City of Muncie

Design Manual

XX-XX-2024

Approved By:_____

Adam K. Leach P.E. City Engineer

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Purpose and Intent

The purpose of the City of Muncie Design Manual is to provide a minimum standard for both private and public construction projects within the corporate limits of the City of Muncie. The intent of the establishment of such standards is to provide for the safety, health, and welfare of the citizens of Muncie and the general public. Measurement and payment are for use with City Contracts and may be disregarded by developers.

Referenced Specifications

AASHTO, A Policy on Geometric Design of Highways and Streets, 2018 (7th Edition)

American National Standards Institute/Illuminating Engineering Society Recommended Practice No. 8 (ANSI/IES RP-8)

AWWA C600 - Latest

AWWA C651 - Latest

AWWA C800 - Latest

ASTMC 828 - Latest

City of Muncie Sanitary District Standard Specifications

Indiana-American Water Pipeline Specifications (November-2019 or Latest Edition)

Indiana Department of Transportation, Standard Specifications for Road and Bridge Construction – (2024, or Latest Edition)

Indiana Department of Transportation, Indiana Design Manual – (2013, or Latest Edition)

National Electric Safety Code (NESC)

000 - Definitions and Terms

Active Construction - Construction sites are deemed active if measurable progress is being made on a regular basis toward substantial completion of the project, e.g. work valued at greater than $1000 per day is occurring.

Annual Exceedance Probability (AEP) - The probability that a storm event equal to or in excess of a particular magnitude will occur in any given year.

Asphalt - Liquid Bitumen used as a binding agent for mineral aggregate.

Asphaltic Concrete - Commonly referred to as “Asphalt,” asphaltic concrete contains graded aggregates and antistripping compounds in addition to liquid asphalt binder necessary for use in pavements.

Base Course - First layer of typical asphalt section composed of larger aggregates.

Best Management Practice (BMP) - Stormwater management techniques or measures that control the quantity and quality of stormwater runoff. BMPs can function independently or in series and can be structural, non-structural, or natural.

Binder Course - Second layer of typical asphalt section composed of medium aggregates that "binds" the base to the wearing/surface course.

City Administrator - The designated person who is responsible for the implementation of all policy set by the Mayor.

City Building Official - The designated person who is responsible for the enforcement and oversight of the municipal ordinance and building codes.

City Engineer - The licensed professional engineer who is responsible for the review, approval, and supervision of all civil works within the City.

City - The City of Muncie, Indiana.

Construction Entrance/Exit - The point at which construction vehicles enter and exit a construction site constructed of large crushed stone or shot rock.

Curve number (CN) - A parameter indicating stormwater runoff potential based on the Hydrologic Soil Group and land use.

Design Storm Event - A hypothetical discrete precipitation event characterized by a specific duration, temporal distribution, rainfall intensity, recurrence interval, and total depth of rainfall.

Drainage Area - The total upstream area from which flowing surface water converges to a common point. Similar terms include catchment, basin, and watershed.

Drainage Facilities - Ditches, open channels, closed conduits, stormwater storage systems, retention and detention systems, tiles, swales, sewers, and other natural or artificial means of draining stormwater from land.

Duration - The total time period of a precipitation event.

e.g. - For example.

Engineer - A licensed professional engineer in the state of Indiana.

Engineer of Record (Design Engineer) - The engineer who is responsible for the preparation of construction plans and documents and who has reviewed and stamped the construction plans and/or any subsequent revision or modifications. A registered professional engineer in the state of Indiana.

Engineer's Designee - Inspectors and other staff tasked with oversight of civil projects.

Excavatable Flowable Fill - Cementitious backfill with a compressive strength of not less than 150 PSI and not greater than 250 PSI.

Fill - Non-organic soils, sand, and gravel free of organic or other deleterious material used to increase the elevation of natural or cut grades.

Floodplain - The topographic area that will be inundated by the 1 percent AEP storm event, consisting of the floodway and flood fringe.

Flood Fringe - The portion of the floodplain outside the floodway that will be inundated by the 1 percent AEP storm event.

Floodway - The portion of the floodplain consisting of the channel of a waterway plus adjacent area that must be kept free from encroachment and obstructions to maintain the carrying capacity of the waterway. Serves as the primary conveyance for flood waters resulting from the 1 percent AEP storm event.

Flowable Fill - Cementitious backfill material with a compressive strength of not less than 1000 PSI but not greater than 1200 PSI.

Foreman - Construction professional in charge of a crew of workers typically responsible for a certain scope of work types, such as utility and grading, concrete, etc.

Furnish - Supply materials in regard to an item.

g.p.m. - Gallons per minute.

Grout - A high-strength mixture of sand, cement, and water used for sealing concrete joints and other repairs.

i.e. - In other words.

Impervious - A term applied to material through which water cannot pass, or through which passes with difficulty.

Indiana Department of Environmental Management (IDEM) - State department responsible for water, sewer, and stormwater oversight as well as other environmental concerns.

Inactive Construction - Construction sites are deemed inactive if no measurable progress has been made toward substantial completion within a 14 calendar day period, e.g. only maintenance of erosion control measures and minor work such as cleaning roadways, landscaping, or other activities that would not significantly advance the site for utilization.

Install - Place and fix indicated item in accordance with the specification so that it provides its intended function and is ready to use.

Land Alteration - Action taken relative to land which either: changes the contour; or increases the runoff rate; or changes the elevation; or changes the rate at which water is absorbed; or changes the drainage pattern; or creates or changes a drainage facility; or involves construction, enlargement, or location of any building on a permanent foundation; or involves a subdivision of land as regulated in the Delaware County Subdivision Ordinance or a planned unit.

Land Disturbance - Manmade changes of the land surface including but not limited to: removal of vegetative cover, excavating, filling, transporting, and grading.

Limits of Construction - The perimeter of the maximum extent of land that may be disturbed due to construction activities.

