SECTION 1 – GENERAL CONDITIONS

PART 1 – GENERAL

DEFINITIONS

Wherever used in these specifications, the following terms have the meanings indicated that are applicable to both the singular and plural thereof.

CONTRACTOR is the person, firm, or corporation who has entered into an agreement to perform the work of public infrastructure improvements or infrastructure improvements that will be built within the City of Hastings.

CITY is the corporation of the City of Hastings, Michigan.

DIRECTOR OF PUBLIC SERVICES shall refer to the City of Hastings DIRECTOR OF PUBLIC SERVICES, City of Hastings staff or agents or consultants employed and empowered by the City of Hastings to represent the City of Hastings DIRECTOR OF PUBLIC SERVICES.

Drawings are the drawings, which show the scope, extent, and character of the work to be performed by the CONTRACTOR. All drawings shall be reviewed and approved by the DIRECTOR OF PUBLIC SERVICES.

Final Completion. The time at which the Work has been deemed to be totally completed and final payment has been authorized.

Substantial Completion. The Work has progressed to the point where, in the opinion of the DIRECTOR OF PUBLIC SERVICES, it is sufficiently complete, in accordance with the Contract, so that the Work can be utilized for the purposes for which it is intended.

Furnish. The term “furnish” is used to mean “supply and deliver to the Project site, ready for unloading, unpacking, assembly, installation, and similar operations.”

Install. The term “install” is used to describe operations at the Project site, including the actual “unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.”

Provide. The term “provide” means “to furnish and install, complete and ready for the intended use.”

Regulation. The term “Regulation” includes laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, as well as rules, conventions, and agreements within the construction industry that control performance of the Work, whether lawfully imposed by authorities having jurisdiction or not.

Standard Specifications. All requirements contained in the latest edition of the City of Hastings Standard Construction Specifications, including Standard Details included therein.

Testing Laboratories. A “testing laboratory” is an independent entity engaged to perform specific inspections or tests, either at the Project Site or elsewhere, and to report on and, if required, to interpret results of those inspections or tests.

Work. The entire completed construction to be furnished under the Drawing and Standard Specifications. Work includes and is the result of performing or furnishing labor and furnishing and incorporation materials and equipment into the construction, and performing or furnishing services and furnishing documents.

INDUSTRY STANDARDS

Publication Dates. Where the date of issue of a referenced standard is not specified, comply with the standard in effect as of date of Contract.

Conflicting Requirements. Where compliance with two or more standards is specified, and they establish different or conflicting requirements for minimum quantities or quality levels, the most stringent requirement will be enforced, unless the Contract Documents indicate otherwise. Refer requirements that are different, but apparently equal, and uncertainties as to which quality level is more stringent to ENGINEER for a decision before proceeding.

Abbreviations and Names. Trade association names and titles of general standards are frequently abbreviated. The following acronyms or abbreviations as referenced in Contract Documents are defined to mean the associated names. Names are subject to change and are believed to be, but are not assured to be, accurate and up to date as of date of Contract Documents.

AASHTO	American Association of State Highway and Transportation Officials
ACI	American Concrete Institute
ACPA	American Concrete Pipe Association
AI	Asphalt Institute
AIA	American Insurance Association
AISI	American Iron and Steel Institute
ANSI	American National Standards Institute
ASTM	American Society for Testing and Materials
AWWA	American Water Works Association
NAPA	National Asphalt Pavement Association
PCA	Portland Cement Association

Government Agencies. Names and titles of state and federal government standard or Specification producing agencies are frequently abbreviated. The following acronyms or abbreviations referenced in the Contract Documents indicate names of standard or Specification producing agencies of the federal government. Names are subject to change but are believed to be, but are not ensured to be, accurate and up to date as of the date of the Contract Documents.

CE	Corps of Engineers
DOT	Department of Transportation
EPA	Environmental Protection Agency
EGLE	Department of Environment, Great Lakes, and Energy
MDOT	Michigan Department of Transportation

MIOSHA State of Michigan OSHA

OSHA Occupational Safety and Health Administration

SUSPENSION OF WORK AND TERMINATION

DIRECTOR OF PUBLIC SERVICES may suspend work:

At any time and without cause, the DIRECTOR OF PUBLIC SERVICES may suspend the Work or any portion thereof for a period of not more than ninety days by notice in writing to the CONTRACTOR which will fix the date on which the Work will be resumed. The CONTRACTOR shall resume the Work on the date so fixed. The CONTRACTOR shall be allowed an adjustment in the Contract Price or an extension of the Contract Times, or both, directly attributable to any such suspension if the CONTRACTOR makes an approved claim therefor.

The DIRECTOR OF PUBLIC SERVICES may terminate work upon the occurrence of any one or more of the following events:

1. If the CONTRACTOR persistently fails to perform the Work in accordance with the Contract Documents (including, but not limited to, failure to supply sufficient skilled workers or suitable materials or equipment or failure to adhere to the project schedule);

2. If the CONTRACTOR disregards Laws or Regulations of any public body having jurisdiction;

3. If the CONTRACTOR disregards the authority of the DIRECTOR OF PUBLIC SERVICES or

4. If the CONTRACTOR otherwise violates in any substantial way any provisions of the Specifications;

The DIRECTOR OF PUBLIC SERVICES may, after giving the CONTRACTOR (and the surety, if any) seven days' written notice and to the extent permitted by Laws and Regulations, terminate the permit of the CONTRACTOR.

UNDERGROUND FACILITIES

The information and data shown or indicated in the Drawings with respect to existing Underground Facilities at or contiguous to the site is based on information and data furnished to the DIRECTOR OF PUBLIC SERVICES by owners of such Underground Facilities or by others. The DIRECTOR OF PUBLIC SERVICES shall not be responsible for the accuracy or completeness or any such information.

LAWS AND REGULATIONS

The CONTRACTOR shall give all notices and comply with all Laws and Regulations applicable to furnishing and performance of the Work. Except where otherwise expressly required by applicable Laws and Regulations, the DIRECTOR OF PUBLIC SERVICES shall not be responsible for monitoring the Contractor's compliance with any Laws or Regulations.

SAFETY AND PROTECTION

The CONTRACTOR shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the Work. The CONTRACTOR shall take all necessary precautions for

the safety of, and shall provide the necessary protection to prevent damage, injury, or loss to all persons on the Work site who may be affected by the Work; all the Work and materials and equipment to be incorporated therein, whether in storage on or off the site; and other property at the site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures, utilities, and Underground Facilities not designated for removal, relocation, or replacement in the course of construction.

The CONTRACTOR shall comply with all applicable Laws and Regulations of any public body having jurisdiction for safety of persons or property or to protect them from damage, injury or loss; and shall erect and maintain all necessary safeguards for such safety and protection.

The CONTRACTOR shall designate a qualified and experienced safety representative at the site whose duties and responsibilities shall be the prevention of accidents and the maintaining and supervising of safety precautions and programs.

CONTRACTOR'S LIABILITY INSURANCE

Certificates indicating insurance coverage shall be required by all contractors or individuals that do work on City owned property including land, parks, roads, sidewalks, easements, rights-of-way, and buildings.

The following coverage is required:

	Type	Limit of Liability
1.	Worker's Compensation Statutory Coverage B and Employers Liability	$500,000
2.	Public Liability (including products and completed operations liability)	$500,000 each person
	Bodily Injury	$1,000,000 each accident
	Property Damage	$500,000 each accident $1,000,000 each aggregate
3.	Automobile Liability (including hired cars and automobile non-ownership)	
	Bodily Injury	$250,000 each person $500,000 each occurrence
	Property Damage	$250,000 each accident $500,000 each aggregate
4.	Additional Insured	City of Hastings to be specifically named in clause on policy and certificate as an " additional insured."

CONTRACTOR'S GENERAL WARRANTY AND GUARANTEE

The CONTRACTOR warrants and guarantees the DIRECTOR OF PUBLIC SERVICES that all Work will be in accordance with the Drawings and Standard Specifications and will not be defective. The CONTRACTOR's warranty and guarantee exclude defects or damage caused by abuse, modification, or improper maintenance or operation by persons other than the CONTRACTOR or by normal wear and tear under normal usage.

Unless otherwise specified, the warranty and guarantee period shall be for a period of one (1) year, or such longer period of time as may be prescribed by Law, from the date of substantial completion.

INSPECTION OF THE WORK

Bonds and Insurance Certificates shall be submitted to and approved by City prior to the initiation of any construction on site.

Permits, Licenses, and Certificates. For the CITY's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, and similar documents; correspondence and records established in conjunction with compliance with standards; and regulations bearing upon performance of the Work.

SUBMITTAL PROCEDURES

Coordination. Coordinate preparation and processing of submittals with performance of construction activities. Transmit each submittal sufficiently in advance of performance of related construction activities to avoid delay.

Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.

Coordinate transmittal of different types of submittals for related elements of the Work so processing will not be delayed by the need to review submittals concurrently for coordination.

The DIRECTOR OF PUBLIC SERVICES reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

Processing. Allow sufficient review time so that installation shall not be delayed as a result of the time required to process submittals, including time for resubmittals.

The DIRECTOR OF PUBLIC SERVICES will review and return submittals with reasonable promptness, or advise the CONTRACTOR when a submittal being processed must be delayed for coordination or receipt of additional information by putting the submittal "ON HOLD" and returning a transmittal identifying the reasons for the delay.

No extension of Contract Time will be authorized because of failure to transmit submittals to the DIRECTOR OF PUBLIC SERVICES sufficiently in advance of the Work to permit processing.

SHOP DRAWINGS

Submit newly prepared information, drawn to accurate scale. Highlight, encircle, or otherwise indicate deviations from the Contract Documents. Do not reproduce Contract Documents or copy standard information as the basis of Shop Drawings. Standard information prepared without specific reference to the Project is not considered Shop Drawings.

Shop Drawings include fabrication and installation drawings, setting diagrams, schedules, patterns, templates, and similar drawings. Include the following information:

Dimensions.
Identification of products and materials included. Compliance with specified standards.
Notation of coordination requirements.
Notation of dimensions established by field measurement.

Nameplate data for equipment including electric motors shall be included on shop drawings. Electric motor data shall state the manufacturer, horsepower, service factor, voltage, enclosure type, oversize wiring box, etc.

Shop Drawings shall indicate shop painting requirements to include type of paint and manufacturer.

Standard manufactured items in the form of catalog work sheets showing illustrated cuts of the items to be furnished, scale details, sizes, dimensions, quantity, and all other pertinent information should be submitted and approved in a similar manner.

Measurements given on the shop drawings or standard catalog sheets, as established from the Contract Drawings and as approved by the DIRECTOR OF PUBLIC SERVICES, shall be followed. When it is necessary to verify field measurements, they shall be checked and established by the CONTRACTOR. The field measurements so established shall be followed by the CONTRACTOR and by all affected trades.

RESPONSIBILITIES

Contractor Responsibilities. The CONTRACTOR shall provide inspections, tests, and similar quality control services, specified in individual Specification Sections and required by governing authorities, or are provided by another identified entity; these services include those specified to be performed by an independent agency and not by CONTRACTOR.

The CONTRACTOR shall employ and pay an independent agency to perform specified quality control services.

Where the CITY has engaged a testing agency or other entity for testing and inspection of a part of the Work, and the CONTRACTOR is also required to engage an entity for the same or related element, the CONTRACTOR shall not employ the entity engaged by the CITY, unless otherwise agreed in writing with the CITY.

Retesting. The CONTRACTOR is responsible for retesting where results of required inspections, tests, or similar services prove unsatisfactory and do not indicate compliance with Contract Document requirements, regardless of whether the original test was the CONTRACTOR's responsibility.

Cost of retesting construction revised or replaced by the CONTRACTOR is the CONTRACTOR's responsibility, where required tests were performed on original construction.

Associated Services. The CONTRACTOR shall cooperate with agencies performing required inspections, tests, and similar services and provide reasonable auxiliary services as requested. Notify the agency

sufficiently in advance of operations to permit assignment of personnel. Auxiliary services required include but are not limited to:

Providing access to the Work and furnishing incidental labor and facilities necessary to facilitate inspections and tests.

Taking adequate quantities of representative samples of materials that require testing or assisting the agency in taking samples.

Providing facilities for storage and curing of test samples, and delivery of samples to testing laboratories.

Providing the agency with a preliminary design mix proposed for use for materials mixes that require control by the testing agency.

Security and protection of samples and test equipment at the Project site.

CITY Responsibilities. The CITY will provide inspections, tests, and similar quality control services only if specified in the Standard Specification.

Duties of the Testing Agency. The independent testing agency engaged to perform inspections, sampling, and testing of materials and construction specified in individual Specification Sections shall cooperate with the DIRECTOR OF PUBLIC SERVICES and the CONTRACTOR in performance of its duties, and shall provide qualified personnel to perform required inspections and tests.

The agency shall notify the DIRECTOR OF PUBLIC SERVICES and the CONTRACTOR promptly of irregularities or deficiencies observed in the Work during performance of its services.

The agency is not authorized to release, revoke, alter, or enlarge requirements of the Contract Documents, or approve or accept any portion of the Work.

The agency shall not perform any duties of the CONTRACTOR.

Coordination. The CONTRACTOR and each agency engaged to perform inspections, tests, and similar services shall coordinate the sequence of activities to accommodate required services with a minimum of delay. In addition to the CONTRACTOR, each agency shall coordinate activities to avoid the necessity of removing and replacing construction to accommodate inspections and tests.

The CONTRACTOR is responsible for scheduling times for inspections, tests, taking samples, and similar activities.

SUBMITTALS

The independent testing agency shall submit a certified written report of each inspection, test, or similar service, to the DIRECTOR OF PUBLIC SERVICES, in triplicate, unless the CONTRACTOR is responsible for the service. If the CONTRACTOR is responsible for the service, submit a certified written report of each inspection, test, or similar service through the CONTRACTOR, in triplicate.

Submit additional copies of each written report directly to the governing authority, when the authority so directs.

Report Data. Written reports of each inspection, test, or similar service shall include, but not be limited to:

Date of issue.
Project title and number.
Name, address, and telephone number of testing agency.
Dates and locations of samples and tests or inspections.
Names of individuals making the inspection or test.
Designation of the Work and test method.
Identification of product and Specification Section.
Complete inspection or test data.
Test results and an interpretation of test results.
Ambient conditions at the time of sample-taking and testing.
Comments or professional opinion as to whether inspected or tested Work complies with Contract Document requirements.
Name and signature of laboratory inspector.
Recommendations on retesting.

Traffic Control Plan of Action. The CONTRACTOR shall submit the Plan of Action for Traffic Control in three copies prior to starting work. The CONTRACTOR shall not commence Work on any State trunk line or major artery without written approval of the Plan for that portion of the Contract.

The CONTRACTOR's Plan of Action shall be based upon the CITY's requirements for Traffic Control and shall detail specific detour routes, including individual sign markings and locations. The CONTRACTOR shall also propose the CONTRACTOR's intended method for lane control within the construction Work areas. The Plan of Action shall include long-term maintenance of traffic control devices for Work that is not completed during a construction season or for extended periods when Work is not performed.

The CITY and/or MDOT and/or other agency, where applicable, shall approve the proposed Plan of Action. Modifications to the proposed Plan of Action resulting in changes to the Bid quantities shall be adjusted as required during the CONTRACTOR's submittal of monthly payment estimates.

In addition to the Plan of Action, this Work shall consist of the furnishing, installation, operation, maintenance, and removal of the traffic control devices described in this Section.

The location, type, and wording of warning and guide signs shall be proposed by the CONTRACTOR as part of the CONTRACTOR's required Plan of Action for Traffic Control.

The Erosion Control Program prepared by the CONTRACTOR, as described herein, shall be reviewed and have received at least preliminary concurrence from the local Enforcing Agent before it will be presented and discussed at the preconstruction meeting, at which time final revisions may be made. Copies of the final agreed program, and Act 347 Permit, shall be delivered to the DIRECTOR OF PUBLIC SERVICES a minimum of two weeks prior to beginning any WORK on the site.

QUALITY ASSURANCE

Regulations. Comply with industry standards and applicable laws and regulations of authorities having jurisdiction, including but not limited to:

Building Code requirements.
Health and safety regulations.
Utility company regulations.
Police, Fire Department, and Rescue Squad rules.
Environmental protection regulations.
State and local soil erosion control regulations.

Inspection. Arrange for authorities having jurisdiction to inspect and test each temporary utility before use. Obtain required certifications and permits.

PROJECT CONDITIONS

General. Unless otherwise provided in these Specifications, the CONTRACTOR shall make the CONTRACTOR's own arrangements for electricity, gas, water, and sewer services for use during the construction of the Work and shall pay for all temporary facilities, connections, extensions, and services.

Security and protection facilities required include, but are not limited to:

Soil erosion and sedimentation control measures.
Temporary fire protection.
Barricades, warning signs, lights.
Sidewalk bridge or enclosure fence for the site.
Environmental protection.

Soil Erosion and Sedimentation Control Program. The CONTRACTOR shall prepare a soil erosion and sedimentation control program for submittal to and approval by Local Soil Erosion and Sedimentation Control Agent prior to start of construction, as required in the following paragraphs. Copies of State guidelines "Better Environment through Soil Erosion and Sedimentation Control" and "Protection of Natural Resources" DEQ Handbook of Specifications may be obtained at no charge from EGLE. The "Michigan Soil Erosion and Sedimentation Control Guidebook" and the "Guidebook of Best Management Practices for Michigan Watersheds" may also be obtained from EGLE.

Since it is impractical to identify specific potential soil erosion problems along a utility or road improvement project route, the CONTRACTOR, after award but prior to the preconstruction conference, together with the local soil erosion Enforcing Agent, shall identify all potential soil erosion problem areas and prepare a detailed soil erosion and sedimentation control program satisfying the CONTRACTOR's specific method of operation. This program shall include as a minimum, but not necessarily be limited to, the following:

1. Identify on a separate set of plans all soil erosion problem areas.

2. Identify specific control structure using EGLE United Keying System from the "Michigan Soil Erosion and Sedimentation Control Guidebook" to be placed to control erosion and to prevent soil from entering storm sewers and streams.

3. Indicate timing of placement and removal of structures both in relationship to time of year and to sequence of construction.

4. Indicate timing of completion of cleanup and surface restoration after control structures are removed.

The erosion control program, prepared by the CONTRACTOR, shall be reviewed and have received at least preliminary concurrence from the local Enforcing Agent before it will be presented and discussed at the preconstruction meeting, at which time final revisions may be made. Copies of the final agreed program shall be made available for the DIRECTOR OF PUBLIC SERVICES and the local Enforcing Agent. Should the local regulatory agency determine at any time during construction that the construction operation is in violation of the Act and cite the CITY, the CONTRACTOR or Subcontractor shall take immediate action, as directed by the CITY, to ensure compliance with the Act.

Stormwater Discharge Permit. The CONTRACTOR shall not begin any work onsite until notified by the CITY that the stormwater discharge permit, if applicable, has been obtained for the project. The CONTRACTOR shall indemnify the CITY against any and all fines for discharge permit violations that are assessed against the CITY, and that are due to the CONTRACTOR's actions or failure to maintain the sediment control measures.

PROTECTION OF PROPERTY

The CONTRACTOR shall confine construction equipment, materials, and worker operations to the areas identified or permitted by the Contract. The CONTRACTOR shall assume full responsibility for damage to other property or adjacent lands resulting from performance of the Work. During the Work, the CONTRACTOR shall keep the site free from accumulations of waste material and other debris. At completion of the Work, the CONTRACTOR shall remove all waste materials, rubbish, and debris from and about the site and shall leave the site clean and ready for occupancy or use by the City at Substantial Completion.

The CONTRACTOR shall not load nor permit any existing or proposed structures to be loaded in any manner that will endanger the structure.

PART 2 – PRODUCTS

MATERIALS

General. Provide new materials; if acceptable to the DIRECTOR OF PUBLIC SERVICES, undamaged previously used materials in serviceable condition may be used. Provide materials suitable for the use intended.

Topsoil and Seed shall be in accordance with MDOT Standards, sections 816 and 917 .

Fertilizers shall be at least 200 pounds per acre 12:12:12 or equivalent.

Mulches shall be two tons per acre of straw. Hydro mulch, mulch blanket, or other approved material may be used.

Sod shall be as specified in Section 10 Restoration Work.

Project Identification Signs. Where required, provide 8-foot wide by 4-foot high Project sign as detailed, of solid cedar wood and MDOT plywood, painted, with exhibit lettering by a professional sign painter, with final graphics as approved by the DIRECTOR OF PUBLIC SERVICES.

PART 3 – EXECUTION

REPAIR AND PROTECTION

General. Upon completion of inspection, testing, sample-taking, and similar services, repair damaged construction and restore substrates and finishes to eliminate deficiencies, including deficiencies in visual qualities of exposed finishes.

Protect construction exposed by or for quality control service activities, and protect repaired construction.

Repair and protection are the CONTRACTOR's responsibility, regardless of the assignment of responsibility for inspection, testing, or similar services.

During the progress of the Work, the CONTRACTOR shall accommodate both vehicular and pedestrian traffic as provided in these Specifications and as indicated on the Drawings. In the absence of specific requirements, the CONTRACTOR shall maintain such traffic. Access to fire hydrants, water, and gas valves shall always be maintained. The CONTRACTOR's truck and equipment operations on public streets shall be governed by all local traffic ordinances and regulations of the Fire and Police Department and the Department of Public Services. Work within State highway rights-of-way shall be under the jurisdiction of the Michigan Department of Transportation.

In the event of the CONTRACTOR's failure to comply with the foregoing provisions, the CITY may, with or without notice, cause the same to be done and deduct the cost of such Work from any monies due or to become due to the CONTRACTOR under this Contract; but the performance of such Work by the CITY, or at the CITY's insistence, shall serve in no way to release the CONTRACTOR from the CONTRACTOR's liability for the safety of the traveling public.

REFERENCES

Act 346 of 1972, the Inland Lakes and Streams Act and corresponding general rules.

Act 347 of 1972, the Soil Erosion and Sedimentation Control Act, as amended by Act 197 Public Acts of 1974 of the Michigan Compiled Laws.

Part 21 Rule Revision of Act 245 of the Michigan Water Resources Act Guidebook of Best Management Practices for Michigan Watersheds Local Soil Erosion Control Ordinance or requirements.

Michigan Manual of Uniform Traffic Control Devices.

Standards. Comply with NFPA Code 241, "Building Construction and Demolition Operations," ANSI A10 Series standards for "Safety Requirements for Construction and Demolition," and NECA Electrical Design Library, "Temporary Electrical Facilities."

Refer to "Guidelines for Bid Conditions for Temporary Job Utilities and Services," prepared jointly by AGC and ASC, for industry recommendations.

Electrical Service. Comply with NEMA, NECA, and UL standards and regulations for temporary electric service. Install service in compliance with National Electric Code (NFPA 70).

INSTALLATION

Use qualified personnel for installation of temporary facilities. Locate facilities where they will serve the Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required.

Provide each facility ready for use when needed to avoid delay. Maintain and modify as required. Do not remove until facilities are no longer needed, or are replaced by authorized use of completed permanent facilities.

TEMPORARY UTILITY INSTALLATION

General. Engage the appropriate local utility company to install temporary service or to connect to existing service. Where the company provides only part of the service, provide the remainder with matching compatible materials and equipment; comply with the company's recommendations.

Arrange with the company and existing users for a time when service can be interrupted, where necessary, to make connections for temporary services.

Use Charges. Cost or use charges for temporary facilities are not chargeable to the CITY or the DIRECTOR OF PUBLIC SERVICES, and will not be accepted as a basis of claims for a Change Order.

Water Service. The CONTRACTOR shall at all times provide for the CONTRACTOR's employees an abundant and convenient supply of cool drinking water, taken from some safe and wholesome source.

Sanitary Facilities. Provide self-contained single-occupant toilet units, properly vented and fully enclosed with a glass fiber reinforced polyester shell or similar nonabsorbent material. Comply with regulations and health codes for the type, number, location, operation, and maintenance of fixtures and facilities.

Use of pit type privies will not be permitted.

Temporary Electric Power Service. Provide weatherproof, grounded electric power service and distribution system of sufficient size, capacity, and power characteristics during construction period. Include meters, transformers, overload protected disconnects, automatic ground-fault interrupters, and main distribution switch gear.

Except where overhead service must be used, install electric power service underground.

Install wiring overhead, and rise vertically where least exposed to damage. Where permitted, wiring circuits not exceeding 125 Volts, AC 20 ampere rating, and lighting circuits may be nonmetallic sheathed cable where overhead and exposed for surveillance.

Dewatering Facilities and Drains. For temporary drainage and dewatering facilities and operations not directly associated with construction activities included under individual Sections, comply with dewatering requirements of applicable Division 2 Sections. Where feasible, utilize the same facilities. Maintain the site, excavations, and construction free of water.

Barricades, Warning Signs and Lights. Comply with standards and code requirements for erection of structurally adequate barricades. Paint with appropriate colors, graphics, and warning signs to inform personnel and the public of the hazard being protected against. Where appropriate and needed, provide lighting, including flashing red or amber lights.

Environmental Protection. Provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations, and minimize the possibility that air, waterways, and subsoil might be contaminated or polluted, or that other undesirable effects might result. Avoid use of tools and equipment that produce harmful noise. Restrict use of noise-making tools and equipment to hours that will minimize complaints from persons or firms near the site.

Control of Noise. The CONTRACTOR shall eliminate noise to as great an extent as possible at all times. Air compressors shall be equipped with silencers, and the exhaust of all gasoline motors and other power equipment shall be provided with mufflers. In the vicinity of hospitals, libraries, and schools, special precautions shall be taken to avoid noise and other nuisance, and the CONTRACTOR shall require strict observances of all pertinent ordinances and regulations. ~~Any blasting permitted in such locations shall be done with reduced charges.~~

Onsite Burning. Burning of waste materials resulting from the Work under this Contract will not be allowed. The CONTRACTOR shall haul all waste materials from the site and dispose of same in a manner acceptable to the DIRECTOR OF PUBLIC SERVICES. The costs of hauling and disposal of waste materials shall be included in other items of the Work under this Contract.

Dust Control. The CONTRACTOR shall take all steps necessary for the alleviation or prevention of dust nuisance caused by or resulting from the CONTRACTOR's operations and shall apply water or dust palliative, or both, as required. No direct payment will be made for any such work performed or materials used to control dust from this Contract.

