates for Earthwork.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.

B. Determine exact location and size of hydrants from Drawings; obtain clarification and directions from Engineer prior to execution of work.

C. Verify invert elevations of existing utilities prior to excavation and installation of fire hydrants.

3.2 PREPARATION

A. Identify required lines, levels, contours and datum locations.

B. Locate, identify, and protect utilities to remain from damage.

C. Do not interrupt existing utilities without permission and without making arrangements to provide temporary utility services.
   1. Notify Engineer not less than 3 business days in advance of proposed utility interruption.
   2. Do not proceed without written permission from the Engineer.

D. Perform trench excavation, backfilling and compaction in accordance with Section 31 23 17.

3.3 INSTALLATION

A. Install in accordance with manufacturer’s instructions.

B. Set as plan location and grade as directed by the Engineer.

C. Set on concrete block with minimum dimensions of 4 inches by 8 inches by 16 inches.

D. Restrain as detailed on the plans.

E. In addition in blocking, restrain hydrants with MugaLugs as specified for mechanical joints in 33 11 13.

F. Set plumb.

G. Rotate up to 180 degrees to face the direction shown on the plans.

H. Set only when the Engineer is present.

I. Obtain approval of the Engineer prior to backfilling.

J. Backfill according to Section 31 23 17– Trenching

3.4 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A. Flush and disinfect system in accordance with Section 33 13 00.

3.5 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.

B. Perform pressure test on domestic site water distribution system in accordance with AWWA C600 and/or C605.

3.6 RELOCATING EXISTING HYDRANTS

A. Relocate existing hydrants as noted on the drawings.

B. Remove hydrant, horizontal pipe lead and hydrant valve and box.

C. Plug and block existing water main at hydrant tee.

D. Re-install hydrant and valve according to paragraphs 3.3 and Section 33 12 16 Water Utility Distribution Valves.

E. Replace or repair material damaged during relocation operation.

F. Furnish and install additional material required to complete relocation.

3.7 REMOVING EXISTING HYDRANTS

A. Remove hydrant, horizontal pipe lead and hydrant valve and box.

B. Return existing hydrants and valves to location designated by the Owner.

C. Plug and Block existing water main at hydrant tee.

D. Replace or repair material damaged during removal operation.

E. Furnish and install additional material required to complete removal.

3.8 POLYETHYLENE ENCASEMENT

A. Install in accordance with manufacturer’s instructions and AWWA C105.

B. Install to prevent contact between ductile iron pipe, fittings, valves and hydrants and the surrounding backfill and bedding material.

C. Encasement is not intended to be a completely air tight nor water tight enclosure.

D. Overlap joints a minimum of 18 inches and secure with adhesive tape or plastic string for the purpose of holding polyethylene in place until backfilling operations are complete.

E. Encase valves up to the operating nut without interfering with valve operation.

F. Encase hydrants to the grade line.

G. Repair rips, punctures and other damage with adhesive tape or with a piece of polyethylene secured in place.

END OF SECTION

SECTION 33 13 00
DISINFECTING OF WATER UTILITY DISTRIBUTION

PART 1 GENERAL

1.1 SUMMARY

A. Section includes disinfection of potable water distribution and transmission system; and testing and reporting results.

B. Related Sections:
   1. Section 33 11 13 – Public Water Utility Distribution Piping

1.2 REFERENCES

A. American Water Works Association:
   1. AWWA B300 - Hypochlorites.
   2. AWWA B301 - Liquid Chlorine.
   3. AWWA C600 - Installation of Ductile-Iron Water Mains and Their Appurtenances.
   4. AWWA C605 – Underground Installation of PVC and PVCO Pressure Pipe and Fittings
   5. AWWA C651 - Disinfecting Water Mains
   6. NSF – Plastic Piping System Components and Related Materials.
   7. NSF/ANSI Standard 61 Drinking Water System Components
   8. Michigan Safe Drinking Water Act 1976 PA 399, as amended.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit procedures, proposed chemicals, and treatment levels for review.

C. Test Reports: Indicate results comparative to specified requirements.

D. Certificate: Certify cleanliness of water distribution system meets or exceeds EGLE requirements.

1.4 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for submittals.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with AWWA C651.

B. Maintain one copy of each document on site.

1.6 QUALIFICATIONS

A. Water Treatment Firm: Company specializing in disinfecting potable water systems specified in this section with minimum three years documented experience.

B. Submit bacteriologist's signature and authority associated with testing.

PART 2 PRODUCTS

2.1 DISINFECTION CHEMICALS

A. Chemicals: AWWA B300, Hypochlorite, AWWA B301 and Liquid Chlorine.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify piping system has been cleaned, inspected, and pressure tested.

C. Perform scheduling and disinfecting activity with start-up, water pressure testing, adjusting and balancing, demonstration procedures, including coordination with related systems.

3.2 INSTALLATION

A. Inject disinfectant, chlorine solution, through a corporation cock inserted in the horizontal axis of the water main.

B. Inject at the beginning of the pipe line or a valved section.

C. Slowly fill the line with potable water from the existing distribution line with an approved connection as specified by the Department of Public Works Director. At a minimum, a RPZ shall be in place prior to beginning to fill the line from the existing distribution system. The RPZ must meet all required standardizations and calibrations.

D. Bleed water from a valve at the end of the line to ensure distribution and prevent pressure build up in excess of 20 psi.

E. Inject disinfectant, chlorine solution, to obtain a minimum initial residual concentration of 40 to 50 mg/l in accordance with AWWA C651 “Continuous-Feed” method.

F. Chlorine residual shall be checked with a proper residual test kit that can measure elevated chlorine residuals.

G. Maintain disinfectant in pipe line for 24 hours and verify that the free chlorine residual concentration is no less than 10 mg/l.

H. Flush disinfectant from pipe line. Contractor shall employ dechlorination methods before discharging into storm sewer, open drains, or over land. Dechlorinate flushing water per EGLE requirements.

I. Flushing shall continue until the chlorine residual in the disinfected main is absent or no higher than is normally found in the distribution system.

J. Engineer, with assistance from the Contractor, will obtain samples for laboratory tests, a minimum of 24 hours after flushing the disinfectant from the pipeline.

K. Do not place water mains into service until two (2) consecutive laboratory tests show safe results collected at least 24 hours apart.

L. Repeat the complete disinfection process if laboratory results deem the water unsafe for drinking.

M. Replace corporation cocks with brass plugs when the disinfection process is complete and water is determined safe for drinking.

N. Do not place water mains into service all the requirements of AWWA C651-14 disinfecting water main are met.

O. Sampling: Sets of samples shall be collected approximately every 1200 feet of water main, plus one set from the end of the line and at least one from each branch greater than one pipe length.

3.3 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.

B. Disinfection, Flushing, and Sampling:
   1. Disinfect pipeline installation in accordance with AWWA C651. In addition, the use of chlorine pills or tablets placed during construction will not be permitted.
   2. Upon completion of retention period required for disinfection, flush pipeline until chlorine concentration in water leaving pipeline is no higher than that generally prevailing in existing system or is acceptable for domestic use.
   3. Legally dispose of chlorinated water. When chlorinated discharge may cause damage to environment, apply neutralizing chemical to chlorinated water to neutralize chlorine residual remaining in water.

3.4 WATER COST

A. The Contractor shall pay all water used during construction, including water main breaks and water necessary for testing, cleaning, and chlorinating water mains.

B. The actual volume of water used shall be determined by the Engineer.

C. The rate of pay for all water used shall be at the current rate per 1,000 gallons.

D. The water necessary to fill the volume of the water main at the completion of the project shall be paid by the Owner.

END OF SECTION

SECTION 33 14 13
PUBLIC WATER UTILITY DISTRIBUTION PIPING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Tapping sleeves and valves.
2. Valves and fire hydrants.
3. Positive displacement meters.
4. Underground pipe markers.
5. Precast concrete vault.
6. Pipe support systems.
7. Pile support systems.
8. Bedding and cover materials.
9. Pipe restraint.
10. Pressure testing.

B. Related Requirements:
1. Section 03 20 00 - Concrete Reinforcing
2. Section 03 30 00 - Cast-in-Place Concrete
3. Section 31 05 13 - Soils for Earthwork
4. Section 31 05 16 - Aggregates for Earthwork
5. Section 31 23 16 - Excavation
6. Section 31 23 17 - Trenching
7. Section 33 05 23 - Trenchless Utility Installation
8. Section 33 12 13 - Water Service Connections
9. Section 33 12 16 - Water Utility Distribution Valves
10. Section 33 12 19 - Water Utility Distribution Fire Hydrants
11. Section 33 13 00 - Disinfecting of Water Utility Distribution

1.2 REFERENCE STANDARDS

A. American Association of State Highway and Transportation Officials:
1. AASHTO T180 - Standard Method of Test for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. American Society of Mechanical Engineers:
1. ASME B16.1 - Cast Iron Pipe Flanges and Flanged Fittings.

C. ASTM International:
1. ASTM A126 – Gray Iron Casting for Valves, Flange and Pipe Fittings.
2. ASTM A536 – Standard Specification for Ductile Iron Castings.
3. ASTM D2241 – Standard Specification for Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).
4. ASTM D2922 – Standard Test Method for Density of Soil and Soil-Aggregate in place by Nuclear Methods (Shallow Depth).
5. ASTM D3035 – Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter.

6. ASTM D3139 - Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.
7. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).
8. ASTM F1674 – Standard Test Method for Joint Restraint Products for Use with PVC Pipe
9. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

D. American Water Works Association:
1. AWWA C104 - Cement-Mortar Lining for Ductile-Iron Pipe and Fittings.
2. AWWA C105 - Polyethylene Encasement for Ductile-Iron Pipe Systems.
3. AWWA C110 - Ductile-Iron and Gray-Iron Fittings.
4. AWWA C111 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
5. AWWA C115 - Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges.
6. AWWA C116 – Protective Fusion Bonded Epoxy Coatings for the Interior and Exterior Surfaces of Ductile Iron and Gray Iron Fittings for Water Supply Service.
7. AWWA C151 - Ductile-Iron Pipe, Centrifugally Cast.
8. AWWA C153 - Ductile-Iron Compact Fittings.
9. AWWA C223 – Fabricated Steel and Stainless Steel Tapping Sleeves
10. AWWA C600 - Installation of Ductile-Iron Mains and Their Appurtenances.
11. AWWA C605 - Underground Installation of PVC and PVCO Pressure Pipe and Fittings.
12. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. Through 12 In. (100 mm Through 300 mm), for Water Transmission and Distribution.
13. AWWA C905 - Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14 In. Through 48 In. (350 mm Through 1,200 mm).
14. AWWA C909 – Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe, 4 inch through 24 inch, for water, wastewater and reclaimed water service.
15. NSF 14 – Plastic Piping System Components and Related Materials.
16. NSF/ANSI – Standard 61 Drinking Water System Components.
17. Michigan Safe Drinking Water Act 1976 PA 399, as amended.
18. The Recommended Standards for Water Works Great Lakes Upper Mississippi River Board of State Public Health and Environmental Mangers (10 State Standards) latest edition.
19. The Suggested Practice for Water Works Design, Construction and Operations for Type I Public Water Supply, MDEQ, latest edition.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit data on pipe materials, pipe fittings, valves, and accessories.

C. Shop Drawings: Indicate piping layout, including piping specialties.

D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

E. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

F. Submit certification of manufacture in North America for all products.

1.4 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for closeout procedures.

B. Project Record Documents:
   1. Record actual locations of piping mains, valves, connections, thrust restraints, and invert elevations.
   2. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.5 QUALITY ASSURANCE

A. Perform Work according to Municipal, State, and Federal standards.

B. Maintain one copy of each document on-site.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Deliver and store valves in shipping containers with manufacturer's labeling in place.

C. Block individual and stockpiled pipe lengths to prevent moving.

D. Do not place pipe or pipe materials on private property or in areas obstructing pedestrian or vehicle traffic.

E. Store polyethylene and PVC materials out of sunlight.

1.7 EXISTING CONDITIONS

A. Field Measurements: Verify field measurements prior to fabrication. Indicate field measurements on Shop Drawings.

PART 2 PRODUCTS

2.1 WATER PIPING

A. PVC: AWWA C900, or AWWA C909, SDR 18, Class 235
   1. Fittings: Ductile iron, AWWA C110. compact fittings AWWA C153.
      a. Coating and Lining:
         1) Bituminous Coating: AWWA C110.
         2) Cement Mortar Lining: AWWA C104, double thickness.
      b. Bolts & Fasteners: Only NSS Core-Blue “T” Bolts and fasteners will be accepted.
   2. Joints: ASTM D3139, ASTM F477, PVC flexible elastomeric seals. Solvent-cement couplings are not permitted.
   3. Bolts & Fasteners: Only NSS Cor-Blue “T” bolts and fasteners will be accepted.