Maintenance - Cleaning out, removing obstructions from, spraying, or making minor repairs of a drainage facility so it will perform the function for which it was designed and constructed.

Non-Excavatable Flowable Fill - Cementitious backfill with a compressive strength greater than 500 PSI but less 1200 PSI.

PSI - Pounds per square inch – lbs./in².

Provide For - Supply the necessary materials and preparation necessary to install an item, such as providing a foundation for a headwall, bolts, grease, etc.

Regulated Drain - An open or tiled ditch, as defined by law, which is subject to the jurisdictional control of the Drainage Board of Delaware County, Indiana.

Release Rate - The amount of stormwater released from a drainage facility per unit of time.

Recurrence Interval - A statistical estimate of the average time between precipitation events. The inverse of the AEP (100-year storm event = 1 percent AEP storm event). Also called the return period or return frequency.

ROW - Right of Way.

Runoff Hydrograph - A graphical representation of the flow rate (or discharge) versus time.

Structural Fill - Non-organic soils, sand, and gravel free of organic or other deleterious material that meets required engineering parameters to support structures.

Sub Base - Stone placed on sub grade prior to paving.

Sub Grade - Natural ground graded and compacted that forms the lowest layer of a road cross section.

Superintendent - Construction professional in charge of a site, oversees multiple crews, and carries out a broad scope of work, first point of contact for site issues.

Time of Concentration - The duration required for runoff to travel from the hydraulically farthest point in the watershed to a specific point of interest within the same watershed.

Top Soil - The first 6 inches of undisturbed soil natural to the construction site; does not include past fill, stone, or any material that would inhibit the growth of soil-stabilizing vegetation.

Wearing or Surface Course - Final layer of typical asphalt section composed of a well grade aggregate with a high asphalt percentage to ensure a high-density mix.

100- General Notes and Requirements

101 Engineers Authority

A) The City Engineer or his/her designee(s) retains the right to stop work or request modification of work and/or plans if any of the following conditions are met:
   1) Deviation from approved plans such that structures or grading leave the Right of Way, Easement, or Limits of Construction.
   2) Deviation from approved plans such that structures or grading will not work as designed by the Engineer of Record.
   3) Deviation from the City of Muncie Design Manual, standards, and specifications.
   4) Field observation that design plan will not function as intended.
   5) Use of materials that are not suitable, defective, do not meet specification or are in other ways objectionable.
   6) Field observation that weather or other environmental factors prohibit work
   7) If the work will unduly burden the public through interruption of service or delay of traffic.
   8) A conflict is found between the plans and site conditions that would cost more than $1000 to remediate, e.g. discovery of an unmarked utility service, karst, cave or other geological, ecological, or manmade feature that requires special care to properly address.

9) Any condition that may result in the loss of life, limb, sight, hearing or that may cause a health hazard such as sewage leaks, chemical spill, or pollution to local waterway.

B) On City projects the City Engineer may stop work for any of the following in addition to all conditions stated in 101.A.
1) Insufficient progress.
2) Questions that arise from interpretation of plans and specifications.
3) Quality of work.

102 Plans and Specifications

A) At least one complete set of City approved construction plans signed by the Engineer of Record must be kept on site during active construction, failure to produce construction plans at the request of the City Engineer or their designee may result in a stop work notice.

B) When there is a conflict between the plans and specifications the most stringent standard will apply.

C) When there is a conflict between calculated distances and scaled distances the calculated measurement shall govern.

D) Any modification to the plans that changes the construction cost by more than $1000 dollars, moves structures outside the right of way or easement, or changes the overall function, flow direction, or minimum capacity of an approved structure or facility must be submitted by an engineer, stamped by that engineer, and reviewed by the City Engineer or his/her authorized designee.

E) The standards and specifications in this document are the minimum acceptable standard; any work that is found to be non-conforming may be rejected by the city and must be replaced.

F) Alternative materials indicated as approved equal must be proven to be equivalent to the specifications in all aspects of mechanical and structural properties i.e. equivalent products must show the same material strength, capacity, and bearing characteristics as evidenced in product specifications provided by the manufacturer.

G) Interpretation of these specifications or any other City standard or criteria shall be at the discretion of the City Engineer.

H) If there is a disagreement regarding the decision of the City Engineer it may be appealed to the City Administrator.

103 Safety

A) Site safety is the responsibility of the general contractor performing the work.

B) The following sections pertain to City Employees and Contractors performing work for the City: 106 Personal Protective Equipment and 107 Trench Safety.

C) The City Engineer or his/her designee will stop work or request modification of work practices if unsafe conditions are found, but assume no liability or responsibility for the work practices, means, and methods performed by forces other than the City's.

104 Removal and Disposal of Regulated Materials

A) The removal, testing, transportation and disposal of regulated materials, except for paint, shall be in accordance with applicable Federal, State and local laws, regulations and rules. These include, but are not limited to, the requirements of the Federal Toxic Substances Control Act, the Federal Resource Conservations Recovery Act, the Federal Comprehensive Environmental Response Compensation Liability Act, Occupational Safety and Health Administration, Indiana Department of Environmental Management and State rules requiring certification of underground storage tank removal firms.

B) Regulated materials are defined as follows:

1) Materials classified as a hazardous waste, hazardous substance or hazardous material by the regulations of the EPA or U.S. Department of Transportation.
2) Materials containing more than 1 percent asbestos and are friable or may become friable per 326 IAC 14-10.

C) All provisions of the *INDOT Standard Specifications,* Section 619 shall apply to paint removal.

105 Removal and Disposal of Non-Regulated Materials

A) All materials that do not qualify as regulated materials per 104 and are designated to be removed from the project shall become the property of the Contractor. They shall be disposed of at the contractor's expense in a suitable landfill.

106 Personal Protective Equipment

A) Eye protection

1) Will conform to ANSI/SEA Z87.1-2010 and is required when there exists a risk of flying material such as during rock breaking, weed eating, mowing, sawing, or other activity that presents a hazard of flying material.
2) Appropriate filter lenses and shading must be worn when performing work that may result in eye damaging radiation such as welding, arc cutting, gas cutting, and soldering, appropriate shading to be determined by OSHA Standard 1910.133.