Maintenance of Traffic. During the progress of the Work, the CONTRACTOR shall accommodate both vehicular and pedestrian traffic as provided in these Specifications and as indicated on the Drawings. In the absence of specific requirements, the CONTRACTOR shall maintain such traffic. Access to fire hydrants, water, and gas valves shall always be maintained. The CONTRACTOR's truck and equipment operations on public streets shall be governed by all local traffic ordinances and regulations of the Fire and Police Departments and the Department of Public Services.

When a road or street is closed to all through traffic, movable Type III barricades shall be erected at all points of closures, including cross streets. If barricades are to be left overnight, three warning lights shall be provided for each Type III barricade.

Lane control shall be accomplished by the use of drums and/or Type II barricades to channel the traffic flow, supplemented by guide signs and/or flag persons as necessary. Lighted arrow panels, Type C, shall be required for lane control on both State trunk lines and all City streets open to through traffic.

Whenever the excavation on roads open to through traffic exceeds 10 feet below surface grade, portable concrete barriers shall be provided between the open trench and any traffic lanes, including barriers at the ends of the trench as necessary. The maximum length of open trench shall be 50 feet.

Standard sign sizes and colors, as shown in "MMUTCD," shall be used to make the approach to construction areas and to direct motorists on any detour route. All signs shall be reflectorized.

As required, temporary pavement marking on bituminous surfaces shall be marked with either marking tape or paint after each day's paving or prior to opening to traffic. Temporary marking shall be applied to the leveling course if that section will be open to traffic. Removal of temporary pavement marking will not be required unless markings are improperly applied or incorrectly located by the CONTRACTOR.

Temporary pavement markings shall be placed as directed by the DIRECTOR OF PUBLIC SERVICES and shall include the following types of markings:

Two-foot dashed pavement marking line.
Four-foot dashed pavement marking line.
Solid pavement marking line.

All markings shall have a nominal width of 4 inches. Markings shall be either white or yellow in accordance with the "MMUTCD." Dashed lines shall be spaced not greater than 50 feet, center to center of markings.

Small street openings necessary for manholes, alignment holes, pipe connections, etc., will be permitted. Such holes shall not be open longer than necessary and shall be protected in accordance with the requirements of the local agency having jurisdiction, and any traffic detouring necessary shall be done to the satisfaction of the Agency. Whenever possible, small openings shall be covered with steel plates at pavement level and secured in place at the time that Work is being performed.

Where streets are partially obstructed, the CONTRACTOR shall place and maintain temporary driveways, ramps, bridges, and crossings which, in the opinion of the DIRECTOR OF PUBLIC SERVICES, are necessary to accommodate the public. As part of the Work under this Contract, the CONTRACTOR shall be responsible for providing and maintaining flag persons, warning lights, signs, and/or barricades, including necessary detour signs outside the Project limits as required to direct and protect vehicular and pedestrian traffic. In the event of the CONTRACTOR's failure to comply with the foregoing provisions, the CITY may, with or without notice, cause the same to be done and deduct the cost of such Work from any monies due or to become due the CONTRACTOR under this Contract; but the performance of such Work by the CITY, or at the CITY's insistence, shall serve in no way to release the CONTRACTOR from the CONTRACTOR's liability for the safety of the traveling public.

The CONTRACTOR shall inform Barry County Central Dispatch at ~~616~~269.948.4800 and the local Fire Department in advance of the CONTRACTOR's program of street obstruction and detours, so that the Fire Department can set up plans for servicing the area in case of an emergency. The CONTRACTOR shall also notify the public agency having jurisdiction over the roads at least one week prior to obstructing a road.

Complete all Work as required, such as pipe stubs to connecting mains or utility service replacements, while constructing mains, so the street will only be closed once.

Complete new or restored roadways along a street during the same construction season as the trench work. Work that is not completed within the same construction season (winter construction periods) shall have all traffic control devices maintained and serviced on a biweekly basis. The CONTRACTOR shall, upon written notification by the CITY or the DIRECTOR OF PUBLIC SERVICES, re-erect or replace missing, damaged, or relocated barricades and signage.

Coordinate traffic rerouting with road work by others so as to minimize the disruption of traffic.

Markings shall be applied in accordance with the MDOT 2020 Standard Specifications for Construction. Applications rates vary depending on the specified binder predetermined by the CITY and shown on the

Project Plans. Markings that do not function properly as temporary pavement marking shall be replaced and the application methods revised as directed by the DIRECTOR OF PUBLIC SERVICES.

Shaft locations shall be selected at points where they will interfere with traffic as little as possible and their working site arrangements shall meet the approval of the DIRECTOR OF PUBLIC SERVICES. Detouring of traffic shall be done in accordance with the requirements of the public agencies having jurisdiction over the roads.

Public and Private Utilities. Where any utilities, water, sewer, gas, telephone, or any other, either public or private, are encountered, the CONTRACTOR must provide adequate protection for them, and the CONTRACTOR shall be held responsible for any damages to such utilities arising from the CONTRACTOR's operations.

When it is apparent that construction operations may endanger the foundation of any utility conduit or the support of any structure, the CONTRACTOR shall notify the utility and the CITY of this possibility and the CONTRACTOR shall take such steps as may be required to provide temporary bracing or support of conduits or structures.

Where it is the policy of utility and/or the CITY's to make repairs to damaged conduit or other structures, the CONTRACTOR shall cooperate to the fullest extent with the utility, and the CONTRACTOR shall see that the CONTRACTOR's operations interfere as little as possible with those operations.

When it is necessary to carry out the Work, that an electric, telephone, or light pole be moved to a new location, or moved and replaced after construction, the CONTRACTOR shall arrange for the moving of such poles and the lines thereof, and shall pay any charges therefor.

Where existing utilities are encountered along the line of Work, the CONTRACTOR shall perform the CONTRACTOR's operations in such a manner that service will not be interrupted, and shall, at the CONTRACTOR's own expense, make all temporary provisions to maintain service.

Unless otherwise indicated on the Drawings, the CONTRACTOR shall replace any disturbed sewer or drain, or relay same at a new grade to be established by the DIRECTOR OF PUBLIC SERVICES, such that sufficient clearance for the sewer will be provided.

The CONTRACTOR will receive no extra compensation for replacement of sewers or drains encountered, or for relaying at a new grade and/or line where necessary, except where specifically noted otherwise on the Drawings or the Specifications.

Where existing gas mains and services are encountered, the CONTRACTOR shall arrange with the gas company for any necessary relaying, and shall pay for the cost of such work.

Materials used in repairing or relaying utilities shall be the same type and strength as the existing Work.

Soil Erosion and Sedimentation Control. The CONTRACTOR shall take all precautions necessary to prevent soil erosion of areas disturbed by the construction and shall ensure that all soil erosion be contained within the construction site. The CONTRACTOR shall provide temporary slope protection, temporary dikes, etc., as required to prevent eroded materials from entering any sewers or natural watercourses.

The CONTRACTOR shall comply with the soil erosion and sedimentation control requirements of Act No. 347 of the Public Acts of 1972 as amended by Act 197, Public Acts of 1974 of the Michigan Complied Laws and local city or county soil erosion control programs.

Stormwater Discharge. The CONTRACTOR shall utilize the appropriate Best Management Practices to prevent any of the CONTRACTOR's activities from resulting in an unlawful discharge of pollutants to the waters of the State. The CONTRACTOR shall correct any deficiencies noted by the DIRECTOR OF PUBLIC SERVICES, Local Enforcement Agency, or EGLE within 24 hours of receiving written notice that corrections are necessary. Should the CONTRACTOR fail to take action within the allotted time, the CITY shall have the right to do the work and deduct all costs from amounts due the CONTRACTOR under this Contract.

Dewatering Trenches and Disposal of Excess Excavated Material. Pumping or draining from trench excavations shall be made on either side of the pipeline and not into the waters of the State. It shall be the CONTRACTOR's responsibility to secure the necessary approval of private landowner before discharging water from the trench excavation onto private lands. Water shall be discharged in such a manner as to cause no pollution or erosion problems. The CONTRACTOR shall dewater to existing storm sewer systems wherever possible; method of disposal shall be approved by the CITY. All discharge from dewatering wells discharged onto the ground ahead of being piped to a natural watercourse or lake via an existing storm sewer system or by a temporary piping system shall have built at the point of entry into such storm sewer a silt retention structure.

This silt retention structure may consist of several straw bales adequately anchored and placed as directed by the DIRECTOR OF PUBLIC SERVICES. Any eventual silt or solids retained in the area of these structures shall be removed prior to removal of the structure. At no time will silt or similar materials be permitted to filter into a lake or natural watercourse. There shall be no side casting of any excavated material into any waterway. Excess excavated material from stream crossings and excavation near streams shall be removed and disposed of elsewhere, and not within the floodplain.

Stream Bank Protection. The banks of streams shall not be left unprotected for more than one day where possible, but never more than seven days after the stream crossing is completed. Replacing of bank plug and grading of stream banks within 50 feet of the stream shall be accomplished immediately following pipe laying. Construction will not be allowed to continue at the expense of not providing stream bank protection. All disturbed stream banks shall be finished with a slope not steeper than 2:1 (two horizontal to one vertical). The 2:1 slope shall be graded up and back to the highwater line. If the top of the natural bank is more than 3 feet above the highwater line, a 10-foot (minimum) berm shall be constructed at this level, and the remaining slope constructed upward parallel with or on a flatter slope than the original natural bank, provided sufficient adjoining property is available. If such property is not available, permanent riprap shall be placed to the top of the bank. Permanent riprap material shall be placed from the bed of the channel to 3 feet above the normal highwater line or to the top of the bank. If riprap is placed to the top of the bank, a berm will not be required. Permanent riprap shall be natural rock (Heavy Riprap) per MDOT 2020 specifications, or other material approved by DIRECTOR OF PUBLIC SERVICES. "Sacrete," where used, shall be transferred to burlap or canvas bags. All disturbed areas' raw soil exposed above the riprap shall be either sodded or seeded, fertilized, and mulched. Mulch blankets shall be placed on slopes greater than 10 percent and high velocity mulch blankets shall be placed on slopes equal to 25 percent or greater.

Slope Protection – Adjacent to Stream Crossings. In clearing and grubbing of right-of-way, a 20-foot deep strip of natural vegetation the full width of the right-of-way shall be left on both sides of the streams or drains to be crossed. Deflection dikes consisting of gravel or other suitable material, reinforced by one row of sandbags, shall be used to divert runoff from steep slopes adjacent to water crossing, where contributing

runoff could be great enough to cause slope erosion and resulting sedimentation at the stream crossing. Diversion berms filter berms, diversion ditches, or terracing may be appropriate. On slopes greater than 20 percent, such diversion structures shall be placed at the top of said slopes and at 100-foot intervals or less on the slope face. Similar diversion structures shall be placed along the top of the stream bank where the entire slope is not protected with riprap. Water shall be diverted to undisturbed areas adjacent to the right-of-way.

A pipe trench excavation shall stop some distance from the stream to leave a protective plug of 10 to 20 feet of unexcavated material at each bank. The plugs shall be left in place until the pipe laying operation across the stream has begun. Bypassing of water in the trench to the side by diversion ditches or by pumping may be required. The water shall be diverted to undisturbed areas adjacent to the right-of-way. Replacing of bank plug and grading of stream banks within 50 feet of the stream shall be accomplished immediately following pipe laying. Clearing and the removal of protective vegetation shall be kept at a minimum distance ahead of the trenching unit.

Slope Protection. On slopes greater than 20 percent, but not immediately adjacent to stream crossing, mulch shall be anchored with a spray of asphalt, Type SS-1S emulsion mixed with an equal amount of water at a rate of 200 gal./acre. A chemical self-adhering mulch may be used. Mulch shall be anchored on slopes greater than 10 percent if immediately adjacent to stream crossings. Mulch may also be held in place by disking with a farm disc. If mulch materials such as netting or excelsior blankets are used, they may have to be pegged.

Protection. When final topography has been established, all bared soil shall be seeded, fertilized, and mulched in an effort to restore to a protected condition, except in flat, active farm fields. Critical areas shall be sodded as specified under Section 4, Excavation and Backfill.

The permanent protection measures shall be in effect not more than 30 days after the earth change is completed, except at tie-in areas at both sides of the stream where temporary measures will be installed within three days following a pipeline crossing. Temporary measures may include a row of sand bags at the top of the bank, a row of pegged bales of straw, or an earth berm or diversion ditch. These temporary measures shall be maintained until permanent measures are installed.

Where construction involves placing pipes in roadways or under other impervious materials, special care shall be provided by the CONTRACTOR.

Provide control measures at all storm sewer catch basins by providing straw or other types of filters or construct sediment traps adjacent to inlets.

If a roadway has a grass ditch area, minimize disturbance and provide filter berms (straw or gravel) or sediment traps as appropriate.

Provide proper down drain structures to control increased runoff to streams and drains.

Stabilize the roadway as soon as possible after placement of the utility. Temporary erosion control measures shall be instituted until final paving is complete. Such measures may include a subbase surfacing application or gravel surfacing. Compaction of soil may suffice if other control measures are affected.

FIELD QUALITY CONTROL

Any unforeseen situations that may be encountered during the course of construction that may cause accelerated erosion and deposition of sediment into waterways and/or lakes shall be controlled by methods that may include sediment traps, sediment basins, or holding ponds. Any slope failures or development of gullies after construction has been completed shall be corrected immediately.

Should the local regulatory agency determine at any time during construction that the construction operation is in violation of Act 346 and cite the CITY, CONTRACTOR or Subcontractor shall take immediate action, as directed by the CITY, to ensure compliance with the Act.

END OF SECTION 1

SECTION 2 – SITE CLEARING

PART 1 – GENERAL

SUMMARY

Section includes:

Protection of existing trees.

Removal of trees and other vegetation.

Topsoil stripping.

Clearing and grubbing.

Removing above-grade improvements.

Removing below-grade improvements.

DEFINITIONS

Topsoil. Topsoil is defined as friable clay loam surface soil found in a depth of not less than 4 inches. Satisfactory topsoil is reasonably free of subsoil, clay lumps, stones, and other objects over 1 inch in diameter, and without weeds, roots, and other objectionable material.

PROJECT CONDITIONS

Traffic. Conduct site clearing operations to ensure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities. Do not close or obstruct streets, walks, or other occupied or used facilities without permission from authorities having jurisdiction.

PART 2 – PRODUCTS – NOT USED

PART 3 – EXECUTION

PREPARATION

Protection of Existing Improvements. Provide protections necessary to prevent damage to existing improvements indicated to remain in place.

Protect improvements on adjoining properties and on City of Hastings property.

Restore damaged improvements to their original condition, as acceptable to property of the City.

Protection of Existing Trees and Vegetation. Protect existing trees and other vegetation indicated to remain in place against unnecessary cutting, breaking, or skinning of roots, skinning or bruising of bark, smothering of trees by stockpiling construction materials or excavated materials within drip line, excess foot or

vehicular traffic, or parking of vehicles within drip line. Provide temporary guards to protect trees and vegetation to be left standing.

Water trees and other vegetation to remain within limits of Contract Work as required to maintain their health during course of construction operations.

Provide protection for roots over 1-1/2-inch diameter that are cut during construction operations. Coat cut faces with emulsified asphalt or other acceptable coating, formulated for use on damaged plant tissues. Temporarily cover exposed roots with wet burlap to prevent roots from drying out; cover with earth as soon as possible. Should it be necessary to cut and remove any tree roots affecting the construction, this work will be performed by the Contractor. Roots that are less than 4 inches in diameter may be removed by the CONTRACTOR using the following process:

1. Roots are excavated to just outside the limits of construction.

2. Roots must be cleanly cut cross-sectionally using a carbide tip saw, blade, or axe prior to removal.

3. The Contractor shall not use machinery forks to rip roots up prior to cutting. The use of stump grinders to grind root material to the necessary grade is acceptable after a cross-sectional clean-cut is performed. MISS DIG shall be contacted prior to any stump grinder use in the Right-of-Way.

4. All tools and methods used will have to be approved through the DIRECTOR OF PUBLIC SERVICES office.

5. Roots that interfere with the grade of the sidewalk shall be removed to a depth of 4 inches below the bottom of the sidewalk.

Roots greater than 4 inches in diameter will require approval from the DIRECTOR OF PUBLIC SERVICES prior to cutting and removal. If it is determined by the DIRECTOR OF PUBLIC SERVICES that the necessary removal of the roots will jeopardize the stability or life expectancy of the tree, alternative methods may be considered, including bridging the sidewalk over the root bed or tree removal.

Repair or replace trees and vegetation indicated to remain that are damaged by construction operations, in a manner acceptable to the DIRECTOR OF PUBLIC SERVICES. Employ a licensed arborist to repair damages to trees and shrubs.

Replace trees that cannot be repaired and restored to full-growth status, as determined by arborist.

Salvageable Improvements. Before the Work proceeds, submit a list of existing equipment and materials to be removed and not reused. The CITY shall determine or select items for retention by the CITY. Carefully remove items indicated to be salvaged, and store on City of Hastings' premises as indicated or directed.

SITE CLEARING

General. Remove trees, shrubs, grass, and other vegetation, improvements, or obstructions as required to permit installation of new construction. Remove similar items elsewhere on site or premises as specifically indicated. "Removal" includes digging out and off-site disposing of stumps and roots.

Cut minor roots and branches of trees indicated to remain in a clean and careful manner, where such roots and branches obstruct installation of new construction.

Strip topsoil to whatever depths encountered in a manner to prevent intermingling with underlying subsoil or other objectionable material.

Remove heavy growths of grass from areas before stripping.

Where existing trees are indicated to remain, leave existing topsoil in place within drip lines to prevent damage to root system.

Stockpile topsoil in storage piles in areas indicated or directed. Construct storage piles to provide free drainage of surface water. Cover storage piles, if required, to prevent wind erosion.

Dispose of unsuitable or excess topsoil same as specified for disposal of waste material.

Clearing and Grubbing. Clear site of trees, shrubs, and other vegetation, except for those indicated to be left standing.

Completely remove stumps, roots, and other debris protruding through ground surface.

Use only hand methods for grubbing inside drip line of trees indicated to remain.

Fill depressions caused by clearing and grubbing operations with satisfactory soil material, unless further excavation or earthwork is indicated.

Place fill material in horizontal layers not exceeding 6 inches loose depth, and thoroughly compact to a density equal to adjacent original ground.

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

Abandonment or removal of certain underground pipe or conduits may be indicated on the Drawings, and is included under Work related to other sections. Removal of abandoned underground piping or conduit interfering with construction is included under this Section:

DISPOSAL OF WASTE MATERIALS

Removal from CITY Property. Remove waste materials and unsuitable or excess topsoil from CITY property at the CONTRACTOR's expense. CONTRACTOR shall make own arrangements for obtaining disposal areas. Proposed haul routes between the site and disposal areas shall be submitted by the CONTRACTOR to the DIRECTOR OF PUBLIC SERVICES for approval prior to commencing this Work.

END OF SECTION 2

SECTION 3. – DEWATERING

PART 1 – GENERAL

SUMMARY

Dewatering consists of performing work necessary to lower and control groundwater levels and hydrostatic pressures to permit excavation and construction to be performed in near-dry conditions.

Control of surface and subsurface water, ice, and snow are part of dewatering requirements. All costs for dewatering trenches shall be included in the amount bid for the Contract.

PART 2 – PRODUCTS NOT USED

PART 3 – EXECUTION

DEWATERING

Provide an adequate system to lower and control groundwater in order to permit excavation, construction of structures, and placement of fill materials under dry conditions. Install sufficient dewatering equipment to pre-drain water-bearing strata above and below bottom of structure foundations, drains, sewers, and other excavations. The excavations shall be kept dry until exterior walls have been completed and until the structures have been backfilled. Drainage ditches shall not be placed within the area to be occupied by any structure except where permitted by the DIRECTOR OF PUBLIC SERVICES. When such ditches are placed beneath the structures, they shall be backfilled with Class C concrete.

Reduce hydrostatic head in water-bearing strata below structure foundations, drains, sewers, and other excavations to the extent that water level and piezometric water levels in construction areas are below prevailing excavation surface.

Prior to excavation below groundwater level, place system into operation to lower water levels as required and then operate it continuously 24 hours a day, 7 days a week until drains, sewers, and structures have been constructed, including placement of fill materials, and until dewatering is no longer required.

Dispose of water removed from excavations in a manner to avoid endangering public health, property, and portions of Work under construction or completed. Dispose of water in a manner to avoid inconvenience to others engaged in work about site. Provide sumps, sedimentation tanks, and other flow control devices as required by current Laws and Regulations. Effluent water from dewatering methods shall be sediment free or be discharged through a DIRECTOR OF PUBLIC SERVICES-approved sediment entrapment basin.

Provide standby equipment on site, installed and available, for immediate operation if required to maintain dewatering on a continuous basis in event any part of the system becomes inadequate or fails. If dewatering requirements are not satisfied due to inadequacy or failure of dewatering system, perform work as may be required to restore damaged structures and foundation soils at no additional expense.

END OF SECTION 3

SECTION 4 – EXCAVATION AND BACKFILL

PART 1 – GENERAL

SUMMARY

Section Includes. The Work shall include the excavation, trenching, complete and continual dewatering of excavation, sheeting, bracing and shoring of sides of excavation, backfilling around structures and over pipe lines, and disposal of excess excavated material.

REFERENCES

MDOT STANDARD SPECIFICATIONS FOR CONSTRUCTION, 2012

MDOT	Michigan Department of Transportation
MDOT 6A	Stone Refill
MDOT 902	Granular Fill
ASTM D1557, D2922, D1556, and D3017	Modified Proctor Test
AWWA C600	Installation of Ductile Iron Water Mains and Their Appurtenances

DEFINITIONS

Earth. Earth, as a name for excavated material, shall include all glacial deposits whether cemented or not, except solid boulders 1/2 cubic yard or more in volume; it shall include all alluvial deposits and material of every kind that can be excavated with equal facility by the equipment and means used for other earth excavation in the Work.

Rock. Rock, as a name for excavated material, shall include pre-glacial solid ledge rock that can be removed most practically by ~~blasting,~~ barring, ~~or~~ wedging, or by some other standard method of quarrying solid rock; it shall include solid boulders of 1/2 cubic yard or more in volume. It shall include existing concrete, masonry with mortar joints, or other existing structural work that can be excavated practically only by methods of quarrying solid rock. It shall not include fragile, friable, or disintegrated materials of any kind that can be excavated with equal facility by equipment and means used for earth excavation.

Job-excavated Backfill. Job-excavated backfill shall be defined as job-excavated material, free from frozen earth, boulders, rocks, stones larger than 6 inches in size, debris, and organic material.

Granular Fill. Granular fill shall be defined as sharp sand, gravel, or crushed stone, free from lumps of clay or soft or flaky material and shall conform to the MDOT Specification "Granular Materials – Class II or Class III."

Subgrade. The undisturbed earth or the compacted soil layer immediately below granular subbase, drainage fill, or topsoil materials.

Subbase. The layer of specified materials of designed thickness placed on the subgrade as part of the pavement structure.

Structure. Buildings, foundations, slabs, tanks, curbs, or other man-made stationary features occurring above or below ground surface.

SUBMITTALS

Test Reports. Submit the following reports, where applicable, directly to the DIRECTOR OF PUBLIC SERVICES from the testing services, with copy to the CONTRACTOR:

Test reports on borrow material.

Gradation analysis for granular backfill and subbase materials.

Field reports of in-place soil density tests.

QUALITY ASSURANCE

Codes and Standards. Perform excavation work in compliance with applicable requirements of authorities having jurisdiction. Construct subbase in accordance with Michigan Department of Transportation Standard Specifications for Construction.

Testing and Inspection Service. The CITY will employ and pay for a qualified independent geotechnical testing and inspection laboratory to perform soil testing and inspection service during earthwork operations.

PROJECT CONDITIONS

Existing Utilities. Locate existing underground utilities in areas of excavation work. If utilities are indicated to remain in place, provide adequate means of support and protection during earthwork operations.

The CONTRACTOR shall notify MISS-DIG – Utility Communications System, 811, three working days prior to starting any excavation with power equipment.

Should uncharted, or incorrectly charted, piping or other utilities be encountered during excavation, consult utility owner immediately for directions. Cooperate with the CITY and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to satisfaction of the City.

Do not interrupt existing utilities serving facilities occupied by the CITY or others during occupied hours, except when permitted in writing by the DIRECTOR OF PUBLIC SERVICES and then only after acceptable temporary utility services have been provided.

Provide minimum of two working days' notice to the DIRECTOR OF PUBLIC SERVICES, and receive written notice to proceed before interrupting any utility.

Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies for shutoff of services if lines are active.

Use of Explosives. Use of explosives is not permitted.

PART 2 – PRODUCTS

SOIL MATERIALS

Satisfactory soil materials are defined as those complying with ASTM D2487 soil classification groups GW, GP, GM, SM, SW, and SP.

Unsatisfactory soil materials are defined as those complying with ASTM D2487 soil classification groups GC, SC, ML, MH, CL, CH, OL, OH, and PT.

Bedding. MDOT Specification Granular Material 6A or Class I, except 100 percent must pass 1-1/2-inch sieve.

Bedding for Thermoplastic Pipe, 6-inch Diameter or less. Granular material with 100 percent passing the 1/2-inch sieve and less than 50 percent passing the No. 200 sieve.

Granular Backfill. MDOT Specifications – Granular Materials Class II or Class III.

Stone Refill. MDOT 6A Coarse Aggregate.

Subbase Material. MDOT Specifications – Granular Materials Class II.

Drainage Fill. Washed, evenly graded mixture of crushed stone, or crushed or uncrushed gravel, with 100 percent passing a 1-1/2-inch sieve and not more than 5 percent passing a No. 4 sieve.

Backfill and Fill Materials. Satisfactory soil materials free of clay, rock or gravel larger than 2 inches in any dimension, debris, waste, frozen materials, vegetation and other deleterious matter.

PART 3 – EXECUTION

LIMITS OF EXCAVATION

General. Trenches for pipes shall be excavated so that there will be a minimum clearance of 6 inches on each side of the pipe barrel and a maximum width at the level on the top of the pipe of not more than O.D. of the pipe plus 12 inches on each side. Trenches shall be at all times of sufficient width to permit the pipe to be laid by first-class construction methods. Sufficient space shall be provided in the trench to permit the joints to be properly made. Before excavation is started in either bituminous or concrete paved streets, the paving shall be cut by means specified under this Section.

