

APPENDIX 2-A – STANDARD MODIFICATIONS TO MPWSS

Foreword

The City of Missoula has unique requirements which are not addressed in the “Montana Public Works Standard Specifications” (MPWSS), Sixth Edition, April, 2010. This document addresses those specific requirements that are not addressed in the MPWSS or are modified from the MPWSS. All projects in the right of way and public easements in the City of Missoula shall be completed in accordance with MPWSS and the City of Missoula Modifications to MPWSS.

Where a City of Missoula modification to MPWSS does not exist for a particular Section of MPWSS, it shall be assumed the work is to be completed in accordance with the appropriate MPWSS Section. When a City of Missoula modification to the MPWSS does exist, the requirements of that modification supersede the related MPWSS requirement. The same holds true for City of Missoula Standard Drawings: however, there are some Standard Drawings which do not replace or supersede the MPWSS Standard Drawing but are additional drawings created specifically for the City of Missoula.

Each Section of the MPWSS that has been modified is listed in the Table of Contents. The entire section from the MPWSS has not been rewritten for these modifications. Instead, modifications are indicated for a specific section, subsection, paragraph, sentence or drawing. Also, there are several sections and forms not in the MPWSS which are included in this document and are to be used for all projects where applicable.

Appendix 2-B contains a list of MPWSS Standard drawings followed by “Active” or “Replaced” or “Deleted”. “Active” means that the drawing is usable as shown in MPWSS; “Replaced” indicates that the drawing has been replaced by a City of Missoula Standard Drawing; and “Deleted” indicates the drawing is not to be used

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SECTION 01400 CONTRACTOR QUALITY CONTROL AND OWNER QUALITY ASSURANCE (MPWSS, as amended)

PART 1: GENERAL

Add the following paragraphs:

“1.3 LABORATORY TESTS

- A. The Contractor shall employ and pay for the services of an independent testing laboratory to perform specified laboratory testing of materials and equipment where the technical specifications specifically obligate the Contractor to provide the services.

- B. Unless otherwise indicated, the Owner will employ and pay for the services of an independent testing laboratory to perform soils, concrete, and asphalt testing for determining compliance with the specifications. The Contractor shall cooperate with the laboratory to facilitate the execution of its required services.

1.4 CONTRACTOR’S RESPONSIBILITIES

- A. Cooperate with laboratory personnel and provide access to work.

- B. Secure and deliver to the laboratory adequate quantities of representative samples of materials proposed to be used and that require testing.

- C. Provide to the Engineer the preliminary mix proposed to be used for concrete, asphalt, and other material mixes that require control by the testing laboratory.

- D. Provide samples of materials proposed to be used for backfill of structures or piping for determination of moisture density relationship.

- E. Furnish copies of product test reports as required.

- F. Furnish incidental labor and facilities:
 - 1. To provide access to Work to be tested.

 - 2. To obtain and handle samples at the Project site or at the source of the product to be tested.

 - 3. To facilitate inspections and tests.

- 4. For storage and curing of test samples.
- G. Notify laboratory sufficiently in advance of operations to allow for laboratory assignment of personnel and scheduling of tests.
- H. Coordinate testing services with laboratory and the Owner/Engineer. Understand all requirements of project testing and ensure all testing complete prior to completion of the Project.”

PART 3: EXECUTION

3.1 GENERAL

Add the following paragraphs:

- “E. The Owner shall provide (and the Contractor shall ensure all required testing has been scheduled) nuclear density testing for trench backfill and surfacing materials. (i.e. all base gravels, asphaltic concrete, or gravel surfacing). The Contractor will provide the Owner with all the necessary moisture/density curves for all the density testing on the project for imported materials. The Contractor will be required to utilize the services of an independent and certified testing laboratory for all proctors. The Contractor shall reimburse the Owner the cost of the testing for each failed “trench backfill and/or surface” density test.
- F. The Contractor shall work with the Engineer to schedule all field testing. The Contractor shall notify laboratory representative and the Engineer as to the dates and times of all testing, providing a minimum of 24-hours notification. The Contractor shall coordinate with the Engineer the requirements of the Project and ensure all testing is complete to meet Project Specifications. The Contractor shall provide all required materials, labor, equipment, water, and power required for testing. Contractor shall review and understand the minimum testing requirements of the City of Missoula and ensure all required testing has been performed.
- G. The Contractor shall perform:
 - 1. Initial moisture/density proctor curves for all bedding, gravel bases, and asphaltic concrete surfacing performed by an independent laboratory. The maximum density curve shall be current (within the last 12 months), and the asphalt mix design shall be current (within the last 12 months).
 - 2. The Contractor shall make provisions for the Owner/Engineer to enter all trenches for the purpose of conducting inspection services; an example

would be performing field density tests in a deep trench. Such provisions shall exceed all OSHA requirements, including fall rescue equipment, gas safety equipment, entrance procedures, etc.

H. The following minimum testing requirements shall be required:

ASPHALT CONCRETE PAVEMENT

Test Specification / Material	Test Method	Minimum Required Frequency
Base Course and Surface Course	Mix design	1 submittal per project no older than one year
Specific Gravity, Stability, Flow Data, Density and Void Analysis	AASHTO T245 (ASTM D6926/ D6927): Resistance to Plastic Flow of Asphalt Mixtures Using Marshall Apparatus	1 test/1000 feet of roadway
Compaction	ASTM D3549: Thickness or Height of Compacted Asphalt Mixture Specimens ASTM D2950: Density of Bituminous Concrete in Place by Nuclear Methods	one core sample for every 400 feet of street with a minimum of two samples per project
Cohesion	ASTM D1074: Compressive Strength of Asphalt Mixtures	1 test per project

PORTLAND CEMENT CONCRETE

Test Specification / Material	Test Method	Minimum Required Frequency
Portland Cement Concrete	Mix design	1 submittal per project no older than one year
Sampling Fresh Concrete	ASTM C172: Sampling Freshly Mixed Concrete	1 test per project/Every 50 cy
Slump	AASHTO T119 (ASTM C143): Slump of Hydraulic-Cement Concrete	
Air Content (gravel or stone)	AASHTO T152 (ASTM C231): Air Content of Freshly Mixed Concrete by the Pressure Method	
Air Content (slag or highly porous)	ASTM C173: Air Content of Freshly Mixed Concrete by the Volumetric Method	
Compressive Strength	AASHTO T22 (ASTM C39): Compressive Strength of Cylindrical Concrete Specimens	

Making and Curing Test	AASHTO T97 (ASTM C78): Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading)	
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EARTHWORKS

Test Specification / Material	Test Method	Minimum Required Frequency
Backfill, Subgrade, and Embankment (Moisture-Density)	AASHTO T99 (ASTM D698): Moisture–Density Relations of Soils Using a 2.5-kg (5.5-lb) Rammer and a 305-mm (12-in.) Drop	1 submittal per soil type and borrow source
Trench Backfill & Embankment (Compaction)	AASHTO T191 (ASTM D1556): Density and Unit Weight of Soil in Place by Sand-Cone Method AASHTO T310 (ASTM D6938): In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)	<u>Up to 8 foot deep trenches</u> Every 200 feet, 2 feet from edge of structures, appurtenances, and as material changes: -24 inches above pipe -1/2-way up trench -Surface of trench <u>8 foot and deeper trenches</u> Every 200 feet, 2 feet from edge of structures, appurtenances, and as material changes: -24 inches above pipe -1/3-way up trench -2/3-way up trench -Surface of trench
Subgrade, Base Course & Sub Base Course (Compaction)	AASHTO T191 (ASTM D1556): Density and Unit Weight of Soil in Place by Sand-Cone Method AASHTO T310 (ASTM D6938): In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)	Every 200 feet and as material changes: 1 st lift of material Top 6 inches of subgrade
Pipe Bedding (Compaction)	AASHTO T191 (ASTM D1556): Density and Unit Weight of Soil in Place by Sand-Cone Method AASHTO T310 (ASTM D6938): In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)	every 200 feet below pipe

Type I Pipe Bedding (Plasticity)	AASHTO T89/T90 (ASTM D4318): Liquid Limit, Plastic Limit, and Plasticity Index of Soils	1 submittal per project 1 field test per project
Type I & II Pipe Bedding, Base Course & Sub Base Course (Gradation)	AASHTO T27: Sieve Analysis of Fine and Coarse Aggregates AASHTO T11: Materials Finer Than 75- μ m (No. 200) Sieve AASHTO T96 (ASTM C131): Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine	1 submittal per project 1 field test per project

- I. Related requirements specified elsewhere:
 - 1. Inspection and testing required by laws, ordinances, rules, regulations, orders, or approvals of public authorities: Conditions of the Contract.
 - 2. Certification of products: The respective section of Specifications.
 - 3. Test, adjust, and balance equipment: The respective sections of Specifications.
 - 4. Field tests required and standards for testing: The respective Specification sections.