4. Standard Pipe Lengths: 20 feet with a maximum of 15 percent random lengths not less than 10 feet.
5. Pipe Wall: Shall be marked with NSF-pw or shall otherwise indicate conformance with ANSI/NSF Standards 14 and 61.

B. DI: Class 52 with cement mortar lining and bituminous coating.
1. Fittings: Ductile Iron, AWWA C110, compact fittings AWWA C153.
a. Coating and Lining:
1) Bituminous Coating: AWWA C110.
2) Cement Mortar Lining: AWWA C104.
b. Bolts and Fasteners: Only NSS Cor-Blue "T" bolts and fasteners will be accepted.
2. Joints: AWWA C-111. Push joints for pipe, mechanical joint for fittings.
3. Bolts & Fasteners: Only NSS Cor-Blue "T" bolts and fasteners will be accepted.
4. Standard Pipe Lengths: 20 feet with a maximum of 15 percent random lengths not less than 10 feet.
5. When a piece of ductile iron pipe is cut in the field it shall be checked with an OD tape to make sure the OD falls below the maximum OD as allowed by AWWA Standards.

2.2 CORROSION PROTECTIVE MATERIAL

A. Coatings: To be applied to buried nuts, bolts, threaded rod and flanges including those used for flanged, mechanical and restrained joints.
1. Manufacturers:
a. San Chem, Inc. 1600 South Canal Street, Chicago, IL 60616
Product: NO-OXG-GG-2
b. Coronado Paint Product: Coal Tar Epoxy, 10 mil (DMT)
c. Or equal.

B. Polyethylene Encasement: ANSI/AWWA C105/A21.5, 8 mil linear low-density polyethylene film or 4 mil high-density, cross-laminated polyethylene film. Encasement to be wrapped around all ductile iron pipes, fittings, valves and hydrants to within a foot of finish grade. Secure wrap in place according to manufacturer's instructions.

2.3 TAPPING SLEEVES AND VALVES

A. Tapping Sleeves:
1. Manufacturer List:
a. Romac
b. Mueller Company
c. Substitutions: Approved Equal.
2. Furnish materials according to AWWA C223 standards.
3. Description: Stainless Steel, dual-compression type, with inlet flange bolts and nuts of either 304 or 316 grade stainless steel.
4. Outlet Flange Dimensions and Drilling: ASME B16.1, Class 125 and MSS SP-60.

B. Tapping Valves:
1. Manufacturer List:
a. EJIW
b. Mueller Company
c. Substitutions: Approved Equal.

2. Valves shall be resilient wedge gate valves as specified in Water Utility Distribution Valves 33 12 16.

2.4 JOINT RESTRAINT

A. Manufacturer: MEGALUG by EBAA Iron.
   1. Series 1100 for mechanical joints restraints on ductile iron pipe.
   2. Series 1700 for push joint/bell restraints on ductile iron pipe.
   3. Series 2000 PV for mechanical joint restraints on PVC pipe.
   4. Series 1600 for push joint/bell restraints on PVC pipe.

B. Substitutions: Approved Equa1

C. Restrain all mechanical joints with retainer glands. Restrain all joints within lengths(s) according to restraint schedule.

D. Restrain hydrants, tees, valves, etc. according to manufacturer's requirements for application soil type, trench detail, test pressure of 150 psi, safety factor of 2 and depth of bury.

E. Mechanical joint restraint shall be incorporated into the design of the follower gland. The restraint mechanism shall consist of plurality of individually actuated gripping surfaces to maximize restraint capability. Glands shall be manufactured of ductile iron conforming to ASTM A536-80.

   The gland shall be such that it can replace the standardized mechanical joint gland and can be used with the standardized mechanical joint bell conforming to ANSI/AWWA C111/A21.11 and ANSI/AWWA C153/A21.53 of latest version. Twist off nuts, sized same as tee-head bolts, shall be used to insure proper actuating of restraining devices.

   The restraining glands shall have a pressure rating equal to that of the pipe on which it is used. The restraining glands shall have been tested to ASTM F1674, be listed by Underwriters Laboratories, and be approved by Factory Mutual. The restraint shall be MegaLug as manufactured by EBAA Iron or approved equal.

F. Ductile iron pipe restraint shall consist of a wedge action restraint ring on the spigot joined to a ductile iron follower gland behind that bell. The restraint ring shall have individually actuated wedges that increase their resistance to pullout as pressure or external forces increase. The restraint ring and its wedging components shall be made of a minimum grade of 60-42-10 ductile iron conforming to ASTM A536. The wedges shall be heat-treated to a minimum hardness of 370 BHN. Torque limiting twist off nuts shall be used to insure proper actuation of the restraining wedges. The follower gland shall be made of a minimum grade of 60-42-10 ductile iron conforming to ASTM A536. The connecting tie rods that join the two rings shall be made of low alloy steel that conforms to ANSI/AWWA C111/A21.11. The assembly shall have a rated pressure, with a minimum two to one safety factor, of 350 psi in sizes sixteen inch and below and 250 psi in the sized eighteen inch through thirty-six inch. The product shall be the Series 1700 MegaLug restraint harness manufactured by EBAA Iron or approved equal.

   Restraint for PVC pipe bell (AWWA C900) shall consist of the following. The restraint shall be manufactured of ductile iron conforming to ASTM A536. A split ring shall be utilized behind the pipe bell. A serrated ring shall be used to grip the pipe and a sufficient number of

bolts shall be used to connect the bell ring and the gripping ring. The combination shall have a minimum working pressure rating of 150 psi. The restraint shall be approved by Factory Mutual. The restraint shall be the Series 1600 as manufactured by EBAA Iron, Inc. or approved equal.

Retainer glands for C909 pipe must be specifically manufactured for use with C909 products.

2.5 VALVES AND FIRE HYDRANTS

A. Valves: As specified in Section 33 12 16 - Water Utility Distribution Valves.

B. Fire Hydrants: As specified in Section 33 12 19 - Water Utility Distribution Fire Hydrants.

2.6 VALVE BOXES

A. As specified in Section 33 12 16 – Water Distribution Valves.

2.7 CONCRETE ENCASEMENT AND CRADLES

A. Concrete: As specified in Section 03 30 00 - Cast-in-Place Concrete 3500 psi, 28-day reinforced concrete, air entrained, rough-trowel finish.

B. Concrete Reinforcement: As specified in Section 03 20 00 - Concrete Reinforcing.

C. Concrete Forming: As specified in Section 03 10 00 Concrete Forming Accessories.

2.8 MATERIALS

A. Bedding and Cover:
   1. Bedding: MDOT Class II Granular Material, as specified in Section 31 05 16 – Aggregates for Earthwork.
   2. Cover: MDOT Class II Granular Material as specified in Section 31 05 16 - Aggregates for Earthwork.
   3. Soil Backfill from above Pipe to Finish Grade:
      a. MDOT Class II Granular Material, as specified in Section 31 05 13 - Soils for Earthwork. MDOT 22A compacted crushed limestone in areas under pavement, native material for green belt areas.

2.9 FINISHES

A. Steel: Galvanizing, ASTM A123; hot-dip galvanize after fabrication.

2.10 TRACER WIRE

A. Single Strand – (Double Strand for HDD Only) - #12 Guage Copper – Clad Steel (CCS) – Extra High Strength Hard Drawn.

B. Color – Blue.

C. As manufactured by Copperhead Industries, LLC or approved equal.

D. Joints made using Locking Snakebite connectors as manufactured by Copperhead Industries.

E. Tested for continuity prior to acceptance.

F. Include slack for connections and bring to surface in Snake Pit magnetized tracer box. Model LD14TP with blue cover.

G. Install tracer box next to valve box. Secure tracer box to valve box using a minimum of two (2) stainless steal straps.

2.11 CULVERTS

A. Culverts shall be of the following materials and specifications:
6", 8", 10", 12", 15", 18" and 21" – 16 gage
2/3" x 1/2" Corrugation, C.M.P.
24" – 16 gage, 2 2/3"x1/2" Corrugation C.M.P.
30" – 14 gage, 2 2/3"x1/2" Corrugation C.M.P.
36" – 14 gage, 2 2/3"x1/2" Corrugation C.M.P.
48" – R.C.P. C-76-III
60" – R.C.P. C-76-III

B. Culverts shall include flared metal end section or concrete flared end section, dimple connection bands, complete sand backfill, and restoration of shoulder and/or berm.

2.12 ACCESSORIES

A. Concrete for Thrust Restraints: As specified in Section 03 30 00 - Cast-in-Place Concrete.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for installation examination.

B. Verify that existing utility water main size, location, and invert are as indicated on Drawings.

C. Verify that excavations are to required grade, dry and not over-excavated.

3.2 PREPARATION

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for installation preparation.

B. Cut pipe ends square, ream pipe and tube ends to full pipe diameter, remove burrs. Use only equipment specifically designed for pipe cutting. The use of chisels or hand saws is not permitted. Grind edges smooth with beveled end for push-on connections.

C. Remove scale and dirt on inside and outside before assembly.

D. Hand trim trench excavation to required elevations. Correct over excavation with compacted MDOT 6A compacted crushed limestone at no additional cost.

E. Remove large stones or other hard matter which could damage pipe.

3.3 BEDDING

A. Excavate pipe trench as specified in Section 31 23 17 - Trenching. Hand trim excavation for accurate placement of pipe to elevations indicated on Drawings.

B. Dewater excavations to maintain dry conditions and preserve final grades at bottom of excavation.

C. Provide sheeting and shoring as specified in Section 31 23 17 - Trenching.

D. Place bedding material MDOT Class II Granular Material at trench bottom, level fill materials in one continuous layer not exceeding 12 inches compacted depth; compact to 95 percent.

3.4 CONNECTION TO EXISTING WATER MAIN

A. The Contractor shall connect the proposed water main to the existing water main as shown on the plans or as directed by the Engineer.

B. The Contractor shall locate the existing water main prior to construction of the proposed water main and shall furnish and install the necessary fittings, including tees, bends, crosses, cutting-in-sleeves, pipe and/or adaptors as necessary to complete the construction.

C. No connection to the existing water main shall be made without Department of Public Works Director approval. An approved connection must be in place with, at a minimum, a RPZ installed meeting all required standardizations and calibrations.

3.5 CROSSING EXISTING UTILITIES

A. Where gas mains and services, water mains and services, sewers or any underground utilities cross the trench in open cut, compacted sand backfill shall be required to bed the crossing line.

B. The sand backfill shall extend to 4 inches above the top of the pipe or conduit which is being supported.

C. In addition to the sand backfill it may be necessary to support the pipe crossing the trench with a 6”x6” timber with ends supported on solid earth at both sides of the trench.

D. When supporting pipes with collars or bell joints, the timber shall be placed 3” below such collars or bells and the barrel of the pipe supported with hardwood blocking at 3 foot centers.

E. The cost of sand backfill used for supporting cross trench piping and the timber supports shall be included in the unit price bid for water main.

3.6 MAINTAINING WATER SERVICE

A. The Contractor shall coordinate any proposed interruptions in the existing water system with both the Owner and Engineer.

B. If any portions of the existing water mains cannot remain in service due to construction of the proposed water mains, the Contractor shall extend a temporary 1-1/4 inch polyethylene service to each customer affected by the outage.