The bottom of the trench in granular material shall be loosened to a depth of 3 inches below the bottom of the pipe. Where the trench excavation for pipe is in rock, the trench bottom shall be undercut a minimum of 6 inches below the final location of the pipe and bedding material, hereinafter specified, shall be placed and compacted along the haunch of the pipe.

Excavation for structures shall be made to the outside lines and surfaces of such structures wherever it is practicable to build directly against the sides or bottoms of excavations. In such cases, care shall be taken not to disturb the original foundation or backing, with the final excavation or trimming being done by handwork just before the construction work. If excess excavation is made or the material becomes disturbed so as to require removal beyond the prescribed limits, the resulting space shall be refilled with bedding, as specified hereinafter, solidly machine tamped into place, to the required compaction, before construction work proceeds.

Excavation for structures shall be extended sufficiently beyond the limits of the structure to provide ample room for form construction and other construction methods to be followed, wherever necessary.

LENGTH OF TRENCH OPENING

In excavating for pipelines, the excavation shall at all times be finished to the required grade for an adequate distance in advance of the completed pipeline. Unless otherwise permitted by the DIRECTOR OF PUBLIC SERVICES, not more than 50 feet of trench shall be open at one time in advance of the pipe. The length of street that may be occupied by the construction work at any one time will be based on the requirements of use of the street by the public. No more than 600 consecutive feet of length of the street shall be occupied at one time, and vehicle traffic through the street shall not be entirely stopped without the permission of the DIRECTOR OF PUBLIC SERVICES.

METHOD OF EXCAVATION IN EARTH

All excavation shall be by open cut from the surface except in special cases where tunneling under pavement or structures may be required, or where tunneling under the root system will be required for tree root protection. All excavation shall be made in such a manner and to such depth, length, and width as will give ample room for building the structures, for bracing, sheeting, and supporting the sides of the excavation, for pumping and drainage of groundwater and sewage that may be encountered, and for the removal of all materials excavated. Special care shall be taken so that the soil below the bottom of structures to be built shall be left undisturbed to provide a firm bed for construction.

STABILITY OF EXCAVATIONS

General. Comply with local codes, ordinances, and requirements of agencies having jurisdiction.

Slope sides of excavations to comply with local codes, ordinances, and requirements of agencies having jurisdiction. Shore and brace where sloping is not possible because of space restrictions or stability of material excavated. Maintain sides and slopes of excavations in safe condition until completion of backfilling.

STORAGE OF EXCAVATED MATERIALS

Stockpile excavated materials acceptable for backfill and fill where directed. Place, grade, and shape stockpiles for proper drainage.

Locate and retain soil materials away from edge of excavations. Do not store within drip line of trees indicated to remain.

Dispose of excess excavated soil material and materials not acceptable for use as backfill or fill.

BEDDING

Place granular material MDOT Class II bedding under the pipe, in the haunches along the sides of the pipe, and over the pipe to a level 1 foot above the pipe. The material directly below the pipe shall remain uncompacted. The material in the haunch area shall be placed in layers not to exceed 6 inches in depth, and shall be compacted to 95 percent of its maximum unit weight. The material placed above the haunch area shall be compacted to percentage maximum unit weight as hereinafter specified under “COMPACTION.”

BACKFILLING TRENCHES

All trenches in paved streets, shoulders, traveled roadways, parking areas, and driveways shall be backfilled with job-excavated backfill or granular fill meeting MDOT Class II requirements, as shown on the Drawings, from the level 1 foot above the top of the pipe to the specified road surface subgrade. The job-excavated backfill or granular fill shall be placed in not more than 6-inch layers and thoroughly and uniformly compacted by machine tamping, required compaction. With the approval of the DIRECTOR OF PUBLIC SERVICES, water jetting on granular fill may be accepted in lieu of tamping in 6-inch layers.

Trenches under concrete sidewalks shall be backfilled from a level 1 foot above the top of the pipe to a level 4 inches below the finished grade of the sidewalk with job-excavated backfill or granular fill meeting MDOT Class II requirements and compacted to the required density.

Trenches not in paved streets, shoulders, traveled roadways, parking areas, driveways, and under sidewalks shall be backfilled from a level 1 foot above the top of the pipe to the ground surface with job-excavated backfill or granular fill meeting MDOT Class III requirements and tamped as required to prevent trench settlement.

Any depression resulting from settlement of the trench backfill previous to the date of total acceptance of all Work under this Contract shall be brought to proper grade and surface, and made to match the adjacent surface.

Wherever gas mains, water mains, sewers, etc., are located in the trench area, granular fill meeting MDOT Class II requirements shall be used for backfill from the bottom of the trench up to the spring line of these pipes. Granular fill shall be placed full trench width with two horizontal to one vertical side slopes and compacted in 6-inch layers to 95 percent of its maximum unit weight so as to thoroughly support the pipe within the trench area. Granular fill so required shall be considered included in the unit prices bid for other items of the Work. When directed by DIRECTOR OF PUBLIC SERVICES, dry mix Class C concrete will be substituted for granular fill. The installation of any dry mix Class C concrete shall be considered a change in the Work.

STONE REFILL

In locations where the soil at the bottom of the trench is unstable, when ordered by the DIRECTOR OF PUBLIC SERVICES, the CONTRACTOR shall excavate below the trench bottom and replace excavated material with stone refill.

BACKFILLING AROUND STRUCTURES

As soon as practical after concrete structures have set, forms and debris shall be removed and the surface of the concrete pointed. After the structure has been inspected and approved, the excavated area around the structure shall be backfilled up to the specified subgrade with granular fill or job-excavated backfill meeting MDOT Class II requirements, as called for on the Drawings for the adjacent trench. The fill shall be made in layers not to exceed 6 inches in depth and thoroughly compacted by machine tamping. No large boulders or masonry shall be placed in backfilling. No backfilling will be placed against manhole walls within 24 hours after the plaster coat has been applied to the outside of the walls, nor shall backfilling be placed about concrete structures until the concrete has attained at least 75 percent of its design strength, and approval of DIRECTOR OF PUBLIC SERVICES has been obtained.

CONCRETE CUTS

When the trench must be cut through pavement, driveway, or sidewalk, particular care shall be taken not to unnecessarily damage the adjoining areas of pavement, driveway, or sidewalk. All cuts through existing surfaces shall be made with a concrete saw, sawing deep enough to allow a straight cut parallel to longitudinal or transverse construction or contraction joints.

The saw cuts shall not be nearer than 5 feet to a transverse joint, to the centerline of the pavement, or to the edge of pavement or curb; i.e., no replacement shall be less than 5 feet in width. If the damaged pavement is nearer than 5 feet to a joint, to the centerline of pavement, or to the edge of pavement, surfacing or curb, the removal and replacement shall be extended to said joint, centerline, edge of pavement, surfacing, or curb. These same requirements with reference to existing joints shall also apply to the cutting and replacement of concrete driveways.

If a square or block of sidewalk is cut, broken, or cracked, the entire block or square shall be removed and replaced.

CROSSING EXISTING STRUCTURES

During construction, it may be necessary to cross under certain sewers, drains, culverts, water lines, gas lines, electric conduits, and other underground structures. Every effort shall be made to prevent damage to such underground structures. Wherever such structures are disturbed or broken, they shall be restored to good condition by CONTRACTOR, unless otherwise noted on the Drawings.

METHOD OF EXCAVATION IN ROCK

General. Every trench in rock must be fully opened for at least 30 feet in advance of any place where pipe is being laid. All rock excavation shall be carried to the limits specified under "Limits of Excavation." The CONTRACTOR shall submit a letter to the CITY indicating the method of excavation and the person or subcontractor who shall be performing the excavation prior to the start of the Work.

~~Blasting. If the CONTRACTOR utilizes blasting methods, the CONTRACTOR shall employ an experienced blasting foreperson to supervise the Work, who shall present suitable evidence of experience in excavation by use of explosives and be acceptable to the DIRECTOR OF PUBLIC SERVICES. All applicable codes and ordinances shall be observed, including but not limited to the City, State, Federal, MIOSHA and OSHA requirements for storage, handling, transporting, and use of explosives. At no time will the storage of explosives be allowed on the construction site.~~

~~The Work shall be executed in a safe, coordinated manner. The CONTRACTOR shall take all necessary precautions to prevent damage to any existing utilities and adjacent properties both above and below the surface of the ground. Explosives shall not be used in the proximity of utility lines without the knowledge and consent of the utility firm. The CONTRACTOR shall make a report of the condition of all houses, structures, driveways, walks, and other properties adjacent to and in the Project area before blasting operation begins and after all blasting work is completed. All damages to property, structures, and utilities above and below ground shall be remedied by the CONTRACTOR at the CONTRACTOR's expense and no extra compensation will be allowed.~~

~~The CONTRACTOR shall be responsible for safely stationing flagmen on highways that pass through the danger zone so as to stop traffic during blasting operations. The CONTRACTOR shall also post signs warning against the use of mobile radio transmitters on all roads that are within 1,000 feet of the blasting operations.~~

BACKFILLING ROCK EXCAVATION AREAS

All trench areas in which rock excavation is made shall be backfilled with compacted granular fill up to the limits of the rock excavation.

COMPACTION

Percentage of Maximum Density Requirements. Compact soil to not less than the following percentages of maximum density, in accordance with ASTM D 1557:

> Under pavements, structures, and slabs, compact top 12 inches of subgrade and each layer of backfill or fill material at 95 percent maximum unit weight.
>
> Under lawn or unpaved areas, compact top 6 inches of subgrade and each layer of backfill or fill material at 90 percent maximum unit weight.
>
> Under walkways, compact top 6 inches of subgrade and each layer of backfill or fill material at 95 percent maximum unit weight.

Moisture Control. Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water to surface of subgrade or layer of soil material. Apply water in minimum quantity as necessary to prevent free water from appearing on surface during or subsequent to compaction operations.

Remove and replace, or scarify and air dry, soil material that is too wet to permit compaction to specified density.

DISPOSAL OF EXCAVATED MATERIAL

Excavated material, where suitable, shall be used in backfilling around pipelines and structures. All material in excess of the quantity required for backfilling or unsuitable material shall be disposed of by the CONTRACTOR. The CONTRACTOR shall obtain such spoil sites as may be required, except that the DIRECTOR OF PUBLIC SERVICES may direct the CONTRACTOR to dump materials at any site designated by the CITY within a two-mile radius of the Work area. The CONTRACTOR shall provide all labor and equipment for spreading such material at the place of dumping and shall leave the area in a neat condition satisfactory to the DIRECTOR OF PUBLIC SERVICES.

TREE ROOT PROTECTION

Machines shall freely excavate no closer to the base of a tree than the radius of the tree in inches converted to feet for trees less than 24 inches in diameter; and no closer than 12 feet if the tree is more than 24 inches in diameter. Tunneling under the root system will be required between the points so determined. Approaches closer than the previously stated distance, or tree removal, may be authorized by the DIRECTOR OF PUBLIC SERVICES. Trees removed shall be disposed of at the CONTRACTOR's expense.

ROADSIDE DITCHES AND CULVERTS

All roadside ditches and driveway culverts shall be cleaned, repaired, and replaced to the same condition, or better, as existed before trenching operations commenced. Repair and/or replacement costs shall be included in other portions of the Work unless otherwise noted on the Drawings.

FIELD QUALITY CONTROL

Quality Control Testing During Construction. Provide testing service to inspect, document, and approve each subgrade and fill layer before further backfill or construction work is performed.

EROSION CONTROL

Provide erosion control methods in accordance with details shown on the Drawings and/or requirements of authorities having jurisdiction.

MAINTENANCE

Protection of Graded Areas. Protect newly graded areas from traffic and erosion. Keep free of trash and debris.

Repair and reestablish grades in settled, eroded, and rutted areas to specified tolerances.

Reconditioning Compacted Areas. Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, reshape, and compact to required density prior to further construction.

Settling. Where settling is measurable or observable at excavated areas during general Project warranty period, remove surface (pavement, lawn, or other finish), add backfill material, compact, and replace surface treatment. Restore appearance, quality, and condition of surface or finish to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

END OF SECTION 4

SECTION 5. – HOT MIX ASPHALT PAVING

PART 1 – GENERAL

SUMMARY

Extent of hot mix asphalt (HMA) paving work is shown on Drawings.

Prepared aggregate subbase and aggregate base course is specified in Section 4, Excavation and Backfill.

REFERENCES

MDOT STANDARD SPECIFICATIONS FOR CONSTRUCTION, 2020

MDOT 302	Aggregate Base Course
MDOT 501	Plant Produced Hot Mix Asphalt
MDOT 501.02	Materials
MDOT 501.03.I.1	Weather Limitations
MDOT 503	Paver Placed Surface Seal

DEFINITIONS

Bituminous pavement restoration shall be one of the following types unless otherwise directed:

Type A. 1-1/2-inch No. 13A leveling course over gravel base with 1-1/2-inch No. 13A wearing course in trench areas.

Type B. 1-1/2-inch No. 13A leveling course over gravel base in trench areas with 1-1/2-inch No. 13A wearing course over entire width of pavement.

Bituminous Driveways. All bituminous driveways removed shall be replaced with 1-1/2-inch 13A leveling course and 1-1/2-inch 13A wearing course on a 6-inch-thick compacted gravel base. If the existing driveway has a thicker bituminous cross section, the difference shall be made up using hot mix bituminous base.

SUBMITTALS

Material Certificates. Provide copies of material certificates signed by material producer and the CONTRACTOR, certifying that each material item complies with, or exceeds, specified requirements.

Bituminous Mix Design. Provide a laboratory-designed, Marshall Mix design for all bituminous mixtures. The mix design shall include, at a minimum, the asphalt content, compacted mixture specific gravity, theoretical maximum specific gravity, air voids, voids filled with asphalt (VFA), voids mineral aggregate (VMA), mix proportions, stability, flow, aggregate gradation, crush content, and job mix formula as required by MDOT.

QUALITY ASSURANCE

Codes and Standards. Comply with Michigan Department of Transportation Standard Specifications for Construction.

SITE CONDITIONS

Weather Limitations. Apply prime and tack coats when ambient temperature is above 50 degrees F (10 degrees C), and when temperature has not been below 35 degrees F (1 degree C) for 12 hours immediately prior to application. Do not apply when base is wet or contains an excess of moisture.

Construct asphalt concrete surface course when atmospheric temperature is above 40 degrees F (4 degrees C), and when base is dry. Bituminous base course over 2 inches thick may be placed when air temperature is above 35 degrees F (-1 degree C) and rising. Asphalt may not be placed between November 15 and May 5 unless otherwise approved.

Grade Control. Establish and maintain required lines and elevations. Grade control shall be per MDOT standards.

PART 2 – PRODUCTS

MATERIALS

General. Use locally available materials and gradations that meet the Specifications' requirements and exhibit a satisfactory record of previous installations.

Surface Course Aggregate. MDOT Specification 20AA.

Mineral Filler. MDOT Specifications 3MF.

Asphalt Cement. Asphalt penetration (viscosity) rate of 120 to 150.

Bond Coat. MDOT Specification SS1h or MS-2a.

Lane Marking Paint. Chlorinated rubber-alkyd type, AASHTO M 248 (FS TT-P-115), Type III.

ASPHALT-AGGREGATE MIXTURE

HMA Base Course. MDOT Mixture No. 3EL.

HMA Leveling Course. MDOT Mixture No. 4EL.

HMA Wearing Course. MDOT Mixture No. 5EL.

HMA mixtures shall be HMA Mixture No. 5EL furnished and placed in accordance with MDOT Specification 501. Aggregate Wear Index shall be 220 for local roads and 260 for collection and major roads.

When tested at the optimum asphalt content in accordance with ASTM D1559, the bituminous mixture shall meet the requirements for stability, 1,100 pounds, flow, 8-16 hundredths of an inch, air voids 3.0 percent, and voids in mineral aggregate, 13.5 percent, as specified in Table 902 of the MDOT Specifications. The maximum allowable deviations permitted from the approved Job-Mix Formula shall be as shown in Table 501-1 of the MDOT Specifications. HMA Mix design shall be developed in accordance with the *HMA Production Manual.*

PART 3 – EXECUTION

SURFACE PREPARATION

Proof roll prepared subbase surface to check for unstable areas and areas requiring additional compaction. Do not begin base construction or paving work until deficient subbase areas have been corrected and are ready to receive paving.

Pavement along edges of existing bituminous surfaces shall be removed as directed by the DIRECTOR OF PUBLIC SERVICES to construct butt joints.

Tack Coat. Apply to contact surfaces of previously constructed asphalt or Portland cement concrete and surfaces abutting or projecting into asphalt concrete pavement. Distribute at rate of 0.10 gal. per sq. yd. of surface. Apply to all edges of concrete curb and gutter.

Allow to cure until at proper condition to receive paving.

Exercise care in applying bituminous materials to avoid smearing of adjoining concrete surfaces. Remove and clean damaged surfaces.

PLACING MIX

General. Place asphalt concrete mixture on prepared surface; spread and strike-off in accordance with MDOT Specifications. Spread mixture at minimum temperature of 225 degrees F (107 degrees C). Place inaccessible and small areas by hand. Place each course to required grade, cross-section, and compacted thickness as shown on the Drawings.

Paver Placing. Place in strips to line up with lane lines in accordance with MDOT Specifications.

Joints. Make joints between old and new pavements or between successive days' work, to ensure continuous bond between adjoining work. Construct joints to have same texture, density, and smoothness as other sections of asphalt concrete course. Clean contact surfaces and apply tack coat. All joints on new pavement shall be vertical joints. Joints on old to new pavement shall be butt joints.

ROLLING

General. Begin rolling when mixture will bear roller weight without excessive displacement.

Compact mixture with hot hand tampers or vibrating plate compactors in areas inaccessible to rollers.

Breakdown Rolling. Accomplish breakdown or initial rolling immediately following rolling of joints and outside edge. Check surface after breakdown rolling, and repair displaced areas by loosening and filling, if required, with hot material.

Second Rolling. Follow breakdown rolling as soon as possible, while mixture is hot. Continue second rolling until mixture has been thoroughly compacted.

Finish Rolling. Perform finish rolling while mixture is still warm enough for removal of roller marks. Continue rolling until roller marks are eliminated and course has attained maximum density.

Patching. Remove and replace paving areas mixed with foreign materials and defective areas. Cut out such areas and fill with fresh, hot asphalt concrete. Compact by rolling to maximum surface density and smoothness.

Protection. After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.

Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

TRAFFIC AND LANE MARKINGS

Cleaning. Sweep and clean surface to eliminate loose material and dust.

Striping. Use sprayable thermoplastic traffic lane-marking paint, factory-mixed, quick-drying, and non-bleeding.

Color. White.

Color. Yellow.

Do not apply traffic and lane marking paint until layout and placement has been verified with the DIRECTOR OF PUBLIC SERVICES.

Apply paint with mechanical equipment to produce uniform straight edges. Apply in 2 coats at manufacturer's recommended rates.

FIELD QUALITY CONTROL

General. In-place asphalt concrete courses will be tested for compliance with requirements for thickness and surface smoothness by the CITY. The CONTRACTOR shall repair or remove and replace unacceptable paving as directed by the DIRECTOR OF PUBLIC SERVICES.

Surface Smoothness. Test finished surface of each asphalt concrete course for smoothness, using 10-foot straightedge applied parallel with and at right angles to centerline of paved area. Surfaces will not be acceptable if exceeding the following tolerances for smoothness.

Thickness. In-place compacted thickness will not be acceptable if exceeding following allowable variation from required thickness: Base Course. 1/4 inch, plus or minus. Surface Course. 1/4 inch, plus or minus.

Base Course Surface. Lower Courses – 3/4 inch, Top Course – 3/8 inch.

Leveling and Wearing Course Surface. Multiple course construction – 1/8 inch for top course, 1/4 inch for lower course. Single course construction – 1/4 inch.

END OF SECTION 5

SECTION 6 – CONCRETE PAVING

PART 1 – GENERAL

SUMMARY

Extent of Portland cement concrete paving is shown on Drawings, including curbs, gutters, walkways, and pavement.

Prepared subbase is specified in under Section 4, Excavation and Backfill.

Concrete and related materials are specified in Section 11 Concrete Work.

SUBMITTALS

Provide samples, manufacturer's product data, test reports, and materials' certifications as required in referenced Sections.

QUALITY ASSURANCE

Codes and Standards. Comply with Michigan Department of Transportation, Standard Specifications for Construction, Standard Plans and Special Details, and the ACI.

PROJECT CONDITIONS

Traffic Control. Maintain access for vehicular and pedestrian traffic as required for other construction activities specified in Division 1.

PART 2 – PRODUCTS

GENERAL

Materials for forms, steel reinforcement, joint materials, and curing materials shall comply with MDOT Standard Specifications if not specified in Section 11 Concrete Work.

CONCRETE MIX, DESIGN, AND TESTING

Comply with requirements of applicable sections for concrete mix design, sampling and testing, and quality control and as herein specified.

WHEEL STOPS

Precast of 3,500 psi air-entrained concrete approximately 6 inches high, 9 inches wide, and 7'-0" long with chamfered corners and drainage slots on underside.

CONCRETE RAMPS

Ramps shall be constructed 6 inches thick and to the width and slope shown on the Drawings using Class A concrete. Type of ramp shall be as noted on the Drawings for different intersection conditions.

CONCRETE DRIVEWAYS

All concrete residential and some commercial driveways shall be Class A concrete, 6 inches thick. Joints shall be as specified in concrete work and/or concrete pavements. Heavy load traffic driveways (Industrial some commercial) shall be Class A concrete, 8 inches thick, min. W2.9 welded wire fabric.

CONCRETE SIDEWALKS

Concrete sidewalks shall be 4 inches thick (6 inches thick at driveway crossings) and to the width as shown on the Drawings or to match existing walks. Concrete shall be Class A. Sidewalk Ramps shall be 6 inches thick.

CONCRETE ROADWAYS

Pavement surfaces shall be as shown on the Drawings. Thickness shall be as shown on the Drawings or equal to that removed, but in no case less than 6 inches.

Concrete for pavements and bases shall be Class P concrete.

For pavement replacement, reinforcing steel shall be similar to that in the existing pavement and shall provide the same cross-sectional area of reinforcement per foot as the existing pavement.

CONCRETE CURB AND GUTTERS

Concrete curb and gutter shall be as shown on the Drawings or shall have the same cross-section as that removed, and be constructed using Class P concrete and in accordance with CITY standards. Required to maintain a slump within the range of 1 to 3 inches.

CEMENT

Cement shall be Air-Entraining Portland Cement, Type 1A, conforming to ASTM C150. Air-Entraining Portland cement, Type IS-A conforming to ASTM C595 or High-Early-Strength Air-Entraining Portland Cement, Type IIIA conforming to ASTM C150. The CONTRACTOR shall provide suitable means for storing and protecting the cement against dampness. Cement that for any reason has become partially set or that contains lumps or caked cement shall be rejected.

PART 3 – EXECUTION

SURFACE PREPARATION

Remove loose material from compacted subbase or base surface immediately before placing concrete.

FORM CONSTRUCTION

Set forms to required grades and lines, braced, and secured. Install forms to allow continuous progress of Work and so that forms can remain in place at least 24 hours after concrete placement.

Check completed formwork for grade and alignment to following tolerances:

Top of forms not more than 1/8 inch in 10 feet.

Vertical face on longitudinal axis, not more than 1/4 inch in 10 feet.

Clean forms after each use and coat with form release agent as required to ensure separation from concrete without damage.

Slope step treads at 1/4 inch per foot to drain.

REINFORCEMENT

Locate, place, and support reinforcement as specified in applicable Section, unless otherwise indicated.

CONCRETE PLACEMENT

General. Comply with requirements of applicable Sections for mixing and placing concrete, and as herein specified.

Do not place concrete until subbase, base, and forms have been checked for line and grade. Moisten subbase/base if required to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.

Place concrete by methods that prevent segregation of mix. Consolidate concrete along face of forms and adjacent to transverse joints with internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand-spreading and consolidation. Consolidate with care to prevent dislocation of reinforcing, dowels, and joint devices.

Use bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

Deposit and spread concrete in a continuous operation between transverse joints as far as possible. If interrupted for more than 1/2 hour, place a construction joint.

When adjacent pavement lanes are placed in separate pours, do not operate equipment on concrete until pavement has attained sufficient strength to carry loads without injury.

Fabricated Bar Mats. Keep mats clean and free from excessive rust, and handle units to keep them flat and free of distortions. Straighten bends, kinks, and other irregularities or replace units as required before placement. Set mats for a minimum 2-inch overlap to adjacent mats.

Place concrete in two operations; strike off initial pour for entire width of placement and to the required depth below finish surface. Lay fabricated bar mats immediately in final position. Place top layer of concrete, strike off, and screed.

Remove and replace portions of bottom layer of concrete that have been placed more than 15 minutes without being covered by top layer or use bonding agent if acceptable to the DIRECTOR OF PUBLIC SERVICES.

Curb and Gutter. Automatic machine may be used for curb and gutter placement at the CONTRACTOR's option. If machine placement is to be used, submit revised mix design and laboratory test results that meet or exceed minimums specified. Machine placement must produce curbs and gutters to required cross-section, lines, grades, finish, and jointing as specified for formed concrete. If results are not acceptable, remove and replace with formed concrete as specified.

JOINTS

General. Construct expansion, weakened-plane (contraction), and construction joints true to line with face perpendicular to surface of concrete. Construct transverse joints at right angles to the centerline, unless otherwise indicated.

When joining existing structures, place transverse joints to align with previously placed joints, unless otherwise indicated.

Joints shall be of the type and location as shown on the Drawings. Joints shall be constructed in accordance with MDOT Specifications.

CONCRETE FINISHING

After striking off and consolidating concrete, smooth surface by screeding and floating. Use hand methods only where mechanical floating is not possible. Adjust floating to compact surface and produce uniform texture.

After floating, test surface for trueness with a 10-foot straightedge. Distribute concrete as required to remove surface irregularities, and refloat repaired areas to provide a continuous smooth finish.

Work edges of slabs, gutters, back top edge of curb, and formed joints with an edging tool, and round to 1/2-inch radius, unless otherwise indicated. Eliminate tool marks on concrete surface.