- J. All tests shall be performed in the presence of the Engineer.

- K. Repair all materials that fail during testing at Contractor's expense."

END OF SECTION

SECTION 01570 TRAFFIC CONTROL (*MPWSS, as amended*)

DELETE SECTION 01570 “CONSTRUCTION TRAFFIC CONTROL” IN ITS ENTIRETY AND REPLACE WITH THE FOLLOWING:

PART 1: GENERAL

1.1 SUMMARY

- A. The Contractor shall schedule his construction operations in a manner which will assure that the safety and convenience of motorists, business and residents and the safety of construction workers and the general public are adequately met at all times.
- B. Contractor shall be responsible for the development and submittal for final approval to the City of Missoula of all traffic control procedures associated with the project. Contractor shall work closely with the Engineer and City of Missoula in the development of their traffic control measures, and shall follow all local and state standards.
- C. The contractor shall be responsible for maintaining safe travel corridors for all vehicle, bicycle and pedestrian traffic as part of the approved traffic control plan.
- D. Contractor shall allow adequate time for review of each phase of traffic control. Traffic control plans shall be submitted to the Engineer and City of Missoula. Contractor shall allow a minimum 2-week review time for all traffic control plans.

1.2 REQUIREMENTS

TRAFFIC CONTROL

- A. Traffic control devices shall conform to the current version/revision of the Manual on Uniform Traffic Control Devices (MUTCD) and shall be installed in accordance with an approved traffic control plan before beginning construction operations, and shall be properly maintained and operated during the entire time that the need exists. They shall remain in place only so long as they are needed and shall be immediately removed thereafter.
- B. Construction impacts vary depending on the type of street affected. The following notice requirements shall apply to all non-emergency city street closures more than four (4) hours in length on streets classified as “collectors” or “arterials” as defined in the City of Missoula Street Functional Classification Map.

1. A street closure shall be defined as the closure of all driving lanes on a City Street.
 2. A lane closure shall be defined as the closure of one or more driving lanes on a City Street.
 3. These advance notice requirements do not apply to street closures of less than four (4) hours, mobile and temporary operations, or any emergency utility repairs or connections.
- C. The traffic control plans for streets designated as National Highway System shall be approved by the Montana Department of Transportation (MDT) prior to approval from the City. The MDT permit must be submitted to the City when applying for the City Permit.
- D. All traffic control plans with lane or complete closures for Arterial and Collectors must be designed, maintained and executed by persons trained and certified by an accredited certification agency.
- E. Advanced notice requirements for closures on arterials, collectors and commercial/industrial streets and alleys in commercial areas that are used for regular deliveries, access to parking lots or other commercial uses.
1. Advanced Notice (minimum 14-days): First notice of a planned street closure shall be in writing, delivered by mail or flyer to all property owners, tenants and businesses adjacent to the street closure. Notice shall be provided to businesses within the limits of the advanced "Detour" warning sign locations for the approved traffic control plan, and all properties within the limits of the closed portion of the roadway. The notice may be provided any time in advance of the project with a minimum of 14 calendar days' notice prior of the street closure and contain the following information:
 - a. The estimated date for the start of street closure. If the exact date of the street closure is not known, or if the work is planned in stages, the notice should state information about the approximate dates that the project may begin.
 - b. Include all detour routes if applicable.
 - c. Length of time the street is planned to be closed.
 - d. Company name and phone number for further information.
 - e. The notice shall also state that a second notice will be delivered a minimum of 48-hours prior to the actual street closure. If the closures are following a phasing plan, then a 48-hour notice must

- be given for each phase.
- f. The City Engineer has the authority to waive the 14-day notifications if, in his opinion it would be in the public interest to do so.
 - g. Notice to all property owners, tenants and business on the detour route may be required, at the City Engineer's discretion, when arterial, collectors or commercial/industrial streets are rerouted through residential areas.
2. Use of Message Boards or Other Information Signs: Message boards or information signs may be required to be placed in advance of a street closure or partial street closures on certain roadways. These must be placed in a location as approved on the traffic control plan and stay in place until the actual construction takes place unless otherwise required to remain in place through the entire project per the approved traffic control plan.

Message Boards or other Information Signs may be required for the following:

- a. Roadways that serve large areas for which a closure will result in long detours that will result in significant delay and inconvenience for the traveling public. (Example: Lower Miller Creek Drive, 23rd, Hillview Way)
 - b. For detours that require alternate routes that intersect before the actual street closure. (Example: The closure of Hillview Way between Black Tail and 55th may require an information sign west of 23rd for eastbound vehicles.)
 - c. Operations such as paving or chip and seal that can cause significant delays through the use of flagmen and roadways that have high volumes and lack alternative routes. (Example: Grant Creek Drive, Lincoln Hills Drive)
3. Advanced Notice (minimum 48 hours): Additional notice of a planned street or alley closure shall be in writing, delivered by mail or flyer to all property owners, tenants and businesses adjacent to the street closure. Notice shall be provided to businesses within the limits of the advanced "Detour" warning sign locations for the approved traffic control plan, and all properties within the limits of the closed portion of the roadway.

The notice shall be provided a minimum of 48-hours prior to the street closure and contain the following information:

- a. Date of beginning of street or alley closure.
 - b. Length of time the street or alley is planned to be closed.
 - c. Include all detour routes if applicable.
 - d. Company name and phone number for further information.
 - e. It shall be the contractor's responsibility to notify the media 48-hours before the closure. If the closures are following a phasing plan, then a 48-hour notice must be given for each phase.
- F. All Other Streets. The following notice requirements shall apply to all non-emergency city street and residential alley closures more than one (1) day in length on streets not classified as "collectors" or "arterials".
- 1. Advanced Notice (minimum 48 hours): First notice of a planned street or alley closure shall be in writing, delivered by mail or flyer to all property owners, tenants and businesses adjacent to the street closure. Notice shall be provided to businesses within the limits of the advanced "Detour" warning sign locations for the approved traffic control plan, and all properties within the limits of the closed portion of the roadway.
- The notice shall be provided a minimum of 48-hours prior to the street closure and contain the following information:
- a. Date of beginning of closure.
 - b. Length of time the closure is planned.
 - c. Company name and phone number for further information.
- G. Proof of Notice: The applicant for city street or alley closure shall be required to prove that advance notice or 48-hour notice has been completed by providing the City Engineer copies or logs of such notices and dates of delivery. A City of Missoula form, which may be used for logging and evidence of the notice, is attached along with a sample NOTICE, which may be used in lieu of a contractor-designed form.
- H. Notification of Emergency Services, Transportation Services and Media: The notification of emergency services, transportation services, and media shall be the responsibility of the Contractor.

PEDESTIAN CONTROL

- A. All persons engaged in the construction or repairing of right of way improvements shall, when ordered so to do by City, construct and maintain a temporary sidewalk. The temporary sidewalk shall be constructed to the requirements stated on City standard drawings with a hard, durable, non-slip all-

weather surface, not less than 4 feet in width extending from sidewalk to sidewalk, around such sections of sidewalk or alley approach in the course of construction or repair. All temporary sidewalks shall conform to standards contained in the Americans with Disabilities Act. Such temporary sidewalk shall be constructed before any work whatsoever is commenced on the permanent sidewalk or alley approach and shall not be removed until the permanent sidewalk or alley approach is open to traffic. Where a traffic hazard exists, the City Engineer may require additional protective structures be placed adjacent to the temporary sidewalk. A right of way occupancy permit may also be required per City Standards.

- B. Where overhead hazards exist the City staff may require protective structures be placed over the temporary sidewalk. These structures must be approved by the City and in place prior to opening the temporary sidewalk.

PART 2: PRODUCTS

2.1 GENERAL

- A. The Contractor is solely responsible for the construction traffic control devices, and the material, use, and types of all traffic control devices. All products used for traffic control shall meet the requirements of OSHA and the MUTCD (Manual of Uniform Traffic Control Devices for Streets and Highways) and Local Standards.

PART 3: EXECUTION

3.1 SUMMARY

- A. Prior to starting work or altering an approved segment of the traffic control plan, the Contractor shall submit to the described authorities, their plan for barricading, signing, detouring and securing the project area and its related traffic and all such measures shall be in accordance with the MUTCD. The Engineer and City of Missoula shall have final authority for the review and approval of traffic control and may direct the Contractor to provide additional items at no additional compensation if, in their estimation, the proposed plan does not adequately address the safety and convenience of the public and/or does not conform to the required standards. No work shall commence or advance until the related traffic control plan is approved. Therefore, the initial plan must be submitted prior to issuance of the Notice to Proceed. The Contractor shall then install all required traffic control facilities prior to commencing work and maintain such throughout the project. The Contractor

shall notify property owners a minimum of 72 hours in advance of private driveway closures. Private driveways that are closed due to construction should be reopened as soon as possible.