C. Services shall be reconnected to the existing water main.

3.7 INSTALLATION

A. Pipe:
1. Install pipe according to AWWA C600 for D.I. pipe and AWWA C605 for PVC and PVCO and manufacturer's instructions.
2. Handle and assemble pipe according to manufacturer's instructions and as indicated on Drawings.
3. Install to the line and elevations shown on the drawings.
4. Water Main shall have a minimum cover of 5'-6" from proposed finish grade. Unless shown otherwise on the drawings or directed by the Engineer.
5. After the trench or tunnel has been graded, place a minimum 4 inches of compacted MDOT Class II Granular Material, as specified in Section 31 23 17 – Trenching in the trench as a bed for the pipe.
6. Hand trim for bell and spigot pipe joints.
7. Carefully lay the pipe on the bedding to insure positive bearing along the full length of the pipe.
8. Place 4" of MDOT Class II Granular Material along the side of the pipe, filling any void space under the pipe. Execute tamping with a T-bar or other tamping device approved by the Engineer.
9. Place additional tamped MDOT Class II Granular Material along the side of the pipe to a height equal to the top of the pipe.
10. Place and compact MDOT Class II Granular Material to 12" above the top of the pipe.
11. Restrain pipe and fittings as detailed on the drawings or as described in the specifications.
12. Steel Rods, Bolt, Lugs, and Brackets: Corrosion control per 2.3 Corrosion Protective Material.
13. Maintain 10 feet horizontal separation and 18 inches of vertical separation of water main from sewer piping according to 10 State Standards. Unless otherwise specified, all sewer piping shall be placed a minimum of 18 inches below the water main or water appurtenance being installed. If this cannot be achieved, approval must be given by the Department of Public Works Director.
14. Install ductile-iron piping and fittings according to AWWA C600.
15. Flanged Joints: Not to be used in underground installations except within structures.
16. Route pipe in straight line. Relay pipe that is out of alignment or grade.
17. Install pipe with no high points. If unforeseen field conditions arise that necessitate high points, install air release valves as directed by Engineer.
18. Install pipe to have bearing along entire length of pipe. Excavate bell holes to permit proper joint installation. Do not lay pipe in wet or frozen trench.
19. Prevent foreign material from entering pipe during placement.
20. Install pipe to allow for expansion and contraction without stressing pipe or joints.
21. Close pipe openings with watertight plugs during work stoppages.
22. Install access fittings to permit disinfection of water system performed under Section 33 13 00 - Disinfecting of Water Utility Distribution.
23. Establish and verify elevations of buried piping and furnish a copy to the Engineer.

B. Valves and Hydrants:

1. Install valves as specified in Section 33 12 16 - Water Utility Distribution Valves.
2. Install hydrants as specified in Section 33 12 19 - Water Utility Distribution Fire Hydrants.

C. Tapping Sleeves and Valves:
1. Install valves as specified in Section 33 12 16 - Water Utility Distribution Valves and tapping sleeves according to manufacturer's instructions.

3.8 POLYETHYLENE ENCASEMENT

A. Install in accordance with manufacturer's instructions and AWWA C105.

B. Install to prevent contact between ductile iron pipe, fittings, valves and hydrants and the surrounding backfill and bedding material.

C. Encasement is not intended to be a completely air tight nor water tight enclosure.

D. Overlap joints a minimum of 18 inches and secure with adhesive tape or plastic string for the purpose of holding polyethylene in place until backfilling operations are complete.

E. Encase valves up to the operating nut without interfering with valve operation.

F. Encase hydrants to the grade line.

G. Repair rips, punctures and other damage with adhesive tape or with a piece of polyethylene secured in place.

3.9 THRUST RESTRAINTS

A. Provide valves, tees, bends, caps, and plugs with concrete thrust blocks. Pour concrete thrust blocks against undisturbed earth. Locate thrust blocks at each elbow or change of pipe direction to resist resultant force and so pipe and fitting joints will be accessible for repair.

B. Install tie rods, clamps, setscrew retainer glands, or restrained joints. Protect metal-restrained joint components against corrosion per 2.3 Corrosion Protective Material. Do not encase pipe and fitting joints with concrete.

C. Install thrust blocks, tie rods, and joint restraint at dead ends of water main.

3.10 SERVICE CONNECTIONS

A. Install service connections as specified in Section 33 12 13 - Water Service Connections.

3.11 BACKFILLING

A. Place 4" of MDOT Class II Granular Material along the side of the pipe, filling any void space under the pipe. Execute tamping with tamping device approved by the Engineer.

B. Place additional tamped MDOT Class II Granular Material along the side of the pipe to a height equal to the top of the pipe.

C. Place and compact MDOT Class II Granular Material to 12" above the top of the pipe.

D. Maintain optimum moisture content of bedding material to attain required compaction density.

3.12 DISINFECTION OF POTABLE WATER PIPING SYSTEM

A. Flush and disinfect system as specified in Section 33 13 00 - Disinfecting of Water Utility Distribution.

3.13 FIELD QUALITY CONTROL

A. Field inspection will be performed under provisions of Section 01 40 00- Quality Requirements.

B. Compaction Testing for Bedding: According to ASTM D2922 and ASTM D6938.

C. When test indicate Work does not meet specified requirements, remove Work, replace, and retest.

D. Frequency of Compaction Tests: As determined by Engineer.

3.14 TESTING

A. Pressure Leakage Test:
   1. Perform Hydrostatic pressure test per AWWA C600 for D.I. Pipe and AWWA C605 for C900 PVC and C909 PVCO.
   2. Procedure: Tests shall be performed only after the pipeline has been properly filled, flushed, and purged of air. The specified test pressure shall be applied by means of an approved pumping assembly connected to the pipe in a manner satisfactory to the purchaser. The test pressure shall not exceed the design pressure of the pipe, fittings, valves, or thrust restraints. If necessary, the test pressure shall be maintained by additional pumping for the specified time. During tests, the system and exposed pipe, fittings, valves, and hydrants shall be carefully examined for leakage. Visible leaks shall be stopped. Defective elements shall be required or removed and replaced and the test repeated until the test requirements have been met.
   3. Test Duration: The duration of the hydrostatic test shall be 2 hour.
   4. Test Pressure: The hydrostatic test pressure shall be 150 psi.
   5. Test Allowance: The testing allowance shall be defined at the quantity of water that must be supplied to the pipe section being tested to maintain a pressure within 5 psi (34 kPa) of the specified hydrostatic test pressure. No installation will be accepted if the quantity of makeup water is greater than that determined by the formula:

$$Q = \frac{LD\sqrt{P}}{148{,}000} \qquad \text{(Eq 1)}$$

Where:

Q = quantity of makeup water, in gallons per hour
L = length of pipe section being tested, in ft.
D = Nominal Diameter of pipe in in.
P = Gauge test pressure in psi

   6. Allowance tables: Makeup water allowances for various pipe diameters and test pressures are provided in Table 2.

7. Hydrant: When hydrants are in the test section, the test shall be made against closed hydrant valves and open auxiliary valves.
8. Visible leaks: Visible leaks shall be repaired, regardless of the amount of leakage.

Table 2 Hydrostatic test makeup water allowances per 1,000 ft (305 m) of PVC pipe* --gph†

Avg. Test Pressure		Nominal Pipe Diameter, *in. (mm)*														
psi	*(kPa)*	4 (100)	6 (150)	8 (200)	10 (250)	12 (300)	14 (350)	16 (400)	18 (450)	20 (500)	24 (610)	30 (760)	36 (915)	42 (1,070)	48 (1,220)	
300	(2,070)	0.47	0.70	0.94	1.17	1.40	1.64	1.87	2.11	2.34	2.81	3.51	4.21	4.92	5.62	
275	(1,900)	0.45	0.67	0.90	1.12	1.34	1.57	1.79	2.02	2.24	2.69	3.36	4.03	4.71	5.38	
250	(1,720)	0.43	0.64	0.85	1.07	1.28	1.50	1.71	1.92	2.14	2.56	3.21	3.85	4.49	5.13	
225	(1,550)	0.41	0.61	0.81	1.01	1.22	1.42	1.62	1.82	2.03	2.43	3.04	3.65	4.26	4.86	
200	(1,380)	0.38	0.57	0.76	0.96	1.15	1.34	1.53	1.72	1.91	2.29	2.87	3.44	4.01	4.59	
175	(1,210)	0.36	0.54	0.72	0.89	1.07	1.25	1.43	1.61	1.79	2.15	2.68	3.22	3.75	4.29	
150	(1.030)	0.33	0.50	0.66	0.83	0.99	1.16	1.32	1.49	1.66	1.99	2.48	2.98	3.48	3.97	
125	(860)	0.30	0.45	0.60	0.76	0.91	1.06	1.21	1.36	1.51	1.81	2.27	2.72	3.17	3.63	
100	(690)	0.27	0.41	0.54	0.68	0.81	0.95	1.08	1.22	1.35	1.62	2.03	2.43	2.84	3.24	
75	(520)	0.23	0.35	0.47	0.59	0.70	0.82	0.94	1.05	1.17	1.40	1.76	2.11	2.46	2.81	
50	(340)	0.19	0.29	0.38	0.48	0.57	0.67	0.76	0.86	0.96	1.15	1.43	1.72	2.01	2.29	

* If the pipeline under test contains sections of various diameters, makeup water allowance will be the sum of the test allowance for each size.

† To obtain makeup water allowance in liters per hour, multiply the values in the table by 3.79.

3.15 FILLING AND FLUSHING

A. Lines shall be filled slowly with potable water at a maximum Velocity of 1 ft/sec (0.3 m/sec) while venting air. Precautions shall be taken to prevent entrapping air in the lines. After filling, lines shall be flushed at blowoffs and dead ends at a minimum velocity of 3 ft/sec (0.9 m/sec). A minimum of three changes of treated water shall be used in flushing operations. Valve shall be closed slowly to prevent excessive surges while maintaining positive pressure at all times throughout the new line. Flushing water shall be discharged without causing erosion damage, nuisance, or interruption of traffic. Disposal of flushing water shall be in accordance with SEC. 4.1.1.2 (AWWA C651). A special pipeline pig may be required when the required flushing velocity cannot be achieved or when needed to conserve water. The contractor shall make provisions for launching and retrieving the pig.

3.16 SCHEDULES

A. Pipe Restraint Table:

PIPE RESTRAINT SCHEDULE FOR GROUND BURIED PRESSURE PIPES [a] [b]							
LENGTH OF RESTRAINT REQUIRED [c]							
Deflection Angle / Pipe	22 1/2	33 3/4	45	56 1/4	67 1/2	78 3/4	90 , tee or dead end
6"	8	12	16	20	25	31	59
8"	10	15	20	26	33	40	77
10"	12	18	25	32	40	49	93
12"	14	21	29	37	47	57	109
14"	16	24	33	41	54	66	125
16"	18	27	37	47	60	74	141
18"	20	30	41	53	67	82	157
20"	22	33	45	58	73	90	172
24"	25	39	53	68	85	105	202
30"	30	46	63	82	102	126	244
36"	35	54	74	95	119	146	283
42"	40	61	83	107	133	164	320
48"	44	67	92	118	148	181	356

[a] This table is based on a test pressure of 150 PSI (Operating pressure + water hammer). For other test pressures, all values shall be increased or decreased proportionally.

[b] Table is valid for depths of bury 5' or greater. For depths of bury less than 5', consult D.I.P.R.A. guidelines.

[c] In each direction from point of deflection or termination, except for tee at which only the branch in the direction of the tee stem.

END OF SECTION

SECTION 33 31 13
PUBLIC SANITARY UTILITY SEWERAGE PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Sanitary sewerage pipe and fittings.
2. Connection to existing manholes.
3. Wye branches and tees.
4. Pile support systems.
5. Bedding and cover materials.

B. Related Requirements:
1. Section 036000 – Grouting
2. Section 310513 - Soils for Earthwork
3. Section 310516 - Aggregates for Earthwork
4. Section 312316 - Excavation
5. Section 312317 - Trenching
6. Section 312323 - Fill
7. Section 330513 - Manholes and Structures

1.2 REFERENCE STANDARDS

A. American Association of State Highway and Transportation Officials:
1. AASHTO T180 - Standard Method of Test for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. ASTM International:
1. ASTM C12 – Standard Practice for Installing Vitrified Clay Pipe Lines.
2. ASTM C415 – Standard Specification for Compression Joints for Vitrified Clay Pipe and Fittings.
3. ASTM C443 - Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.
4. ASTM C700 – Standard Specification for Vitrified Clay Pipe, Extra Strength, and Perforated.
5. ASTM C923 - Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals.
6. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3).
7. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3).
8. ASTM D2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
9. ASTM D2466 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
10. ASTM D2564 - Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems.