After completion of floating and when excess moisture or surface sheen has disappeared, complete troweling and finish surface as follows:

> Broom finish by drawing a fine-hair broom across concrete surface perpendicular to the line of traffic. Repeat operation if required to provide a fine line texture acceptable to the DIRECTOR OF PUBLIC SERVICES.
>
> On inclined slab surfaces, provide a coarse, non-slip finish by scoring surface with a stiff-bristled broom, perpendicular to line of traffic.
>
> Burlap finish by dragging a seamless strip of damp burlap across concrete, perpendicular to the line of traffic. Repeat operation to provide a gritty texture acceptable to the DIRECTOR OF PUBLIC SERVICES.

Do not remove forms for 24 hours after concrete has been placed. After form removal, clean ends of joints and point-up any minor honeycombed areas. Remove and replace areas or sections with major defects, as directed by the DIRECTOR OF PUBLIC SERVICES.

SIDEWALKS

Forms shall be of metal or wood, straight and free of distortion, and of sufficient strength to resist springing during the placing of concrete. Forms shall be securely staked, braced, and tied to the required line and grade. Flexible steel or adequately sized lumber may be used for short radius forms.

The walk subgrade shall be compacted to 95 percent compaction by tamping. After wetting the subgrade, the concrete shall be placed to the proper depth and spaded along the form faces.

Concrete shall be alternately tamped and screeded until all voids are removed and the surface has been brought to the required grade. The surface shall then be floated to produce a smooth, dense surface, free from irregularities. All edges and joints shall be rounded to a radius of 1/4 inch with an edging tool and trowel. As soon as all excess moisture has disappeared, the surface shall be finished by light brooming.

Walks shall be divided into blocks approximately square, using slab division forms or by cutting joints after floating. These joints shall be 1/2-inch deep by 1/8 to 1/4 inch in width and shall be finished smooth and true to line. Bituminous expansion joints shall be provided at intervals of 50 feet and at junctions with structures and curbs. Control joints shall be located between expansion joints at intervals equal to the sidewalk width.

As soon as concrete surfaces have hardened sufficiently to prevent marring, they shall be covered by an approved curing compound, or they shall be thoroughly wetted and cured by an approved method for a period of six days unless otherwise directed by the DIRECTOR OF PUBLIC SERVICES.

PAVEMENT

The surface of concrete pavements shall be properly consolidated and struck off to such elevations so as to match adjacent pavement and made uniform by transverse floating. As soon as all excess moisture has disappeared, the pavement shall be given a final light brooming finish by dragging a seamless strip of damp burlap or cotton fabric. Edges of all joints shall be tooled.

As soon as concrete surfaces have hardened sufficiently to prevent marring, they shall be covered by an approved curing compound, or they shall be thoroughly wetted and cured by an approved method for a period of six days unless otherwise directed by the DIRECTOR OF PUBLIC SERVICES.

CURB AND GUTTER

Concrete curb and gutter shall be placed prior to the placement of other types of roadway surfaces, including concrete pavements.

Curb and gutter to be replaced shall be determined by the DIRECTOR OF PUBLIC SERVICES and shall include any cracked or broken sections and any sections that have settled 1/4 inch or more.

Forms shall be complete front and back type. Back forms resulting in hand forming the curb and gutter will not be allowed. Forms shall be of metal, straight and free of distortion, and of sufficient strength to resist springing during the placing of concrete. Forms shall be securely staked, braced, and tied to the required line and grade. Flexible steel or adequately sized lumber may be used for short radius forms.

One-inch expansion joints shall be placed opposite expansion joints in an abutting pavement. If curb or curb and gutter does not abut a concrete pavement, place expansion joints at all spring lines of street returns. If intersecting streets are more than 300 feet apart, place expansion joints at 200-foot intervals. For MDOT

Standard Details (no longer a detail A), B, C5, C6 and D curb and gutter, place expansion joints in abutting pavement.

If the structure does not abut a concrete pavement or base, contraction joints shall be placed at approximately 100-foot intervals.

Intermediate plane of weakness joints shall be placed at approximately 10-foot intervals between other joints as called for above.

Curb returns and curb cuts for driveways shall be installed as required.

The gutter and top of curb shall not vary more than 3/16 inch in 10 feet when checked with a 10-foot straightedge. The balance of the exposed surfaces shall not vary more than 3/8 inch from the alignment and typical cross section.

After the back forms are removed, honeycomb and minor defects shall be filled with mortar, composed of one part Portland cement and two parts sand.

As soon as concrete surfaces have hardened sufficiently to prevent marring, they shall be covered by an approved curing compound, or they shall be thoroughly wetted and cured by an approved method for a period of six days unless otherwise directed by the DIRECTOR OF PUBLIC SERVICES.

CURING

Protect and cure finished concrete paving in compliance with applicable requirements of applicable Section. Use membrane-forming curing and sealing compound or approved moist-curing methods.

REPAIRS AND PROTECTIONS

Repair or replace broken or defective concrete, as directed by the DIRECTOR OF PUBLIC SERVICES.

Protect concrete from damage until acceptance of Work. Exclude traffic from pavement for at least 14 days after placement. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials as they occur.

Sweep concrete pavement and wash free of stains, discolorations, dirt, and other foreign material just before final inspection.

END OF SECTION 6

SECTION 7 – WATER DISTRIBUTION

PART 1 – GENERAL

SUMMARY

Section Includes. The principal buried pipelines and their locations to be included under this heading, together with the pipe material required in each case, are shown on the Drawings.

Plugs in open ends of pipe, temporary caps and fittings, protection of surface and subsurface improvements, cleaning, pointing, testing and disinfection, as required, shall be included in the unit prices for the type, size, and class of water main as part of this Work.

The Work shall include the dismantling of existing piping and supports, where required and/or shown or noted on the Drawings. Piping connections shall be made to existing piping, valves, gates, measuring devices, pumps, and other equipment, including equipment erected under other Divisions of the work.

REFERENCES

Reference Standards. Reference standards are under the individual items of Work.

Piping and Valves shall be as specified in Section 12 Pressure Piping and Valves.

SUBMITTALS

Shop Drawings. Furnish, as prescribed under the General Conditions, shop drawings covering the items included under this Section of the Contract.

As-constructed Drawings. The CONTRACTOR shall submit one complete set of drawings showing the GPS location of pipe valves and fittings as installed. The location of all valve boxes shall be witnessed via GPS along with at least two permanent reference points such as utility poles, building, etc. Other valve boxes shall not be used as reference points.

Warranty. Furnish, as prescribed under the General Conditions, warranties covering the items included under this Section of the Work.

QUALITY ASSURANCE

All Work under this Section shall be done in accordance with standard practices as recommended by the manufacturer, AWWA and EGLE.

PART 2 – PRODUCTS

MANUFACTURERS

Corporation Stops shall be the product of the following manufacturer: Mueller Co. H-15000

Curb Stops shall be the product of the following manufacturer: Mueller Co. H-15200

Curb Boxes shall be the product of the following manufacturer: East Jordan Iron Works

MATERIALS

Piping shall be as specified under Section 12 Pressure Piping and Valves, and shall be of the types listed below or as shown on the Drawings:

Ductile Iron Pipe (DIP), Pressure Class 350, Thickness Class 52.

Service Connection shall be Type K, soft temper copper, ASTM B88, water tube with flared joints for underground service.

Corporation Stops shall conform to AWWA C800 with copper American National Taper pipe threads conforming to ASA B2.1 1960. Inlet and outlet shall be of same size as service connection.

Curb Stops. Curb stops shall conform to AWWA C800, shall be drip tight, ball type, and shall be of same size as service connection.

Curb Boxes. Curb boxes shall fit curb stop and be extension type, of suitable length complete with lid and stationary rod.

PART 3 – EXECUTION

INSTALLATION

Service Connections shall be as noted on the Drawings, but shall be no smaller than 1 inch in diameter. The underground service connection shall extend from the main to the street face of walk, or if no walk, to the property line or connect to an existing service, if present. All service connections shall be installed with a minimum 5.5 feet of cover over the top of the pipe.

Corporation Stops shall be the same size as the service connection, shall be installed per AWWA standards and shall be located 26 feet from road centerline or as directed.

END OF SECTION 7

SECTION 8 – SEWERS

PART 1 – GENERAL

SUMMARY

Work Included. This Work shall include all labor, materials, and equipment necessary for furnishing the fabrication, production, installation, or erection of the items specified in this Section as shown on the Drawings or listed in the Schedule.

Excavation, trenching, and complete and continual dewatering of excavation; sheeting, bracing, or shoring of sides of excavation; furnishing and installing of the pipe and bedding; backfilling; placing and maintaining temporary roadway surfaces over trenches in streets, drives, and parking areas; testing; and disposal of excess excavated materials are to be done under Section 4 Excavating and Backfill of the Specifications.

SUBMITTALS

Shop Drawings. Furnish, as prescribed under Section 1 General Conditions, Shop Drawings covering the items included under this Section of the Work.

Design details of the joint shall be submitted to the DIRECTOR OF PUBLIC SERVICES for DIRECTOR OF PUBLIC SERVICES' consideration and approval before ordering any pipe.

Boring and jacking methods of construction shall be submitted to the DIRECTOR OF PUBLIC SERVICES and approved prior to performing any boring and jacking operation. Submit the pressure grout design mix for approval by the DIRECTOR OF PUBLIC SERVICES.

Warranties. Furnish as prescribed under Section 1 General Conditions warranties covering the items included under this Section of the Work.

Certification of Pipe. All pipe delivered to the jobsite shall be accompanied by certification papers showing that the pipe has been tested in accordance with the applicable Specifications and that the pipe meets the Specifications for this Project.

Pipe Tests. The requirements for the necessary Infiltration/Exfiltration Tests are found in detail under the Laying Pipe Section. Submit a written report to DIRECTOR OF PUBLIC SERVICES documenting testing and/or inspection results. The report shall be prepared as noted under the General Equipment Stipulations.

PART 2 – PRODUCTS

SEWER PIPE

Locations of various types of pipe are shown on the Drawings. Sanitary sewer pipe shall be designed for air testing.

Sewer pipe and fittings used in this Work shall meet requirements of referenced standard specifications. Sewer piping shall be of following types as noted on Drawings.

Storm Sewer.

Reinforced Concrete Sewer Pipe (RCSP) – ASTM C 76, class as designated on Drawings or special design conforming to ASTM C655.

Concrete Sewer Pipe (CSP) – ASTM C14, Class 3.

Smooth Lined Corrugated Plastic Pipe (SLCPP) – ASTM F2881 or AASHTO M330, dual wall, watertight joint, ADS HP Storm Pipe or equal.

Sanitary Sewer.

Polyvinyl Chloride Gravity Pipe (PVC) – ASTM D3034 or ASTM D679, SDR 35; ASTM D2680, PVC truss pipe. PVC compounds to meet ASTM D1784, Cell Class 12454B or C.

Polyvinyl Chloride Pressure Pipe (PVCP) – ASTM D2241, SDR 26; ASTM D2672; AWWA C900; AWWA C905; UNI-B-11. PVC compounds, ASTM D1784 with cell class 12454 B or C.

Polyvinyl Chloride Pipe (PVC) and Fittings – ASTM D1785, Schedules 40, 80 and 120; ASTM D2466; ASTM D2467; ASTM D3036; PVC compounds to meet ASTM D1784, Cell Class 124548 or C.

ABS or PVC Truss Pipe – ASTM D2680. Joints to meet requirements of ASTM D3212 with gaskets conforming to ASTM F 477.

Culverts.

Corrugated Metal Pipe (CMP) ASTM A760/A760M, all sections shall conform to MDOT 2020 Standard Specifications.

Concrete Sewer Pipe Culvert (CSPC) ASTM C14, Table 3

Reinforced Concrete Sewer Pipe Culverts (RCSPC) ASTM C76, Class as designated on the Drawings or special design conforming to ASTM C655. Box culverts conforming to ASTM C789 or C850 as conditions allow.

Concrete End Sections. Concrete end sections shall conform to MDOT Specification 401 and MDOT Standard Plan R-86 Series.

PIPE JOINTS

Concrete Or Reinforced Concrete Pipe.

Sanitary Sewers. For joints in concrete sanitary sewer pipe, provide bell and spigot or tongue and groove, with compression-type O-ring rubber gasket. Joints in circular gravity sewer pipe shall conform to ASTM C361. Joints in pressure circular pipe shall conform to AWWA C300, C301, or C302.

Modified groove tongue concrete pipe shall have compression type rubber gasket snapped into a groove cast into the tongue. Modified groove or bell end of pipe shall be made smooth and shall have not over a 3 degree slope tapered to fit gasket to tolerances as detailed by gasket manufacturer.

Rubber gaskets shall meet physical requirements of ASTM C443.

Lubricant shall be supplied by manufacturer for use on the groove and tongue in making up joints, and joints shall be coupled in accordance with pipe manufacturer's requirements.

Around concrete pressure pipe joint, place a band at least 5-1/2 inches wide around the outside of pipe as recommended by pipe manufacturer. This band shall serve as form for placing 1:2 cement mortar grout in external recess formed by face of bell and shoulder of spigot. If air temperature is below 40 degrees F, heat spigot, bell, and mortar. If reinforced paper joint band is used, draw it up tight around pipe and tamp backfill against it up to springline before pouring grout. If cloth band is used, wire it around outside of pipe and pour grout before backfilling.

As a substitute for concrete band, prefabricated joint protectors may be used. They shall be made from high density polyester, polyurethane foam containing at least the equivalent of 9 bags per cubic yard of unhydrated Portland cement. Protectors shall be of suitable cross-section to fully protect joint rings and shall be supplied in form of continuous rings.

Completely fill inside annular space between pressure pipe joints with preformed, cold-applied, ready-to-use plastic joint-sealing compound and primer. Installation of joint materials shall be as recommended by its manufacturer. Trim excess joint materials smooth on inside of pipe.

All exposed steel joint material shall have 4-mil factory-applied galvanized, or equal, protective coating.

Make joints in non-round concrete sewer pipe for which rubber gaskets are unavailable with flexible butyl rubber internal joint sealant conforming to AASHTO M198 or external bands conforming to ASTM C877. Use both internal sealant and external bands for pipe sizes equal to or greater than equivalent 48-inch diameter pipe.

Materials used for joint-sealing compound shall be compatible with gasket.

Storm Sewers and Culverts. For joints in concrete or reinforced concrete pipe for storm sewers or culverts, provide bell and spigot or tongue and groove pipe with compression type rubber gasket.

Lubricant shall be supplied by pipe manufacturer and the joint shall be made in accordance with manufacturer's instructions.

Rubber gaskets shall meet physical properties requirements of ASTM C443.

Make joints in non-round reinforced concrete sewer pipe for which rubber gaskets are unavailable with caulking compound, flexible butyl rubber sealant or external bands conforming to ASTM C877. Caulking compound shall be "Sewertite" asphalt sewer joint compound as produced by Philip Carey Manufacturing Company, #10-WM sewer joint sealant as produced by DeWitt Product Company, or equal.

Butyl rubber sealant shall meet AASHTO M198.

Jacked Pipe. Joints in reinforced concrete pipe to be jacked-in-place shall be with compression-type rubber gasket or with tongue and groove, jointed with cold mastic and inside tuck-pointing. The cold mastic compound shall be "DeWitt #10-WM" as produced by DeWitt Products Co.; or "Sewertite", asphalt joint compound, as manufactured by Philip Carey, Mfg.; or equal. Place cushioning material, similar to Celotex

or hardboard, in joint shoulder between the pipe sections to distribute jacking pressures uniformly. After jacking operation is complete, point joints in pipe 30 inches and larger on inside by removing existing materials to depth of 3/4 inch and cementing this space by pointing with cement mortar, composed of one (1) part of cement and two (2) parts sand.

Polyvinyl Chloride Pipe. Joints in polyvinyl chloride pipe shall be bell and spigot type unless solvent weld joints are specified. Bell and spigot joints shall consist of spigot and formed bell, complete with a factory installed flexible elastomeric gasket meeting ASTM F477. Joints for pressure pipe (PVCP) shall conform to ASTM D3139. Joints for non-pressure pipe (PVC) shall conform to ASTM D3212. Solvent weld joints shall conform to ASTM D2855. Joints in tee branches, wyes, fittings, riser pipes, and service laterals shall be similar to (including pressure rating) and compatible with joints furnished for sewer pipe. Joints shall be made using lubricant as recommended by pipe manufacturer. When necessary to field cut standard length of pipe, the new spigot end shall be prepared as recommended by pipe manufacturer. Joints in Schedule 40, 80, or 120 pipe shall be solvent weld according to ASTM D2564 and D2855.

ABS or PVC Truss Pipe. Provide sleeve coupling type "SC" chemically welded joint in ABS truss pipe as specified in ASTM D2680.

Additionally, fully and thoroughly coat exposed ends of ABS Truss Pipe with plastic jointing cement prior to making joints so as to seal ends to eliminate possibility of false low pressure air tests. Take care to ensure joints are pushed to full "home" position and held tightly in "home" position during grade or line adjustments. Rotate pipe during joint insertion to ensure complete spread of jointing cement. Provide ABS Plastic Cement Primer and ABS Plastic Pipe Cement in sealed and labeled containers at jobsite. Use "Johnny Mops" or similar swab type applicators to apply primer and cement. Protect opened containers in trench from dirt, water, and other contaminants.

Joints in PVC truss pipe shall be bell and spigot with a flexible elastomeric gasket meeting ASTM F477. Assembled joint shall meet the requirements of ASTM D3212. Lubricant for gasketed truss pipe shall be according to pipe manufacturer's recommendations.

FLOWABLE FILL CONCRETE GROUT

Flowable fill shall be a mixture of Portland cement thoroughly mixed with mortar sand and fly ash, as permitted by DIRECTOR OF PUBLIC SERVICES, with sufficient water to permit steady flow through grout pipes. The mix shall be two parts of sand to one part of cement, or an alternate mix with minimum compressive strength of 300 psi, to be approved by DIRECTOR OF PUBLIC SERVICES. Proportions may be varied at DIRECTOR OF PUBLIC SERVICES' order, even to extent of enriching mix to neat cement. If necessary to speed up setting of grout, use approved admixtures of quick-setting cement as directed by DIRECTOR OF PUBLIC SERVICES.

PART 3 – EXECUTION

STORING FLEXIBLE PIPE

After delivery, flexible pipe shall be stored on flat surface so that barrel is evenly supported. Pipe shall not be stored in piles higher than 4 feet. If pipe is to be stored for over two weeks, it shall be covered with opaque material so that it is protected from sun's rays and bells shall be inverted in alternate rows so they are not supporting direct load. Deflection of pipe shall not exceed 5 percent.

DISPOSAL OF WATER AND SEWAGE

The CONTRACTOR shall remove by well points, pumping, bailing, or other acceptable method any water that may accumulate or be found in the trenches or other excavations to be made. They shall make all necessary provisions to keep the trenches and other excavations entirely free of water during construction of pipelines and structures. Newly laid concrete shall be adequately protected from injury resulting from groundwater or sewage or from the handling or disposal of water or sewage. No drainage ditches shall be placed within the area to be occupied by any structure except as permitted by the DIRECTOR OF PUBLIC SERVICES.

The CONTRACTOR shall at all times have upon the site sufficient pumping equipment ready for immediate use to carry out the intent of this Section. All cost for dewatering trenches shall be incidental to the Contract.

Additional requirements for dewatering are specified in Section 02140, Dewatering.

DIVERTING EXISTING SEWERS

Where existing sewers or drains are encountered in this Work, adequate provision shall be made for diverting the flow in the existing sewers so that the excavation will be kept dry during the progress of the construction Work. Upon completion of the construction Work, the existing sewers shall be restored or otherwise provided with an adequate outlet as directed by the DIRECTOR OF PUBLIC SERVICES.

CROSSING EXISTING STRUCTURES

During construction, it may be necessary to cross under certain sewers, drains, culverts, water lines, gas lines, electric conduits, and other underground structures. Every effort shall be made to prevent damage to such underground structures. Wherever such structures are disturbed or broken, they shall be restored to good condition by the CONTRACTOR, unless otherwise noted on the Drawings.

LAYING PIPE

General. Pipe shall be laid from downstream to upstream, starting at the most downstream end of a run, unless approved by the DIRECTOR OF PUBLIC SERVICES.

Lay pipe with bells upgrade and to line and grade called for on the Drawings. Finished sewer shall be straight and free of dirt or debris between manholes.

Install VCP pipe in accordance with ASTM C12, plastic pipe in accordance with ASTM D2321, and plastic pressure pipe in accordance with ASTM D2774.

Inspect each pipe for defects prior to being lowered into trench. Clean inside of pipe and outside of tongue and grooves of dirt or foreign matter. Place joint materials as recommended by manufacturer.

Center pipe in grooves and push tight together to form smooth and continuous invert. Use mechanical means for pulling pipe home in making up joint and for holding pipe joints tight until completion of line. Mechanical means shall consist of a cable placed inside of pipe with a suitable winch, jack, or come-along for pulling pipe home and holding pipe in position.

Use laser aligning equipment for laying of sewers to specified lines and grades. Furnish equipment and personnel required to operate laser equipment.

Rigidly mount laser beam projection to its support platforms in a manner approved by the DIRECTOR OF PUBLIC SERVICES. This will ensure that ground equipment vibrations will be kept to a minimum and will permit laser beam to be projected coaxially through the center of the pipe. Furnish units with equipment to control atmospheric conditions in the pipe that could affect construction.

The DIRECTOR OF PUBLIC SERVICES will establish centerline stakes and offset stakes at each manhole and other centerline and offset stake as required for check points.

Check short culverts not aligned by laser with grade pole and visual sighting through culvert to ensure straightness.

Furnish openings in the pipe, as required for installation of laser equipment, at no additional cost to the CITY. Details of these openings shall be approved by the DIRECTOR OF PUBLIC SERVICES.

After pipe is laid, carefully compact Class II bedding under the haunches of the pipe, and backfill trench to 12 inches above pipe with Class II material. Place sufficient Class II backfill after each joint is made along sides of pipe to offset conditions that might tend to move pipe off line and grade. Relay pipe found off grade or out of line.

Regrade and channel ditch adjacent to culverts to provide unrestricted flow of surface water to the culvert.

Allowable Tolerances in Sewer Grade. Construct and lay sewers to alignment and grade shown on the Drawings or as designated by the DIRECTOR OF PUBLIC SERVICES. A variation greater than 1/4 inch from Plan or designated grade is sufficient reason for rejection of sewer and sewer shall be re-laid to proper grade if so directed by the DIRECTOR OF PUBLIC SERVICES, at no cost to the CITY.

Pipe Placed In Casings. Place pipes in casing pipe in locations shown on the Drawings. Under this Work, place carrier pipe, fill annular space between casing and carrier pipe, place bulkheads, and complete backfilling.

Fill void spaces between casing pipe and carrier pipe with peastone or flowable fill concrete. Furnish the DIRECTOR OF PUBLIC SERVICES with information on quantity of flowable fill material placed. If required by the DIRECTOR OF PUBLIC SERVICES, furnish fill holes in carrier pipe as required to ensure complete filling of void spaces.

Bulkhead annular space at ends of casing pipe with 8-inch minimum of thick solid masonry and with a 1-inch fiberboard cushion between masonry and carrier pipe.

Furnish skidding materials required to protect carrier pipe.

Sewer Jacked-In-Place. Pipe jacked-in-place under this Work shall be considered sewer or carrier pipe without casing pipe. Locate pipe to be jacked-in-place as shown on the Drawings. Reinforcing steel for concrete pipe jacked-in-place shall be circular.

Submit method of boring to the DIRECTOR OF PUBLIC SERVICES for approval prior to construction.

Maintain groundwater table to level 2 feet below invert of pipe throughout the reach prior to and during jacking.

Shafts and Jacking Pits. Furnish, construct, maintain, and refill shafts or jacking pits. Remove other temporary structures and construction and equipment upon completion of jacking.

Completely sheet each jacking shaft to provide proper support for banks and adequate support for reaction blocks. Construct shaft long enough to provide room for jacking head frame, reaction blocks, and two sections of pipe. Provide width sufficient to allow ample working room. Place backstops or reaction blocks absolutely perpendicular in all directions to axis of pipe and install guide timbers carefully to proper line and grade.

Provide ladderways of steel construction in each shaft at least 24 inches wide, with rungs 14 inches on center and with safety cage.

Power and Lighting. Operate power machinery and tools used in shafts and tunnels by electricity or compressed air. No electric voltage in excess of 440 volts will be permitted. Mount transformers on platforms or in an approved enclosure. The use of gasoline in power shafts or tunnels is prohibited.

All machinery and equipment used in tunnel headings or shafts under gaseous conditions shall bear the approval plate of the United States Bureau of Mines.

Provide a sufficient number of lights to illuminate all parts of the Work. Thoroughly insulate and keep separate lighting circuits from power circuits. In gaseous conditions, mount lamps in protected gas and vapor-proof fixtures.

Ventilation. Keep tunnel air in a condition suitable for the health of the workers and clear enough for the surveying operations of the ENGINEER. Provide a sufficient supply of fresh air for the safety and efficiency of workers and the ENGINEER at all times throughout the length of tunnels, especially at working places and in all places underground. Provide for quick removal of gases. Whenever a 24-hour tunneling operation exists, the CONTRACTOR shall have attainable, within one hour's time, any spare piece of equipment or material vital to the tunnel operation.

Steel Liner Plates. Exercise care in trimming the excavated soil section in order that the steel liner plates fit snugly against undisturbed material. Do not excavate ahead of the previously installed liner plates any more than is necessary for the installation of the succeeding liner plate. Support the vertical face of the excavation as necessary to prevent sloughing. At any interruption of the tunneling operation, completely bulkhead the heading. If soil conditions deem it necessary, tunnel continuously on a 24-hour basis.

Employ a shield at the discretion of the ENGINEER when soil or other conditions indicate its need. It shall be of sufficient length to permit the installation of at least one complete ring of liner plates within the shield before it is advanced for the installation of the next ring of liner plates. Submit detail plans sufficient to determine the adequacy of the shield, accompanied with design calculations, to the ENGINEER for approval; do not proceed until such approval is obtained.

Place flowable fill grout under pressure, behind the liner plates to fill any voids existing between the liner plates and the undisturbed material.