- C. The Contractor shall provide safe and continuous passage for pedestrians at all times in those areas where designated pedestrian routes exist and are in use. The Contractor's traffic control plan shall detail pedestrian passages in conformance with the latest edition of ADA Accessible Guidelines (ADAAG), in addition to traffic routing.

3.2 TRAFFIC CONTROL SIGNING COMPLIANCE

- A. The Contractor is solely responsible for the construction traffic control devices, and the material, use, and types of all traffic control devices shall meet the requirements of the Manual of Uniform Traffic Control Devices (MUTCD).

3.3 NOTIFICATION OF CONSTRUCTION

- A. The Contractor shall be responsible for notifying all State, County, City, local or private services, departments, agencies, or organizations whose normal or emergency services may be affected by the construction activity. Notification shall be made at least seventy-two (72) hours in advance of the proposed construction activity. Immediately after the applicable construction activity has been completed, the notified department, agencies, or organizations shall be contacted and informed that the affected highway, road, street, alley, or access is open for normal traffic flow.

3.4 TRAFFIC CONTROL PROCEDURES

- A. When construction operations are conducted along streets and roadways, the Contractor shall have proper signs and barricades in place at each side of the work site. All public thoroughfares that are closed to traffic shall be protected by means of effective barricades on which shall be placed acceptable warning signs. Barricades shall be located at the nearest intersecting public highway or street on each side of the blocked section. All barricades and obstructions shall be illuminated by means of warning lights and signs at night. All lights used for this purpose shall be kept burning from sunset to sunrise. Materials stored upon or alongside public streets and highways shall be so placed, and the work at all times shall be so conducted as to cause the minimum obstruction and inconvenience to the traveling public. All barricades, signs, lights and other protective devices shall be installed and maintained in conformity with applicable statutory requirements and, where within railroad and highway right of ways, as required by the authority having jurisdiction there over. When it is

necessary for the Contractor to leave a section of trench open, materials stockpiled or equipment parked alongside the street at the end of a work day, or prior to weekends or holidays, the Contractor shall, with the approval of the Engineer, install adequate barricades, vertical panels, sign, and lights at the work site to the extent adequate protection is provided to the Public. Trenches across private driveways shall be backfilled immediately after installing pipe. All private access shall be open at the end of each workday and on weekends and holidays. When trenching operations disturb the edge of the paved street so as to create a traffic hazard, vertical panels or delineators shall be placed, as approved by the Engineer, until the street is repaired. All signs and barricades shall be attached to portable mounts.

- B. Where operations are performed in stages, there shall be in place only those devices that apply to the conditions present. Devices or signs that do not apply to existing conditions shall be removed, covered or turned so as to not be readable by oncoming traffic. Barricade and sign supports shall be constructed and erected in a proper manner. Weeds, tree shrubbery, construction materials, equipment, spoil piles, etc., shall not obscure any traffic control device or present a site visibility obstruction as defined in the City of Missoula Standards.

3.5 EMERGENCY SERVICES

- A. Full time access to and from fire station(s) and other locations where emergency vehicles are housed will be provided. It shall be the Contractor's responsibility to coordinate with local emergency providers to determine emergency vehicle locations.
- B. The Contractor shall have an emergency contact(s) available during all working and non-working hours, to include weekends and holidays, for notification of replacement, re-erection, or corrections to traffic control devices.

END OF SECTION

SECTION 02110 GEOTEXTILES (*MPWSS, as amended*)

PART 2: PRODUCTS

Add the following sections:

"2.4 DRAINAGE FABRIC

- A. Drainage fabric, where indicated on the plans or within the project details, shall be a nonwoven geotextile, Propex 401, or approved equal. Drainage fabric shall be installed per manufacturer's recommendation and drawings.

2.5 SEPARATION FABRIC

- A. Separation fabric, where indicated on the plans or within the project details, shall be a woven geotextile, Propex 200ST, or approved equal. Separation fabric shall be installed per manufacturer's recommendation and the standard drawings."

END OF SECTION

SECTION 02221 TRENCH EXCAVATION & BACKFILL FOR PIPELINES & APPURTENANT STRUCTURES (MPWSS, as amended)

PART 1: GENERAL

1.3 STANDARD DRAWINGS

Delete paragraph A. and add the following:

“A. Refer to the most recent versions of City of Missoula Standard Drawings, or the project details contained within the Drawings, for applicable details.”

PART 2: PRODUCTS

2.1 PIPE BEDDING MATERIALS

Delete paragraph A in its entirety and replace with the following:

“A. TYPE 1 PIPE BEDDING

1. Unless otherwise shown on the drawings, pipe-bedding material will be placed in a thickness equal to 1/4 x pipe O.D. below the pipe (4-inch minimum) to 6 inches above the pipe. Bedding material will be clean, non-cohesive, natural, unwashed gravel, sand, or crushed hard stone graded as follows with a maximum plasticity index of six (6) as determined by AASHTO testing methods T89 and T90 or by ASTM D4318.

NORMAL TYPE 1 BEDDING		WET CONDITION TYPE 1 BEDDING	
<u>Sieve Size</u>	<u>Percent Passing</u>	<u>Sieve Size</u>	<u>Percent Passing</u>
1 inch	100	1 inch	100
#4	40 - 70	#4	40 – 100
#200	Less than 10	#200	0

2. Where groundwater is encountered, Wet Condition Type I bedding shall be used. Material shall be washed, crushed rock passing meeting the gradation indicated above. Native trench material will not be used for pipe bedding material. In rock areas the minimum bedding below the pipe will be 6 inches. No stones or hard rock larger than 6 inches will be

placed within 2 feet above the pipe unless the bedding above the pipe is increased to 12 inches.

3. Bedding material will be compacted to 95% of theoretical maximum proctor density as determined by ASTM D698.
4. Special pipe embedment may be required when shown on the drawings, or as directed by the Engineer.”

Delete paragraph B, Select Type 1 Bedding, in its entirety.

C. Type 2 Pipe Bedding

Delete paragraph 3. In its entirety and replace with the following:

- “3. Type 2 Pipe Bedding shall consist of granular material meeting the following gradation and a maximum plasticity index of 6 and a maximum liquid limit of 25%.

<u>Sieve Opening % Passing</u>	
3 Inch	100
No. 4	0 – 25
No. 200	0 – 10

Type 2 bedding shall be placed and compacted to 95% of theoretical maximum proctor density as determined by ASTM D698.”

D. SEPARATION GEOTEXTILE

Delete paragraph 1 in its entirety and replace with the following:

- “1. In locations where pipelines are installed below the groundwater level, or as directed by the Engineer, a geotextile pipe bedding wrap shall be installed around the entire pipe bedding. Where lapping is required and where edges are brought together at the top of the bedding, the geotextile fabric shall overlap a minimum of 2 feet. The geotextile fabric for bedding wrap shall be a non-woven geotextile in accordance with AASHTO M288 Class 1, 2, or as specified by the Engineer and in conformance with specification section 02110.”

2.2 TRENCH BACKFILL MATERIALS

Delete paragraph A in its entirety and replace with the following

“A. Materials from Trench Excavation

1. Backfill material obtained from trench excavations must be free of cinders, ash, refuse, organic or frozen material, boulders, concrete, asphalt, brick, heavy plastic clay, hard dry clay, or other deleterious materials. Backfill materials and placement are further described in the Execution Section of this specification.”
2. Material containing a moisture content outside of specified limits shall be reconditioned such that limits are achieved, or shall be removed and hauled to waste.

2.4 DETECTABLE WARNING TAPE

Delete paragraph A in its entirety and replace with the following:

- “A. Detectable buried warning tape shall be installed with all water, storm and sanitary sewer mains and services. Detectable tape is to have a minimum 3 inch width and 5 mil thickness and a solid aluminum core running the full length and width of the tape enclosed in a color coded inert plastic jacket, impervious to alkalis, chemical reagents and solvents in the soil. The tape is to meet APWA/ULCC Color Code requirements and is to have a maximum 36 inches imprint, marked “Caution Water Line Buried Below” or “Caution Sewer Line Buried Below”. Tape shall be placed directly over the pipeline, a minimum of 18 inches and maximum of 24 inches below finished surface. Warning tape shall not be required for any lines that are tunneled or pushed beneath roadways.”

Add the following paragraphs:

“2.5 TRACER WIRE

- A. Contractor shall bury tracer wire with all water and sewer force main pipeline and service lines. Tracer wire shall be at minimum #14 solid copper direct bury wire and shall be blue color for water and green for sewer.
- B. Tracer wire shall be taped to the top center of the pipeline prior to backfilling. Tracer wire connections will be made by twisting the wires, installing a silicone-filled water resistant wire nut, and wrapping the connection with electrical tape.