11. ASTM D2729 - Standard Specification for Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
12. ASTM D2855 - Standard Practice for Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings.
13. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).
14. ASTM D3034 - Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
15. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

1.3 COORDINATION

A. Section 013000 - Administrative Requirements: Requirements for coordination.

B. Coordinate Work of this Section with the system's operating personnel.

C. Notify affected utility companies at least 72 hours prior to construction.

1.4 SUBMITTALS

A. Section 013300 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit manufacturer catalog cuts and other information indicating proposed materials, accessories, details, and construction information.

C. Shop Drawings:
1. Indicate layout of sewer system and appurtenances.
2. Show size, materials, components of system, and burial depth.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

E. Test and Evaluation Reports: Submit reports indicating field tests made and results obtained.

F. Manufacturer Instructions:
1. Indicate special procedures required to install specified products.

G. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

H. Qualifications Statements:
1. Submit qualifications for manufacturer and installer.
2. Submit manufacturer's approval of installer.

1.5 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for submittals.

B. Project Record Documents: Record invert elevations and actual locations of pipe runs, valves, connections, manholes, and drop connections.

C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.6 QUALITY ASSURANCE

A. Perform Work according to Municipal, State, and Federal standards.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

C. Storage:
   1. Store materials according to manufacturer instructions.
   2. Store valves in shipping containers with labeling in place.

D. Protection:
   1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
   2. Block individual and stockpiled pipe lengths to prevent moving.
   3. Provide additional protection according to manufacturer instructions.

1.8 EXISTING CONDITIONS

A. Field Measurements:
   1. Verify field measurements prior to fabrication.
   2. Indicate field measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 SANITARY SEWERAGE PIPE AND FITTINGS

A. Plastic Pipe – Gravity Sewer, Less than 19’ deep:
   1. Material: Polyvinyl Chloride (PVC).
   2. Comply with ASTM 3034, SDR-35.
   3. End Connections: Bell and Spigot style, with rubber-ring-sealed gasket joint.
   4. Elastomeric gaskets complying with ASTM F477.
   5. Fittings: PVC
   6. Joints: Shall meet ASTM D3212.

B. Plastic Pipe – Gravity Sewers, 19’ and deeper:
   1. Material: Polyvinyl chloride (PVC).

2. Comply with ASTM D2241, SDR-26.
3. End Connections: Bell and spigot style, with rubber-ring-sealed gasket joint.
4. Elastomeric gaskets complying with ASTM F477.
5. Fittings: PVC
6. Joints: Shall meet ASTM D3139.

C. Vitrified Clay Pipe (VCP):
1. ASTM C700 – Extra Strength.
2. Flexible Compression joints per ASTM C425.

2.2 FLEXIBLE PIPE BOOT FOR MANHOLE PIPE ENTRANCES

A. Manufacturers:
1. Trelleborg – Kor N Seal Flexible Connector
2. Substitutions: As specified in Section 01 60 00 - Product Requirements.

B. Description:
1. Material: Ethylene propylene rubber (EPDM).
2. Comply with ASTM C923.
3. Attachment: Stainless-steel clamp and hardware.

2.3 MATERIALS

A. Bedding and Cover:
1. Bedding: Fill Type MDOT Class II A Sand as specified in Section 31 05 16 - Aggregates for Earthwork.
2. Cover: Fill Type MDOT Class II A Sand as specified in Section 31 05 16 - Aggregates for Earthwork.
3. Soil Backfill from above Pipe to Finish Grade:
   a. Soil Type S2, as specified in Section 31 05 13 - Soils for Earthwork.
   b. Soil Type S1, as specified in Section 31 05 13 - Soils for Earthwork for areas in the influence of pavement.

B. Grout: As specified in Section 03 60 00 – Grouting

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 017000 - Execution and Closeout Requirements: Requirements for installation examination.

B. Verify that trench cut is ready to receive Work.

C. Verify that excavations, dimensions, and elevations are as indicated on Drawings.

3.2 PREPARATION

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for installation preparation.

B. Hand trim trench excavation to required elevations. Correct over excavation with compacted Type MDOT 6A compacted crushed limestone as specified in 31 05 16 - Aggregates for Earthwork at no additional cost.

C. Remove large stones or other hard materials that could damage pipe or impede consistent backfilling or compaction.

D. Protect and support existing sewer lines, utilities, and appurtenances.

E. Utilities:
   1. Maintain profiles of utilities.
   2. Coordinate with other utilities to eliminate interference.
   3. Notify Engineer if crossing conflicts occur.

3.3 INSTALLATION

A. Bedding:
   1. Excavate pipe trench as specified in Section 31 23 17 - Trenching.
   2. Excavate to lines and grades as indicated on Drawings, or as required to accommodate installation of encasement.
   3. Dewater excavations to maintain dry conditions and to preserve final grades at bottom of excavation.
   4. Provide sheeting and shoring as specified in Section 31 23 17 - Trenching.
   5. Placement:
      a. Place bedding material at trench bottom.
      b. Level materials in continuous layer not exceeding 12 inches compacted depth.
      c. Compact to 95 percent of maximum density.

B. Plastic Piping:
   1. Install pipe, fittings, and accessories according to ASTM D2321, and seal joints watertight.
   2. Lay pipe to slope gradients as indicated on drawings by the use of a laser beam alignment method proven reliable and operated by competent experienced personnel.
   3. Maximum Variation from Indicated Slope: 1/8 inch in 10 feet.
   4. Begin at downstream end and progress upstream.
   5. Assemble and handle pipe according to manufacturer's instructions, except as may be modified on Drawings.
   6. Keep pipe and fittings clean until Work has been completed and accepted by Architect/Engineer.
   7. Cap open ends during periods of Work stoppage.
   8. Lay bell and spigot pipe with bells upstream.
   9. Polyethylene Pipe Encasement: Conform to AWWA C105, Method A.
   10. Backfill and compact as specified in Section 31 23 17 - Trenching.

11. Do not displace or damage pipe when compacting.

C. Vitrified Clay Piping (VCP):
1. Install per ASTM C12 and seal joints water tight.
2. Lay pipe to slope gradients as indicated on drawings by the use of a laser beam alignment method proven reliable and operated by competent experienced personnel.
3. Maximum Variation from Indicated Slope: 1/8 inch in 10 feet.
4. Begin at downstream end and progress upstream.
5. Assemble and handle pipe according to manufacturer's instructions, except as may be modified on Drawings or by Architect/Engineer.
6. Keep pipe and fittings clean until Work has been completed and accepted by Architect/Engineer.
7. Cap open ends during periods of Work stoppage.
8. Lay bell and spigot pipe with bells upstream.
9. Polyethylene Pipe Encasement: Conform to AWWA C105, Method A.
10. Backfill and compact as specified in Section 31 23 17 - Trenching.
11. Do not displace or damage pipe when compacting.

D. Connection to Existing Structures:
1. Drilling:
   a. Core drill existing manhole to clean opening.
   b. Use of pneumatic hammers, chipping guns, and sledge hammers are not permitted.
2. Install watertight Kor N Seal boot and seal.
3. Prevent construction debris from entering existing sewer line when making connection.

E. Tees:
1. Concurrent with pipe-laying operations, install pipe tees and/or wyes at locations indicated on Drawings.

F. Backfilling:
1. Backfill around sides and to top of pipe with cover fill in minimum lifts of 12 inches, tamp in place, and compact to 95 percent of maximum density; place and compact material immediately adjacent to pipes to avoid damage to pipe and prevent pipe misalignment.

G. FIELD QUALITY CONTROL

H. Section 014000 - Quality Requirements: Requirements for inspecting and testing.

I. Testing:
1. If tests indicate that Work does not meet specified requirements, remove Work, replace, and retest.
2. Compaction Testing - Comply with ASTM D1557.

3.4 PROTECTION

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for protecting finished Work.

B. Protect pipe and aggregate cover from damage or displacement until backfilling operation is in progress.

END OF SECTION

SECTION 33 41 13
PUBLIC REAR LOT DRAINAGE PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Storm drainage piping.
   2. Piping accessories.
   3. Drainage structures.
   4. Bedding and cover materials.
   5. Pile support systems.
   6. Pipe support systems.
   7. Concrete encasement and cradles.

B. Related Sections:
   1. Section 33 05 13 - Public Manholes and Structures

1.2 REFERENCE STANDARDS

A. All references refer to the most recent version.

B. Code of Ordinances Tittabawassee Township, Michigan
   1. Chapter 34. Land Divisions and Subdivisions
   2. Chapter 66. Utilities

C. Saginaw County Public Works Stormwater Management Design Requirements

D. American Association of State Highway and Transportation Officials:
   1. AASHTO M170 - Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
   2. AASHTO M252 - Standard Specification for Corrugated Polyethylene Drainage Pipe.
   3. AASHTO M288 - Standard Specification for Geotextile Specification for Highway Applications.
   4. AASHTO M294 - Standard Specification for Corrugated Polyethylene Pipe, 300- to 1500-mm (12- to 60-in.) Diameter.
   5. AASHTO T180 - Standard Method of Test for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

E. ASTM International:
   1. ASTM B745 - Standard Specification for Corrugated Aluminum Pipe for Sewers and Drains.
   2. ASTM C76 - Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
   3. ASTM C443 - Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.
   4. ASTM C969 - Standard Practice for Infiltration and Exfiltration Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines.

5. ASTM C1103 - Standard Practice for Joint Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines.
6. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3).
7. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3).
8. ASTM D2235 - Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings.
9. ASTM D2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
10. ASTM D2564 - Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems.
11. ASTM D2680 - Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) and Poly(Vinyl Chloride) (PVC) Composite Sewer Piping.
12. ASTM D2729 - Standard Specification for Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
13. ASTM D2855 - Standard Practice for Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings.
14. ASTM D3034 - Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
15. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).
16. ASTM F405 - Standard Specification for Corrugated Polyethylene (PE) Pipe and Fittings.
17. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
18. ASTM F667 - Standard Specification for 3 through 24 in. Corrugated Polyethylene Pipe and Fittings.
19. ASTM F2881 – Standard Specification for polypropylene (PP) dual wall pipe and fittings.

F. MDOT Standard Specifications for Construction, current edition.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit data indicating pipe and pipe accessories.

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

D. Manufacturer Instructions: Submit detailed instructions on installation requirements, including storage and handling procedures.

E. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

F. Qualifications Statements:
1. Submit qualifications for manufacturer and installer.
2. Submit manufacturer's approval of installer.

1.4 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for submittals.

B. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.5 QUALITY ASSURANCE

A. Perform Work according with MDOT Standard Specifications for Construction, current edition.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years' documented experience.

B. Installer: Company specializing in performing Work of this Section with minimum three years' documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

C. Storage:
   1. Store materials according to manufacturer instructions.
   2. Block individual and stockpiled pipe lengths to prevent moving.
   3. Do not place pipe or pipe materials on private property or in areas obstructing pedestrian or vehicle traffic.
   4. Do not place pipe flat on ground; cradle to prevent point stress.

D. Protection:
   1. Keep UV-sensitive materials out of direct sunlight.
   2. Provide additional protection according to manufacturer instructions.

PART 2 - PRODUCTS

2.1 STORM DRAINAGE PIPING

A. ADS N-12 Dual Wall with smooth interior and corrugated exterior minimum pipe size shall be a minimum of 6”. Polypropylene pipe shall be joined with a gasketed integral bell & spigot joint and shall be watertight according to the requirements of ASTM D3212 unless otherwise indicated on the plans.

B. Reinforced Concrete Pipe
   1. Comply with ASTM C76

2.2 DRAINAGE STRUCTURES

A. Description: As specified in Section 33 05 13.16 - Public Manholes and Structures.

B. A minimum diameter of 2’ will be required for all manhole structures unless otherwise approved by the Department of Public Works Director.

2.3 MATERIALS

A. Description: As specified in Section 31 05 16 – Aggregates for Earthwork

B. Bedding and Cover:
   1. As specified in Section 31 05 16 – Aggregates for Earthwork and as shown on the drawings.

C. Subsoil: No rocks more than 6 inches in diameter, frozen earth, or foreign matter.

2.4 ACCESSORIES

A. Geotextile filter fabric as specified in Section 31 05 19.13 for non-woven geotextile fabric.

2.5 REINFORCING

A. Steel reinforcing bars and mesh must comply with American Iron and Steel requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for installation examination.