B) Head protection

1) Will conform to ANSI Z89.1-2009 and is required when there exists a risk of falling objects that may cause injury such as trench excavation, swinging material, or working near multiple story structures.

C) Foot protection

1) Will conform to ANSI Z41-1999 and is required when there exists a danger of foot injuries such as punctures, cuts, or crushing hazards.

D) High visibility outerwear

1) Will Conform to ANSI/ISEA 107-2015 and will be a minimum a “level 2” rated garment. High visibility outerwear is required when working near active roadways of any speed and any site where visibility could be impaired due to lighting, weather conditions, dust or vegetation.

107 Trench Safety

A) Trenches deeper than 4 feet require trench protection.
B) Never enter an unprotected trench.
C) Store Materials at least 2 feet from trench edge.
D) Do not undermine or excavate within 10 feet of any structure without adequate support as determined by a registered professional engineer.
E) Work is not authorized in trenches in which standing or flowing water is present unless suitable precautions have been taken to ensure worker safety such as pumping, bracing, shoring, or other acceptable methods.
F) A stairway, ladder, ramp, or other safe means of egress shall be located in trench excavations greater than 4 feet in depth such that at no time is a worker more than 24 feet from safe egress.
G) Trench protection can be provided through bracing, shoring, benching or sloping
H) Maximum allowable slopes:

Soil Type	Description	Max allowable slope for excavations less than 20 feet in depth
Stable Rock	Granite, Sandstone, Hard Limestone	Vertical - 90°
Type A	Clay	2V:1.5H 53°
Type B	Gravel, Silt	1V:1H 45°
Type C	Sand	3V:2H 34°
Type A Short-Term	Less than 24 hours	2V:1H 63°

1) Sloping or benching for excavations greater than 20 feet in depth shall be designed by a registered professional engineer.
2) When using trench shields or boxes the slope leading to the box shall not exceed 1V:1H or 45°.
3) When using trench shields or boxes the upper horizontal edge of the box or shield shall be at least 18 inches above the bottom edge of the slope.

106 Sanitation and Cleanliness

A) Site sanitation and cleanliness is the responsibility of the contractor performing the work.
1) Job sites should be kept such that trash (e.g. food wrappers, cans, bottles, paper products) is deposited in on site trash cans or dumpsters.

2) Debris (e.g. lumber, steel, and pipe material) should be collected in central locations for disposal.
3) Disposal of chemicals is the responsibility of the contractor and any chemical shall be stored in accordance with the Material Safety Data Sheet for that product.

B) At a minimum every site will have at least one (1) dumpster for the disposal of refuse.

C) At a minimum every site will have at least one (1) portable toilet or access to an onsite toilet facility. Usage of offsite or public facilities will not be authorized in lieu of providing this requirement. Portable toilets will be serviced and maintained such that they remain safe, clean, and sanitary.

107 Work Hours

A) Weekday work hours shall be from 0700 to 1800 unless otherwise authorized.

B) Weekend work hours shall be from 0800 to 1800 unless otherwise authorized.

108 Inspections

A) Inspections shall be conducted in accordance with the City of Muncie Required Inspection Procedures.

B) The following work must be completed with a city inspector onsite:
1) Placement of structural fill (road bed, foundations, piping).
2) Testing required by the city, state, or federal codes, ordinances, or law.
3) Concrete pours greater than 4 cubic yards (excluding home foundations and private driveways).
4) Paving final lift of asphalt.
5) Backfill of buried public utilities.
6) All water line and sewer line must be tested as witnessed by a city inspector.

C) Inspections and testing require forty-eight (48) hour notice, failure to provide notice may delay work. Weekend or off-day inspections may be performed at cost to the developer, calculated at 2.5 times the inspector's hourly rate at the discretion of the City Engineer.

D) All projects are subject to periodic inspection during and after completion of the project with and without warning. Inspection may consist of full-time on-site resident inspectors or part-time at the discretion of the City Engineer.

E) The absence or presence of an inspector does not relieve the contractor and/or developer from conformance with approved plans and specifications

109 Work Schedule and Phasing

A) Work shall be phased in a logical manner such that it:
1) Minimizes disturbed area.
2) Minimizes traffic delay.

3) Minimizes utility outages to other residents or businesses.

B) Contractor shall provide a phasing plan that clearly identifies the precedence and anticipated schedule of the following prior to beginning work:
   1) Initial erosion control.
   2) Utility Installation (per utility line).
   3) Traffic Control and Roadwork (per closure, traffic, etc).
   4) Storm Structures (per pond or other major detention, retention, facility).
   5) Completion.

C) Phasing schedule may be presented as a Gantt (bar chart), a list with commencement and completion dates, or a Pert Chart.

110 Licensing Requirements

A) All work performed within the city, unless undertaken by city, state, or federal employees shall be done under the supervision of a contractor licensed to perform that category of work in the state of Indiana.

111 Permits

A) The general contractor shall be responsible for obtaining any permits necessary to perform the work that were not obtained by the Engineer of Record.

B) Typical Permits
   1) Land Disturbance - Greater than one Acre
   2) Building
   3) Road Cut
   4) Blasting
   5) Sewer Tap

C) Permits for City-funded projects
   1) Fees for city permits shall be waived on city projects, however, the contractor is still responsible for obtaining said permits for record-keeping purposes by the City.

112 Notifications

A) All projects
   1) Prior to commencing construction, after obtaining the appropriate land disturbance permits, a completed Construction Start Notification shall be submitted to IDEM.

B) Water and Sewer Projects
   1) Prior to commencing construction after obtaining all other permits send a completed Construction Start Notification form to IDEM.

113 Surety

A) Adequate surety shall be provided for all public projects to ensure that once started work is completed in a satisfactory manner.