- C. Tracer wire shall be brought to the surface at each valve or other appurtenance that is at the ground surface.
- D. Small diameter PVC conduit shall be used in valve boxes to house the tracer wire brought to the surface.
- E. Where new service line transitions to existing galvanized service line, the new tracer wire should be attached to the galvanized pipe using a ground pipe clamp suitable for direct burial.”

PART 3: EXECUTION

3.1 PROTECTION OF EXISTING PROPERTIES

E. Exploratory Excavations

Delete paragraphs 1 through 4 in their entirety and add the following:

- “1. The Contractor shall be responsible for locating all underground utilities associated with the Project. All costs associated with such exploratory excavations or “potholing”, shall be at the Contractor’s expense, and shall be considered incidental to the work.”

3.3 TRENCH EXCAVATION

A. General

Add the following:

- “10. After each pipe has been graded, aligned, and placed in final position on the bedding materials, and shoved home or jointed, sufficient pipe embedment material will be deposited and compacted under and around each side of the pipe and back of the bell or end thereof to hold the pipe in proper position and alignment during subsequent pipe jointing, embedment, and backfilling operations.
- 11. All granular fill material beneath the pipe will be spread and compacted to provide a uniform and continuous support beneath the pipe at all points between bell holes or pipe joints. It will be permissible to slightly disturb the finished subgrade surface by the withdrawal of pipe slings or other lifting tackle. No part of any bell or coupling will be in contact with the trench bottom, trench walls, or granular fill when the pipe is jointed.

12. Embedment material will be deposited and compacted uniformly and simultaneously on each side of the pipe to prevent lateral displacement of the pipe. Bedding material shall be “knifed” under the pipe haunches by the use of hand equipment to assure no voids remain. Mechanical tampers may be used provided results equal to hand tamping methods can be obtained. Material shall be placed in layers not exceeding six inches loose thickness before compaction.
13. Do not proceed with excavations unless materials are on hand for immediate installation.
14. Maintain excavations and warning barricades at all times to guard against and prevent injury to employees and the public in accordance with appropriate safety practices for utilities construction.
15. The contractor shall not open more trench in advance of pipe laying than is necessary to expedite the work. Complete construction and backfill without delay. Any trenches left open for an extended period of time shall be protected in accordance with specification section 01570 Traffic Control.”

B. Trench Dimensions

2. Width

Delete paragraph a. in its entirety and replace with the following:

- “a. Excavate to provide room to install, join and bed pipe as specified. The minimum trench width is 3 foot-6 inches for outside pipe diameters of 18 inches or less. The minimum trench width is 3 feet-0 inches plus the outside diameter of the pipe for pipe sizes exceeding 18 inches. The trench shall be excavated so a minimum clearance of 12 inches is maintained on each side of the pipe for proper compaction of the bedding and backfill material.”

3. Depth

Delete paragraph a. in its entirety and replace with the following:

- “a. Excavate the trench as required for the invert grade or pipe bury as specified in the contract documents, plus the depth under the

pipe specified for Type 1 Pipe Bedding. If bedrock, boulders or large stones are encountered at the bottom of the trench, excavate at least 8 inches below the bottom of the pipe for backfilling with Type 1 Pipe Bedding.”

Add the following paragraph:

“4. Excavation for Appurtenances

Excavation for manholes, valve pits, or similar structures shall be sufficient to leave ample room for work activities. Any over-excavation below specified grade shall be refilled with Type 2 Bedding as specified in Section 2.2.”

E. Pavement Damage Caused by Equipment

Delete paragraph 2 in its entirety and replace with the following:

- “2. All pavement damaged during construction by the Contractor’s equipment or the use thereof shall be removed to at least a depth of 2 inches and replaced. Removal and replacement shall be over an area that is continuous with the asphalt restoration and as otherwise required by the Engineer to provide a smooth and durable patch. No compensation will be allowed for removal and replacement of damaged pavement outside of the pay limits for pavement restoration. Patches less than 2 inches in thickness will not be allowed. Work and materials shall be in accordance with the requirements for pavement restoration.
3. Damaged pavement outside of the replacement area may be subject to pavement damage assessment fees as required in Chapter 2 of the City of Missoula Public Works Standard Specifications Manual.”

3.4 DEWATERING

Delete paragraph A. in its entirety and replace with the following:

- “A. The contractor shall provide and maintain adequate dewatering equipment to remove and dispose of all surface and groundwater entering excavations, trenches or other parts of the work. Each excavation shall be kept dry during subgrade preparation and continually thereafter until the structure to be built, or the pipe to be installed therein, is completed and backfilled to the extent that no damage from hydrostatic pressure, flotation, contamination or other cause will result. All excavations for pipelines and structures which extend down to or

below static ground water elevations, shall be dewatered by lowering and maintaining the ground water surface at the bottom of the excavation. Surface water shall be diverted or otherwise prevented from entering excavated areas or trenches to the greatest extent practicable without causing damage to adjacent property. The cost of dewatering operations is considered a part of the excavation cost.

- B. If dewatering is deemed necessary at the time of bidding, the Contractor shall consult a licensed professional engineer or certified professional hydrogeologist familiar with the local geologic, hydrogeologic, and geotechnical conditions as well as the construction practices pertaining to the Contractor's means and methods of dewatering and submit a dewatering and monitoring plan for review prior to commencing dewatering operations. The dewatering plan shall be designed and stamped by a licensed professional engineer or certified professional hydrogeologist."

3.6. TRENCH FILLING AND BACKFILLING

- B. Pipe Bedding Placement

Type 1 Bedding

Delete paragraph a. in its entirety and replace with the following:

- "a. Place Type 1 Pipe Bedding material under the pipe to the depth as specified in the standard drawings details; around the pipe and up to the spring line of the pipe for reinforced concrete pipe; and around the pipe to 6 inches over the top of the pipe for flexible piping. Place in maximum lifts of 6 inches using hand operated or other compaction methods without damaging or disturbing the pipe. Thoroughly compact each layer. Use special care to assure compaction under pipe haunches."

Delete Section 2 Select Type 1 Bedding in its entirety.

- C. TRENCH BACKFILL

- 1. Delete the last sentence and replace with the following:

"From the top of the Type 1 Pipe Bedding to 6 inches below the ground surface, or to the subgrade elevation, material containing rock up to 6 inches in the greatest dimension may be used. All larger material must be removed and hauled to waste."

- 2. Delete Paragraphs a., b., and c. in their entirety and replace with the

following:

- a. Type A Trench Backfill is compacted backfill and will be used for all work within the right of way.
- b. Type B Trench Backfill will not be used in the right of way unless approved by the Engineer.
- c. Type C Trench Backfill will not be used in the right of way unless approved by the Engineer.”

Add the following paragraph:

“3.10. CONSTRUCTION PHOTOGRAPHS

- A. Construction photographs shall be required for sanitary sewer, storm sewer, and water main installations for acceptance of the system by the City of Missoula.
- B. At a minimum, construction photos shall be taken at all fittings and valves for water and pressure sewer main installations, and for underground pipe connections to manholes and junction structures for gravity sewer main and storm drain.
- C. Photos shall be taken before fittings are wrapped to create a record of the connections and after the tie downs and thrust blocks are in place for future reference as to size and construction for water and pressure sewer main installations.
- D. Photographs of flexible connections at manholes shall be provided for all sewer main and storm drainage structures. Pictures shall be taken before and after the annular void of the penetration is completed. Photos must show the manhole number as designated on the plans, and designate invert “in” or “out” as required. This shall be done by visible markings on the manhole barrel that clearly show in each photo.
- E. Photos shall be clearly annotated for future identification of location and orientation using a whiteboard, noting the date, station and items(s) pictured.
- F. Additional photos shall be taken as necessary to document construction.
- G. There will be no payment for manholes or fittings until photos are delivered and accepted by the Engineer. If photographs for any manhole or fittings are not furnished to the Engineer, the Contractor shall re-excavate the manholes or

fittings to expose all connections to obtain photographs at contractor's expense."

END OF SECTION

SECTION 02234 SUB BASE COURSE (*MPWSS, as amended*)

PART 2: PRODUCTS

2.1 GENERAL

Add the following to the end of paragraph A:

“Limit use of recycled concrete and/or asphalt in the crushed sub base course to a maximum of 50% by weight. Recycled materials shall be all asphalt or all concrete, not a mixture of recycled materials. Recycled material shall be mechanically blended to assure thorough mixing. Contractors are required to use a pug mill or other approved combining method to mix the virgin aggregate and recycled products prior to testing and placement.

Gradation of blended recycled materials shall meet the following gradation:

- 6 inch maximum aggregate size,
- 90 to 100% passing 3-inch screen,
- Less than 15% passing the No. 200 sieve; and
- Material passing the No. 40 sieve must have a maximum liquid limit and plasticity index of 30 and 6, respectively.”