Provide grout holes tapped for no smaller than 1-1/2-inch pipe, spaced at approximately 3 feet around the circumference of the tunnel liners, in every third ring. Start grouting at the lowest hole in each grout panel and proceed upwards simultaneously on both sides of the tunnel. Install a threaded plug in each grout hole as the grouting is completed at that hole. Keep the grouting as close to the headings as possible, using grout stops behind the liner plates as necessary. Grouting shall proceed as directed by the ENGINEER, but in no event shall more than 6 lineal feet of tunnel be progressed beyond the grouting.

Jacking Pipe. Apply jacking pressure by pushing frame at right angles to line to avoid breaking pipe or forcing it out of alignment. Equip first section of pipe with a steel cutting shield placed over its circumference and securely bolt to pipe. Excavate ahead of pipe manually or by boring from inside of pipe.

When excavating, keep voids outside of pipe and disturbances of surrounding material to a minimum. Fill excessive voids immediately with sand or other suitable material and thoroughly compact.

Jack continuously insofar as possible to prevent seizure of pipe. However, if operation is discontinued, safely support with wood bulkhead and adequately block excavation.

Fill void spaces between pipe and ground by pressure grouting. Provide the ENGINEER with grout design mix for approval.

Keep grouting pressure sufficiently high to fill all voids. Install necessary grouting holes at a maximum of 10 feet apart and as required to ensure complete filling of void spaces. Insert and securely caulk to the grout hole. Grout pipe at least 2 inches in diameter with control valve attached.

Following satisfactory pipe grouting operations, remove grout pipe from grout hole after grout has taken its initial set. Completely fill space occupied by grout pipe with stiff mortar and trowel smooth at the inner face.

Open Trench. Where called for on the Drawings, use open trench construction to install casing pipe. Excavation shall be as specified hereinbefore. Lay casing pipes on granular bedding and backfill the trench with granular fill, machine tamped in place, 95 percent compaction, as specified hereinbefore. Complete open trench construction through railroad roadbed between train movements and place 18 inches of crushed rock below the base of rail.

Sewer Jacked in Place. Pipe jacked in place under this Work shall be considered as the sewer or carrier pipe without the use of a casing pipe. Locate pipe to be jacked in place as shown on the Drawings.

Concrete Cradle For Pipe. Where called for on the Drawings, install pipe with concrete cradle of Class C concrete.

Rest each pipe on 6-inch minimum thickness bed of dry mix concrete, shaped to fit bottom of pipe. Dry mix concrete shall be machine mixed Class C concrete described in Specification Section 11 Concrete Work. After setting pipe, fill space between outside of pipe and undisturbed trench bank to a level equal to a point 1/3 of diameter above pipe invert with Class C concrete, having a 2-inch slump. Mechanically vibrate concrete to ensure complete filling of annular space between excavated face of original ground and outside face of pipe.

All concrete work shall be in accordance with Specification Section 11 Concrete Work.

Concrete Encasement. Concrete for encasement shall be Class C concrete as specified under Section 11 Concrete Work with that below pipe mixed dry. Build concrete encasement to form and dimension shown on the Drawings. Take particular care to bed pipe in concrete so that complete support of pipe is made. Place encasement at sides and top where pipe will not be disturbed or floated from its bedding. Encasement shall be incidental to the Work where shown on the Drawings or specified herein.

Concrete Cap. Concrete for pipe cap shall be Class A concrete, as specified under Section 11 Concrete Work. Build caps with shape and dimensions shown on the Drawings. Precast caps are allowed.

Stubs, Bulkheads And Miscellaneous Work. Furnish material and labor required to construct stubs, bulkheads, and miscellaneous work shown on the Drawings or called for in the Specifications. The cost of this Work shall be included in unit prices bid for manholes, structures, catch basins, inlets, and/or sewers.

Where shown on the Drawings, set stubs with bulkheads in manholes or structures for connections to future sewers. Stubs shall consist of one length of sewer pipe with watertight plug or brick and cement bulkhead. Stubs shall have size, material, and class shown on the Drawings and/or specified herein under this Section.

Catch Basin Leads. Construct catch basin leads as shown on the Drawings. Catch basin leads shall have size, material, and class of pipe as shown on the Drawings and/or specified herein under "Sewer Pipe." Lay leads in straight lines and at uniform grades.

Culvert Pipe. Lay pipe and end sections to the line and grade called for on the Drawings. Check each pipe, as laid, with line and grade pole to ensure that this result is obtained.

After the pipe and end sections are laid, carefully compact the Class II bedding under the haunches of the pipe, and backfill the trench to 12 inches above the pipe with Class II material, as specified under "Backfill." Place sufficient Class II backfill after each joint is made along the sides of the pipe to offset conditions that might tend to move the pipe off line and grade. Relay any pipe found off grade or out of line.

Grade, or if existing, regrade and channel ditches adjacent to new culverts so as to drain away all surface water through the culvert. The cost of this grading shall be incidental to the Work under this Section.

Connections To Existing Manholes. Furnish labor and materials required for connection of sewers and catch basin leads under this Contract to existing manholes, structures, and catch basins as called for on the Drawings. Wherever possible, core holes in manhole walls for new pipe connections and install resilient boots or NPC contour seal, if approved by the DIRECTOR OF PUBLIC SERVICES. If coring is not possible, star-drill the opening and provide a smooth hand-troweled mortar finish in opening to allow installation of boot or seal. When making holes, take care to prevent debris from entering existing sewers or leads. After installation of pipe, seal manhole or catch basin around pipe, both on inside and outside of the manhole or catch basin, so that it is restored to a watertight condition. Install new flow channels in existing manholes where called for on the Drawings. Install pipes made of plastic or other non-porous materials with the DIRECTOR OF PUBLIC SERVICES-approved waterstop at manhole entry and exit points to provide watertight seal. Receive the DIRECTOR OF PUBLIC SERVICES approval on waterstop prior to laying pipe.

> Wye Branch Connections. Provide wye branch connections at such points as are shown on the Drawings or as directed by the DIRECTOR OF PUBLIC SERVICES. Provide size and character indicated on the Drawings. Form branch connections with standard wye branches. Close by stoppers branches that will not have pipes connected to them. Stopper shall be adequate for air testing requirements. Immediately set and joint stopper bell or groove of branch outlet by same type jointing material as used for sewer pipe.
>
> In order to properly mark location of every branch connection, take accurate measurements along with GPS coordinates of all branches before sewer trench is backfilled. Measurements shall indicate distance from each branch to center of nearest downstream manhole. Furnish the DIRECTOR OF PUBLIC SERVICES with a written copy of these measurements and GPS coordinates immediately upon completion of block or sewer.

In addition to measurements and GPS coordinates, furnish and place a 1/2-inch diameter iron rod or pipe, or a 1-inch by 2-inch cypress, ash, or cedar marking stick at each branch connection of such length that it will reach from the branch up to within 6 inches of the ground surface. Set each marker in a vertical position and hold vertical while backfilling trench.

Construct wyes on existing sewers with watertight joints on each end. Submit method for joining wye to the existing pipe and for supporting wye to maintain proper grade to the DIRECTOR OF PUBLIC SERVICES for approval prior to construction.

Cored Tap. For rigid sewers 18 inches or larger in diameter, cored taps may be used in place of wyes. Make cored tap with coring machine, which will create clean and circular opening in sewer pipe. The opening shall not be larger than outside diameter of service lateral pipe plus 10 percent. Use rubber boot such as that produced by Kor-N-Tee to connect service lateral to pipe. Sewers may be pre-cored at factory if approved by the DIRECTOR OF PUBLIC SERVICES. The service lateral must not protrude into existing sewer.

Riser Pipe. Where directed by the DIRECTOR OF PUBLIC SERVICES, or shown on the Drawings, furnish and place risers, of size and type shown on the Drawings. Extend risers from branch opening of sewer up to elevation of house sewer service lateral, or to such elevation as will provide existing or future service. Lay up and firmly hold riser in place. Surround riser by Class C concrete as shown on the Drawings. Close openings in top of riser pipe with stoppers. Provide each riser with marking stick as specified above for branches.

Service Lateral Connections. Whenever indicated or noted on the Drawings, install service lateral connection sewer and locate so that property owner may readily connect to building plumbing. Connections shall be as shown on the Drawings and as specified herein under “Sewer Pipe” with minimum grade of 1/8 inch per foot for 6-inch sewers. Place stopper of same material and joint as pipe at end of each connection. Mark stopper with a marker stick as specified hereinbefore.

Where new service lateral sewer must be extended to service existing building not connected to a public sewer, locate termination of service stopper so that its extension can intersect and/or connect to building owner’s existing sewerage system.

Where service lateral sewer must be provided for empty lot, locate terminus where directed by the DIRECTOR OF PUBLIC SERVICES.

Install service lateral sewer at elevation required to serve present and future basement sanitary facilities. Unless directed otherwise by the DIRECTOR OF PUBLIC SERVICES, install service to buildings without basements no higher than 8 feet below first floor elevation, or empty lots no higher than 7 feet below probable future finish building grade or, if sewer main is shallow, at minimum grade permitted by sanitary sewer main.

Whenever a service connection crosses under roadway pavement that may not be disturbed, an opening may be bored to proper grade in soil beneath pavement. In case the earth is not sufficiently stable, install suitable casing pipe by boring and jacking method to enable laying of service lateral sewer through casing pipe. Install casing pipe and service lateral connection according to applicable requirements given under this Section, Casing Pipe Construction Section, and details shown on the Drawings.

Service lateral sewers made with ABS truss pipe shall have pipe SDR 23.5. Service lateral sewers made with PVC or PVCP pipe shall have pipe SDR 26, gasketed joints, unless otherwise noted on the Drawings.

Edge Drains. Edge drain systems shall meet requirements of MDOT Specification for Highway Construction. Pipe materials shall be corrugated plastic tubing with geotextile pipe wrap.

Connections To Existing Sewers. When service lateral sewer or other pipe is to be connected to existing sewer, use either wye or approved tapping saddle. Wyes shall be of the same material as pipe unless otherwise approved by the DIRECTOR OF PUBLIC SERVICES, and shall be as set forth under "Wye Branch Connections." Direct taps of rigid pipes, other than cored taps, shall not be permitted unless approved in writing by the DIRECTOR OF PUBLIC SERVICES.

When a new section of sewer or wye is to be installed in line with an existing sewer, use compression type coupling with shear rings. Adjustable rings are required in couplings 6 inches or larger. Clamps and shear ring shall be stainless steel. The following types of couplings are approved for the Work:

Logan LCP Coupling Fernco Series 1001-66

FIELD QUALITY CONTROL

General. Conduct acceptance tests for tightness on sanitary sewers and laterals. In areas where live leads have to be connected as the Work progresses, then only television inspection will be required.

Test sewers 24 inches in diameter and smaller using low pressure air. Also test sewers for infiltration where groundwater is above sewer invert. In areas where groundwater is more than 2 feet above the sewer crown at upstream end, air test with dewatering system in operation or use infiltration test after dewatering system is turned off and groundwater has returned to its normal level.

Test sewers above 24 inches in diameter using infiltration or exfiltration tests, as directed by the DIRECTOR OF PUBLIC SERVICES.

Make provisions for determining groundwater level prior to testing. The DIRECTOR OF PUBLIC SERVICES shall be able to confirm level by visual inspection. Water level holes in manholes shall be sealed watertight after sewer has passed test.

The CONTRACTOR may, at the CONTRACTOR's option, test any or all of the sewer lines prior to backfilling. However, such tests shall be in addition to required test following backfilling of trench.

Following completion of first section of sewer, if the DIRECTOR OF PUBLIC SERVICES determines that there is some question as to installation of sewer, the DIRECTOR OF PUBLIC SERVICES may direct the CONTRACTOR to conduct a presumptive test to check installation for defective pipe or faulty joints before it is completely covered with backfill material.

Provide necessary materials, equipment, and personnel to conduct tests.

Acceptance test sections include entire length of sewer under Contract, including laterals. Clean and flush pipe prior to conducting acceptance tests.

Make tests under supervision of the DIRECTOR OF PUBLIC SERVICES. Submit testing schedule and procedures for the CONTRACTOR and approval by the DIRECTOR OF PUBLIC SERVICES prior to start of the Work.

For those sections of sewer that cannot pass the acceptance test, make segmented TV testing or visual inspection to examine length of sewer being tested to locate possible cracks, breaks, bad joints, or

misaligned pipe sections. Remove cracks and breaks and replace bad joints or misaligned pipe sections located by inspection. Any sewers found with defects as listed above shall be repaired to like-new condition. The DIRECTOR OF PUBLIC SERVICES may order reconstruction of defective portion of sewer. After all repair work has been completed, repeat test. Final acceptance of the sewer being tested will not be made until satisfactory tests have been passed.

Repair visible leakage in sewers or manholes even though acceptance tests have been satisfactory.

Air Testing. Except for test times, air test concrete pipe sewers in accordance with ASTM C924, vitrified clay pipe in accordance with ASTM C828, and all other sewers in accordance with ASTM F1417. After pipe section to be checked is plugged, supply air to pipe section at a rate sufficient to maintain internal pressure of 4.0 psig. If the reach of pipe has not been backfilled, spray exposed surface of the pipe, fittings and plugs with foamable soap solution to detect abnormal leakage due to cracks, holes or improperly sealed joints by foam. Correct sources of abnormal leakage. After all corrections are made, add air again until internal pressure of 4.0 psig is obtained. Then allow pressure to decrease to 3.5 psig, at which time a stopwatch shall be started to determine total time required for internal pressure to decrease to 2.5 psig.

General. Test equipment shall include source of compressed air, air hose, plugs, hose connections, shutoff valve, throttling valve, cage cock, monitoring pressure gauge, delicate 0.1 psi graduations pressure gauge, and stopwatch.

In all test pressures noted, add pressure adjustment of 0.433 psi pressure for each foot of groundwater level above invert of pipe being tested.

If section of sewer to be tested includes more than one pipe size, calculate test time for each size and add test times to arrive at total time for section.

Carefully observe safety precautions during air testing, recognizing the danger from plugs blowing out.

Do not allow persons in manholes during testing.

Isolate Pipe To Be Tested. Plug section of pipe to be tested at each end. Plug ends of branches, laterals, and wyes that are included in the test. Carefully brace plugs to prevent slippage and blowout due to the internal pressure.

Add Air. Supply air to pipe section. Monitor air pressure so that pressure inside pipe does not exceed 5.0 psig, plus adjustment for groundwater.

Stabilize. When pressure reaches 4.0 psig, throttle air supply so that internal pressure is maintained between 4.0 and 3.5 psig, plus adjustment for groundwater, for at least 2 minutes. If plugs are found to leak, bleed off air, tighten plugs, and supply air again.

Determine Rate of Air Loss. The control equipment consists of pressure gauges, valves, and pocket stopwatch. After allowing pressure to stabilize for 2-minute period, disconnect air supply and allow pressure to decrease to 3.5 psig. At 3.5 psig, start stopwatch to determine time required for pressure to drop to 2.5 psig. (NOTE: Make proper pressure adjustment for groundwater, where applicable, in determining beginning and end of period for 1.0 psig pressure drop) Pipeline shall be considered acceptable if time interval for 1.0 psi pressure drop is greater than holding time listed in Low Pressure Air Test Tables included in this Specification Section. If the CONTRACTOR's pressure gauge has minor graduation marks for 0.25 psi or greater, a pressure drop of only 0.5 psi will be

permitted for all pipes but VCP or concrete pipe. Times for 0.5 psi drop are same as those given in this section for VCP and concrete pipe at 1.0 psi drop.

Infiltration/Exfiltration Tests. In sanitary sewers, place weirs temporarily for testing purposes in such manholes as necessary to measure amount of infiltration. Such tests at option of the DIRECTOR OF PUBLIC SERVICES may be any length of sewer between two manholes, entire length of sewer under Contract, or any combination of sewer reaches.

The allowable amount of infiltration shall not be more than 200 gallons per inch diameter of sewer and laterals per mile of sewer per 24 hours. Allowable amount of infiltration shall include infiltration into manholes.

If, in the DIRECTOR OF PUBLIC SERVICES' opinion, there is not sufficient groundwater for infiltration testing of various sections of sewer, then conduct exfiltration tests. The allowable amount of exfiltration shall not be more than 200 gallons per inch diameter of sewer and laterals per mile of sewer per 24 hours.

Ring Deflection Testing. A minimum of 30 days after the sewer has been installed, ring deflection testing shall be performed. Test all reaches of flexible PVC pipe and truss pipe for vertical ring deflection under load. Testing shall be performed by accredited independent testing company, unless otherwise approved by the DIRECTOR OF PUBLIC SERVICES. Testing shall be performed by "Go-No Go Gauge" method for compliance to maximum deflection limits or by instruments that measure and record actual pipe deflection. The maximum allowable pipe deflection shall be 5 percent of the average inside diameter. Replace sections of pipe that do not pass these tests at no cost to the CITY.

Television Inspection. Furnish materials, labor, and equipment for television inspection of all new sanitary sewers and storm sewers. Included will be necessary cleaning and pumping of sewage or storm water.

The DIRECTOR OF PUBLIC SERVICES' representative shall directly supervise televising and view recordings.

Record sewer interior on video, which shall be turned over to the CITY. Make recording on continuous running audio video in MPG or AVI format.

The inspection shall involve visual observation by closed circuit television. Perform inspection at rate of speed that will allow examination of all points of infiltration, cracked or crushed pipe, defective joints, misalignment in line or grade, location of wye openings, and other defects. Precisely locate and describe by detailed statement of condition any item that, in the opinion of the DIRECTOR OF PUBLIC SERVICES, requires repair.

As part of television inspection, note precise location of each wye in relation to downstream manhole. Record this location on wye location sheets supplied by the CONTRACTOR.

If camera encounters dip in sewer such that water is standing above springline of sewer pipe, and if camera lens becomes submerged because of this condition, withdraw camera rig from sewer and insert from other end as far as possible. Prevent back flooding into reach from adjacent section.

Provide two copies of notes, wye locations, and other pertinent information as part of television inspection report. Turn over one set of this information to the DIRECTOR OF PUBLIC SERVICES upon completion of inspection of each line. Hold second copy of information until completion of Project, at which time assemble and turn it over to the DIRECTOR OF PUBLIC SERVICES.

LOW PRESSURE AIR TEST TABLES
TIME REQUIRED FOR 1.0 PSIG PRESSURE DROP
WHEN TESTING ONE PIPE DIAMETER ONLY FOR SIZE AND LENGTH OF PIPE INDICATED.
TABLE FOR PVC, PVCP, ABS, AND DI PIPE

1 Pipe Diameter	2 Minimum Time	3 Length for Minimum Time	4 Time for Longer Length	Test Time for Length (L) Shown (min:sec)							
(in.)	(min:sec)	(ft.)	(sec.)	100 ft.	150 ft.	200 ft.	250 ft.	300 ft.	350 ft.	400 ft.	450 ft.
4	3:46	597	.380 L	3:46	3:46	3:46	3:46	3:46	3:46	3:46	3:46
6	5:40	398	.854 L	5:40	5:40	5:40	5:40	5:40	5:40	5:42	6:24
8	7:34	298	1.520 L	7:34	7:34	7:34	7:34	7:36	8:52	10:08	11:24
10	9:26	239	2.374 L	9:26	9:26	9:26	9:53	11:52	13:51	15:49	17:48
12	11:20	199	3.418 L	11:20	11:20	11:24	14:15	17:05	19:56	22:47	25:38
15	14:10	159	5.342 L	14:10	14:10	17:48	22:15	26:42	31:09	35:36	40:04
18	17:00	133	7.692 L	17:00	19:13	25:38	32:03	38:27	44:52	51:16	57:41
21	19:50	114	10.470 L	19:50	26:10	34:54	43:37	52:21	61:00	69:48	78:31
24	22:40	99	13.674 L	22:47	34:11	45:34	56:58	68:22	79:46	91:10	102:33
27	25:30	88	17.306 L	28:51	43:16	57:41	72:07	86:32	100:57	115:22	129:48
30	28:20	80	21.366 L	35:37	53:25	71:13	89:02	106:50	124:38	142:26	160:15
36	34:00	66	30.768 L	51:17	76:55	102:34	128:12	153:50	179:29	205:07	230:46

TABLE FOR VCP AND CONCRETE PIPE

1 Pipe Diameter	2 Minimum Time	3 Length for Minimum Time	4 Time for Longer Length	Test Time for Length (L) Shown (min:sec)							
(in.)	(min:sec)	(ft.)	(sec.)	100 ft.	150 ft.	200 ft.	250 ft.	300 ft.	350 ft.	400 ft.	450 ft.
4	1:53	597	.190L	1:53	1:53	1:53	1:53	1:53	1:53	1:53	1:53
6	2:50	398	.427L	2:50	2:50	2:50	2:50	2:50	2:50	2:51	3:12
8	3:47	298	.760L	3:47	3:47	3:47	3:47	3:48	4:26	5:04	5:42
10	4:43	239	1.187L	4:43	4:43	4:43	4:57	5:56	6:55	7:54	8:54
12	5:40	199	1.709L	5:40	5:40	5:42	7:08	8:33	9:48	11:24	12:50
15	7:05	159	2.671L	7:05	7:05	8:54	11:08	13:21	15:35	17:48	20:02
18	8:30	133	3.846L	8:30	9:37	12:49	16:01	19:14	22:26	25:38	28:51
21	9:55	114	5.235L	9:55	13:05	17:27	21:49	26:11	30:32	34:54	39:16
24	11:20	99	6.837L	11:24	17:57	22:48	28:30	34:11	39:53	45:35	51:17
27	12:45	88	8.653L	14:25	21:38	28:51	36:04	43:16	50:30	57:42	64:54
30	14:10	80	10.683L	17:48	26:43	35:37	44:31	53:25	62:19	71:13	80:07
36	17:00	66	15.384L	25:39	38:28	51:17	64:06	76:55	89:44	102:34	115:23
42	19:50	57	20.939L	34:54	52:21	69:48	87:15	104:42	122:09	139:36	157:03

Note: When testing two sizes of pipe simultaneously, time shall be computed by ratio of lengths involved. Example: 400 feet of 8-inch PVC pipe and 150 feet of 6-inch VCP pipe.

$$\text{Time} = \frac{\text{Time} = \text{Length1} \times \text{Time1} + \text{Length2} \times \text{Time2}}{\text{Length1} + \text{Length2}}$$

$$= \frac{400 \times 10:08 + 150 \times 2:50}{400 + 150}$$

$$= \frac{400 \times 608 + 150 \times 170}{400 + 150}$$

= 489 seconds = 8:09 (min:sec).

END OF SECTION 8

SECTION 9 – MANHOLES AND CATCH BASINS

PART 1 – GENERAL

SUMMARY

Work Included. This Work shall consist of the furnishing and construction of manholes and catch basins, including inlets as detailed on the Drawings and at the locations shown on the Drawings. Concrete, excavation, and backfill shall be as specified hereinbefore. Manholes and catch basins shall be complete with frames, covers, and steps. Adjustment of frames, inlets, etc., on new manholes and catch basins to meet new or existing pavement surfaces or sidewalks shall be included in the Work under this Section of the Contract.

REFERENCES

ASTM A48	Gray Iron Castings
ASTM A536	Ductile Iron Castings
ASTM C55	Concrete Building Brick
ASTM C76	Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
ASTM C139	Concrete Masonry Units for Construction of Catch Basins and Manholes
ASTM C443	Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets
ASTM C478	Precast Reinforced Concrete Manhole Sections
ASTM C923	Resilient Connectors Between Reinforced Concrete Manhole Structures and Pipes

SUBMITTALS

Shop Drawings and Guarantees. Furnish, as prescribed under The General Conditions, shop drawings covering the items included under this Section of the Work.

Shop drawings shall include dimensions and reinforcement of precast concrete units, joint details, orientation and elevation of preformed openings in riser sections, pipe-to-manhole connection details, casting details, and certification papers.

Warranty. Furnish, as prescribed under the General Conditions, warranties covering the items included under this Section of the Work.

Certification of Materials. All precast concrete manhole sections, resilient connectors between manhole sections, and pipes and castings delivered to the jobsite shall be preceded or accompanied by certification papers or stamped markings showing that the materials have been tested in accordance with applicable standard testing procedures and that the materials meet the Specifications for this Contract.

PART 2 – PRODUCTS

MANUFACTURERS

Cast Iron Manhole Steps shall be the product of one of the following, or equal:

James B. Clow and Sons East Jordan Iron Works Neenah Foundry Co.

Steel-Reinforced Manhole Plastic Steps shall be the product of one of the following, or equal:

Manufacturer	Cast-in-Place	Masonry	Mechanical Lock
M.A. Industries, Inc.	PS1-PF	PS1-B	PS1-PF
American Step Co., Inc.	PI-10	MSN-10	ML-10

Frames and Covers shall be the product of one of the following, or equal:

East Jordan Iron Works			
Frame –1045	#104510		
Cover – 1040A Sanitary Sewer	#1040016	10408 Storm Sewer	#1040017
Bolt Down Assembly			
1040ZPT APT Sanitary Sewer	#1040014b01	1040ZPT BPT Storm Sewer	#1040015b01

MANHOLES

Materials. Manholes on new sanitary sewers of 48-inch diameter and smaller shall be precast reinforced concrete with flexible watertight connections between the manhole wall and the sewer pipe.

Manholes on existing sanitary sewers shall be precast reinforced concrete with preformed arched openings and the sewer pipe grouted into the opening and made watertight.

Manholes on new or existing storm sewers, water mains, and pumping mains shall be precast reinforced concrete or of concrete block or concrete brick unless otherwise noted on the Drawings.

Manhole slabs shall be constructed of Class B concrete; manhole channels and fillets shall be constructed of Class C concrete, according to the details given on the Drawings. Unless otherwise directed, all surfaces of concrete channels and fillets shall be screeded and floated to a smooth, uniform surface and troweled to a hard finish.

CATCH BASINS

Materials. Catch basins shall be constructed of precast reinforced concrete units. These precast units shall conform to the requirements of ASTM. Inside grouting with either cold-applied, ready-to-use plastic joint-sealing compound, or rubber gasket shall be used to connect the units. As an alternate, the use of concrete manhole block conforming to ASTM will be permitted. If block is used, a mortar coating shall be applied the same as with masonry construction of manholes.

If noted on the Drawings, catch basins shall be constructed with sumps.

Foundations. Foundations shall be constructed as a cast-in-place concrete slab according to details given on the Drawings or precast reinforced concrete base slabs as specified under Manholes.