B) Forms of Surety

1) Bond
2) Letter of Credit
3) Cash - A cash bond in the form of cashier's check may be given as an acceptable bond. Upon receiving said cash bond, the city shall deposit it, and any interest accrued shall be returned, less banking fees, upon surrender of surety by the city following accepted work.

C) Surety Setting

1) Surety for private construction by a developer of future city infrastructure shall be set by the planning commission in accordance with the City of Muncie subdivision regulations.
2) Surety for public projects shall be determined by the City Engineer prior to project letting.

D) Surety Release

Commented [SK1]: Anything additional needed?

Commented [KS2R1]: Adam - Describe what is needed to release the surety

114 Submittals

A) Material and equipment submittals are required.

B) Items that are standard may be listed categorically indicating manufacturer, size, and quantity to be installed as part of the submittal.

C) Any items that are non-standard, as in not specifically identified in these specifications, must be submitted to the City Engineer for approval prior to installation.

115 Change Orders

A) A Change Order is required whenever field conditions materially differ, unforeseen conditions require changes to the plans, or differences in furnished materials require additional compensation or schedule time.

B) Report any condition that may require a change order immediately to the project engineer and inspector.

200- Existing Conditions and Site Preparation

201 Payment

A) Payment for site preparation and meeting the general requirements set forth in Section 100 shall be made under pay item 200- Site Preparation. This item will be site-specific and account for job trailers, site marking, surveying, and other items typically considered "overhead". Site preparation will be paid at 50 percent

when job is initially prepared, and the remaining 50 percent will be paid when job is complete.

202 Job Board

A) All job sites will include a job board with the following items:
   1) Land Disturbance Permit as issued.
   2) Building permits as issued.
   3) Contact Sheet listing the owner/developer and site superintendent.
   4) Site address.
   5) Job board is to be placed as near as practical to the ROW at the planned construction entrance.

B) This item shall be paid for under item 200- Site Preparation

203 Construction Limits and Protection

A) The limits of construction will be marked at least every 200 feet utilizing high visibility markings such as fluorescent orange flagging, orange construction fence, or orange painted posts.

B) Silt fence can serve as appropriate delineation for the limits of construction.

C) In areas that are not to be disturbed, such as habitat, stream buffers will be delineated per the engineer's plans or cordoned with fluorescent orange construction fence.

D) This item shall be paid for under item 200- Site Preparation

204 Utility Identification and Protection

A) Prior to any work, have utilities located by calling Indiana 811 and/or contacting any suspected utilities that may be in the area. Damage to utilities that have been located will be repaired at the contractor's expense. If no one-call is placed, damage to utilities will be paid for at the contractor's expense. If a call is placed and the utility has not been located within 72 hours (excluding holidays and weekends), damage to a city utility shall be repaired at utility's expense provided a one-call ticket is provided verifying the request for location.

B) Once utilities have been located, they should be protected according to the following. Care should be taken to not damage the utility in the placing of rebar or t-post stakes.
   1) Water - Valve boxes, meter boxes, reverse pressure backflow preventers, irrigation controls, and other water-related vaults or appurtenance will be painted fluorescent blue and 3 to 4 stakes protruding not less than 3 feet from the ground surface will be placed in a triangular or rectangular arrangement, then roped with either caution tape or blue flagging for protection.
   2) Sewer - Cleanouts, manholes, valve boxes, or other sewer-related vaults or appurtenance will be painted fluorescent green, and 3 to 4 stakes protruding

not less than 3 feet from the ground surface will be placed in a triangular or rectangular arrangement, then roped with either caution tape or green flagging for protection.

3) Underground Electric - Vaults, pull boxes, and other electric-related appurtenance will be painted fluorescent red, and 3 to 4 stakes protruding not less than 3 feet from the ground surface will be placed in a triangular or rectangular arrangement, then roped with either caution tape or red flagging for protection.
4) Gas - Valves, Meters, and other gas-related appurtenance will be painted fluorescent yellow, and 3 to 4 stakes protruding not less than 3 feet from the ground surface will be placed in a triangular or rectangular arrangement, then roped with either caution tape or yellow flagging for protection.
5) Communications and Fiber - Vaults, pull boxes, and other communications-related appurtenance will be painted fluorescent orange, and 3 to 4 stakes protruding not less than 3 feet from the ground surface will be placed in a triangular or rectangular arrangement, then roped with either caution tape or orange flagging.

C) This item shall be paid for under item 200- Site Preparation.

205 Geological and Ecological Identification and Protection

A) Any area identified as having ecological or geological importance, such as a sinkhole, cave, or endangered species habitat, must be protected upon discovery.
1) Sinkholes shall be protected as described in Section 600.
2) Caves shall be fenced off with orange construction fencing and caution tape; the cave should be protected from stormwater pollution in a similar manner to sinkholes.
3) Habitat protections shall be installed and maintained per the instructions included in the plans; in the absence of instructions, a qualified ecologist should be consulted to determine the appropriate methods for protection.

B) Payment shall be made under item 200- Site Preparation.

206 Site Investigations

A) Site investigations such as geotechnical drilling, excavation pits, and survey clearing shall be conducted in such a manner as to have a minimum impact upon the site until such time as a land disturbance permit has been issued.

B) Geotechnical investigations performed via drilling shall be backfilled with drill tailings of local soil unless soil contamination is found.
(i) Drilling in roadways shall be backfilled with native material until the last 8 inches which will be filled with cold mix asphalt, hand compacted, and mounded not less than 1/4 inch above the road surface.

(ii) In addition to any soils information provided by explorations and reports included in the Contract Documents, the Contractor shall make all arrangements for and pay all costs involved for additional soil testing. These tests and reports shall be provided by accepted and qualified professionals.

(iii) If soil contamination is suspected, contact IDEM immediately to have the soil tested.

C) This item shall be paid for under item 200- Site Preparation.

207 Construction Surveying

A) Protect any surveyor located bench marks, iron rods, or monuments from damage.