END OF SECTION

SECTION 02235 CRUSHED BASE COURSE (*MPWSS, as amended*)

PART 2: PRODUCTS

2.2 CRUSHED BASE MATERIAL

Add the following to the end of paragraph A:

“Limit use of recycled concrete and/or asphalt in the crushed base course to a maximum of 50% by weight. Recycled materials shall be all asphalt or all concrete, not a mixture of recycled materials. Recycled material shall be mechanically blended to assure thorough mixing. Contractors are required to use a pug mill or other approved combining method to mix the virgin aggregate and recycled products prior to testing and placement.

Gradation of blended recycled materials shall meet the gradation requirements of 3/4 inch minus within the Table of Gradations.”

Delete paragraph C in its entirety and replace with the following:

“C. Crush material so that the percentage of fractured particles in the finished product is as constant and uniform as practical. Crush to produce material where at least 50% of the material retained on the No. 4 sieve has at least one fractured face.”

END OF SECTION

SECTION 02510 ASPHALT CONCRETE PAVEMENT (*MPWSS, as amended*)

PART 2: PRODUCTS

2.2 PLANT MIX AGGREGATES

Add the following sentence to the end of paragraph E.:

“The use of reclaimed asphalt pavement shall only be allowed with prior approval of the City, and with a maximum 20% of reclaimed asphalt.”

Add the following sentence to the end of paragraph I:

“The gradation for City streets will be Type B.”

2.3 ASPHALT BINDER MATERIAL

Add the following sentence to the end of Paragraph A.:

“Use (PGAB) PG 58-28 or equivalent.”

2.5 COMPOSITION OF MIXES

A. General

Add the following:

“5. Current job mix is defined as a mix design done within the last 12 months in which no change in material sources or amounts has been made.”

PART 3: EXECUTION

3.10 WEATHER LIMITATIONS

Add the following paragraph:

C. Cold-Weather Placement: Generally comply with MDT Standard Specification 401.03.18 (Surface Conditions, Weather Limitations, and Paving Dates), and 401.03.21 (Compaction, Compaction Control Testing, and Density Acceptance Testing) and as follows:

1. Plant mix paving is not allowed when, a) the surface temperature is less than 35F (measured by the City), b) the surface is wet, c) the roadbed is unstable, d) any portion of the base course layer is frozen, or e) the City of Missoula PM determines adverse weather conditions prevent the proper handling, finishing, or compacting of the mix.
2. The paving permit holder shall submit a written request to the City PM 24 hours in advance of paving, and obtain written approval in order to pave after October 1st and before April 15th.
3. The maximum compacted asphalt layer thickness cannot exceed 6 inches.
4. Complete compaction rolling within the temperature range recommended by the liquid asphalt manufacturer included in the hot mix design, or before the mat temperature falls below 175F for hot mix asphalt. Warm mix asphalt mixes are allowed to be paved in temperatures below 175F, to be determined by the mix design and additives used for the mix, per manufacturers recommendations. During cold weather periods, or generally October 1 through April 15, the contractor must take all precautions as necessary to transport load with tarps, or otherwise, in order to maintain the minimum required compaction temperatures.
5. Compaction rolling after the mat temperature of hot mix falls below 175F is cause to suspend paving operations. Compaction rolling is required in the vibratory mode. The City Project Manager may adjust the minimum mat temperature if compaction damages the new pavement.
6. The paving permit holder or independent testing company shall take asphalt cores after rolling is complete. Obtain a minimum of one 4-inch diameter core the full depth of the plant mix surfacing along each 400-foot section of roadway, or for each approximate 10,000 square feet of paving area. A minimum of two cores per project is required, regardless of the size. (need to discuss with City)

The average density of cores taken from the project shall be equal to or greater than 93% of the maximum density as determined by ASTM D2041, and no individual sample shall be less than 92% of the maximum density. The contractor or independent testing company shall test for the maximum density as determined by ASTM D2041 from plant-produced material during production.

7. Any asphalt placed out of compliance will be deemed temporary and permanent asphalt replaced at a later date.

3.29 PAVEMENT AND MATERIAL TESTING REQUIREMENTS

Add the following:

- “G. Pavement thickness will be a minimum as indicated on the plans, with a maximum tolerance of 1/4 inch. The City has the right to reject all pavement that does not meet the minimum thickness requirements, and these sections shall be removed and replaced at no cost to the City. The City also has the right to reduce the unit price of the material represented by the cores by the same percentage that the cored thickness is less than plan thickness (i.e., less than the minimum thickness within tolerance, 3-3/4 inches for 4 inches thickness, etc.). If the core thickness is less than 75% of plan, the material represented by the core will be removed and replaced at no cost to the City.”

END OF SECTION

SECTION 02528 CONCRETE CURB AND GUTTER (MPWSS, as amended)

PART 1: GENERAL

1.1 DESCRIPTION

Delete Paragraph B. in its entirety and replace with the following:

“B. Refer to the most recent versions of City of Missoula Standard Drawings.”

Add the following section:

“1.3 CERTIFIED FLATWORK FINISHER

- A. The City of Missoula requires Contractors bidding on the project to have at least one (1) American Concrete Institute (ACI) Certified Flatwork Finisher available, on-site at all times during placement and finishing, on any/all public infrastructure concrete such as curb and gutter, sidewalk, medians, approaches, bus stops, etc., within the City of Missoula. At minimum one of the bidders’ ACI Certified Flatwork Finishers’ name and Certification ID No. must be provided to the City of Missoula for verification”

PART 2: PRODUCTS

Delete Section 2.5 in its entirety and replace with the following:

“2.5 CURING AND PROTECTIVE COATING MATERIALS

- A. Curing Concrete: Contractor shall utilize a concrete curing compound on all concrete surfaces.

CURING COMPOUND: Clear spray Applied Membrane Forming Liquid conforming to ASTM C309-81, Type 1. Curing compound shall not reduce bonding or adhesion of finish materials applied to concrete surfaces.

1. Water-Based Acrylic Membrane Curing compound: ASTM C309, Type I, Class B.
 - a. Provide material that has a maximum volatile organic compound (VOC) rating of 350 g/L.
 - b. Available Products: Subject to compliance with requirements, products that may be incorporated into the work include, but are not limited to the following:
 - Highseal, Conspec Marketing and Mfg. Co.

- Sealco – VOC, Cormix Construction Chemicals
- Safe Cure and Seal, Dayton Superior Corp.

2. Evaporation Control: Monomolecular film-forming compound applied to exposed concrete slab surfaces for temporary protection from rapid moisture loss.

- a. Available Products: Subject to compliance with requirements, products that may be incorporated in the work include, but are not limited to, the following:
- Aquafilm, Conspec Marketing and Mfg. Co.
 - Eucoar, Euclid Chemical Co.
 - E-Con, L&M Construction Chemicals, Inc.”

PART 3: EXECUTION

3.1 GENERAL

Add the following paragraph:

“B. During periods of Cold Weather, contractor must submit a cold weather concreting plan applicable to Section 3310, and comply with City of Missoula Standards for cold weather concrete placement.”

3.2 FOUNDATION PREPARATION

C. Change “3 inches” to “4 inches” to both references within paragraph.

3.3 FORMS

Add the following Section:

“E. The Contractor shall verify that all sidewalk, laydowns, driveways, and miscellaneous concrete construction meet applicable Federal, State, and local ADA standards prior to pouring concrete.”

Delete paragraph C. Crew in its entirety.

3.9 CURB BACKFILL

Add the following paragraph:

“F. Complete all backfill within three (3) days after curb and gutter is cured adequately.”

3.11 TOLERANCES

Delete paragraph A in its entirety and replace with the following:

“A. Perform the work to produce a curb and gutter meeting the specified line and grade uniform in appearance and structurally sound. Remove and replace at Contractors expense curb and gutter having unsightly bulges, ridges, and/or low spots in the gutter, cracks at locations other than control joints, excessive honeycombing, or other defects as determined by Engineer. Grade shall not deviate more than 1/8 inch and alignment shall not vary more than 1/4 inch from plan elevation, grade or alignment. Tolerances may be checked using survey instruments, straight edges, or water puddling. Puddled water cannot exceed 1/4 inch in depth. Defective curb and gutter shall be removed and replaced at existing expansion or control joints (typically a 10 foot section). Replacement sections be to the nearest joint.”

END OF SECTION

**SECTION 02529 CONCRETE SIDEWALKS, DRIVEWAYS, APPROACHES,
CURB TURN FILLETS, VALLEY GUTTERS, AND MISCELLANEOUS NEW
CONCRETE CONSTRUCTION (MPWSS, as amended)**

PART 1: GENERAL

1.2 REFERENCES

Delete Paragraph A. in its entirety and replace with the following:

“A. Refer to the most recent versions of City of Missoula Standard Drawings.”