MANHOLE STEPS

Manhole steps shall be asphalt-coated cast iron or be steel-reinforced, high-density polypropylene plastic meeting OSHA requirements. They shall be a minimum of 10 inches wide and placed a maximum of 16 inches apart.

FRAMES AND COVERS

Cast iron frames and covers shall be furnished and placed on each manhole by the CONTRACTOR. Casting materials shall conform to ASTM A48, Class 30 or better for gray iron, or ASTM A536 for ductile iron. Casting shall be free of defects and shall be smooth and well-cleaned by shot blasting. Castings shall be of the size and type as called for on the Drawings. Lids shall be self-sealing on all sanitary sewer manholes. Castings shall be set flush with sidewalk, pavement, or ground surface and shall be securely cemented in place. In gravel streets, covers shall be set 4 inches below the surface.

Where noted on the Drawings, bolted gasketed frames and covers shall be provided. The frames shall be anchored to the concrete manhole sections according to details shown on the Drawings.

DROP CONNECTIONS

Where shown on the Drawings, as directed by the DIRECTOR OF PUBLIC SERVICES, or where a sanitary branch sewer is brought into a manhole more than 24 inches above the invert elevation in the manhole, a drop connection shall be provided according to the details shown on the Drawings.

PRECAST REINFORCED CONCRETE MANHOLES

Precast manhole base sections, riser sections, conical sections, flat slab tops, grade rings, manhole steps and ladders shall meet the requirements of ASTM C478.

Joints. Premium modified tongue and groove joints with rubber gaskets meeting the requirements of ASTM C443 shall be provided for all sanitary sewer manholes. Joints in storm sewer, water main, and pumping main manholes shall be either premium joint as specified for sanitary manholes or shall be tongue and groove with a cold-applied plastic joint-sealing compound and primer.

The joints around the inside circumference of the manhole shall be pointed with cement mortar. All holes provided for handling and lifting shall be filled with mortar and made watertight.

Foundations. Foundations for precast manholes shall be constructed as a cast-in-place concrete slab, precast reinforced concrete slab, or precast reinforced concrete base riser section with integral floor as specified under Section 11 Concrete Work, and as shown on the Drawings. Steel reinforcing for precast base slabs shall meet the requirements of ASTM C472.

Pipe-to-Manhole Connections. Pipe-to-manhole connections on new sanitary sewers shall be made with resilient connectors meeting the requirements of ASTM C923 and shall be adequate for hydrostatic pressures of 10 psi, without leakage, when tested in accordance with ASTM C923 Specifications.

MASONRY MANHOLES

Masonry Manholes Masonry manholes shall only be allowed in situations where custom shapes or configurations are required or where precast manholes are not practical or will not fit within the space available.

Foundations. Foundations shall be constructed as a cast-in-place concrete slab, or precast reinforced concrete base slab as specified under Section 11 Concrete Work and as shown on the Drawings.

Masonry. Masonry units for manholes shall be either concrete brick or concrete manhole blocks, and shall meet the requirements of the ASTM C139.

Cement Mortar. Mortar for laying masonry work in manholes and other appurtenances shall be mixed in the proportion of one part Portland cement to three parts sand. Hydrated lime may be added in proportions not to exceed 10 percent of the volume of the cement.

Mortars mixed by hand shall be prepared in a suitable, clean, watertight box. The ingredients, except the water, shall first be thoroughly mixed dry until of uniform color; then water shall be added and the mixing continued until mortar is of proper consistency and uniform texture is produced.

No retempered mortar or mortar that has been mixed for more than 30 minutes shall be used in the Work. No cement mortar shall be mixed when temperature is below 30 degrees F without properly heating the sand and water.

PART 3 – EXECUTION

DEWATERING

Dewatering of the site shall be as specified under Section 3 Dewatering.

Subbase preparation is an adequate foundation for all manhole structures and shall be obtained by removal and replacement of unsuitable materials with 4 inches minimum crushed stone, or by such other means as provided for foundation preparation of the connected sewers.

EXCAVATION AND BACKFILL

Excavation and backfill shall be in accordance with Section 4 Excavation and Backfill.

The excavation shall be of sufficient dimensions to provide ample space for sheeting and bracing where sheeting and bracing are required and ample space to perform the Work in a satisfactory manner.

When the earth at the normal depth of the structure is unsuitable for a foundation for the structure, such unsuitable materials shall be removed as required by the DIRECTOR OF PUBLIC SERVICES and replaced with MDOT Class II material.

BEDDING

Precast base section shall be placed on a well-graded granular bedding course conforming to the requirements for sewer bedding, but not less than 4 inches in thickness and extending to the limits of the excavation. The bedding course shall be firmly tamped and made smooth and level to ensure uniform contact and support of the precast element.

MASONRY MANHOLES

Laying Brick. All brick shall be clean and shall be thoroughly wetted by immersion, when practical to do so, just before laying. If immersion is impractical, brick shall be thoroughly sprinkled just before laying. All brick and block shall be laid in a full bed of mortar, without requiring subsequent grouting, flushing, or filling, and shall be thoroughly bonded. Bricks shall be laid with long dimensions radially in the manhole and all joints must be entirely filled with mortar. Each seventh course shall be laid as a “stretcher” course. The outside surface of each manhole shall be plastered with mortar to a depth of not less than 1/2 inch.

Laying Concrete Manhole Blocks. All blocks shall be clean and shall be laid in full bed of mortar, in courses with full and close mortar joints. The courses shall be level throughout, except where otherwise specified. Adjoining courses shall break joints by 1/2 the length of the block as nearly as practicable. The outside surface of each manhole shall be plastered with mortar to a depth of not less than 1/2 inch.

PRECAST REINFORCED CONCRETE MANHOLES

Lift Holes and Joints. All lift holes and all joints between precast elements in manhole shall be thoroughly wetted and then completely filled with mortar, smoothed and painted both inside and out, to ensure water-tightness.

Precast sections shall be placed and aligned to provide vertical sides and vertical alignment of the manhole steps. The complete manhole shall be rigid, true to dimensions, and watertight.

PLACING OF CASTINGS, GRADE RINGS, AND TOP SECTIONS

Castings placed on concrete surface shall be set in full mortar beds. The mortar shall be mixed in proportion of one part Portland cement to two parts sand, by volume, based on dry materials. Castings shall be set accurately to the finished elevation so that no subsequent adjustment will be necessary, or unless otherwise specified by the DIRECTOR OF PUBLIC SERVICES.

Street at Grade. Where Work is in paved streets or areas that have been brought to grade, not more than 15 inches shall be provided between the top of the cone or slab and the underside of the manhole casting for adjustment of the casting to street grade.

Where Work is in unpaved streets or alleys, provide not less than 12 inches of adjusting rings between the top of the cone or slab and the underside of the manhole casting for adjustment of the casting to finished grade. Set the top of the manhole casting 5 inches below finished grade, unless otherwise directed by the DIRECTOR OF PUBLIC SERVICES.

Where Work is in cultivated agricultural areas, bury the top of the manhole casting 3 feet, and in non-cultivated areas, set the casting flush with the finished grade, unless otherwise directed by the DIRECTOR OF PUBLIC SERVICES.

Where the last manhole section is a reducing cone and it is set to final grade as required by the DIRECTOR OF PUBLIC SERVICES, if as part of the continuous Work it becomes necessary to lower this casting and the adjustment entails going below the cone, compensation to the CONTRACTOR will be allowed for said adjustment and changing of the manhole stacks.

Point up and make watertight adjusting rings used to set the casting to grade.

CHANNELS AND INVERTS

Channels and inverts shall be made to conform accurately to the sewer characteristics and grades and shall be brought together smoothly with well-rounded junctions.

PIPE CONNECTIONS

Make pipe-to-manhole connections on sanitary sewers with properly sized watertight resilient connector. Fill other pipe joints firmly full of jointing materials to ensure watertightness. The pipes shall not protrude

into the inside face of the manhole, measured along the horizontal center of the pipe unless the pipe is placed through the entire diameter of the manhole.

Use rubber water stops, O-ring gaskets, or poured-in-place pipe sleeves for watertightness between the pipe and manhole. Core drill or star drill new holes in a circle of the required diameter. In no instance shall new holes be sledge hammered out.

REMOVALS, REPLACEMENTS, AND MODIFICATIONS

Removing Existing Manholes. Remove existing manholes where indicated on the Drawings or as directed by the DIRECTOR OF PUBLIC SERVICES. Remove frame and cover and deliver to the CITY. Bulkhead all abandoned pipes and either remove the manhole and backfill the area as specified under "Excavation and Backfill," or, if in good condition, remove to a depth of 24 inches below grade and fill with granular fill materials.

Removing Existing Catch Basins. Remove existing catch basins where indicated on the Drawings or as directed by the DIRECTOR OF PUBLIC SERVICES. Remove frame and cover and deliver to the CITY. Completely break up masonry or pipe, and remove and dispose. Bulkhead all abandoned pipe connections at both ends where accessible. Backfill the area occupied by existing catch basins after their removal as specified under Section 4 Excavating and Backfill.

Catch Basin Modifications. Where indicated on the Drawings and/or as directed by the DIRECTOR OF PUBLIC SERVICES, fit existing catch basins to be retained with a new frame and cover of the type noted on the Drawings, including all necessary work required to adjust to grade. Where indicated on the Drawings or as directed by the DIRECTOR OF PUBLIC SERVICES, fillet existing sumps with Class C concrete and bulkhead abandoned leads. This Work shall be considered incidental to construction of the new catch basin lead.

Replacing Existing Casting. Where noted on the Drawings and/or as directed by the DIRECTOR OF PUBLIC SERVICES, remove existing manhole and/or catch basin castings and replace with a new casting as hereinbefore specified.

END OF SECTION 9

SECTION 10 RESTORATION WORK

PART 1 – GENERAL

SUMMARY

Work Included. This Work shall include the replacement of all permanent type roadway bases and surfaces, concrete sidewalks, curbs and gutters, trees, lawns, and driveways damaged or removed due to the construction of the pipe and appurtenant structures. All such Work shall be in accordance with the best modern practice, City of Hastings' standards, and/or as specified herein.

Related Work Specified Elsewhere.

Section 4 Excavation and Backfill
Section 5 Bituminous Paving

Reference Standards.

MDOT STANDARD SPECIFICATIONS FOR CONSTRUCTION, 2020

MDOT 302	Aggregate Base Courses
MDOT 816 & 917	Turf Establishment/Turf and Landscaping Materials
MDOT 816.03.B & 917.09	Fertilizing

SUBMITTALS

Guarantees. Furnish, as prescribed under Section 1 General Conditions, guarantees covering the items included under this Section of the Contract.

Warranty. Furnish a special warranty for planted grass for 6 months or one growth season.

Material Certificates. Provide copies of material certificates signed by materials producer and the CONTRACTOR, certifying that each materials item complies with or exceeds specified requirements.

QUALITY ASSURANCE

Certification. The CONTRACTOR shall submit certificates of compliance with applicable MDOT Standard Specifications. Seed bags and fertilizer bags should be provided to the DEPARTMENT OF PUBLIC SERVICES for review of material placed.

TREE/SHRUB REPLACEMENT

Trees noted on the Drawings or designated by the DIRECTOR OF PUBLIC SERVICES to be removed shall be replaced with trees of the sizes and types listed in the Tree Schedule. The City shall decide which of the thirteen types of trees will be replaced in each location. All ornamental shrubs in private lawn areas that are damaged must be removed and replaced in kind, with the largest available specimen.

PART 2 – PRODUCTS

AGGREGATE BASE

Aggregate base shall be constructed with not less than 12 inches of compacted aggregate placed in two 6-inch layers. Aggregate base shall meet requirements of MDOT Specification for 21A or 22A aggregate. Aggregate base shall extend beyond pavements to match existing aggregate or a minimum of 24 inches.

AGGREGATE SURFACE

Aggregate surface shall be constructed with not less than 12 inches of aggregate placed in two 6-inch layers. Aggregate surface shall meet MDOT Specifications for 22A.

GRAVEL DRIVEWAYS

Gravel or dirt driveways removed shall be replaced with gravel, and shall be constructed to match existing thickness but with not less than 6 inches of gravel, compacted to 95 percent compaction. Gravel shall meet MDOT Specifications for 22A.

STONE DRIVEWAYS

Existing stone drive surfaces removed during construction shall be replaced with washed stone, pea stone, or limestone of type, size, and thickness that matches the existing surface. Road gravel (22A) shall not be used to replace stone drives unless authorized by the CITY and the DIRECTOR OF PUBLIC SERVICES.

SEEDING

Seeding shall be one of the following types and shall include MDOT specified topsoil and fertilizer:

1. Sodded Shoulders, Slope Area, or Flat Field. Provide the required certified seed and mixture meeting the purity, germination, and proportions specified in Table 917-1. Supply seed in durable bags, with a tag marked by the manufacturer and supplier of the blended mix showing the species and variety name, lot number, net weight of contents, purity, and germination. Minimum requirements are: 4 inches of topsoil, 20 pounds of 10-6-4 commercial fertilizer per thousand square feet of area, and 5 pounds of MDOT roadside mixture per 1,000 square feet of area.

2. Flat Lawn Area. 4 inches of topsoil, fertilizer as specified above, 3 pounds of MDOT Class A mixture per 1,000 square feet of area.

Sod. Sod shall consist of a densely rooted blend of at least two bluegrass varieties with at least 30 percent creeping red fescue content. Obtain the ENGINEER'S approval of the sod in the field prior to harvesting. Prior to placing sod, provide MDOT specified topsoil and fertilizer. Provide strongly rooted sod, not less than 2 years old, free of weeds and undesirable native grasses, and machine cut to pad thickness of 1/2 inch to 3/4 inch in 10 square feet per roll for to ensure ease of handling of the sod without tearing or breaking. Provide only sod capable of vigorous growth and development when planted (viable, not dormant). Peat sod will not be acceptable. Before harvesting, cut sod to 3 inches to 4 inches above ground surface.

Provide sod of uniform pad sizes with maximum 5 percent deviation in either length or width. Broken pads or pads with uneven ends will not be acceptable. Sod pads incapable of supporting

their own weight when suspended vertically with a firm grasp on upper 10 percent of pad will be rejected.

Provide sod composed principally of following:
Mixed Kentucky Bluegrass (Poa pratensis).

TREE/SHRUB REPLACEMENT

Stakes and Wrap. Trees shall be staked and wrapped. Stakes for guying shall be wood, 2-inch by 2-inch by 30 inches long, minimum size.

Stakes for staking shall be sound, 4-inch diameter, 9-foot long cedar posts with bark skinned off for shade trees; 2-inch by 2-inch, 8 feet long for conifers under 5 feet in height.

Staking wire shall be No. 12 gauge galvanized steel.

Hose for covering wire shall be new or used, black or red, two-ply, fiber-reinforced garden hose, not less than 1/2 inch inside diameter. Seconds rejected by factory are acceptable.

Tree wrap shall be treated wrapping Kraft wrap or approved equal.

Plant Materials.

Quality and Size. Plant materials shall be sound, healthy, vigorous, and free from plant diseases and insect pests or their eggs, and shall have normal, healthy root systems. All measurements such as spread, ball size, number of canes, quality designation, etc., shall be in accordance with the latest edition of AAN USA Standard for nursery stock. Trees shall be calipered 6 inches above the ground.

Sources. Must be located in the same or higher hardiness zone as determined by the latest edition of the "Plant Hardiness Zone Map," Agricultural Research Service, U.S. Department of Agriculture.

Plant Material Quality Assurance. Plant Material Selection and Approval Operations. All trees required by this Contract shall be tagged by the CONTRACTOR at the source for inspection and approval by the DIRECTOR OF PUBLIC SERVICES in writing at least two weeks prior to each desired inspection date. Photographs of materials may be required for preliminary inspection of materials from remote sources.

Root Protection. Trees and shrubs shall be balled and burlapped. They shall be dug with firm, natural balls of earth of sufficient diameter and depth to encompass the fibrous and feeding root systems necessary for full recovery of the plant. Balls shall be securely wrapped with burlap and bound with cord. No balled and burlapped plant shall be planted if the ball is cracked or broken.

Protection During and After Delivery. All plant material is to be delivered to the site in closed vehicles or in open vehicles with the entire load properly covered in transit for protection from drying winds. They shall be planted immediately upon delivery. No plant shall be bound with rope or wire in a manner that would damage the bark or break the branches.

PART 3 – EXECUTION

COORDINATION OF WORK

Type of restoration shall be as noted on the Contract Drawings regardless of existing surface.

The placing of base and surface courses shall follow immediately after backfilling the trench so that no more than 600 feet of length of trench shall be incomplete at one time. If areas of trench in excess of 600 feet are left incomplete, then the CONTRACTOR shall provide such necessary temporary roadway surface as directed by the DIRECTOR OF PUBLIC SERVICES. Any material placed in the trench other than that specified shall be considered as a temporary surface and shall be removed. No payment will be allowed for temporary roadway construction.

All utilities such as catch basins, manhole castings, water valve boxes, etc., shall be adjusted prior to the installation of the new pavement so that the finished surface will meet such utilities smoothly when surfacing is completed.

SAW CUT JOINTS

Damaged areas shall be removed by sawing a straight cut parallel with longitudinal and transverse construction or contraction joints. No saw cuts shall be nearer than 5 feet to a longitudinal or transverse joint or to the edge of the pavement. If the damaged area is less than 5 feet from an existing joint, the existing surface shall be saw cut 5 feet from the damaged area, removed, and replaced. If the damaged area is less than 5 feet from the edge of the pavement, the removal and replacement shall be extended to said edge of pavement.

Saw cutting of concrete shall be done with a carborundum saw to a minimum depth of half the slab thickness or that depth required to cut reinforcing steel. Bituminous surfaces shall be cut full depth.

After the trench is backfilled and before the pavement over the trench is replaced, all angular and ragged irregularities on the edges of the cut pavement shall be removed, giving a smooth and regular edge of pavement. Payment for cut joints required shall be included under the unit price of pavement restoration.

EXCAVATION

Before repaving is started, all trenches and the area around structures shall be excavated or backfilled to the level of the subgrade as required by the type of pavement replacement and cross section specified. All existing pavement that has been undercut by the excavation for the pipe or structures shall be removed. The finished subgrade shall be smoothed, trimmed and compacted to the required grade and cross section. Compaction of the finish subgrade shall be obtained by suitable means approved by the DIRECTOR OF PUBLIC SERVICES.

AGGREGATE BASE

Place aggregate base on a prepared subbase or subgrade in accordance with construction methods described in Section 302 of MDOT Specifications.

AGGREGATE PAVEMENTS

Aggregate surfaces shall be replaced with aggregate. After placing aggregate, this surface shall immediately be opened to traffic, and as holes and ruts appear, they shall be filled with aggregate and the surface shall be maintained as a smooth, dust-free street surface until the Work is accepted by the DIRECTOR OF PUBLIC SERVICES and the CITY.

SEEDING

Wherever the pipe trench passes through an area to be seeded, the backfilling shall be carried up to the surface except the top 4 inches, which shall be selected topsoil preserved or secured elsewhere for this purpose. This topsoil shall be rich, black surface earth, free from sod, weed stalks, or debris. The trench surface shall be carefully raked to an even surface, and all stones, sticks, and other debris removed therefrom.

Seeded areas shall receive a proper mulch of chopped straw, jute matting, or woven Kraft paper yarn. Seed shall not be sown between June 15 and August 15, nor between October 15 and April 15, nor at any time when the soil has insufficient moisture to ensure proper germination, or the CONTRACTOR shall provide sufficient application of water by sprinkling until a growing catch of grass is established.

SODDING

Lay sod within 24 hours from time of stripping. Do not plant dormant sod or if ground is frozen.

Lay sod to form a solid mass with tightly fitted joints. Butt ends and sides of sod strips; do not overlap. Stagger strips to offset joints in adjacent courses. Work from boards to avoid damage to subgrade or sod. Tamp or roll lightly to ensure contact with subgrade. Work sifted soil into minor cracks between pieces of sod; remove excess to avoid smothering of adjacent grass.

> When sod is laid on slopes, the first row of sod shall be laid at the bottom of the slope parallel to it, with subsequent rows laid from bottom to top. On slopes steeper than 3:1, the sod shall be secured with pegs spaced at 2 feet maximum, vertically and horizontally.

Water sod thoroughly with a fine spray immediately after planting.

Sodded areas shall be kept moist for the maintenance period. After the sod is installed, all areas greater than one foot that fail to show a uniform stand of grass shall be resodded.

RECONDITIONING EXISTING LAWNS

Recondition existing lawn areas damaged by the CONTRACTOR's operations, including storage of materials and equipment and movement of vehicles. Also recondition existing lawn areas where minor regrading is required.

Provide fertilizer, seed or sod, and soil amendments as specified for new lawns, and as required, to provide a satisfactorily reconditioned lawn.

Provide new topsoil, as required, to fill low spots and meet new finish grades.

Cultivate bare and compacted areas thoroughly to provide a satisfactory planting bed.

Remove diseased and unsatisfactory lawn areas; do not bury into soil. Remove topsoil containing foreign materials resulting from the CONTRACTOR's operations, including oil drippings, stone, gravel, and other loose building materials.

Where substantial lawn remains, but is thin, mow, rake, aerate if compacted, fill low spots, remove humps, and cultivate soil, fertilize, and seed. Remove weeds before seeding, or if extensive, apply selective chemical weed killers as required. Apply a seedbed mulch, if required, to maintain moist condition.

Water newly planted lawn areas and keep moist until new grass is established.

TREE/SHRUB REPLACEMENT

Preparation. Tree pits shall be excavated as shown on the Drawings. Subsoil dug from pits, trenches, and beds shall be disposed of by the CONTRACTOR.

Topsoil shall be provided in sufficient quantities to be placed (a) in tree pits, 6 inches in depth below the balled root and 1 foot in width around the ball; and (b) in shrub pits, 6 inches in depth below the balled or container root and 6 inches in width around it.

All other planting beds shall receive a minimum of 6inches of topsoil.

Planting. The CONTRACTOR is responsible for planting to correct grades and alignment, and all plants shall be set so that, when settled, they will bear the same relation to finish grade as they did before being transplanted. No filling will be permitted around trunks or stems.

When the plant has been properly set, the pit shall be backfilled with planting mixture, gradually filling, tamping, and settling with water. No soil in a frozen or muddy condition shall be used for backfilling. A ring of soil shall be formed around the edge of each plant to hold water.

The CONTRACTOR shall make adjustments in the location of plants where necessary as directed by the DIRECTOR OF PUBLIC SERVICES.

Mulching. All planting shall be mulched with a cover of shredded bark mulch. The mulch should consist of tree bark stripped and shredded from saw logs with a debarking machine. Do not use wood chips.

Watering. All plants shall be thoroughly soaked after planting. After each watering, all beds shall be raked and left in a complete and finished manner.

Pruning and Repair. Upon completion of planting, all trees and shrubs shall have been pruned and injuries repaired. The amount of pruning shall be limited to the minimum necessary to remove dead or injured twigs and branches and to compensate for the loss of roots from transplanting. Pruning shall be done in such a manner as not to change the natural habit or shape of the plant, as directed by the DIRECTOR OF PUBLIC SERVICES. All cuts shall be made flush, leaving no stubs. Notify the DIRECTOR OF PUBLIC SERVICES at least one week prior to pruning operations.

Guying, Staking, and Wrapping Trees. Guying and staking shall be completed immediately after planting. Maintain guys and stakes until the end of the guarantee period. The trunks of all deciduous trees larger than 6 feet to 8 feet grade shall be wrapped with standard tree wrap from the first branch down to the ground and secured at every second wrap with twine.

Protection and Maintenance. The CONTRACTOR shall assume responsibility for maintaining the CONTRACTOR's Work to the end of the guarantee period. During this period, the CONTRACTOR shall make a minimum of one maintenance trip every four weeks during the growing season, and as many more as necessary to keep the plantings in a thriving condition.

Maintenance of plants shall consist of pruning, cultivating, weeding, watering, keeping guying taut and trees erect, raising tree balls that settle below grade, and furnishing and applying such sprays as are necessary to keep the planting free of insects and diseases.

Acceptance. At the end of the period of guarantee, final acceptance will be made by the DIRECTOR OF PUBLIC SERVICES and the CITY, provided all requirements of the Specifications have been fulfilled.

Guarantee. The CONTRACTOR agrees to guarantee all plants for one year from the time of planting. This guarantee includes furnishing new plants as well as labor and materials for installation of replacements. Replacement plantings shall meet or exceed all requirements for original plant materials as specified herein.

The CONTRACTOR shall not assume responsibility for damages or loss of plants or trees caused by fire, flood, lightning storms, freezing rains, winds over 60 miles per hour, or vandalism.

Inspection of the plantings will be made jointly by the CONTRACTOR and the DIRECTOR OF PUBLIC SERVICES at the completion of planting. All plants not in a healthy growing condition shall be removed and replaced with plants of like kind, size, and quality as originally specified before the close of the next planting season.

Tree Schedule

1. Red Maple (Acer, Rubrum) 2-inch diameter (S/PS) M-F growth *
2. Japanese Maple "Bloodgood" (Acer Palmatum) 1 inch dia
3. Quaking Aspen (Populus Tremuloides) 2 inch *
4. Sugar Maple (Acer Saccharum) 2 inch *
5. Eastern White Pine (Pinus, Strobus) 8 feet high (S) Fast growth *
6. Colorado Blue Spruce (Picea, Pungens) 7 feet high (S)
7. White Spruce (Picea, Glauca) 7 feet (S) *
8. Norway Spruce (Picea Abies) 8 feet high
9. Ginkgo "Autumn Gold" (Ginko Biloba) 2 inch
10. Little Leaf Linden "Glenlevel" (Tilia Cordata) 2 inch
11. Black Gum (Nyssa Sylvatica) 2 inch *
12. America Hornbeam (Carpinus Caroliniana) 2 inch *
13. Japanese Zelkova "Green Vase" (Zelkova Serrata) 3 inch

    * the CITY puts preference on the Michigan native species to be used first unless stated otherwise in the project plans.