B) Provide sufficient stake out to identify the lines and grades indicated on approved lines prior to grading.

C) Payment for necessary construction staking will be under item 200- Site Preparation.

208 Mobilization

A) Transport, deliver, and set up the equipment necessary to perform the work.

B) Obtain necessary permits for oversized/overweight loads.

C) Mobilization will be paid as item 208 on a per-job basis; 50 percent of the item to be paid upon initial mobilization with the remaining 50 percent to be paid following job completion when all equipment, debris, and excess material has been removed from the site.

108 Dust Control

D) Provide for the adequate control of dust on active job sites.

E) Stabilize exposed soil as soon as possible to prevent dust from leaving the job site.

F) Utilize water sprayers, mulching, polymer, or fencing to control and contain dust to the job site.

G) Payment for dust control shall be part of item 200- Site Preparation.

209 Traffic Control

A) Provide adequate traffic control for operations as provided for in the Manual for Uniform Traffic Control Devices (MUTCD).

B) Traffic Control plans prepared by either an engineer or traffic control specialist shall be submitted to and approved by the City Engineer prior to work commencing on any road or lane closures.

C) Work that reduces a lane to less than 6 feet shall be considered a lane closure.

D) Lane diversions may be used for shoulder work assuming compliance with MUTCD.
E) Adequate signage shall be displayed to adequately warn traffic of impending road work.
F) Class 2 reflective vests are required for all work within 10 feet of the roadway.
G) Flaggers shall be equipped with a reflective stop and yield sign not less than 24 inches in width, conforming to MUTCD standards, a radio to communicate with other flaggers and site supervisor, and a class three reflective vest.
H) For roadway or lane closures message boards indicating the road or lane closure must be in place no less than 14 days prior to work beginning if the work is expected to take more than 2 days.
I) Detours signs must be in place and inspected by the City Engineer or their representative at least 3 days in advance of the detour routes becoming active.
J) For lane closures utilizing mobile traffic control signals, adequate signage, temporary stop bars, and a signal plan must be provided to and approved by the City Engineer prior to utilization.
K) Traffic Control shall be paid on a per-site basis. Cost shall include flagging, temporary striping, temporary signal, barricades, barrels, cones, temporary signs, message boards, labor, delivery, and any other costs associated with implementation of the traffic control plan.

300- Muncie Street Design Standards

301 General

A) The purpose of this section is to establish basic guidelines and certain minimum criteria for the design of streets in the City of Muncie. Unusual circumstances or special designs requiring variance from the standards in this manual must be approved by the City Engineer.
B) The criteria outlined in this section of the Manual are intended to be used in conjunction with the governing design standards and specifications described above (AASHTO, INDOT, etc.).
C) In order to provide consistency in the construction of pavement cross sections, standards have been adopted for new streets in the City and in the Planning Area. All street pavements should be designed and constructed to the same standards regardless of whether it is a public or private street. The consistent design, construction, and inspection of streets will not only better serve the public in the planning area, but also the citizens of the city when these areas are annexed. If a private street is not designed according to public street standards, the private street must be brought up to the public street standards prior to potential dedication to the city.

D) All streets, roads, alleys, access ways, commercial drives, etc., shall be designed and constructed in accordance with the latest edition of the City of Muncie Design Manual, INDOT Design Manual, AASHTO Manual, INDOT Standard Specifications, good construction practice, and the recommendations of the City Engineer.

E) Street signage shall be per the Standard Construction Details and the latest Indiana-adopted version of the Manual on Uniform Traffic Control Devices (MUTCD).

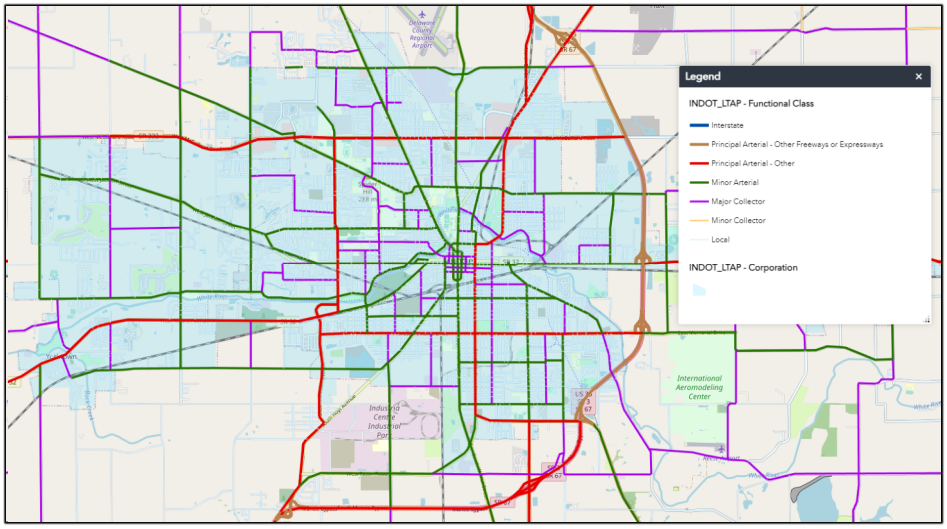
302 Basic Design Controls

A) Roadway Classification

1) Arterials
   i. Principal Arterials - These are primary roadways within the city having a higher traffic carrying capacity and provide high mobility. Such roadways typically consist of 2 to 4 lanes in each direction.
   ii. Minor Arterials - These are defined as local urban routes that provide intra-community connections with higher mobility but also access within the community. They typically do not penetrate a neighborhood. These roadways have lower traffic capacity than principal arterials and will typically have 1 or 2 lanes in each direction.
2) Collectors - A collector route is characterized by a roughly even distribution of its access and mobility functions. Traffic volume and speed will be somewhat lower than that for an arterial. It acts as an intermediate link between the arterial system and points of origin and destination. Local bus routes often include collector streets. Collectors will be defined as minor and major collectors.
3) Local Road or Streets - Each public road not classified as an arterial or collector is classified as a local road or street. A local road or street is characterized by its many points of direct access to adjacent properties and its relatively minor value in accommodating mobility. Speed and traffic volume are low and trip distances are short. Through traffic is often deliberately discouraged.