Add the following section:

“1.3 CERTIFIED FLATWORK FINISHER

A. The City of Missoula requires Contractors bidding on the project to have at least one (1) American Concrete Institute (ACI) Certified Flatwork Finisher available, on-site at all times during placement and finishing, on any/all public infrastructure concrete such as curb and gutter, sidewalk, medians, approaches, bus stops, etc., within the City of Missoula. At minimum one of the bidders’ ACI Certified Flatwork Finishers’ name and Certification ID No. must be provided to the City of Missoula for verification”

PART 2: PRODUCTS

2.4 GRAVEL BASE MATERIAL

Change “1 inch minus material” to “3/4 inch minus material” in paragraph A.

Delete Section 2.5 in its entirety and replace with the following:

“2.5 CURING AND PROTECTIVE COATING MATERIALS

A. Curing Concrete: Contractor shall utilize a concrete curing compound on all concrete surfaces.

CURING COMPOUND: Clear spray Applied Membrane Forming Liquid conforming to ASTM C309-81, Type 1. Curing compound shall not reduce bonding or adhesion of finish materials applied to concrete surfaces.

1. Water-Based Acrylic Membrane Curing compound: ASTM C309, Type I, Class B.
 - a. Provide material that has a maximum volatile organic compound (VOC) rating of 350 g/L.
 - b. Available Products: Subject to compliance with requirements, products that may be incorporated into the work include, but are not limited to the following:
 - Highseal, Conspec Marketing and Mfg. Co.
 - Sealco – VOC, Cormix Construction Chemicals
 - Safe Cure and Seal, Dayton Superior Corp.

2. Evaporation Control: Monomolecular film-forming compound applied to exposed concrete slab surfaces for temporary protection from rapid moisture loss.
 - a. Available Products: Subject to compliance with requirements, products that may be incorporated in the work include, but are not limited to, the following:
 - Aquafilm, Conspec Marketing and Mfg. Co.
 - Eucobar, Euclid Chemical Co.
 - E-Con, L&M Construction Chemicals, Inc.”

Add the following sections:

“2.6 DETECTABLE WARNING SURFACES

- A. Furnish Detectable Warning Surfaces (DWS) at all new or repaired curb ramps or other areas as designated on the plans.

- B. Furnish DWS meeting City of Missoula Standard Drawings and comprised of the following approved material, consistent throughout the project:
 1. Cast iron natural (rusting to red) domes - Hunton Precast or approved equivalent.”

PART 3: EXECUTION

3.1 GENERAL

Add the following paragraph:

“C. During periods of Cold Weather, contractor must submit a cold weather concreting plan applicable to Section 3310, and comply with City of Missoula Standards for cold weather concrete placement.”

3.2 FOUNDATION PREPARATION

Delete paragraph B in its entirety and replace with the following:

“B. Place and compact at least 4 inches of gravel base material compacted to 95% of ASTM D-698.”

3.3 FORMS

Delete paragraph C in its entirety and replace with the following:

“C. Use forms and expansion joint material that is the same depth as the concrete.”

Add the following paragraph:

“D. The contractor shall verify that all sidewalk, laydowns, driveways, and miscellaneous concrete construction meet applicable Federal, State, and local ADA standards prior to pouring concrete.”

3.10 TOLERANCES

Delete paragraph A in its entirety and replace with the following:

“A. Assure all items of construction covered by this section present clean, uniform surfaces and lines free of irregularities and distortions. Remove and replace at Contractor’s expense work having irregularities, distortions, cracks at locations other than joints, and other defects as determined by Engineer. Plane surfaces and vertical tangent lines are tested with a 10-foot straightedge and shall not deviate more than 1/4-inch from the straightedge. Defective work shall be removed and replaced in full sections between joints.”

Add the following sections:

“3.12 DETECTABLE WARNING SURFACES

A. Detectable warning surfaces shall be installed per the manufacturer recommendations and in conformance with City of Missoula Standard Drawings.”

END OF SECTION

SECTION 02660 WATER DISTRIBUTION (*replaced section*)

Delete Section in its Entirety and Refer to Chapter 4 of the City of Missoula Public Works Standard Specifications Manual

END OF SECTION

SECTION 02720 STORM DRAIN SYSTEMS (*MPWSS, as amended*)

PART 1: GENERAL

1.4 STANDARD DRAWINGS

Delete paragraph A and replace with the following:

“A. Refer to the City of Missoula Standard Drawings.”

PART 2: PRODUCTS

2.2 PIPE MATERIALS

Change “Standard Drawings Details” to “Details on the plans” in the first sentence of Section E. MANHOLES a.1.

Delete Paragraph d. In its entirety and replace with the following:

“d. FRAMES AND COVERS

1. Furnish frames and covers meeting City of Missoula standards.”

END OF SECTION

SECTION 02724 INSULATION (*added section*)

PART 1: GENERAL

1.1 SUMMARY

- A. This section covers the furnishing and installation of insulation as shown on the drawings and as specified.

PART 2: PRODUCTS

2.1 MATERIALS

- A. Material shall be as specified herein.
- B. Insulation material shall be extruded polystyrene insulation board, in conformance with AASHTO Designation M230-70. Insulation material shall be designed specifically for in-ground installation.
- C. Insulation material shall be square edge and shall have the following properties:
 - 1. Compressive Strength: 35 psi minimum at 5% deformation or yield, as determined by ASTM D1621. Higher compressive strength insulation shall be designed by Engineer when traffic loading requires.
 - 2. Water Absorption (Percent by Volume): 0.25% maximum as determined by ASTM C 272.
 - 3. Thermal Resistance (R) Value: 5.0 SQ FT HR F/BTU at 75 Deg F, mean temperature in a 1-inch thickness as determined by ASTM C 518.
- D. Sealant and Mastic: Manufacturer's recommended standard.

PART 3: EXECUTION

3.1 INSTALLATION

- A. Thickness and overall dimensions of insulation material shall be as shown on the drawings. Minimum length of insulation material boards shall be 8 feet, and minimum width shall be 4 feet. Insulation material shall be installed in the locations shown on the drawings.
- B. If 1 IN thick insulation material is used to provide the 2 IN thickness required,

insulation material boards must have staggered joints to prevent loss of heat. All joints shall be tightly butted. If 2 IN thick installation material is used, the insulation boards must be overlapped a minimum distance of 6 IN or a one-foot long piece of insulation board put over each joint completely covering the joint from edge to edge.

- C. All field cutting of insulation material board shall be done with a straight edge to a neat line.
- D. Polystyrene insulation must be protected against exposure to sunlight. Any unwrapped insulation to be stored on the job site for long periods of time shall be covered with a light-colored tarpaulin. The Contractor shall follow the manufacturer's recommendations to protect the insulation against combustion.
- E. When sumps or storm drain inlets are within 10 feet of a water main or service, insulate between the pipe and sump. Insulate at all locations shown on the plans and per City of Missoula Standard details.
- F. 3 inches of bedding material is required between the top of the pipe being insulation and the insulation board, and 2 inches of pipe bedding is required above the insulation.

END OF SECTION

SECTION 02730 SANITARY SEWER COLLECTION SYSTEMS (*MPWSS, as amended*)

PART 1: GENERAL

1.4 STANDARD DRAWINGS

Delete paragraph A. and add the following:

“A. Refer to the most recent versions of City of Missoula Standard Drawings.”

PART 2: PRODUCTS

2.2 PIPE MATERIALS

A. Polyvinyl Chloride (PVC) Pipe

2. Gravity Sewer Pipe

Delete paragraph a. 3) in its entirety.

5. Fittings

Delete Paragraph a. in its entirety and replace with the following

“a. Sewer service connections shall be made by installing standard “tee” fittings or tapping saddles. Wye fittings are not allowed. The use of tapping saddles on new main installation shall be approved by the City. Tapping saddles shall be Predco Fast-Fit sewer saddle with epoxy kit and tapping donut, or approved equal.”

Add the following paragraph:

“6. Gravity Sewer Service Lines

a. Gravity sewer service pipe and fittings shall be ASTM D 1785 (PVC) Schedule 40. Pipe shall conform to ASTM D2665-82 and D3311-71 standards in accordance with UPC. Fittings shall conform to ASTM D2665-78 and D3311-79a and shall be glue fitting only. Solvent cement and primer shall conform to ASTM D2564-86.”

2.3 MANHOLES

A. General

Delete section 1 in its entirety and replace with the following:

- “1. Construction manholes from precast concrete sections having frames, covers, and steps meeting City of Missoula Standard Drawings. Manholes shall have eccentric cones only unless otherwise noted on the plans.”

C. Steps

Add the following sentences to the end of paragraph 1.

“Manhole steps shall be located at an angle of 90° from the line of the sewer pipe when possible. Steps shall be installed at maximum 16 inch centers.”