B. Verify that excavation base is ready to receive Work.

C. Verify that excavations, dimensions, and elevations are as indicated on Drawings.
   1. Pipe shall have a minimum of 2’ of cover and meet all minimum slope requirements.
   2. Catch Basins shall be installed a minimum of every 300’ and at any bend, 90 degree turn or dead end.
   3. Catch Basins and Manholes shall be a minimum of 2’ in diameter precast concrete structures.

D. All drainage systems shall connect to an approved storm water drainage system.

E. Where a proposed subdivision or condominium abuts the rear of an existing subdivision or condominium, the proposed subdivision must install rear lot drainage.

F. It is the responsibility of the developer to construct rear lot drainage systems at 100 percent their cost prior to final plat or site plan approval. The proprietor and engineer of the plat or condominium shall certify the rear lot drainage system has been installed in accordance with the proposed plan and Township Standard Specifications for Construction.

3.2 PREPARATION

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for installation preparation.

B. Correct over-excavation with per Section 31 23 17 - Trenching.

C. Remove large stones and other hard matter that could damage piping or impede consistent backfilling or compaction.

D. Hand trim excavations to required elevations. Correct over excavation with fill material.

E. Cut out soft areas of subgrade not capable of insitu compaction. Backfill with MDOT 6A course aggregate and compact to density equal to or greater than requirements for support of pipe or structure and subsequent backfill material.

F. Hand trim excavation for accurate placement of pipe to elevations indicated allowing for bedding thickness.

3.3 INSTALLATION

A. Excavation and Bedding:
   1. Excavate pipe trench as specified.
   2. Hand trim excavation for accurate placement of piping to indicated elevations.
   3. Dewater excavations to maintain dry conditions to preserve final grades at bottom of excavation.
   4. Provide sheeting and shoring as needed.
   5. Level materials in continuous layers not exceeding compacted depth of 12 inches.
   6. Maintain optimum moisture content of bedding material to attain required compaction density.
   7. Install pipe on compacted subgrade meeting bedding requirements.

B. Piping:
   1. Install piping according to the manufacturer’s instructions.
   2. Handle and assemble pipe according to manufacturer's instructions and as indicated on the drawings.
   3. Install to the line and elevations shown on the drawings.
   4. After the trench has been graded, place a minimum 4 inches of compacted MDOT Class II Granular material in the trench as a bed for the pipe.
   5. Hand trim for bell and spigot pipe joints.
   6. Carefully lay the pipe on the bedding to insure positive bearing along the fill length of pipe.
   7. Place 4” of MDOT Class II Granular material along the side of the pipe, filling any void space under the pipe. Execute tamping with a T bar or other tamping device approved by the Engineer.
   8. Place additional tamped MDOT Class II Granular material along the side of the pipe to a height equal to the top of the pipe.
   9. Place and compact MDOT Class II Granular material to 12” above the top of the pipe.

C. Installation Standards: Install Work according to MDOT Standard Specifications for Construction, current edition.

3.4 OWNERSHIP

A. Rear lot drainage systems shall be owned and maintained by the subdivision/condominium. Public utility maintenance easements ten feet wide shall be provided for the rear lot drainage system in all cases, even when rear lot drainage may not be required. Easements shall be written to permit neighboring property owners with a specific interest in the rear lot drainage as it may affect their property. For example, a lot owner in a subdivision may repair a drain tile which extends through their neighbor's lot provided the neighbor's lot is restored to its original condition.

3.5 TOLERANCES

A. Section 01 40 00 - Quality Requirements: Requirements for tolerances.

B. Maximum Variation from Indicated Pipe Slope: 1/8 inch in 10 feet.

3.6 FIELD QUALITY CONTROL

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for testing, adjusting, and balancing.

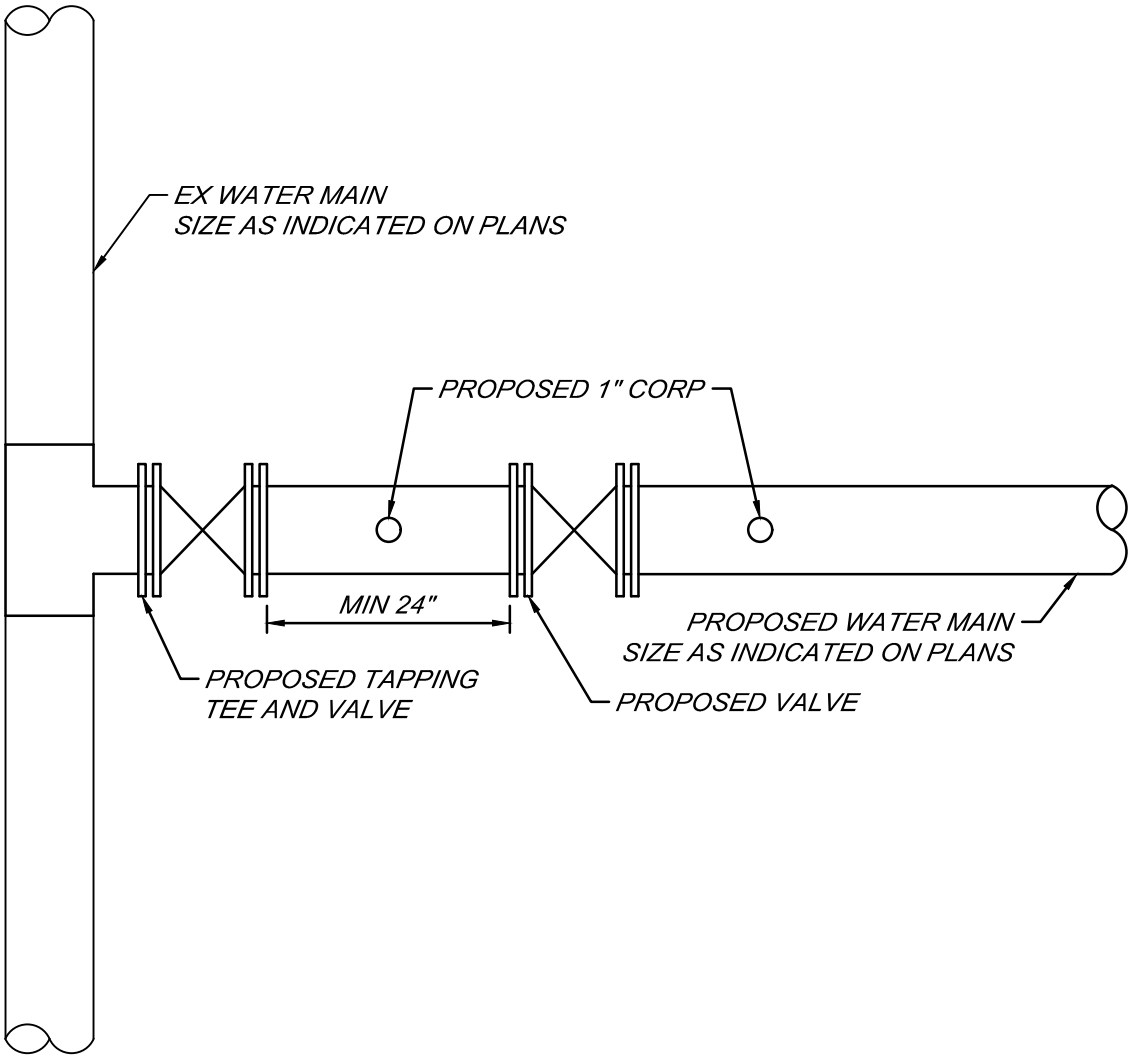
B. Request inspection by Engineer prior to and immediately after placing aggregate cover over pipe.

3.7 PROTECTION

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for protecting finished Work.

B. Protect pipe and aggregate cover from damage or displacement until backfilling operation is in progress.

END OF SECTION

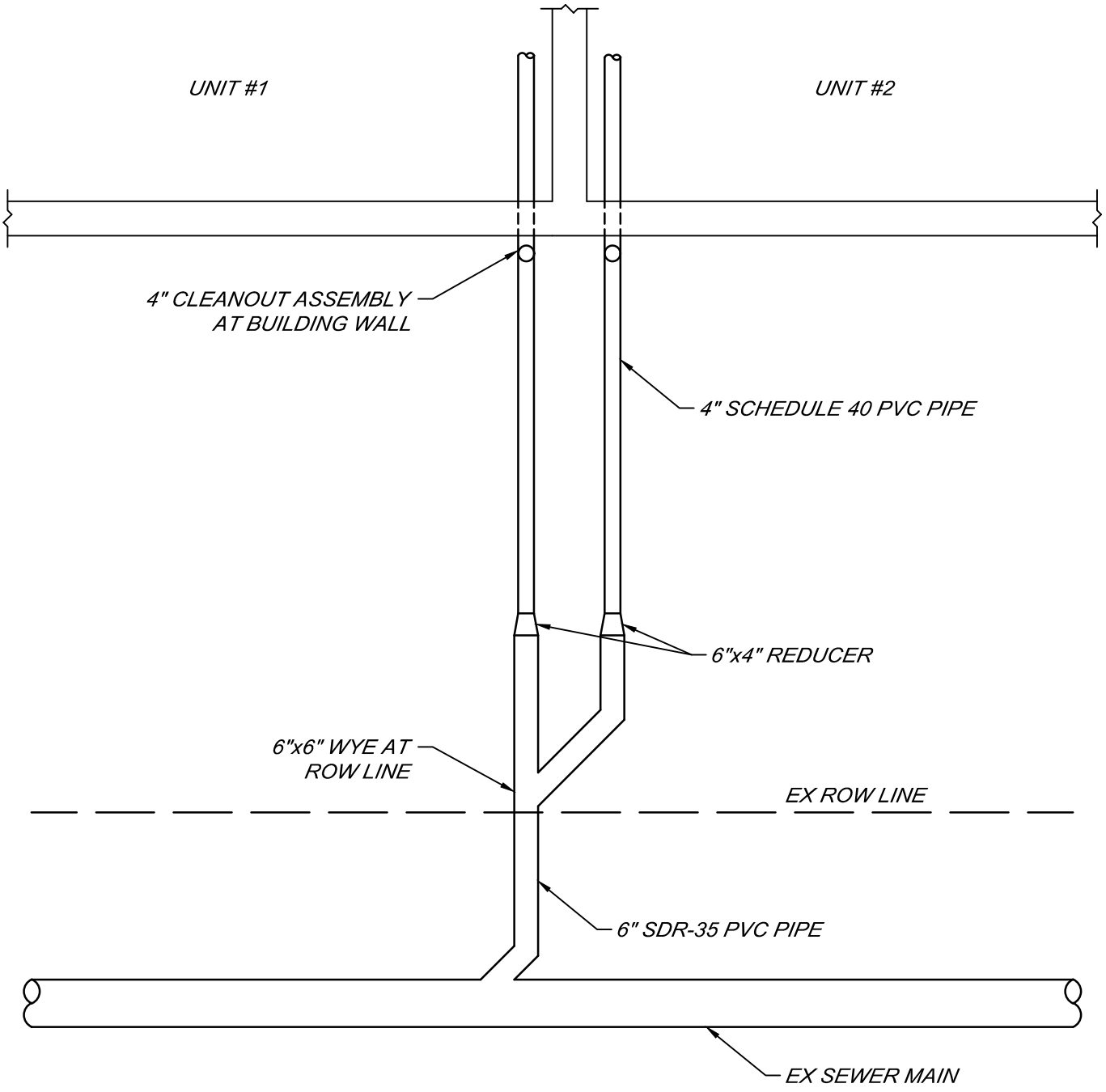


NOTES:

1. DETAIL MUST BE APPROVED BY DPW SUPERVISOR PRIOR TO INSTALLATION.
2. ALL WORK MUST BE COMPLETED IN ACCORDANCE WITH THE TITTABAWASSEE TOWNSHIP STANDARD SPECIFICATION FOR CONSTRUCTION.