B) Roadways within the City of Muncie have been classified among these categories and are shown in Figure 302.A.3. The above definitions shall be used to determine the functional classification of new roadways.

Figure 302.A.3: Roadway Classification Map



Source: INDOT Roadway Inventory & Functional Classification Viewer

C) Roadways shall be designed in accordance with the AASHTO Manual and the INDOT Design Manual, as applicable, however, the minimum requirements noted in this manual shall apply and supersede any other manual.

Table 302-1: City of Muncie Roadway Design Table

Design Criteria	Local Road	Minor Collector	Major Collector	Minor Arterial	Major Arterial
Design Volume (AADT)	Up to 1,000	1,001-2,500	2,501-10,000	10,001-15,000	Over 15,000
Truck Volume	<5%	<5%	<5%	<5%	Any
Min. Design Speed	25 mph	30 mph	35 mph	40 mph	40 mph
Min. ROW Width w/ storm sewer	50’	70’	90’	90’	110’
Min. ROW Width w/ open drainage	60’	70’	100’	100’	125’
Min. Lane Width	10’	11’	11’	11’	11’ Min., 12’ Des.

Table 302-1: City of Muncie Roadway Design Table

Design Criteria	Local Road	Minor Collector	Major Collector	Minor Arterial	Major Arterial
Min. Shoulder Width (Uncurbed)	2’ Min., 4’ Des.	2’ Min., 4’ Des.	2’ Min., 4’ Des.	6’	6’ Min., 8’. Des.
Cross-slope	2%	2%	2%	2%	2% for up to 2 lanes; 3% for 3rd lane
Curb Offset	2’	2’	2’	2’	2’
Parking Lane Width	8’	8’	8’	8’	8’ Min., 10’. Des.
Superelevation Rate (e_{max})	4%	4%	4%	4% / 6%	4% / 6%
Min. Clear-Zone Width (Curbed Roadways) (1)	10’	10’	10’	10’	10’
Min. Pavement Edge Radius at Intersection	15’	30’	30’	30’	40’
Min. Driveway Spacing	25’	50’	50’	150’	225’
Min. Intersection Centerline Spacing	200’	300’	300’	400’	400’
Min. Driveway to Intersection spacing	25’	150’	300’	300’	300’
Min. Sidewalk Width	Width = 5’. (With Grass Buffer Width of 2’. or more); 6’. (Without Grass Buffer) Slope: 1.5% Des., 2.0% Max.				
Min. On-street Bike Lane Width (7)	6’	6’	6’	6’ (2’ Des. Buffer Width)	6’ (2’ Min. Buffer Width)
Vertical Clearance (New or Replaced Overpassing Bridge)	14.5’	14.5’	14.5’	16.5’	16.5’

Table 302-1: City of Muncie Roadway Design Table

Design Criteria	Local Road	Minor Collector	Major Collector	Minor Arterial	Major Arterial
Vertical Clearance (Existing Overpassing Bridge)	14’	14’	14’	14’	14’

(1) Clear-Zone Width. The following will apply:

a. Facility with Vertical Curbs. The clear-zone width will be measured from the edge of travel lane or will be to the right-of-way line, whichever is less. No clear zone is required where there is 24-hour parking.

b. Facility with Sloping Curbs or without Curbs. The clear-zone width will vary according to design speed, traffic volume, side slopes, and horizontal curvature.

c. Curbed Facility. There should be an appurtenance-free area as measured from the gutter line of a curb.

Table 302-2: City of Muncie Geometry Table

Design Speed	25 mph	30 mph	35 mph	40 mph	45 mph
Stopping Sight Distance	155’	200’	250’	305’	360’
Intersection Sight Distance, -3% to +3% Approach Grades (8)	P: 280’ SUT: 350’	P: 330’ SUT: 420’	P: 390’ SUT: 490’	P: 440’ SUT: 560’	P: 500’ SUT: 630’
Minimum Radius without Superelevation (Adverse Crown) (9)	198’	333’	510’	762’	1038’
Minimum Radius for e_{max} = 4%	154’	250’	371’	533’	711’
Minimum Radius for e_{max} = 6%	N/A	231’	340’	485’	643’
Vertical Curvature, K-value - Crest Curves	12	19	29	44	61

Table 302-2: City of Muncie Geometry Table

Design Speed	25 mph	30 mph	35 mph	40 mph	45 mph
Vertical Curvature, K-value - Sag Curves	26	37	49	64	79
Maximum Grade	10%	9%	8%	7%	6.5%
Minimum Grade	Minimum: 0.3%				

303 Design Speed

A) The design speed for new roadways will be determined based on the functional classification of the roadway as shown in Table 303. For existing roadways, the existing posted speed limits shall be used as the minimum design speed for the roadway, however, the design speeds shown in Table 303 should be used wherever practical.

Table 303: Roadway Design Speeds

Roadway Functional Classification	Minimum Design Speed
Major Arterial	40 mph
Minor Arterial	30 mph
Major Collector	30 mph
Minor Collector	25 mph
Local Road or Street	25 mph

304 Sight Distance

A) Stopping Sight Distance shall be provided in accordance with Table 302-2.

B) Intersection Sight Distance shall be provided in accordance with Table 302-2. The intersection sight distance triangle shall be provided with construction plans. If sight lines fall outside of public right-of-way, the City Engineer shall be notified. All variances or design exceptions to sight distance shall be submitted and approved by the City Engineer.

C) Minimum Distance Between Driveway and Parallel Adjacent Street shall be 25 feet for local streets, 300 feet for collectors, and 300 feet for arterials, as measured from the radius of the curve, unless otherwise approved by the City Engineer.