Delete paragraph D. in its entirety and replace with the following:

“D. Frames and Covers

1. All manhole frames and covers must be made of gray iron, meeting the requirements of AASHTO M 306 and complying with the City of Missoula Standards and Standard Drawings. All covers shall be bolt down and watertight.”

PART 3: EXECUTION

3.1 PIPE AND SERVICE LINE INSTALLATION:

Add the following paragraph:

“F. Pipe Slope

1. The following are minimum slopes that must be provided, unless specifically indicated otherwise on the Drawings.”

Minimum Slope in Feet			
Sewer Size	Per 100 feet	Sewer Size	Per 100 feet
6 inch	0.60	21 inch	0.10
8 inch	0.40	24 inch	0.08
10 inch	0.28	27 inch	0.067
12 inch	0.22	30 inch	0.058
14 inch	0.17	33 inch	0.052
15 inch	0.15	36 inch	0.046
16 inch	0.14	39 inch	0.041

Add the following Paragraph:

“F. Detectable Warning Tape

1. Install detectable buried warning tape centered over all sanitary sewer mains and service lines in accordance with specification section 02221.”

Delete Section 3.2 “MANHOLES” in its entirety and replace with the following:

“3.2 Manholes

“A. Construction

1. Construct manholes to the specified dimensions. Make invert channels smooth and semicircular in shape conforming to the inside of the adjacent sewer section. Make changes in flow direction with a smooth curve of as large a radius as the manhole size will permit. Make changes in channel grade and size gradually and evenly. The invert channels may be formed directly in the manhole base concrete or by laying half-pipe in the concrete. Make the floor of the manhole outside the channel smooth and slope toward the channel at one inch per foot.
2. All manhole joints shall have O-ring gasket joints meeting ASTM C923 (Resilient connectors between reinforced concrete manhole structures). The use of RAM-NEK jointing compound may be substituted on the manholes.
3. Manhole precast barrels, lids and base sections shall meet ASTM C478, and the rejection criteria therein stated. Base sections shall be

monolithically poured with the manhole walls or constructed with integral water stop gasket at the construction joint between the base and wall. Manhole inverts may be either pre-cast with the base or field poured.

4. Manholes shall include an O-ring water stop ring at pipeline penetrations or be cast with an A-Lok gasket or approved equivalent. The Contractor shall present to the Engineer the proposed method of joining the pipes at the flexible joint immediately outside the manhole to insure the complete insertion of the pipe into the bell and adherence to the specified pipe alignment tolerances.
5. Install adjusting rings on each manhole to bring the manhole top elevation to match the existing or specified ground elevations. A minimum of 2 inch and maximum of 12 inches adjusting rings are permitted. Use tapered adjustment to match the slope of street, sidewalk, or related surfacing. Install Ram-Nek or approved equal joint sealant compound between the first adjusting ring and the top of the manhole, between each adjusting ring, and between the last adjusting ring and the manhole frame. Adjusting rings that are offset to set final grade shall have any voids grouted to prevent penetration of water. Install adjusting rings meeting current City of Missoula requirements.
6. Manhole steps shall be located at an angle of 90° from the line of the sewer pipe.”

Add the following sections:

“B. Connections to Existing Manholes

1. Connections to existing manholes will be core drilled unless otherwise approved by the Engineer. When connecting to existing manholes, line and grade must be verified by the Engineer so grade and alignment can be adjusted if necessary. Contractor shall be responsible for performing all modifications to existing manholes per the plans and details. These modifications shall include pouring or rechanneling of the manhole floor, including sealing all penetrations and any manhole coatings required.

C. Photos

1. Photographs of all underground connections to new and existing manholes are required by the City of Missoula as specified in Section 02221.

D. Sanitary Sewer Connection Report

1. An accurate record of the location of all sanitary sewer service laterals as installed, and the length of all service lines installed must be provided to the Engineer. Depth at the end of dry service line stub-ins is required. Sanitary service laterals shall be tied to manholes for gravity sewers and valves for STEP sewers. Contractor shall complete a Sanitary Sewer Connection Report for all sanitary sewer services installed on the Project. Sanitary services will not be paid for until these connection reports are received and approved by the Engineer. A Sanitary Sewer Connection Report for and sample is attached for the Contractor's use."

3.3 SANITARY SEWER SERVICE LINES

- A. Change "Standard Drawing 02730-2" to "City of Missoula Standard Drawings or the Details on the Plans"

3.4 TESTS

Delete Paragraph D. "Water Test" in its entirety relating to Gravity Sewer Main.

- E. Air Test (Alternative)

Delete Paragraph 1. in its entirety and replace with the following:

- "1. The Contractor shall utilize low pressure air to test all gravity sewer mains. Use the test procedure described in the paragraphs below."

Delete paragraph G. "T.V. Inspection" in its entirety and replace with the following

- "G. T.V. Inspection

1. T.V. inspection will be required for new or repaired sanitary sewer mains installed with the project prior to final acceptance. All television inspection shall be coordinated with the Engineer, and the means and methods shall be accepted by the Engineer prior to starting the inspection. All lines inspected shall be jetted with a commercial hydraulic sewer cleaner and televised within one hour of jetting/flushing. A representative for the engineer of record must be present during performance of jetting, flushing, and TVI. An approved measuring device shall also be attached to the camera for verification of ponding. A sewer line is deficient and unacceptable if:

- a) The alignment is outside the specified limits,
- b) Water ponds in any section equal to or greater than 1/2 inch unless otherwise approved by the City of Missoula, or
- c) The pipe has visible defects such as open joints, pinched gaskets, cracked barrels, or bell, or similar defects.

2. Television inspection shall comply with the following:

- a) All TVI shall start in the center of the upstream manhole and shall start recording from this point to the center of the downstream manhole. One section of pipe only, shall be displayed in each electronic file.
- b) The video shall display both the starting and next downstream manhole numbers as shown on the construction drawings, date, accurate footage, and contractor's name continually in either of the upper quadrants during video playback.
- c) The display screen shall show the entire pipe diameter and the measuring device in focus during playback.
- d) The screen contrast shall be adequate to clearly show any and all requirements and defects of the pipe.
- e) Only standard Windows Media Player DVD format shall be acceptable to the City of Missoula. All TVI Information shall be transmitted on DVD disc(s) and all disc(s) shall display the project name on the front of the disc(s).
- f) During mainline TVI, the camera shall view and record the sewer service lateral(s) at the connection to the main, if applicable.
- g) If deficiencies are shown on the video, the deficiencies shall be repaired and the entire length of pipe from center of manhole to center of manhole shall be re-televised in accordance with this administrative rule.
- h) The City of Missoula shall approve all devices used to measure residual water in the mainline.

- i) Any TVI retest of sewer mains must conform to all of the above standards.
- 3. All costs incurred for the television inspection performed shall be the Contractor's responsibility. All television inspections shall be DVD format. Pull the camera through the sewer at 30 feet per minute (9 meters per minute) maximum. If the camera is pulled by attaching to the hose of a hydraulic sewer cleaner, assure the hose is not active during the pulling process.
- 4. Any remediation measures required to correct defect in the piping shall be per the direction of the Engineer, at the Contractor's expense. Any repairs to the main shall require additional T.V. inspection.
- 5. The City of Missoula reserves the right to perform such tests and inspections, in conformance with the testing requirements contained herein, including T.V. testing, prior to the end of the warranty period, and any non-conforming work discovered from such testing procedures shall be repaired by Contractor at Contractor's expense."

H. Deflection Testing

Add the following paragraph:

- "4. The 7-day deflection test is required on all sanitary sewer mains, minimum mandrel diameter shall be determined as 95% of inside pipe diameter, including manufacturer fabrication tolerances as an additive allowable deflection."

Add the following Paragraphs:

"J. Manhole Leakage Test

- 1. All manholes shall be tested in accordance with ASTM C1244, test method for concrete sewer manholes by the negative air pressure (vacuum) test. The vacuum test shall be conducted prior to manhole backfilling and witnessed by the Engineer. No backfilling of the manhole shall commence until authorized by the Engineer. The vacuum test may be performed prior to the placement of adjusting rings and cast iron ring.