TITTABAWASSEE TOWNSHIP
145 S. Second St.
P.O. Box 158
Tel. 989-695-9512
Fax. 989-695-5060

ALTERNATE CONNECTION WITH DOUBLE VALVES DETAIL

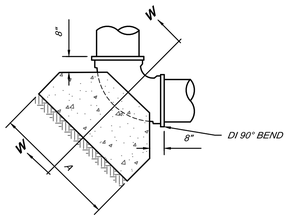


NOTES:

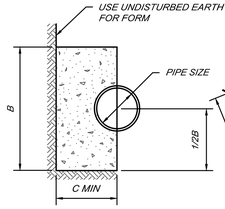
1. SEWER MAIN AND 6" SDR-35 PVC PIPE TO THE ROW LINE WILL BE CONSTRUCTED DURING DEVELOPMENT.
2. 4" SCHEDULE 40 PVC PIPE TO BE CONSTRUCTED BY HOME BUILDER.
3. IF FERNCOS ARE USED THEY MUST HAVE STAINLESS STEEL BANDS OR HAVE A CONCRETE COLLAR POURED AROUND THEM.
4. DETAIL MUST BE APPROVED BY DPW SUPERVISOR PRIOR TO INSTALLATION.
5. ALL WORK MUST BE COMPLETED IN ACCORDANCE WITH THE TITTABAWASSEE TOWNSHIP STANDARD SPECIFICATION FOR CONSTRUCTION.

TITTABAWASSEE TOWNSHIP
145 S. Second St.
P.O. Box 158
Tel. 989-695-9512
Fax. 989-695-5060

ALTERNATE DUPLEX SEWER LEAD DETAIL



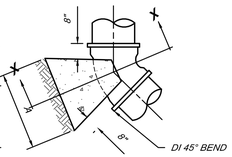
PLAN



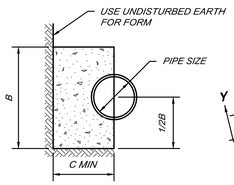
SEC. W-W

DETAIL OF BLOCK FOR 90° BEND OR TEE

Q - MIN CU. YD. CONCRETE PER BLOCK



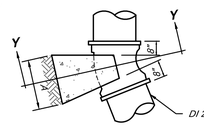
PLAN



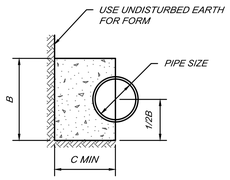
SEC. X-X

DETAIL OF BLOCK FOR 45° BEND

Q - MIN CU. YD. CONCRETE PER BLOCK



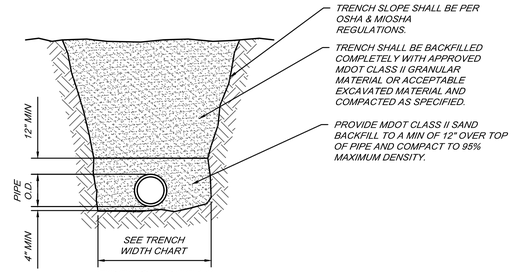
PLAN



SEC. Y-Y

DETAIL OF BLOCK FOR 22 1/2° BEND

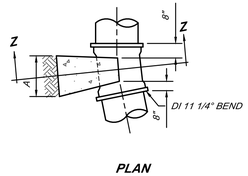
Q - MIN CU. YD. CONCRETE PER BLOCK



TRENCH DETAIL

TRENCH WIDTH CHART

PIPE SIZE	TRENCH WIDTH	
	MINIMUM	MAXIMUM
6"	18"	24"
8" & 10"	24"	30"
12" & 15"	30"	36"
18"	34"	40"
21"	38"	42"
24"	42"	46"
27"	45"	49"
30"	49"	53"
36"	56"	60"
LARGER THAN 36"	I.D.+20"	I.D.+24"



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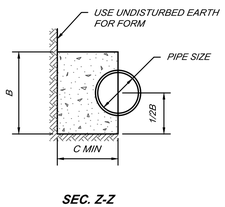
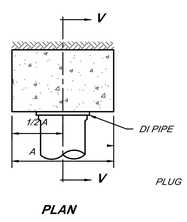


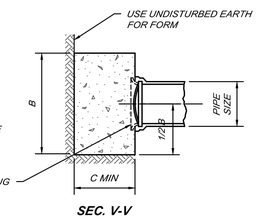
SEC. Z-Z

DETAIL OF BLOCK FOR 11 1/4° BEND

Q - MIN CU. YD. CONCRETE PER BLOCK



PLAN



SEC. V-V

DETAIL OF BLOCK FOR PLUG

Q - MIN CU. YD. CONCRETE PER BLOCK

PIPE SIZE	90° BEND OR TEE				45° BEND				22 1/2° BEND				11 1/4° BEND				PLUG			
	A	B	C	Q	A	B	C	Q	A	B	C	Q	A	B	C	Q	A	B	C	Q
6",8" & 10"	3'-0"	2'-0"	1'-3"	0.3	2'-0"	1'-6"	1'-3"	0.1	1'-6"	1'-0"	1'-3"	0.1	1'-0"	1'-0"	1'-3"	0.1	2'-0"	2'-0"	1'-6"	0.2
12"	3'-0"	2'-6"	1'-6"	0.4	2'-0"	2'-0"	1'-6"	0.2	2'-0"	1'-0"	1'-6"	0.1	1'-0"	1'-0"	1'-6"	0.1	2'-0"	2'-6"	1'-6"	0.3
16"	4'-0"	3'-0"	2'-0"	0.9	3'-0"	3'-0"	2'-0"	0.5	2'-0"	2'-0"	2'-0"	0.2	1'-0"	2'-0"	2'-0"	0.1	3'-0"	3'-6"	1'-9"	0.7
20"	5'-0"	4'-6"	2'-6"	1.23	4'-0"	3'-0"	2'-6"	0.82	3'-0"	2'-6"	2'-6"	0.58	2'-0"	1'-10"	2'-6"	0.3	4'-0"	4'-0"	2'-6"	1.45
24"	6'-0"	5'-6"	3'-0"	2.74	4'-0"	4'-0"	3'-0"	1.21	3'-0"	3'-0"	3'-0"	0.8	2'-6"	2'-2"	3'-0"	0.42	5'-0"	5'-0"	3'-0"	2.78
30"	7'-0"	7'-0"	3'-9"	5.39	5'-6"	5'-0"	3'-9"	2.14	4'-0"	3'-0"	3'-9"	1.35	3'-0"	2'-8"	3'-9"	0.98	6'-0"	6'-0"	3'-9"	4.96
36"	8'-0"	7'-6"	4'-6"	8.12	6'-0"	6'-0"	4'-6"	4.03	5'-0"	4'-0"	4'-6"	2.77	3'-0"	3'-2"	4'-6"	1.36	8'-0"	6'-0"	4'-6"	8.00
42"	9'-0"	8'-0"	5'-3"	11.58	7'-7"	7'-0"	5'-3"	6.43	5'-0"	5'-0"	5'-3"	3.85	4'-0"	3'-9"	5'-3"	2.17	8'-0"	8'-0"	5'-3"	12.44

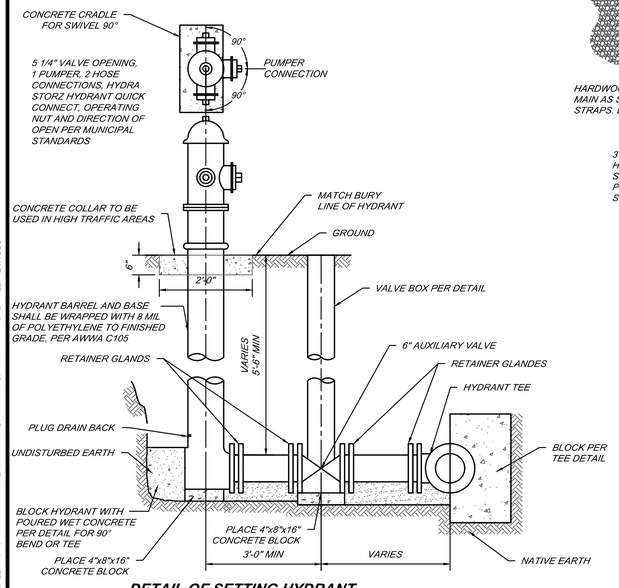
NOTE:

THE CONTRACTOR SHALL SECURE ALL MECHANICAL JOINT FITTINGS WITH RETAINER GLANDS IN ADDITION TO THRUST BLOCKING RETAINER GLANDS SHALL BE MEGA-LUG AS MANUFACTURED BY EBAA IRON OR APPROVED EQUAL

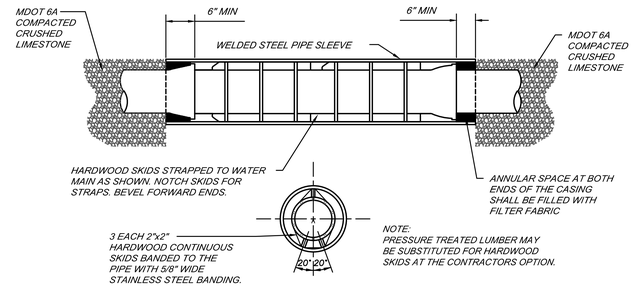
ALTERNATE FOR HYDRANTS: TWO 3/4" THREADED RESTRAINING RODS MAY BE USED AT HYDRANTS IN ADDITION TO ALL BLOCKING. RODS SHALL RECEIVE A MINIMUM DRY FILM OF 15 MILS (DTM) OF COAL TAR EPOXY. ALL COSTS ASSOCIATED WITH THIS WORK SHALL BE INCLUDED IN THE UNIT PRICE BID PER EACH HYDRANT INSTALLED.

WRAP ALL FITTINGS, VALVES, HYDRANTS, AND ALL DI PIPE IN 8 MIL POLYETHYLENE SHEET PER AWWA C105

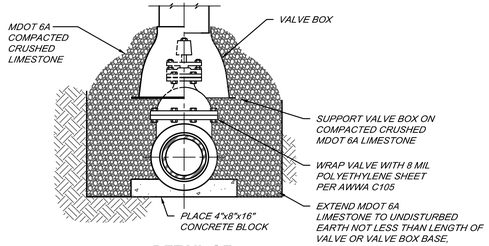
THE CONCRETE USED FOR BLOCKING SHALL HAVE A MINIMUM COMPRESSIVE STRENGTH OF 3500 PSI IN 28 DAYS.



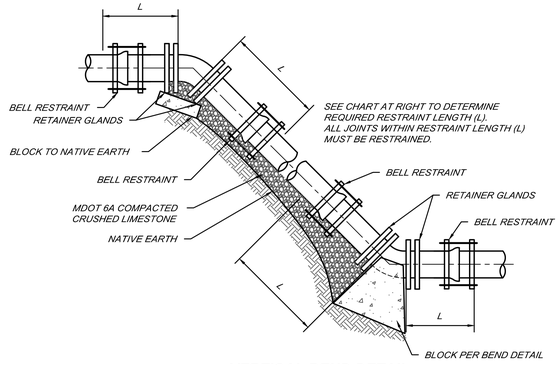
DETAIL OF SETTING HYDRANT



WATER MAIN IN SLEEVE DETAIL



DETAIL OF SETTING OF VALVE BOXES

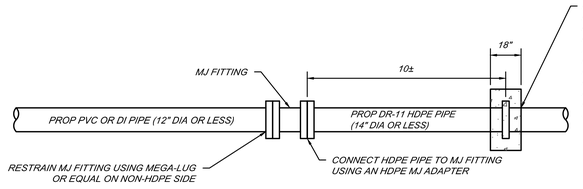


VERTICAL BEND DETAIL

PIPE RESTRAINT SCHEDULE FOR GROUND BURIED PRESSURE PIPES

LENGTH (L) OF RESTRAINT REQUIRED (IN FEET)

DEFLECTION ANGLE / PIPE	11-1/4° AND 22-1/2°	33-3/4°	45°	56-1/4°	67-1/2°	78-3/4°	90°, TEE, OR DEAD END
6"	8	12	16	20	25	31	59
8"	10	15	20	26	33	40	77
10"	35	18	25	32	40	49	93
12"	14	21	29	37	47	57	109
14"	16	24	33	41	54	66	125
16"	18	27	37	47	60	74	141
18"	20	30	41	53	67	82	157
20"	22	33	45	58	73	90	172
24"	25	39	53	68	85	105	202
30"	30	46	63	82	102	126	244
36"	35	54	74	96	119	146	283
42"	40	61	83	107	133	164	320
48"	44	67	92	118	148	181	356