Prohibited Tree Species

1. Amur Maple (Acer Ginnala)
2. Autumn Olive (Eleagnus Umbellata)
3. Black Locus (Robinia Spp.)
4. Box Elder (Acer Negundo)
5. Bradford Pear (Pyrus calleryana)
6. Common Buckthorn (Rhamnus athartica)
7. Common Reed (Phragmites australis)
8. Flowering Rush (Butomus umbellatus)

9. Garlic Mustard (Alliaria petiolata)
10. Giant Knotweed (Polygonum sahalinensis)
11. Glossy Buckthorn (Rhamnus Frangula)
12. Japanese Barberry (Berberis Thunbergii)
13. Japanese Knotwood (Fallopia japonica)
14. Lombardy Poplar (Populus nigra var. italica)
15. Multiflora Rose (Rosa Multiflora)
16. Norway Maple (Acer platanoides)
17. Purple Loosestrife (Lythrum salicaria)
18. Russian Olive (Elaeagnus Angustifolia)
19. Spotted Knapweed (Centaurea Biebersteinii)
20. Tree of Heaven (Ailanthus Altissima)
21. White Mulberry (Morus alba)

END OF SECTION 10

SECTION 11 – CONCRETE WORK

PART 1 – GENERAL

REFERENCES

ACI	American Concrete Institute
ASTM A185	Specification for Steel welded Wire, Fabric, Plain, for Concrete Reinforcement
ASTM A497	Specification for Welded Deformed Steel Wire Fabric for Concrete Reinforcement
ASTM A615	Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
ASTM A94	Specification for Ready-Mixed Concrete
ASTM C150	Specification for Portland Cement
ASTM C260	Specification for Air-Entraining Admixtures for Concrete
ASTM C309	Specification for Liquid Membrane-Forming Curing Compounds for Curing
ASTM C494	Specification for Chemical Admixtures for Concrete
ASTM C595	Specification for Blended Hydraulic Cements
ASTM C618	Specification for Fly-Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete
MDOT 902	Coarse Aggregates for Portland Cement Concrete
MDOT 902	Fine Aggregates for Portland Cement Concrete and Mortar 2NS

SUBMITTALS

Mix Design. Submit concrete mix design as early as possible, but no later than four weeks before scheduled pouring. Submittal shall also include a sieve analysis of the course aggregates, including the quantity of deleterious materials present.

Product Data. Submit data for proprietary materials and items, including reinforcement, admixtures, patching compounds, water stops, joint systems, curing compounds, and others used under this Section.

QUALITY ASSURANCE

Testing. During the progress of construction and at the direction of the DIRECTOR OF PUBLIC SERVICES, perform tests to determine that the concrete complies with the compressive strength and consistency requirements. The DIRECTOR OF PUBLIC SERVICES will witness the preparation of test cylinders.

Provide concrete for test cylinders. Make, handle, and store test specimens. Pack and ship specimens in substantial packages to prevent damage during transit. The CONTRACTOR shall bear expenses of shipment and testing specimens by an approved, independent testing laboratory.

PART 2 – PRODUCTS

FORM MATERIALS

Forms for Exposed Finish Concrete. Use plywood, metal, metal-framed plywood faced, or other acceptable panel materials, to provide continuous, straight, smooth, exposed surfaces. Furnish largest practicable sizes to minimize number of joints and to conform to joint system shown on Drawings.

Form for Unexposed Finished Concrete. Use plywood, lumber, metal, or other acceptable material. Use lumber dressed on at least two edges and one side for tight fit.

REINFORCING MATERIALS

Reinforcing Bars. ASTM A615, Grade 60, deformed as per Section 905.

Welded Wire Fabric. ASTM A185, welded steel wire fabric.

Welded Deformed Steel Wire Fabric. ASTM A497.

CONCRETE MATERIALS

Portland Cement. ASTM C150, Type I or Type III. Use Type III where high-early-strength is required.

Blended Hydraulic Cement. Conforming to ASTM C595, Type IP (Portland Pozzolan cement), with pozzolan content not to exceed 20 percent by weight.

Fly-Ash. ASTM C618, Type C or Type F with loss on ignition not more than 6 percent.

Aggregates. Fine aggregate – MDOT (Michigan Department of Transportation) 2NS. Coarse aggregate – MDOT 6AA.

Water. Drinkable.

Air-Entraining Admixture. ASTM C260.

Water-Reducing Admixture. ASTM C494, Type A, and containing not more than 0.1 percent chloride ions.

Curing Compound. ASTM C309, Type 1 or 2, Class B. Limit moisture loss to 0.040 gm per sq. cm. when applied at 200 sq. ft. per gal. coverage.

CONCRETE MIX DESIGN

Classes.

Class A	All concrete not otherwise indicated.
Class B	Sidewalks and manhole bases (unless otherwise indicated on the Drawings).
Class C	Fill in structures.
Class F	Flowable fill for filling spaces as permitted and directed by the DIRECTOR OF PUBLIC SERVICES

Proportions. Proportion concrete by volume in agreement with the following table:

Concrete Class	A	B	C	F
28-day Compressive strength, psi * Laboratory Trial Batch for Selecting Concrete Proportions, Average 28-day	3500	3000	2000	50-100
Compressive Strength, psi, Design Mix	4100	3600	2600	NA

Concrete Class	A	B	C	F
Cement Content per cu. yard of concrete, sacks minimum **	6	5	4	0.4-3.0 12-16.0**
Water/Cement Ratio by weight, maximum	0.44	0.58	0.75	0.40-0.75
Air Content, percent by volume	5+1	6.5+1.5	NA	NA
Slump at point of placement, inches ***	2-4	3-5	3-6	NA

*7-day compressive strength for high-early-strength concrete

**For concrete with fly ash, values are total of cement plus fly ash (Except Class F).

***For concrete containing HRWR admixture (superplasticizer), slump shall not exceed 8 inches after addition of HRWR to verified 2-4 inches slump concrete

PART 3 – EXECUTION

FORMS

Install forms to conform to the shape, lines, and dimensions of the structures as called for on the Drawings. Forms shall be substantial and sufficiently tight to prevent leakage of mortar and shall be properly braced or tied together to maintain position and shape. Forms shall be clean inside before concrete is poured.

Reinforcement. Place bars in the exact position shown on the Drawings. Fasten bars to prevent displacement while depositing concrete.

Space bars with a clear distance of not less than the diameter of the bar, nor 1 inch. Place bars so that the distance from the surface of the concrete to the nearest surface of the nearest bars is 2 inches in slabs, walls, beams, and columns and 3 inches in the bottom of footings (where no mud mat is used).

Splicing of Reinforcement. At splices, lap bars a distance of not less than the following to ensure full bond development of each bar:

Bar Size	Lap Length	Bar Size	Lap Length
No. 3	16 inches	No. 8	38 inches
No. 4	20 inches	No. 9	42 inches
No. 5	24 inches	No. 10	50 inches
No. 6	28 inches	No. 11	62 inches
No. 7	34 inches		

Wire mesh: 14 inches overlap between outermost cross wires of each fabric.

PLACING CONCRETE

Forms shall be moist when concrete is placed. Concrete shall be handled to maintain its consistency and not to permit the ingredients to separate. Place concrete in layers not over 18 inches deep. Vibrate, rod, tamp, or work into places after each layer so that no voids or segregation of the aggregate show when the forms are removed.

Discharge concrete at the Work within 1-1/2 hours after the cement has been added to the water or the aggregates. When the air temperature exceeds 85 degrees F, reduce the maximum permitted mixing time to 45 minutes.

When depositing concrete against the ground for slabs and footings, place the concrete on undisturbed or compacted granular base moistened but free from standing water, mud, frost, and ice.

REMOVAL OF FORMS

The removal of forms shall be made without damage to the concrete and in a manner to ensure complete safety to the structures. Do not remove shoring until the member has acquired sufficient strength to support safely its weight and loads placed thereon.

After form removal, exposed vertical and overhead surfaces shall have burrs and fins removed and holes filled with non-shrink non-metallic grout. The surfaces shall be true to line, with full corners and shall be reasonably smooth.

CURING

Maintain concrete in a moist condition for at least the first seven days after placing for normal concrete and three days after placing for high-early-strength concrete. This shall be done by keeping the surface continuously wet, covering it with a plastic membrane, or by the application of a curing compound approved by the DIRECTOR OF PUBLIC SERVICES.

The surfaces of concrete from which forms are removed before seven days after placing shall be similarly protected until the concrete has been in place for seven days.

CONCRETE WORK IN COLD WEATHER

Concrete, when deposited, shall have a temperature of not less than 50 degrees F nor more than 85 degrees F. During cold weather, which shall be taken to mean weather in which the temperature of the air falls as low as 40 degrees F during any part of the 24 hours which follows, the ingredients of the concrete, including the water, shall be heated immediately before being mixed. If an antifreeze additive is allowed by the DIRECTOR OF PUBLIC SERVICES, it must also conform to ACI 306.1, along with all other aspects when concreting during cold weather. During cold weather, concrete work shall be housed, or covered with canvas or other suitable material, and shall be kept warm by salamanders or by other means, which shall ensure protection from freezing during the setting period.

CONCRETE WORK IN HOT WEATHER

During hot weather, concrete temperature shall be closely monitored and kept below 85 degrees F with the use of cold water or ice for mixing water. The total water in the concrete mix shall not exceed the quantity approved in the concrete mix design (http://civilwares.free.fr/ACI/MCP04/3061_90.pdf).

END OF SECTION 11

SECTION 12 – PRESSURE PIPING AND VALVES

PART 1 – GENERAL

SUMMARY

Section Includes. Furnish all labor, materials, and equipment necessary for fabrication and production of the items specified in this Section as listed in the Schedule on the Drawings.

Unless otherwise noted on the Drawings, or in this Section, pressure piping including wastewater force mains and water mains shall be part of this Work.

Dismantling of existing piping and supports, where required or shown or noted on the Drawings; piping connections to existing piping, structures, valves, gates, measuring devices, pumps, and other equipment, including equipment erected under other Contracts, are included in the Work of this Section. Piping shall contain necessary unions or companion flanges to allow ease of equipment removal.

For exposed piping, furnish all shop-applied interior and exterior pipe linings and coatings. Provide plugs in open ends of pipe, temporary bulkheads, protection of surface and subsurface improvements, cleaning, painting, testing, and disinfection, as required to accomplish the Work as specified and shown on the Drawings.

Sewers are specified under Section 8 Sewers.

REFERENCES

Reference Standards. Reference standards are under the individual items of Work.

Reference No.	Subject
AWWA C600	Standard for Installation of Ductile Iron Water Mains and their Appurtenances
ANSI B16.1	Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250 and 800
ANSI/AWWA C110/A21.10	Ductile Iron and Gray Iron Fittings, 3 in. through 48 in. for Water and Other Liquids
ANSI/AWWA C111/A21.11	Rubber Gasket Joints for Ductile Iron and Gray Iron Pressure Pipe and Fittings
ANSI/AWWA C500	Gate Valves for Water and Sewage Systems
ASTM A48	Specification for Gray Iron Castings
ASTM A126	Specification for Gray Iron Castings for Valves, Flanges and Pipe Fittings
ASTM A182/A182M	Specification for Forged or Rolled Alloy Steel Pipe Flanges, Forged Fittings and Valves and Parts for High Temperature Service
ASTM A183	Specification for Carbon Steel Track Bolts and Nuts
ASTM A194/194M	Specification for Carbon and Alloy Steel Nuts for Bolts for High Pressure and High Temperature Service
ASTM A276	Specification for Stainless and Heat Resisting Steel Bars and Shapes
ASTM A436	Specification for Austenitic Gray Iron Castings
ASTM A536	Specification for Ductile Iron Castings
ASTM B148	Specification for Aluminum Bronze Castings
ASTM B584	Specification for Copper Alloy Sand Castings for General Applications
ASTM B61	Specification for Steam of Bronze Castings
AWWA/ANSI C504	Rubber Seated Butterfly Valves

Reference No.	Subject
ANSI B16,3, B2.1	Threaded Valve Joint Standards
ANSI B16-104	Reinforced Teflon Steel Standard
AWWA/ANSI C509	Resilient Seated Gate Valves for Water Supply Service

SUBMITTALS

Shop Drawings. Furnish, as prescribed in the General Conditions – Submittals, shop drawings covering the items included under this Section of the Work.

Details of joints and joint restraint shall be submitted to the DIRECTOR OF PUBLIC SERVICES for the DIRECTOR OF PUBLIC SERVICES' consideration and approval before ordering any pipe.

Submit catalog cuts of all valve types indicating materials of construction.

As-constructed Drawings. The CONTRACTOR shall submit one complete set of drawings showing the location of pipe and equipment as actually installed.

Warranty. Furnish, as prescribed under the General Conditions, warranties covering the items included under this Section of the Work.

QUALITY ASSURANCE

All Work under this Section shall be done in accordance with standard practices as recommended by the manufacturer and AWWA.

Codes, Ordinances and Standards. Manufacture, storage, and erection of equipment under this Contract shall be in accordance with current ASA (ANSI), AWWA, and ASTM Standards. Standards and Specifications referenced herein shall be the current published edition. The manufacturer of the pipe and fittings shall furnish the DIRECTOR OF PUBLIC SERVICES a certified statement that all pipe and fittings furnished by the Manufacturer meet the material requirements and have been inspected and tested in accordance with the applicable Specification and Standard.

DELIVERY, STORAGE, AND HANDLING

Disinfection compounds shall be stored in well-ventilated areas, protected from moisture and fire.

Storage. All pipe and related items installed under this Section shall be stored as recommended by the Manufacturer. The CONTRACTOR shall take all actions necessary to protect all items installed under this Contract, including furnishing all special storage areas required by equipment manufacturers. Pipe shall be stored on suitable timber skids free from contact with the ground. Gaskets shall be stored in as cool, clean, and shaded a place as practicable.

Handling. All items installed under this Contract shall at all times be handled as recommended by the manufacturer and in such a manner as to avoid any damage. All special handling equipment and temporary supports shall be furnished by the CONTRACTOR. Items will be subject to inspection and approval upon delivery to the jobsite and after storage. No cracked, broken, or damaged pipe shall be used. In the event coatings are damaged, the damaged area shall be recoated with an approved coating similar to that specified for that item. Steel pipe shall be handled by means of rubber or fabric slings. No hooks shall be permitted to come in contact with joint rings or be inserted in the ends of the pipe and fittings for any reason. During

handling, hauling, and storage of pipe, each piece shall be kept from contact with adjacent pieces by means of wooden blocks or timbers.

PROJECT CONDITIONS

Drawings. The Drawings are not intended to show every detail of construction or location of piping or equipment. Where existing conditions make it necessary or advisable to change location of piping or equipment, the CONTRACTOR shall so inform the DIRECTOR OF PUBLIC SERVICES for the DIRECTOR OF PUBLIC SERVICES' approval.

PART 2 – PRODUCTS

MANUFACTURERS

Adapter Flange Coupling (AFC) shall be the product of one of the following manufacturers, or equal:
Uni-Flange Corp.
Victaulic Co.
Smith-Blair, Inc.

Bolted Flexible Coupling (BFC) shall be the product of one of the following manufacturers, or equal:
Dresser Industries, Inc.
Smith-Blair, Inc.

Grooved Couplings (GC) shall be the product of: Victaulic

Liquid Chlorine may be allowed.

Sodium Hypochlorite shall meet the requirements of AWWA B-300. Containers shall have an expiration date marked at time of shipment to ensure that excessive deterioration has not occurred.

Calcium Hypochlorite shall meet the requirements of AWWA B-300.

MATERIALS

Ductile Iron Piping shall be as specified herein:

The ductile iron pipe to be furnished, delivered, and installed under this Specification shall conform in all respects with the requirements of the current edition American National Standards Institute and American Waterworks Association for "Ductile-Iron-Pipe, Centrifugally Cast in Metal or Sand-Lined Molds for Water or Other Liquids,"(ANSI/AWWA C151/A21.51) except as may otherwise be specified herein.

All sizes of pipe shall be Class 52 and conform to the dimensions shown in the following table unless a higher thickness class is called for on the Drawings.

Size Nominal Inside Dia. Inches	Outside Dia. Inches	Pipe Barrel Thickness Inches	Class
6	6.90	0.31	52
8	9.05	0.33	52
12	13.20	0.37	52
16	17.40	0.40	52

The manufacturer shall furnish a sworn statement in conformance with the requirements of Section 51-5 of ANSI/AWWA C151/A21.51, stating that the pipe furnished meets the aforementioned.

Pipe Joints.

General. All joint material and lubricants shall be furnished with the pipe, including all joint material required for connection to equipment furnished under other Sections of the Work. All joint materials shall be assembled in accordance with standard practice and the manufacturer's recommendations. All equipment connections shall be flanged, union, or grooved coupling so that equipment can be removed without disassembly of the connecting piping.

Bolted Flexible Couplings (BFC). Bolted flexible couplings, where required or shown on the Drawings, shall consist of a steel sleeve, with centering bead removed, rubber gaskets, follower rings, and a full complement of nuts and bolts. Couplings shall allow a deflection of approximately 4 degrees per joint. Bolted flexible couplings shall not be used on buried pipes.

Couplings shall have a minimum middle ring thickness and minimum length as follows:

Pipe Size (inches)	Middle Ring Thickness	Middle Ring Length
4	.203-inch	5-inch
6 to 12	1/4-inch	5-inch
14 to 20	5/16-inch	7-inch

Couplings shall have a maximum gap between pipe ends as follows:

Sleeve Length	Max. Gap Allowed
5-inch	1-inch
7-inch	2-inch
10-inch	3-inch

Couplings and accessories shall be galvanized and shall be shop-coated with a sealer suitable for subsequent field painting or coating. Restraint rods shall be installed across bolted flexible couplings to prevent joint separation under pressure.

Flanged Joints (FJ). Pipe flanges shall not be used on buried pipes. Pipe flanges shall conform to American Standards: dimensions, ANSI B16.1 and threads, ANSI B2.1. Flange faces except stainless steel shall be coated with a rust inhibitor immediately after drilling.

Flanges for cast or ductile iron pipe and fittings shall be ductile iron and meet the requirements of AWWA C115 (ANSI 21.15).

Flanged joints shall be made up with full face 1/8-inch rubber gaskets. Flanges shall be firmly bolted with machine, stud, or tap bolts of the proper size and number meeting the requirements of ASTM A307 Grade B. Joints made with bolts or bolt studs shall have a nut on each side. Bolt projection through nuts shall be equal, and where studs are used, bolt projection on each side of the flange shall be equal.

All nuts and bolts shall be cadmium plated or hot-dip galvanized. Flange connections to all flexible connectors and expansion joints shall have a lock washer under all nut and bolt heads, two control rods across each joint and steel retainer rings at each flange. All steel materials shall be galvanized.

Flange joints shall not be used on ground-buried pipe.

Grooved Couplings (GC). Furnish rigid grooved couplings where shown or noted on the Drawings, or noted in the Pipe Schedule. Flexible type will only be used in applications approved by the DIRECTOR OF PUBLIC SERVICES. Grooved couplings and fittings may be used in lieu of flanged joints. Grooved couplings shall not be used on buried pipes.

Couplings shall conform to AWWA Standard C606.

Gaskets shall be molded or extruded of an elastomer that is recommended by the coupling manufacturer and that will satisfy the end use. End use includes consideration for pipe material and material being transmitted by the pipe. Generally, ductile iron pipe gaskets shall be halogenated Butyl compound, and steel pipe shall be an ethylene, propylene, diene-monomer (EPDM) compound. Shop drawings submitted shall identify the gasket material, pipe material, and material being transmitted in the pipe.

Cast iron or ductile iron fittings shall conform to the requirements of ANSI Specifications A-21.10 or AWWA C-110 with end preparation of a radius cut groove configuration.

Ductile iron pipe in sizes 4 inches to 24 inches shall be radius cut grooved in accordance with manufacturer's specifications.

Push-On Joint (POJ). Where shown or noted on the Drawings, rubber gasket type push-on or slip-on joints of approved manufacturer (Bell-Tite, Ring-Tite, Tyton, Fastite, or equal) will be allowed as approved by the DIRECTOR OF PUBLIC SERVICES. Joints shall conform to ANSI A211.11 and AWWA C111. Push-on joints will generally be used on all ground-buried ductile iron or PVC pipe. All push-on joints are to be restrained in accordance with the paragraph on joint restraints. Nitrile (Buna-N) gaskets shall be used in areas with contaminated soils.

Mechanical Joints (MJ). Mechanical joints shall conform to ANSI A-21.10 and A-21.11 and AWWA C110 and C111. Each joint shall be complete with rubber gasket, cast iron gland, and a full complement of high-strength, low-alloy steel bolts and nuts. Mechanical type joints shall be in accordance with the current standard for "Rubber Gasket Joints for Cast Iron Pressure Pipe and Fittings" ANSI/AWWA C111/A21.11. Bolts for mechanical joints shall be of low alloy steel conforming with the characteristics listed in this standard. All joints in which bolts are used shall be protected from corrosion by coating with Bitumastic #50 or cement mortar to a minimum thickness of 1 inch after the joint is completed. Nitrile (Buna-N) gaskets shall be used in areas with contaminated soils.

All mechanical joints are to be restrained in accordance with the paragraph on joint restraints.

Adapter Flange Coupling (AFC). Adapter flange couplings for steel or ductile iron pipe shall be provided where shown on the Drawings or where required or authorized by the DIRECTOR OF PUBLIC SERVICES. The coupling shall be designed to meet the test requirements of ANSI B16.1 -125 lb. flanges. The coupling shall be designed to handle a 525 psi hydrostatic test, and 175 psi working pressure at temperatures of -20 to 150 degrees Fahrenheit without leaking or requiring additional restraint. Adapter Flange Couplings shall not be used on buried pipe or fittings.

The coupling shall consist of a standard flange drilling (ANSI B16.1); a standard mechanical joint material (ANSI A21.11 or AWWA C111); and standard retainer gland construction (AISI 4140 steel set screws, galvanized, with ductile iron body ASTM A536). Flanged joints, when and where approved, shall be in conformity with the requirements of the current standard for "Gray Iron and Ductile Iron Fittings, 3" through 48" for Water and Other Liquids" (ANSI/AWWA C110/A21.10). Flanged joints shall be made with single piece full face rubber gasket, 1/8 inch thick.

Piping.

Ductile Iron Pipe (DIP). Buried ductile iron pipe shall be Thickness Class indicated in the Bid Form or Schedule. If no classification is indicated, pipe shall be Thickness Class 52 (Minimum). Ductile iron pipe shall be manufactured in accordance with AWWA C151 (ANSI A21.51). Pipe placed in structures to be joined by flanges or grooved couplings for the pipe size shown shall have a minimum thickness of Special Thickness Class 53. Each pipe run shall be of the same class. Pipe sizes indicated are inside diameter (I.D.).

Fittings. Fittings for ductile iron pipe shall be ductile iron or cast iron and shall meet the requirements of AWWA C110 (ANSI A21.10) or AWWA C153 (ANSI A 21.53). All radii on the fitting shall meet the requirements of AWWA C110 (ANSI A21.1). Ductile iron fittings shall be rated for 350 psi, pipe sizes 24-inch diameter and less and 250 psi for pipe sizes over 24-inch diameter, except that ductile iron flanged fittings shall be rated for 250 psi for all pipe diameters.

Cast iron fittings shall be rated for 250 psi, pipe sizes 12-inch diameter and less and 150 psi for pipe sizes over 12-inch diameter.

Joints. Ductile iron joints shall be mechanical, bolted flexible coupling, and push-on, as specified under Pipe Joints, as shown or noted on the Drawings, listed in the Schedule, and approved by the DIRECTOR OF PUBLIC SERVICES. Joints shall meet the requirements of AWWA C111 (ANSI A 21.11). All joint materials shall be furnished with the pipe.

Coatings and Linings. Ductile iron pipe and fittings to be ground-buried shall be coated by the manufacturer on the outside with an asphaltic coating, 1 mil thick, in accordance with AWWA C151 and C110 (ANSI A21.51) and cement-lined, double thickness, in accordance with AWWA C104/ANSI 21.4. The pipe shall be supplied with and wrapped in polyethylene encasement in accordance with AWWA C105 (ANSI 21.5) and shall be installed following Method "A."

Exposed pipe and fittings shall be coated by the manufacturer on the outside with a universal rust-inhibitive primer 2.0 mils minimum dry thickness, and cement lined, standard thickness, in accordance with AWWA C104/ANSI 21.4.

At all points where pipes must pass through the walls, floors, or slabs of structures, the CONTRACTOR shall furnish and install suitable sleeves or wall castings. Unless otherwise shown or permitted, the space between the pipe and the sleeve shall be sealed at the inside and outside wall faces on walls exposed to earth or water/sewage, at one face of other walls, at the top surface of floors, and slabs with a rubber link seal.

In general, the wall sleeve or castings shall be of the same material as the pipe. Iron pipe wall castings, wall pipe, transition sleeves, and solid sleeves shall meet the requirements of AWWA Specification C100 and shall be of the lightest class conforming to the pressure rating of the pipelines that they connect, but in no case shall be lighter than Class B.

Steel sleeves and wall pipe shall not be painted in areas to be embedded in the concrete. Under this Section of Work, all loose rust, scale, grease, or oil shall be removed prior to pouring of the concrete.

Where water-tightness is essential and at other locations where indicated on the Drawings, wall castings and sleeves shall be provided with an intermediate flange located approximately at the center of the wall.

Sleeves and castings at the point of manufacture shall be coated on the inside with a universal rust-inhibitive primer 1.5 to 2.0 mils minimum dry thickness.

Rubber link seal shall be identical rubber links interconnected with bolts and elongated nuts and washers. The sealing element shall be made of synthetic rubber material especially compounded to resist aging, ozone, sunlight, and chemical action. Bolts and metal parts shall be made of galvanized or cadmium-plated steel to resist corrosion. Rubber link seal joints shall be submitted to the DIRECTOR OF PUBLIC SERVICES for approval.

Equipment Connections. The connecting piping to pumps and other equipment shall be supported independently of the pump or equipment so as to avoid any strain on the pump or equipment. All equipment connections shall be flanged or have unions to facilitate removal of the equipment. Piping to vibrating equipment shall contain control-rodded, retainer ringed flanges, flexible spool-type expansion joint of duct and chlorobutyl or Buna-N material as shown or noted on the Drawings. All carbon steel shall be galvanized.