K. Hydrostatic and Leakage Testing for Force Mains

1. Perform hydrostatic and leakage testing in accordance with AWWA C600. Once the pipe is laid and backfilled, test for at least 2 hours, all newly laid pipe, or any valved section, at the highest point along the test section. Test to a hydrostatic pressure 2.0 times the normal operating pressure at the test point, but in no case less than a minimum gage pressure of 125 pounds per square inch (931 kPa) or greater than the pressure rating of the pipe being tested.
2. Slowly fill the pipe with water, purging all air, and apply the test pressure using a pump hooked up so that the pressure and leakage can be measured. To purge the pipe of air during the test, it is necessary to tap the pipe at its highest points if permanent air vents are not located at the high points. Use corporation stops for this purpose. Furnish the pump connections, gauges, stops, and all necessary apparatus for testing.
3. Disassemble and reassemble all joints showing leakage after thorough cleaning. Remove and replace all cracked or defective pipes or fittings discovered during the pressure test with sound material and repeat the test.
4. Conduct the leakage test concurrent with the pressure test for 2 hours. Leakage is defined as the quantity of water supplied into the pipe, or any valved section thereof, necessary to maintain pressure within 5 pounds per square inch of the pressure test after the pipe has been filled with water and purged of air.
5. The pipe installation will be rejected if the leakage exceeds that determined by the following formula:

$$L = SD(P)^{1/2} \div 148,000$$

In which L equals the allowable leakage in gallons per hour; S is the length of pipe being tested, in feet; D is the nominal diameter of the pipe being tested, in inches; and P is the average test pressure during the leakage test, in pounds per square inch gauge.

Where the pipe being tested for leakage is thermally fused HDPE, the allowable leakage will be reduced to 25% of L, as calculated.

6. Should any test of pipe laid disclose leakage exceeding that specified above, locate and repair the defective joints until the leakage is within the specified allowance.

7. Conduct the pressure and leakage tests with the Engineer present.”

END OF SECTION

SECTION 02740 PIPE CASINGS AND APPURTENANCES (*added section*)

PART 1: GENERAL

1.1 SUMMARY

- A. This section covers the furnishing and installation of steel pipe used for casing of sewer or water main pipe in locations where jurisdictional authority or City Engineer requires.

PART 2: PRODUCTS

2.1 MATERIALS

- A. Steel Casing Pipes
 - 1. Steel casing shall be new, smooth wall, welded steel pipe fabricated from ASTM A36 plate or ASTM A570 and ASTM A139 (straight seam pipe only) Grade "B" with minimum yield strength of 35,000 psi.
 - 2. External loading shall be AASHTO H20 highway or railroad loading plus jacking load, or E80 railroad loading when required. Casing pipes shall have the minimum nominal diameter and wall thickness as shown in table below. Field and shop welds of the casing pipes shall conform to the American Welding Society (AWS) standard specifications. Field welds shall be complete penetration, single-bevel groove type joints. Welds shall be airtight and continuous over the entire circumference of the pipe and shall not increase the outside pipe diameter by more than 3/4-inch.
 - 3. Minimum casing inside diameter shall exceed outside diameter of carrier pipe joints or couplings by an amount appropriate to allow the installation of the casing spacer to be used. Casing size stated above is a minimum but shall generally be as shown in the Table below.

Casing Pipe Minimal Nominal Diameter and Wall Thickness			
Carrier Pipe Nominal Dia. (in)	Casing Nominal Diameter (in)	Min. Thickness for Coated Pipe (in)	Min. Thickness for Non-Coated Pipe (in)
8	18	0.250	0.312
10	20	0.281	0.344
12	24	0.312	0.375
16	30	0.406	0.469
18	30	0.406	0.469
20	36	0.469	0.531
24	42	0.500	0.563
30	48	0.563	0.625

B. CASING SPACERS

1. Casing spacers shall be 12-inch wide stainless steel, bolt on style type with a shell made of at least two halves. The bands shall be 14 gauge T304 stainless steel at a minimum, the risers shall be 10 gauge T304 stainless steel at a minimum, and the coating shall be fusion bonded epoxy or heat fused PVC. Each spacer shall have a minimum of four runner supports manufactured of an ultra-high molecular with polyethylene or glass reinforced polymer. Bolts shall be T304 stainless steel with lock nuts. The runner supports shall be of adequate height to position the carrier pipe in the center of casing with a maximum clearance of 1-inch from the upper runner to the inside of the steel casing. Spacers shall be installed on the carrier pipe per the manufacturer's recommendations. Spacing of the casing spacers shall be per manufacturers recommendation for carrier pipe type and application. Modifications to the casing spacers may be allowed on a case by case basis to maintain the correct grade of the carrier pipe. Acceptable manufacturers are as follows:
 - Power Seal – Model 4810
 - Cascade Waterworks – Model CCS
 - Advance Products & Systems - Model SS1
 - City Approved Equal

C. END SEALS

1. Casing end seals shall be used to completely close both openings on either side of the casing water-tight. These ends seals shall be pull-on (seamless) or wrap-around with stainless steel straps for securing to the carrier pipe and the casing. End seals shall be constructed of specifically compounded synthetic rubber a minimum thickness of 1/8-inch.

Acceptable manufacturers are as follows:

- Advance Products & Systems – Model AW
- PSI – Model C
- Power Seal
- City Approved Equal

D. CATHODIC PROTECTION

1. Where soil conditions warrant, Engineer shall design cathodic protection to prevent corrosion with the use of magnesium anodes.

PART 3: EXECUTION

3.1 INSTALLATION

- A. Steel casing shall be installed with the same tolerance specifications as required for Sanitary Sewer. See MPWSS Section 02730, Paragraph E.
- B. Minimum distance between the end of the steel casing and manholes, valves, or other structures shall be 5 feet unless otherwise approved by the City Engineer.
- C. Carrier pipes shall be fusion welded HDPE, when approved, or have restrained joints.
- D. Do not use petroleum products for lubricant. Contractor shall take care during installation of carrier pipe to not damage pipe. All carrier piping shall be pressure tested as required in the Specifications.

END OF SECTION

SECTION 03310 STRUCTURAL CONCRETE (*MPWSS, as amended*)

PART 2: PRODUCTS

2.2 COMPOSITION OF CONCRETE

B. Performance and Design Requirements

1. Replace Table 2.1 – Minimum Cement Content Requirements with the following:

“All concrete supplied on the project shall have a minimum cement content of 564 lb/yd³ unless otherwise approved by the Engineer, and maximum H₂O/cement ratio of 0.45 as the concrete will be exposed to freezing and thawing and possibly the presence of deicing chemicals.”

4. Replace Table 2.2 – Total Air Content of Concrete for Minimum Cement Content Requirements with the following:

“All concrete supplied on the project shall have a TOTAL AIR CONTENT of 6.5%, +/- 1 ½% tolerance, and considered severe exposure.”

Delete Section 4.c in its entirety and replace with the following:

- “c. Furnish the compressive strength and the water-cement or water cementitious, material ratio of concrete for each portion of the work as specified in the Contract documents.
- 1) Cement content shall be 6-sack only, with no allowance for fly ash, pozzolan, or slag without written approval of the Engineer.
 - 2) Strength requirements are based on the 28-day compressive strength determined on 6 inch x 12 inch cylindrical specimens, or other approved specimens per testing standards, made and tested under ASTM C31 and C39 respectively.”

PART 3: EXECUTION

3.5 CURING CONCRETE

Add the following paragraph to E.2 Impervious Membrane Curing

- “e. All concrete shall be cured in conformance with the latest City of Missoula standards. Reference specification sections 02528 and 02529 for current standards and allowable curing products and applications.”

3.6 WEATHER AND NIGHT LIMITATIONS

A. GENERAL

Replace paragraphs 2-6 with the following sections:

- “2. Cold-Weather Placement: Comply with ACI 306.1 and as follows:
 - a. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
 - b. When forecasted low temperature is expected to fall below 40°F (4.4°C) for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301 (ACI 301M), which could vary depending on the mix design constituents, list temp range?.
 - c. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen base, subbase, or subgrade materials, or on base, subbase, or subgrade containing frozen materials.
 - d. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.
 - e. A cold weather placement and curing plan in accordance with ACI 306R-16 should be developed and submitted for approval by the Engineer of Record if cold weather conditions as discussed in ACI 306R-16 are expected. This approved plan should be sent to the City prior to placement of concrete.
 - f. If placement occurs during cold weather conditions, both laboratory and field specimens should be fabricated by an independent testing agency and allowed to cure in accordance with ASTM C31. Design compressive strength verification (lab cured specimens) should be evaluated as well as the effectiveness

of cold weather placement and protection methods (field cured specimens) used in relation to compressive strength.

3. Hot-Weather Placement: Comply with ACI 301 (ACI 301M) and as follows:
 - a. Maintain concrete temperature below 90°F (32°C) at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
 - b. Fog-spray all forms, steel reinforcement, and base, subbase, or subgrade just before placing concrete. Keep base, subbase, or subgrade uniformly moist without standing water, soft spots, or dry areas.
 - c. If placement occurs during hot weather conditions, discussed in ACI 305R-99, list conditions here? both laboratory and field specimens should be fabricated and allowed to cure in accordance with ASTM C31. Design compressive strength verification of lab cured specimens should be evaluated as well as the effectiveness of hot weather placement and protection methods for field cured specimens used in relation to compressive strength.”

3.7 TESTING

- A. Add the following sentence:

“The frequency of testing specified in this section may be reduced or increased at the sole discretion of the Engineer.”

END OF SECTION