305 Horizontal Design

A) The horizontal alignment design shall follow the design parameters provided in Table 302-1 and Table 302-2 (minimum radius, maximum superelevation). All design exceptions to the horizontal geometry and/or superelevation rate shall be submitted and approved by the City Engineer.

306 Vertical Design

A) The vertical profile design shall follow the design parameters (length of curve, “K” value, minimum and maximum grade) provided in Table 302-2.

B) The grades of intersecting streets, where vehicles are stored while waiting to enter the intersection, should be as flat as practical. The desirable grade within 100 feet of the intersection should be no more than 2 percent, with 5 percent as a maximum.

C) The desirable minimum grade of streets with curb or curb and gutters is 0.5 percent, with 0.3 percent as a minimum.

307 Cross Sectional Elements

A) The cross-section of all streets shall be as shown on the typical street sections in the Muncie Standard Construction Details.

B) Underdrains are required under the curb for all Local, Collector, and Arterial Streets, as shown in the Muncie Standard Construction Details for new construction and reconstruction involving new full-depth pavement and/or replacement of curb or curb and gutter.

C) Hot Mix Asphalt (HMA) Pavement - Typical pavement sections shall be as shown in the Muncie Standard Construction Details. The thickness may be adjusted for special soil conditions or special base preparation as determined by the City Engineer.

D) Portland Cement Concrete Pavement (PCCP) - The use of concrete pavement must be approved by the City Engineer. The thickness may be adjusted for special soil conditions or special base preparation as determined by the City Engineer.

E) In cases where the truck volume exceeds 10 percent of the traffic volume (or a total of 2000 trucks/day), a pavement design report for either HMA pavement or PCCP is required to be submitted to the City Engineer for approval.

F) Stabilized subgrade shall be defined as subgrade soil compacted to 100 percent of maximum dry density in accordance with Section 400 of this Manual.

G) Curb and Gutter - See Muncie Standard Construction Details for applicable drawings and details for allowable curb and gutter types on City Streets. See the Stormwater Design and Specification of this Manual for details regarding curb inlets and grates.

H) Cross-slope - See cross-slope requirements in Table 302-1.

I) Sidewalks

1) The sidewalk width is measured exclusive of the curb, i.e. measured from the back face of curb. A typical sidewalk is 5 feet wide with a 5-foot buffer area between the roadway and sidewalk. If there is no buffer area provided, the sidewalk width should be 6 feet to accommodate any appurtenances which may be included in the sidewalk. Any appurtenance or obstruction must provide a minimum clearance of 4 feet at the obstruction. If this cannot be met, relocation or removal of the obstruction should be considered and shall be brought to the attention of the City Engineer for resolution.
2) Existing sidewalks that are rehabilitated or reconstructed can be constructed to the existing width if the above requirements cannot be met due to ROW constraints.
3) The longitudinal grade of all sidewalks adjacent to roadways shall not exceed the grade of the roadway. If the sidewalk is not adjacent to a roadway, the maximum allowable grade is 5 percent.
4) Cross slope for sidewalks should not exceed 1.5 percent and shall not exceed a maximum slope of 2.0 percent.

J) Americans with Disability Act (ADA) Compliant Curb Ramps

1) All pedestrian street crossings shall be accessible to pedestrians with disabilities. The U.S. Access Board's Public Right of Way Accessibility Guidelines (PROWAG) and the City of Muncie Standard Construction Details shall be followed for the design and construction of ADA-compliant curb ramps.

K) Trails & Multi-use Paths

1) The AASHTO Guide for the Development of Bicycle Facilities provides details and guidelines for the development of bike facilities.
2) On-street bike lanes shall follow the minimum criteria set forth in Table 302-2.

308 Intersection at Grade

A) Intersection Sight Distance shall be provided in accordance with Section 304 and Table 302-2.

B) The angle between intersecting streets should be as close to 90 degrees as possible. 75 degrees is the desirable minimum. Intersection angles less than 75 degrees shall be submitted and approved by the City Engineer.

C) Intersection radii measured along the back of the curb shall be provided in accordance with Table 302-1.

D) Cul-de-sac design shall be according to the Muncie Standard Construction Details.

E) Provide Level of Service C or better at all new intersections. Level of Service D is acceptable for existing reconstructed intersections where providing a higher level of service is not possible due to physical constraints and/or if such improvements are beyond the scope of the project.

F) A detailed capacity analysis shall be performed using the Transportation Research Board Special Report 209 Highway Capacity Manual, current edition, and shall be based on future design year projections and the design Level of Service.

G) The number of lanes and turn lanes at intersections shall be determined using the guidance in AASHTO's A Policy on Geometric Design of Highways and Streets, current edition, chapter 9.

H) Intersections with existing or proposed signals must meet at least one of the signal warrants described in FHWA's Manual of Uniform Traffic Control Devices, current edition, chapter 4C.

309 Monuments and Markers

A) Monuments shall be of concrete with a diameter of not less than 6 inches and 36 inches long, with a copper dowel 3/8 inches in diameter, at least 2-1/2 inches in length embedded so that the top of the dowel shall be not more than 1/4 inches above the surface and at the approximate center of the monument.

B) Monuments shall be set so that the top is level with the established grade adjoining it and placed so that the marked point on the metal center shall coincide exactly with the intersection of street property lines (or street center lines), the intersection of all angles in the boundary line, and at the beginning and end of all curves along streets on the inside street lines.

C) Lot corners not marked by concrete monuments as required above, shall be marked by galvanized or wrought iron pipe, or iron or steel bars at least 2 feet in length and not less than 5/8 inches in diameter, the top of the pipe or bar to be set level with the established grade of the ground adjoining it.

400- Earthwork and Clearing

401 Clearing and Grubbing

A) Remove any living or dead trees, vegetation, stumps, and roots within the construction limits. Debris, dead vegetation, and invasive vegetation shall be removed within the right of way even if outside the construction limits.