(14" DIPS OR LESS) HDPE CONNECTION DETAIL

BY	MARK	REVISIONS	DATE

STANDARD WATER MAIN DETAILS

WATER MAIN STANDARD DETAILS

TITTABAWASSEE TOWNSHIP
145 S. Second St.
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DR. BY:	APP. BY:	
STDS.	SHEET 1 OF 1	
DATE DECEMBER, 2023	FILE NO.	
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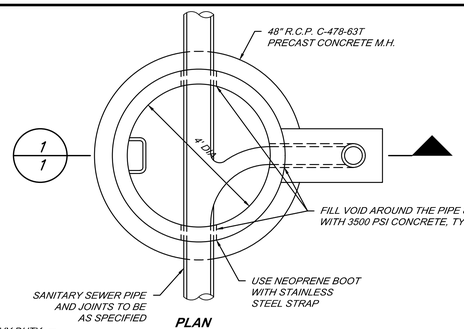
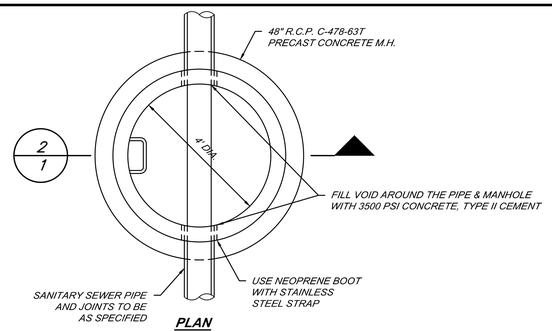
PLOTTING SCALE: 1=1 RET. F.B. PG. ACAD FILE: DWT536



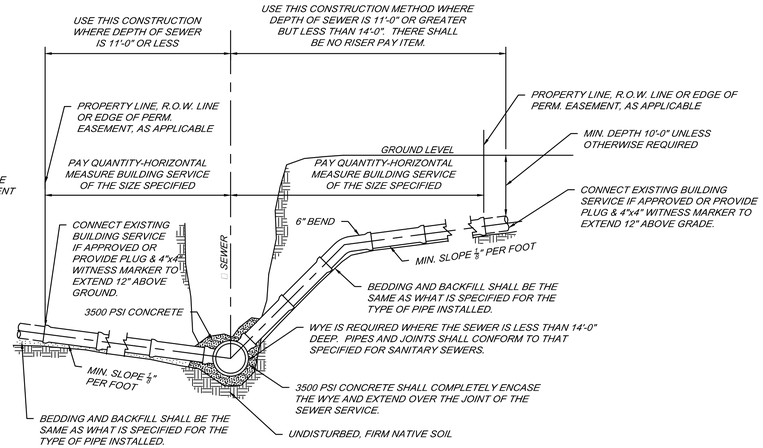
1/1 **PLAN**

TRENCH WIDTH CHART

PIPE SIZE	MINIMUM	MAXIMUM
8" & 10"	24"	30"
12" & 15"	30"	36"
18"	34"	40"
21"	38"	42"
24"	42"	46"
27"	45"	49"
30"	49"	53"
36"	56"	60"
LARGER THAN 36"	I.D. +20"	I.D. +24"

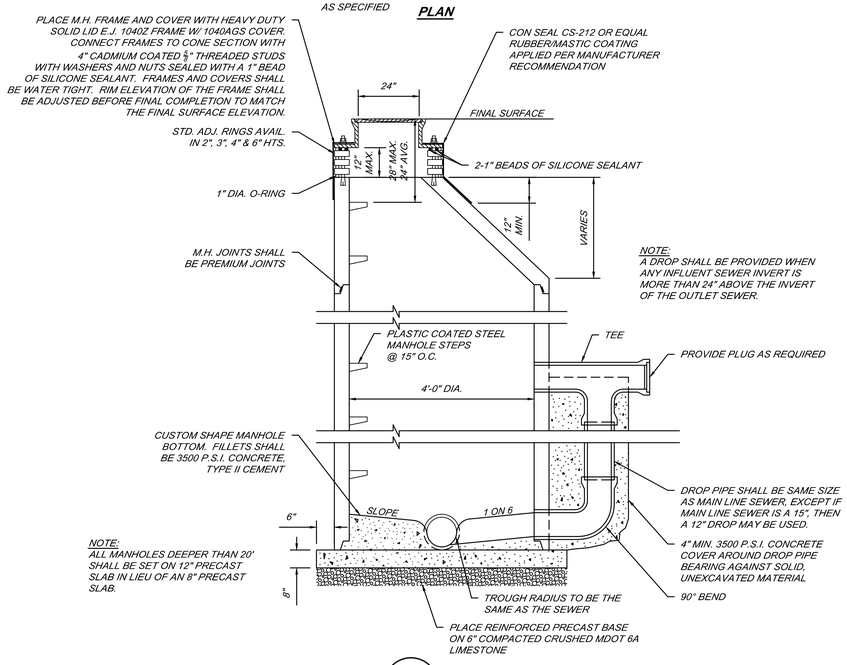


2/1 **PLAN**



SEWER SHALLOWER THAN 14'-0" SERVICE DETAIL

1/4" = 1'-0"

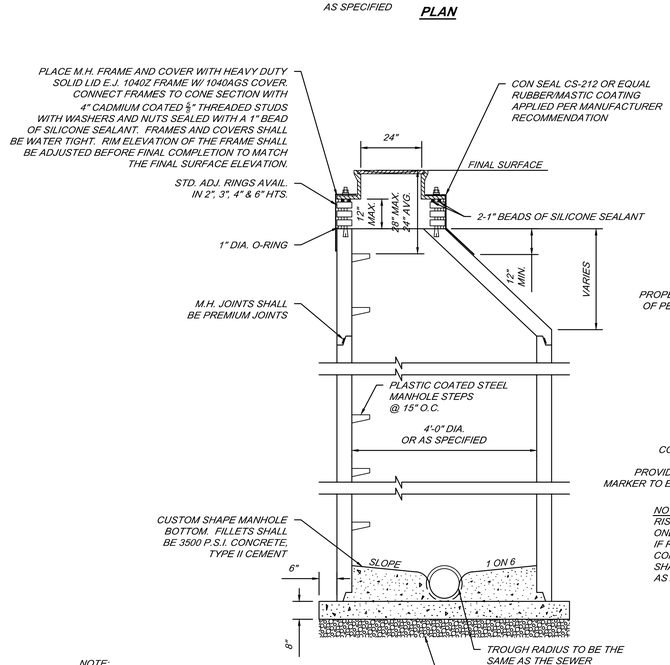


NOTE: ALL MANHOLES DEEPER THAN 20' SHALL BE SET ON 12" PRECAST SLAB IN LIEU OF AN 8" PRECAST SLAB.

1/1 **SECTION**

STANDARD DROP MANHOLE

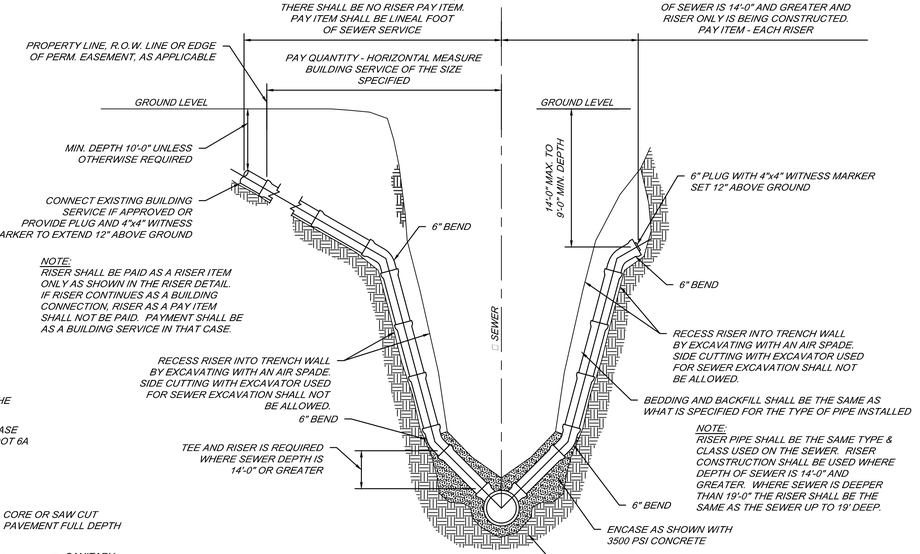
SCALE: 1/2" = 1'-0"



2/1 **SECTION**

STANDARD MANHOLE

SCALE: 1/2" = 1'-0"



NOTE: RISER SHALL BE PAID AS A RISER ITEM ONLY AS SHOWN IN THE RISER DETAIL. IF RISER CONTINUES AS A BUILDING CONNECTION, RISER AS A PAY ITEM SHALL NOT BE PAID. PAYMENT SHALL BE AS A BUILDING SERVICE IN THAT CASE.

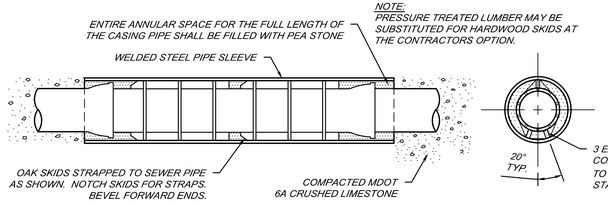
NOTE: RISER PIPE SHALL BE THE SAME TYPE & CLASS USED ON THE SEWER. RISER CONSTRUCTION SHALL BE USED WHERE DEPTH OF SEWER IS 14'-0" AND GREATER. WHERE SEWER IS DEEPER THAN 19'-0" THE RISER SHALL BE THE SAME AS THE SEWER UP TO 19' DEEP.

SEWER DEEPER THAN 14'-0" SERVICE AND RISER DETAIL

1/4" = 1'-0"

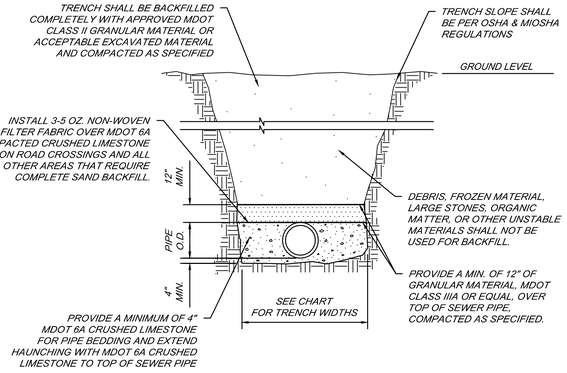
LEGEND

- PROPOSED SANITARY SEWER
- PROPOSED WYE OR TEE
- PROPOSED RISER
- PROPOSED FORCE MAIN



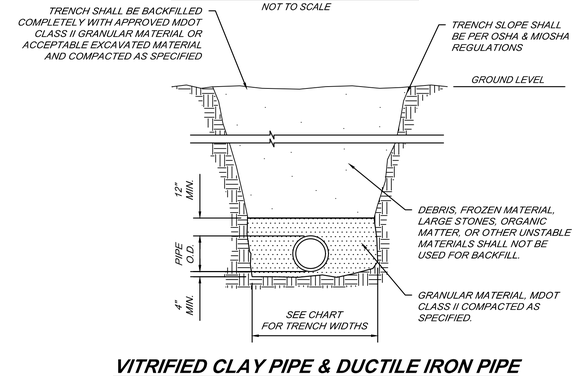
SEWER IN SLEEVE DETAIL

NOT TO SCALE



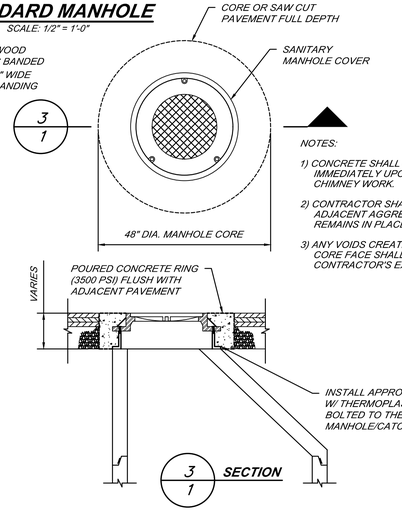
P.V.C. PIPE TRENCH DETAIL

1/4" = 1'-0"



VITRIFIED CLAY PIPE & DUCTILE IRON PIPE TRENCH DETAIL

1/4" = 1'-0"



3/1 **SECTION**

NOTES:
1) CONCRETE SHALL BE POURED IMMEDIATELY UPON COMPLETION OF CHIMNEY WORK.
2) CONTRACTOR SHALL ENSURE THE ADJACENT AGGREGATE BASE COURSE REMAINS IN PLACE AND UNDISTURBED.
3) ANY VOIDS CREATED OUTSIDE OF THE CORE FACE SHALL BE CORRECTED AT THE CONTRACTOR'S EXPENSE.