Joint Restraint. Where water or air pressure exerts a disjoining force, at all pipe deflections over 20 degrees, and all tees and dead ends, joints shall be restrained, tied, or harnessed in a manner approved by the DIRECTOR OF PUBLIC SERVICES. The restraint shall be applied to joints in each direction from the deflection an adequate distance to resist the axial thrust of the test pressure as shown on the Pipe Restraint Schedule on the Drawings. Fire hydrants shall be restrained from the main line to the hydrant. Details of all proposed joint restraint, showing the type and locations, shall be submitted to the DIRECTOR OF PUBLIC SERVICES for approval. Concrete thrust blocks will not be permitted except where noted. All pipe and fitting restrained joints shall be rated for a minimum of 250 psi.

Acceptable methods of joint restraint are as follows:

> Concrete Pipe: Snap ring or harnessed clamp joint.
>
> Ductile Iron Pipe. Mechanical joint pipe with EBAA Iron "Megalug Series," or Uni-Flange Block Buster 1400 retainers, shall be used when shown on the Drawings. Megalug or Uni-Flange Block Buster 1400 retainers may also be used to restrain joints for unanticipated deflection points, or where connections require a mechanical joint. No other manufacturers or types of mechanical joint-retaining glands will be accepted. Push-on joint pipe shall be restrained with American Lok-Ring, Flex-ring or Fast-Grip Gaskets, U.S. Pipe TR Flex, Field Lok Gasket, or equal.

Joint Harnessing. Pipe and fittings that require harnessing shall be provided with standard lugs ASTM A283, Grade B, or A285, Grade C, or equal meeting the requirements of AWWA Specification C111 or AWWA Manual M11, unless otherwise noted. Harness tie rods and nuts shall be mild steel meeting the requirements of ASTM A193, Grade B7, or A307, Grade B, or equal with American Standard threads. The nuts shall seat on steel plate washers. The rod, washers, and nuts shall be hot-dip galvanized ASTM A153.

Hangers and Supports. Hangers and supports shall include all hanging and supporting devices of metallic construction shown, specified, or required for piping, apparatus, and equipment installed under this Section of the Work. All supports and parts shall conform to the latest requirements of ANSI B31.1, except as supplemented or modified by the requirements of this Specification or as detailed on the Drawings. Materials shall be stainless steel, galvanized steel, galvanized malleable iron, or galvanized wrought iron.

Hangers and supports shall be adequate to maintain the pipelines, apparatus, and equipment in proper position and alignment under all operating conditions with due allowance for expansion and contraction, and shall have springs where necessary. Hangers and supports shall be of standard design where possible and be best suited for the service required, as approved by the DIRECTOR OF PUBLIC SERVICES. Supporting devices shall be designed in accordance with the best practice and shall not be unnecessarily heavy. Sufficient hangers and supports shall be installed to provide a working safety factor of not less than

5 for each hanger. Hangers shall have a minimum spacing in accordance with ANSI B31.1. Point loading hangers are not acceptable. Hangers shall be sling or saddle type.

Wherever possible, pipe attachments for horizontal piping shall be pipe clamp, and structural attachments shall be beam clamps. All rigid hangers shall provide a means of vertical adjustment after erection. Generally, hangers shall be sized for supporting the pipe, excluding insulation. Proper pipe protection saddles shall be installed on pipes that are covered with insulation where hangers and supports are outside the insulation. Overhead hangers shall be supported by threaded rods properly fastened in place by suitable screws, clamps, inserts, or bolts, or by welding. Saddle stands shall be of the adjustable type. Each stand shall consist of a length of steel pipe fitted at the base with a standard threaded flange and at the top with an adjustable saddle or roll. The base flange shall be bolted to the floor, foundation, or concrete base.

Anchors shall be furnished and installed where specified, shown, or required for holding the pipelines and equipment in position or alignment. Anchors shall be designed for rigid fastening to the structures, either directly or through brackets. The design of all anchors shall be subject to approval by the DIRECTOR OF PUBLIC SERVICES. Materials shall be galvanized or stainless steel. Inserts for concrete shall be galvanized or stainless steel or galvanized malleable iron and shall be installed in the concrete structures where required for fastening supporting devices. They shall be designed to permit the rods to be adjusted horizontally in one place and to lock the rod nut or head automatically. Inserts shall be recessed near the upper flange to receive reinforcing rods. Inserts shall be so designed that they may be held in position during concrete pouring operations. Inserts shall be designed to carry safely the maximum load that can be imposed by the rod which they engage.

Casing Spacers shall be timber strapped to the carrier pipe or stainless steel with high-density plastic runners. Timber spacers shall be treated lumber to resist decay or insect damage and shall be strapped to the carrier pipe as indicated in the Drawings. Stainless steel casing spacers shall be Cascade Waterworks Manufacturing Company (Yorkville IL) or equal. Spacers shall be installed per the manufacturer's recommendation. Filling of the annular space shall be as specified in Section 02345 Casing Pipe Construction.

Concrete supports shall be placed in structures wherever shown or required. Equipment shall be supported in accordance with manufacturer's recommendations.

Cleanouts. Cleanouts shall be provided where shown or specified. Cleanout openings for pipe 8 inches or larger in diameter shall be not less than 6 inches in diameter (unless otherwise noted on the Drawings). Cleanout openings for pipe 6 inches and smaller shall be of the same diameter as the pipe. Cleanout covers shall be standard 125-pound blind flanges, where conformation is required with the inside curvature of the pipeline, in which case the covers shall be flanged of proper shape with standard flange drilling. Covers shall be fastened by means of galvanized steel studs and nuts and shall be drilled and tapped for a 1-1/2-inch pipe connection. A 1-1/2-inch galvanized steel plug shall be furnished. The flange or conformed plugs shall be provided with a dowel or other suitable means to ensure proper setting.

Taps and Plugs. Where indicated or required, pipe or fittings shall be tapped to receive small or special fittings under this or other headings of the Work. Required taps shall be furnished as part of this Work. All taps will be temporarily plugged at point of fabrication.

SOURCE QUALITY CONTROL

Tests, Inspections

General. All pipe and fittings delivered to the Project shall be accompanied by certification papers showing that the pipe and fittings have been tested in accordance with the applicable Specifications and that pipe and fittings meet the Specifications for this Project. All pipe and fittings will be inspected upon delivery to the jobsite by the DIRECTOR OF PUBLIC SERVICES or CITY's representative. No cracked, broken, or damaged pipe or fittings will be allowed in this Work. All materials shall be BUY AMERICA certified for MDOT and EGLE (SRF) funded projects.

Ductile Iron Pipe. Each pipe shall be hydrostatically tested to 500 psi at the point of manufacture. The class of nominal thickness, net weight without lining, and casting period shall be clearly marked on each length of pipe. Additionally, the manufacturer's mark, county where cast, year in which the pipe was produced, and the letters "DI" or "ductile" shall be cast or stamped on the pipe. Where required, other designation marks shall be painted on the pipe or fittings to indicate correct location in the pipeline in conformity to a detailed layout plan.

VALVE MANUFACTURERS

Butterfly Valves (B) shall be the product of one of the following manufacturers, or equal: East Jordan

Resilient Seated Gate Valves (RA) shall be the product of one of the following manufacturers, or equal: East Jordan

Standard Swing Check Valves (C) shall be the product of one of the following manufacturers, or equal: East Jordan

Combination Air and Vacuum Release Valves (ARV) East Jordan

Combination Air and Vacuum Release Valves (Pipe) (ARV) East Jordan

Plug Valves (P) shall be the product of one of the following manufacturers, or equal: East Jordan

Fire Hydrants (FH) shall be the product of one of the following manufacturers, or equal: East Jordan Iron Works 5BR with the weep hole plug installed.

VALVE COMPONENTS

Butterfly Valves. Butterfly valves shall be Class 150B and meet the requirements of AWWA Specification C504. Butterfly valves shall be short body laying length and be provided with square wrench nut operators.

Butterfly valves shall be installed in manholes or ground buried as shown on the Drawings and/or as listed in the Bid Form. Butterfly valves to be installed in manholes shall be furnished with flanges that are ductile iron and meet the requirements of AWWA C115 (ANSI 21.15). Ground-buried butterfly valves shall be furnished with mechanical joint end connections, except with polyethylene water main valve shall have flanges that are ductile iron and meet the requirements of AWWA C115 (ANSI 21.15).

Resilient Seated Gate Valves. Resilient seated gate valves shall be designed for 150 psi working pressure and shall meet the requirements of AWWA Specification C509 except as otherwise specified herein. Valves shall be cast or ductile iron body, bronze stem, O-ring stem seal, and non-rising stem. The interior and

exterior surfaces of the valve body shall be coated with an epoxy coating meeting the requirements of AWWA C550. The bronze, iron, or ductile iron wedge shall be fully encapsulated with molded rubber. No bare metal shall be left exposed. The valve shall seal on both sides of the wedge. Gate valves shall have a clear waterway equivalent in area, when fully open, to that of the connecting pipe. Valves shall be made to open when turned to the left, or counterclockwise. The gate valves shall have square wrench nuts mounted on non-rising stems. All fasteners shall be stainless steel. Ground-buried gate valves shall be furnished with valve boxes. Flanges shall meet the requirements of AWWA C115 (ANSI 21.15). Two complete sets of joint accessories shall be furnished with each valve.

The force mains will be laid with a minimum 5.0 feet of cover or as noted on the Drawings. One operating wrench of suitable length shall be provided under this Section.

Standard Swing Check Valves. Standard swing check valves shall meet the requirements of ANSI/AWWA C508. In quality of material and workmanship, check valves shall fulfill the requirements of the Specification set forth above for gate valves insofar as they are applicable to the construction of check valves. Check valves shall be cast iron body and fully bronze mounted with an elastomer seating ring. Check valves shall be of the balanced single disc type with the disc hinged at the top, with outside lever and adjustable weight or spring. A clear waterway opening equal to the full area of the connecting pipe shall be provided when the valve is open.

Disc on sizes smaller than 6 inches shall be solid bronze and on larger sizes shall be cast iron with bronze facing. Hinge pins shall be stainless steel.

Combination Air And Vacuum Release Valves (Pipe). Combination valve shall be the compound lever type with the size as noted on the Drawings and designed for 100 psi working pressure. The valve body shall be cast iron with a stainless steel float and internal parts. Valves shall be provided with isolation valves.

Plug Valves. Plug valves shall be non-lubricated, eccentric type with nitrile butadiene (Hycar) or Buna-N resilient faced plugs. End connections shall generally be flanged or grooved for inside valves and mechanical joint for exterior ground-buried valves. Port areas shall be equal to at least 80 percent of the nominal size pipe area. Valve bodies shall be suitably marked to indicate whether the valve is open or closed.

The seating surface of the valve body shall be welded in stainless steel or nickel. Bearings at the top and bottom supporting the rotating element shall be self-lubricating, corrosion-resistant type, suitable for sewage plant service. The valve shall be of the bolted bonnet design. Packing shall be visible for inspection without dismantling valve or removing operator. The packing shall be adjustable and replaceable without disassembling of the valve. The valve body shall be cast or ductile iron marked to show seat side of valve.

Plug valves shall be of adequate design to operate with a pressure of 50 psi on both sides or on either side of the valve without leakage.

Fire Hydrant. Hydrants shall be furnished for 6 feet of cover.

Hydrants shall meet the requirements of AWWA C502 and shall be made to open in conformance with the CITY's standards. Generally, hydrants shall be 5-1/4-inch MVO with 6-inch M/J inlet as noted on the Drawings with two 2-1/2-inch bibs and one 4-inch bib. The hydrant shall be of adequate length to meet minimum depth requirements. Hydrant shall be of safety coupling and break flange construction. Hydrant isolation valve shall be a 6-inch valve located 3 feet from the hydrant.

HYDRANT REQUIREMENTS

Fire Hydrants shall be the product of the following manufacturer, or City approved equal: East Jordan, 4-1/2-inch NST pumper nozzle and 2-1/2-inch NST hose nozzles, 1-3/4-inch square with adapter nut operation nut, 6-inch mechanical joint inlet connection, open left (counterclockwise).

Surface Preparation. All hydrants shall be supplied painted red. Each fire hydrant shall be tagged with its distinguishing mark letter and number. Mark letter and number will be as listed in the Schedule. Identification tag shall be 1-1/2-inch diameter, 18-gauge polished brass or aluminum with 1/2-inch high, embossed, black-filled mark letter and number placed thereon.

Testing. Each hydrant assembly shall be tested by the CONTRACTOR; the test shall consist of flushing the hydrant for a minimum of ten minutes at flow rate equivalent to 3.0 feet per second through the hydrant lead per the AWWA C600 and C651 standards. During the test period, the 6-inch gate valve shall be closed and opened. The CONTRACTOR shall furnish necessary hoses for the disposal of CITY-furnished water.

VALVE JOINTS

Flange Joint. Flanges shall meet the requirements of ANSI-B16.1 Standard Class 125, except that bolt holes at shaft hubs may be drilled and tapped on the flanges. Flanges' faces shall be coated with a rust inhibitor immediately after drilling. Flange joints shall not be used on buried pipes.

Grooved Coupling. Grooved coupling joints shall be the rigid type and shall have housing fabricated in two or more parts of malleable iron in accordance with ASTM Specification A47 Grade C32510. Ends shall be factory grooved in accordance with the coupling manufacturer's standard groove dimension. Bolts shall be oval neck track head type with hexagonal heavy nuts, per ASTM A183 and A194/A194M. Gasket material shall be Grade "H," "E" chlorinated butyl, or E.P.D.M. for water service and grade "T" Buna-N for sewage. Grooved couplings shall not be used on buried pipes.

Mechanical Joints. Mechanical joints shall conform to ANSI/AWWA C110/A-21.10 and ANSI/AWWA C111/A-21.11.

VALVE ACCESSORIES

Manual Operators. Operators shall be designed with a safety factor of 5 for torsional and shear stresses. The operating mechanism shall be so located and so designed that parts subject to the maintenance shall be easily accessible.

Manual operators shall be so sized that a maximum of 80 pounds of rim force/pull is required for operation. Positions of operators shall be approved by the DIRECTOR OF PUBLIC SERVICES.

Valve shall be made to open when turned to the left or counterclockwise.

The direction of the operator to open position shall be indicated on the operator.

Lever. Lever shall be fabricated steel, shall include a set screw, and be grease lubricated.

Position Lever. Position lever shall be of extra heavy steel with a multiple position throttling plate.

Wrench Head. Wrench heads shall be cast iron with set screw. They shall be furnished for wrench nuts except where extension stems or T-handle wrenches are required.

Wrench Nut. Wrench nuts shall be provided with a 2-inch operating nut when a T-handle wrench or extension stem is required. Other wrench nuts shall be furnished with a wrench head.

Valve Box (Length). Valve boxes shall be either cast iron or ABS plastic. Cast iron lids shall be furnished with valve boxes and shall be marked "WATER" in raised letters.

Cast Iron Boxes. Cast iron boxes shall be of the three-piece adjustable type. A number 6 base shall be furnished with valves 8 inches or less, and a number 8 base shall be provided for valves over 8 inches.

Cast iron material shall meet requirements of ASTM A126-B.

Bolt material shall meet requirements of ASTM B316 and B253.

A magnet shall be permanently molded into both the upper and lower sections for easy locating with a dip needle or magnetic locator.

PART 3 – EXECUTION

ERECTION

Equipment furnished and installed under this Section shall be fabricated, assembled, erected, and placed in proper operating condition in full conformity with detail drawings, Specifications, DIRECTOR OF PUBLIC SERVICES data, instructions, and recommendations of the equipment manufacturer as approved by the DIRECTOR OF PUBLIC SERVICES.

INSTALLATION

Laying and Erecting Pipe. Pipe shall be installed as recommended by the manufacturers or by the applicable AWWA installation manual or specification. Pipe shall be carefully laid to line and grade as shown on the Drawings. Care shall be taken to keep the interior of the pipe clean and free from dirt and other foreign materials. Bulkheads or other means shall be used at the open ends of the pipe for this purpose. At the end of each day's work, ground-buried pipe shall have its working end bulk-headed. Pipe shall be wrapped with polyethylene encasement in accordance with AWWA C105 (ANSI 21.5) following Method "A."

Depth of Bury. All water main and service connections shall be installed with a minimum of 5.5 feet of cover over the top of the pipe.

Field Cutting Piping. The spigot ends of all pipe lengths, which have been cut in the field, shall be ground to a smooth surface and painted with two coats of asphaltum metal protective paint.

Bolted Flexible Couplings. All bolted flexible couplings shall be harnessed with tie bolts or studs across the joint, design based on test pressures. On cast iron or ductile iron pipe, tie bolts shall be installed between flanges across the coupling unless otherwise noted on the Drawings or approved by the DIRECTOR OF PUBLIC SERVICES. Piping of other materials shall be furnished with lugs. The number and size of the bolts and studs and other details of the harnessed joint shall be submitted to the DIRECTOR OF PUBLIC SERVICES for review. Tie bolts or studs shall be galvanized.

Concrete Encasement. Where shown on the Drawings or directed by the DIRECTOR OF PUBLIC SERVICES, pipework shall be encased in concrete. In general, pipe will be encased when it passes under structures. Pipe to be encased shall be supported on wood blocking at least at two points for each length of

pipe and joints made and the line tested wherever specified. Blocking shall be of sufficient size to raise the pipe at least 6 inches above the bottom of the trench so that a 6-inch encasement may be placed entirely around it. After an approved test of the pipeline, concrete encasement shall be placed.

Concrete Cradle. Pipework shall be placed on Class C concrete cradle in locations and according to details shown on the Drawings.

Bedding. Where the subgrade is disturbed during excavation, the space shall be refilled with Class II bedding material solidly tamped to form a firm foundation for the pipe. At least the bottom quarter of the pipe shall be laid on a Class II sand or pea gravel bedding, except that the bedding shall be exclusively pea gravel for pipe 48 inches and larger in diameter. Bedding shall be provided as specified under Division 2 Site Work.

Joints. All joints shall be assembled in accordance with that described in the Pipe Joint Section.

Connections to Existing Facilities. The CONTRACTOR shall furnish all labor and materials required for the connection of piping under this Contract to existing structures as called for on the Drawings. Where breaking holes for connections to existing structures, care shall be taken to prevent debris from entering. After installation of the pipe, the structure shall be pointed up around the pipe, both on the inside and outside so that it is restored to a watertight condition.

Connections to Existing Mains. Where shown on the Drawings, connections of existing main to the new mains shall be done only after the new mains are shown to be disinfected by the results of the bacteriological analysis. Care should be taken to prevent debris from entering water main.

REPAIR

Repair of all damaged interior pipe coatings, ground-buried exterior pipe coatings, and galvanized coatings shall be under this Section of the Work. Repair of exposed painted pipe shall be as specified by the Manufacturer.

Damaged linings, coatings, and wrapping shall be repaired under this Section of the Work and, if possible, before pipe is laid. Surfaces shall be thoroughly cleaned, dried, and free of old materials. They shall then be given a field coating of the same material as specified for the pipe. Coating shall meet the requirements of AWWA C203, AWWA C210, or AWWA C602 as approved by the DIRECTOR OF PUBLIC SERVICES.

All other pipe coatings and linings shall be as stated in Piping Section.

FIELD QUALITY CONTROL

Defective Pipe. No pipe or special casting known to be defective shall be laid in the Work. Any piece found to be defective after it has been laid shall be removed by the CONTRACTOR and replaced by a sound and perfect piece. If the major part of a defective pipe is sound, the good end may be cut off and used. The cutting of pipes for this and any other purpose shall be done by skilled workers, and in such manner as will not injure the pipe. Every such cut shall be square and smooth. Cut surfaces shall be recoated as specified for the pipe.

Tests.

General. After completion, each run of pipe shall be tested by the CONTRACTOR in the presence of the DIRECTOR OF PUBLIC SERVICES. All appurtenances such as service connections, corporation stops, and curb stops shall be tested with the run of pipe. Any leaks shall be made tight. Under this Work, the CONTRACTOR shall furnish all water or air, piping, bulkheads, pumps or compressors, gauge, and other equipment required to carry out the test.

Water samples will be taken as directed by the CITY and witnessed by the ENGINEER or authorized agent.

All pressure testing will be done by the CONTRACTOR and witnessed by the DIRECTOR OF PUBLIC SERVICES or authorized agent.

Prior to and during the hydrostatic test, the new main is not to be connected to the existing water system, except as specified herein. Temporary blow-offs, caps, or plugs shall be provided at the ends of the new main.

At the option of the CONTRACTOR, they may test against closed new valves providing that the new main to be tested and the testing apparatus shall have first been flushed and chlorinated in accordance with accepted procedure. After chlorination and subsequent flushing, a sample of water must show by test, by a recognized laboratory, safe bacteriological results. The CONTRACTOR shall state in writing and deliver to the OWNER prior to the hydrostatic tests, that in event of an unsatisfactory hydrostatic test, they will cut the new main, install caps or plugs, pressure test ,and re-chlorinate without additional cost or charge.

The CONTRACTOR shall furnish all necessary personnel, temporary timber bracing, plugs, test pumps, and all other necessary apparatus for conducting the test.

Before applying a test pressure, all air shall be expelled from the pipe; if necessary to accomplish this, taps shall be made at points of highest elevation in the pipe and such openings subsequently closed prior to test, with tight threaded brass plugs.

Pressure tests shall be in conformity with the current standards for pressure and leakage test, AWWA C600. Test pressure shall be maintained at 1.25 times the working pressure or 150 pounds per square inch (p.s.i.) minimum at the point of highest elevation in the test section by pumping potable water into the pipe for a period of at least two hours, and in all cases long enough to permit assurance of a satisfactory test. Leakage as measured by the quantity of water pumped into the pipe to maintain the test pressure setting during the test shall not exceed a rate of 10.49 gallons per inch diameter of main, per mile of pipe, in 24 hours.

All exposed pipe, fittings, valves, hydrants, and joints shall be examined carefully during the test. Any damaged or defective pipe, fittings, valves, hydrants, or joints that are discovered following the pressure test shall be repaired or replaced with sound material, and the test shall be repeated until satisfactory results are obtained.

In the event that the leakage exceeds the specified amount, the joints in the line shall be carefully inspected for leaks and repaired where necessary. Any pipes or special castings found to be cracked shall be removed and replaced with new pieces by the CONTRACTOR. After this work has been done, the test shall be repeated. Final acceptance of the lines will not be made until satisfactory tests have been passed.

Acceptance of installation. Acceptance shall be determined on the basis of allowable leakage. If any test of laid pipe disclosed leakage greater than that specified above, repairs or replacements shall be accomplished in accordance with the Specifications.

All visible leaks are to be repaired regardless of the amount of leakage.

Each valve assembly shall be tested by the CONTRACTOR; the test shall consist of opening and closing the valve.

Each hydrant assembly shall be tested by the CONTRACTOR; the test shall consist of flushing the hydrant for a minimum of ten minutes. During the test period, the 6-inch gate valve shall be closed and opened. The CONTRACTOR shall furnish necessary hoses for the disposal of CITY-furnished water.

FLUSHING

Installed water main must be flushed per the methods required in AWWA C600 and C651. The flushing rate must be at least 3.0 feet per second.

DISINFECTION

Potable water piping and water mains shall be flushed and disinfected in accordance with AWWA C651, continuous feed or slug method. All potable water piping shall be flushed. Disinfection may precede or follow pressure testing; however, new work shall not be connected to existing piping or water mains until two consecutive samples taken 24 hours apart per every 1,200 linear feet of water main have passed bacteriological tests.

Provide all temporary piping, fitting, backflow preventers, disinfectant feeding equipment, sampling, and laboratory testing necessary to complete the flushing and disinfection procedure. The DIRECTOR OF PUBLIC SERVICES shall be notified of flushing and disinfection schedule, and shall witness the sampling.

All chlorination of water mains shall be done in accordance with “Disinfecting Water Mains” (AWWA C651).

After a satisfactory hydrostatic test is obtained, the new main shall be chlorinated. A chlorine gas (or sodium hypochlorite)-water mixture shall be applied by means of a solution-feed chlorinating device. The chlorine solution shall be applied through a corporation stop at the beginning of the main. A slow flow of water shall be let into the main approximately at the point of injection of the chlorine solution, at a rate such that the chlorine dosage of the entering point shall be at least 50 parts per million. An open discharge shall be maintained at the far end of the main, and the introduction of chlorine solution and water shall continue until the water discharging at the far end shall carry the required dosage of chlorine. As the main is filled with chlorinated water, each outlet from the main shall be opened and sufficient water drawn off to ensure that the full dosage of chlorine reaches each outlet.

The chlorine treated water shall remain in the main at least 24 hours, and at the end of that time, the chlorine residual at pipe extremities and other representative points shall be at least 10 PPM. If the chlorine residual is less than 10 PPM at the end of 24 hours, further application of chlorine shall be made and the retention repeated until the required 10 PPM residual is obtained.

Following chlorination, all treated water shall be thoroughly flushed from the main until the replacement water throughout its length shall, upon test, both chemically and bacteriologically, be proven equal to the water quality in the source water supply system and safe.

Should the initial treatment of all or any section of the main, in the opinion of the CITY, prove ineffective, the chlorination procedure shall be repeated until confirmed tests show that water sampled from the new main conforms to the foregoing requirement.

The CONTRACTOR shall dispose of the high residual chlorine water by a method approved by the DIRECTOR OF PUBLIC SERVICES. All chlorinated water shall be de-chlorinated in a manner acceptable to the DIRECTOR OF PUBLIC SERVICES, prior to conveying it to either the City storm sewers or open water courses. If required by EGLE, the CONTRACTOR shall secure permits to discharge the de-chlorinated water.

All disinfection and testing (bacterial analysis) should be performed in accordance with AWWA C651.

FIELD QUALITY CONTROL

Installation. Special attention shall be given by the CONTRACTOR to ensure that valve items furnished under this Section of the Work are installed in accordance with manufacturer's recommendations. Installation methods must follow the methods outlined in AWWA C600.

Shutting Off Water. The CONTRACTOR shall familiarize themself with the locations of existing gate valves, and have them made easily accessible for emergency shutoffs. The Contractor shall notify the CITY to have valves opened and closed on their behalf. The CONTRACTOR shall keep on the job at all times all of the necessary equipment to shut the water off and to make immediate emergency repairs without undue delay.

In case of an emergency break in a water line due to the CONTRACTOR's construction operations, the CONTRACTOR shall supply water to those deprived of water service. Where it is necessary to shut off mains, it shall be done at night, subject to the approval of the CITY, between the hours of 10 p.m. and 5 a.m., unless another time is specifically permitted by the CITY. Twenty-four hour advance notice shall be given to persons whose water is to be shut off.

END OF SECTION 12