MANHOLE COVER ADJUSTMENT (PAVED AREAS)

NOT TO SCALE

NOTES:
ALL HOUSE OR BUILDING SERVICES CROSSING UNDER IMPROVED ROADS SHALL BE INSTALLED AT, AND TO, THE PROPER GRADE BY BORING, UNLESS OTHER METHOD IS APPROVED IN WRITING. CASINGS, IF REQUIRED BECAUSE OF THE GROUND CONDITION, SHALL BE FURNISHED AND INSTALLED BY THE CONTRACTOR AT THE BID PRICE PER FOOT OF HOUSE OR BUILDING SERVICE. ALL SEWER SERVICES SHALL END IN AN OPEN CUT. WHERE THE PROPOSED SEWER IS LOCATED WITHIN THE TRAVELED SURFACE OF AN UNIMPROVED ROAD, THE HOUSE OR BUILDING SERVICE SHALL BE INSTALLED IN AN OPEN CUT. SERVICES CONNECTED INTO MANHOLES SHALL ENTER THE MANHOLE 30" OR LESS ABOVE THE INVERT AND SHALL BE CONSTRUCTED AS SHOWN ABOVE. HOUSE AND BUILDING PIPE AND JOINTS SHALL CONFORM TO THAT SPECIFIED OR AS LISTED IN THE PROPOSAL. PAY QUANTITY FOR SERVICES SHALL INCLUDE MAKING CONNECTIONS WHERE NECESSARY, PROVIDING BENDS, PLUGS, WITNESS MARKERS, AND CONCRETE AS SPECIFIED. ALL PIPE, BENDS, AND PLUGS SHALL BE OF THE TYPE REQUIRED IN THE PROPOSAL ITEM FOR RISERS AND SHALL INCLUDE SAND BACKFILL AND CONCRETE AS SPECIFIED WHERE REQUIRED.
ALL MANHOLES DEEPER THAN 20' SHALL BE SET ON 12" PRECAST SLAB IN LIEU OF AN 8' PRECAST SLAB.
MANHOLE FRAME RIM ELEVATIONS LOCATED IN CULTIVATED FIELDS SHALL BE SET 6" BELOW THE MAXIMUM PLOW DEPTH (TYPICAL).
MANHOLE FRAMES SET PRIOR TO ESTABLISHING FINAL GRADES SHALL BE RESET TO FINAL GRADE IF NEEDED AT NO COST TO THE OWNER.

BY	MARK	REVISIONS	DATE

THE WORK REPRESENTED BY THIS DRAWING WAS DESIGNED BY THE ENGINEER FOR THIS SPECIFIC APPLICATION AND SPECIFIC LOCATION DESCRIBED HEREON IN ACCORDANCE WITH THE CONDITIONS PREVALENT AT THE TIME THE DESIGN WAS DONE. THE ENGINEER DOES NOT GUARANTEE AND WILL NOT BE LIABLE FOR ANY OTHER LOCATION, CONDITION, DESIGN OR PURPOSE.

STANDARD DETAILS
SANITARY SEWER PLANS

SANITARY SEWER DETAILS FOR SEWER TRENCH, SERVICES AND MANHOLES

TITTABAWASSEE TOWNSHIP
145 S. Second St.
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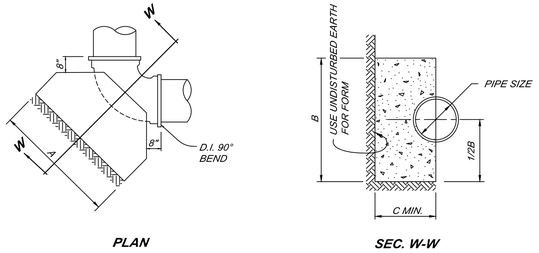
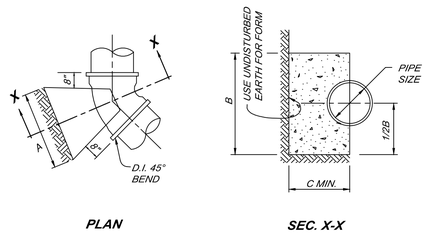
WORKORDER NO.: STANDLS DESIGNED BY: SGI DRAWN BY: MDR/CJA CHECKED BY: DRS APPROVED BY: MJS PLOTTING SCALE: 1=1 RET. F.B. PG. ACAD FILE: DS15624



PLAN SEC. W-W

DETAIL OF BLOCK FOR 90° BEND OR TEE

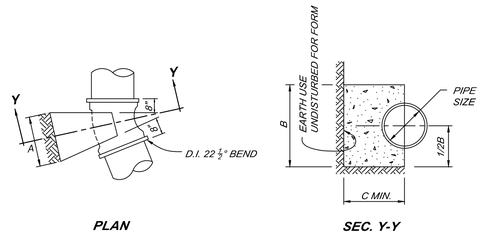
Q - MIN. CU. YD. CONCRETE PER BLOCK



PLAN SEC. X-X

DETAIL OF BLOCK FOR 45° BEND

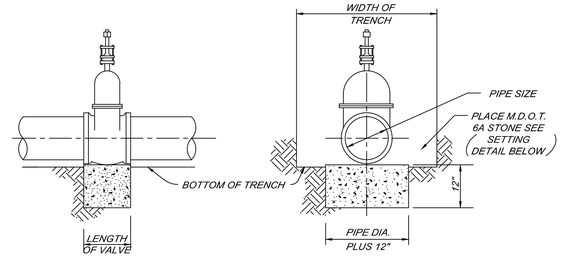
Q - MIN. CU. YD. CONCRETE PER BLOCK



PLAN SEC. Y-Y

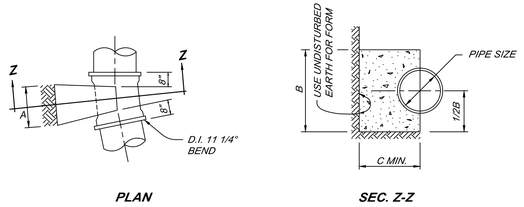
DETAIL OF BLOCK FOR 22 1/2° BEND

Q - MIN. CU. YD. CONCRETE PER BLOCK



DETAIL OF BLOCK FOR VALVES

CU. YD. CONCRETE PER BLOCK VARIES



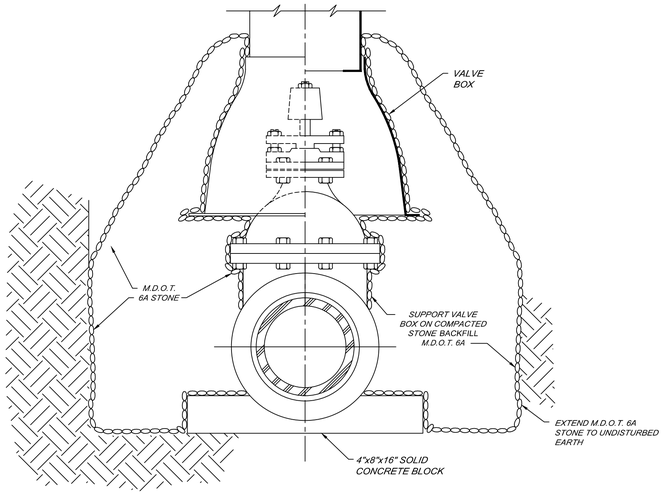
PLAN SEC. Z-Z

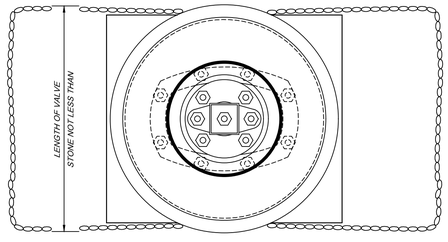
DETAIL OF BLOCK FOR 11 1/4° BEND

Q - MIN. CU. YD. CONCRETE PER BLOCK

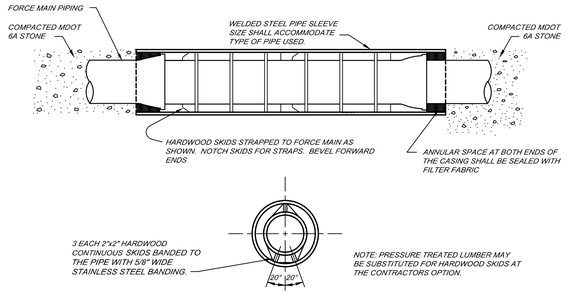
PIPE SIZE	90° BEND OR TEE					45° BEND					22 1/2° BEND					11 1/4° BEND					PLUG				
	A	B	C		Q	A	B	C		Q	A	B	C		Q	A	B	C		Q	A	B	C		Q
6,8 & 10	3'-0"	2'-0"	1'-3"		0.3	2'-0"	1'-6"	1'-3"		0.1	1'-6"	1'-0"	1'-3"		0.1	1'-0"	1'-0"	1'-3"		0.1	2'-0"	2'-0"	1'-6"		0.2
12	3'-0"	2'-6"	1'-6"		0.4	2'-0"	2'-0"	1'-6"		0.2	2'-0"	1'-0"	1'-6"		0.1	1'-0"	1'-0"	1'-6"		0.1	2'-0"	2'-6"	1'-6"		0.3
16	4'-0"	3'-0"	2'-0"		0.9	3'-0"	3'-0"	2'-0"		0.5	2'-0"	2'-0"	2'-0"		0.2	1'-0"	2'-0"	2'-0"		0.1	3'-0"	3'-6"	1'-9"		0.7
20	5'-0"	4'-6"	2'-6"		1.23	4'-0"	3'-0"	2'-6"		0.82	3'-0"	2'-6"	2'-6"		0.58	2'-0"	2'-6"	1'-10"		0.3	4'-0"	4'-0"	2'-6"		1.45
24	6'-0"	5'-6"	3'-0"		2.74	4'-0"	4'-0"	3'-0"		1.21	3'-0"	3'-0"	3'-0"		0.8	2'-6"	3'-0"	2'-2"		0.42	5'-0"	5'-0"	3'-0"		2.78
30	7'-0"	7'-0"	3'-9"		5.39	5'-6"	5'-0"	3'-9"		2.14	4'-0"	3'-0"	3'-9"		1.35	3'-0"	3'-9"	2'-8"		0.98	6'-0"	6'-0"	3'-9"		4.96
36	8'-0"	7'-6"	4'-6"		8.12	6'-0"	6'-0"	4'-6"		4.03	5'-0"	4'-0"	4'-6"		2.77	3'-0"	4'-6"	3'-2"		1.36	8'-0"	6'-0"	4'-6"		8.00
42	9'-0"	8'-0"	5'-3"		11.58	7'-7"	7'-0"	5'-3"		6.43	5'-0"	5'-0"	5'-3"		3.85	4'-0"	5'-3"	3'-9"		2.17	8'-0"	8'-0"	5'-3"		12.44

NOTE: THE CONCRETE USED FOR BLOCKING SHALL HAVE A MINIMUM COMPRESSIVE STRENGTH OF 3000 PSI IN 28 DAYS. THE CONTRACTOR SHALL SECURE ALL BENDS WITH A MINIMUM OF 2-3/4" ANCHOR RODS PER FITTING TO EITHER CONCRETE BLOCK, WELDED STEEL PIPE SLEEVE OR COLLARS, METHOD USED SHALL BE DETERMINED BY THE ENGINEER. ALL BENDS SHALL BE MECHANICAL JOINT. ALL FERROUS PARTS SHALL RECEIVE A 10 MIL (DMT) COATING OF COAL TAR EPOXY. WRAP ALL FITTINGS AND VALVES IN 4 MIL POLYETHYLENE SHEET TO WITHIN ONE FOOT OF FINISHED GRADE. ALL COSTS ASSOCIATED WITH THIS WORK SHALL BE INCLUDED IN THE UNIT PRICE BID PER EACH HYDRANT INSTALLED.





DETAIL OF SETTING OF VALVE BOXES



FORCE MAIN IN SLEEVE DETAIL

BY	MARK	REVISIONS	DATE

STANDARD FORCE MAIN DETAILS

DETAILS OF SPECIAL CONSTRUCTION FOR FORCE MAIN

TITTABAWASSEE TOWNSHIP
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Fax. 989-695-5060

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