B) Appropriately dispose of debris. Burning is not allowed. Haul to designated landfill or transfer station. Hauling and landfill charges will be included in this pay item; no additional compensation will be allowed for hauling and landfill fees.

C) Payment for Clearing and Grubbing shall be paid by the acre or as a Lump Sum item as indicated on the plans. Payment is for all materials, equipment, labor, and incidentals required to complete this work.

402 Removal of structures

A) Buildings

1) Raze, remove, and dispose of structure as indicated on plans.
2) Remove foundations as necessary. If foundation is removed, excavate not less than 1 foot in all directions around structure.
3) Rubbilize floors and basements so they do not retain water.
4) If voids are found under any portion of the structure to remain, fill with non-excavatable flowable fill.
5) If asbestos or lead is found or suspected, contact the City Engineer to provide for abatement plan and possible item price adjustment.
6) Utilities associated with structures to be removed shall be removed and/or capped per the requirements of the utility provider.
7) Underground storage tanks (USTs) shall be removed and disposed of per local ordinances and EPA requirements.
8) Payment to be made per building or as a lump sum for all included buildings includes all excavation, demolition, permits, haul off, labor, equipment, and disposal.

B) Pipes, Culverts, and drainage structures

1) Excavate and remove buried or covered pipes and culverts.
2) Cut or break pipe into manageable sections, then haul off/dispose of.
3) Excavate at least 6 inches in all directions of pipes, culverts, and drainage structures to remove old backfill.
4) Do not remove pipe, culvert, or boxes underneath roadways without an approved plan for traffic control and temporary trench protection.
5) Backfill road trenches per Muncie Standard Construction Details - EC 400 series.
6) Backfill all other trenches with clean fill material free of deleterious materials such as rocks greater than 6 inches in more than 2 dimensions, vegetative matter, or trash.
7) Payment to be made per linear foot of pipe or culvert removed or per each drainage structure removed. Cost includes all excavation, permits, backfill, haul off, trench protection, labor, and equipment.

C) Pavement

1) Concrete pavement, curbs, and sidewalk removed shall be disposed of per 104 or may be recycled by the Contractor at his own risk.
2) Brick pavement removed shall be disposed of per 104.
3) Asphalt pavement removed is classified as excavation per 404 and shall be disposed of per 104 or may be recycled by the Contactor at his own risk.

403 Strip, Stockpile, and Place Topsoil

A) Using mechanical means, remove first 3 to 4 inches of soil top cover from site following grubbing.
   1) Store material in designated location(s) and prevent contamination of topsoil.
   2) Protect topsoil stockpile from excessive erosion by one of the following methods:
      1) Wrap stockpile with an approved silt fence.
      2) Wrap stockpile with mulch berm not less than 1.5 feet tall.
2) For storage longer than 6 months, dress slopes to a slope no greater than 1V:2H and seed and straw.

B) At the end of project, cover all areas that are not designed as impermeable (roads, structures, etc.) with at least 3 to 4 inches of topsoil, if sufficient topsoil is not available on site, import clean topsoil from a nearby site.

C) If covering solid rock or other material that would interfere with the establishment of a vegetative cover, place 6 inches of fill material over the hard surface prior to covering with 3 inches of topsoil.

D) Payment for stripping topsoil shall be on a square yard (SY) or acre (AC) basis depending upon the size of the job site/project. Cost shall include all labor, equipment, on-site hauling, additional topsoil, hauling, dressing, and storage necessary.

404 Excavation

A) Rock Excavation
   1) Excavation involving igneous, metamorphic, or sedimentary rock or other hard matter that is not easily rippable using a hydraulic excavator with a traditional bucket that is not less than one cubic yard capacity.

B) Waterway Excavation
   1) Excavation involving the clearing of waterways and channels including the rerouting of a waterway. Protect banks from collapse and erosion using temporary shoring or other method.

C) Common Excavation
   1) Excavation not characterized as rock or waterway including the removal of asphalt pavement.

405 Trenching

A) Utilizing mechanical methods perform trenching to the lines and depths indicated on the plan.
B) Trench at least 6 inches below the anticipated invert elevation to account for bedding material.
C) Trench should be at least 1/2 diameter larger than the utility installation to account for bedding. i.e., for installing a 6-inch line the trench must be at least 9 inches wide.
D) Provide adequate shoring/bracing as necessary to comply with Section 107.
E) Unless otherwise specified payment for trenching shall be included as part of utility installation (water, sewer, etc.). If specified outside of utility installation, payment shall be by the cubic yard for neat lines of the excavation as common excavation or rock. Cost shall include all labor, material, equipment, hauling, and other incidentals necessary to perform the work.

406 Fill

A) Fill material shall be free of stone or rubble greater than 12 inches and large organic matter such as limbs, trees, and large roots.

407 Embankment

A) Place fill-in lifts not greater than 8 inches compacting between lifts to not less than 95 percent of optimum density.
B) Provide adequate drainage during embankment construction.

408 Structural Backfill

A) Backfill and compact fill under or within 5 feet of structures to the lines, grades, and densities specified in the plans and/or geotechnical report.
B) Structural backfill shall be certified by a geotechnical lab and a standard proctor developed for each proposed material indicating optimum moisture density relationship.
C) Structural backfill shall be compacted to +/- 1 percent of optimum density.
D) Structural backfill shall not be placed until such time as in-place structures have cured sufficiently to withstand the vibratory action of localized compaction, the minimum of which shall be 7 days following placement or as specified by the design engineer.
E) Structural backfill shall be compacted in lifts not to exceed 6 inches.
F) Structural backfill material shall be uniform and free of organics; stone shall be of a non-degradable nature less than 2 inches in diameter in any given plane.
G) Excavatable flowable fill may be used in lieu of proctored material so long as it meets the requirements of the City Engineer.

H) Crushed #5, #8, #9, #11, #12, #53, or #73 stone may be utilized as structural fill so long as it complies with item 1003.

I) Payment for structural backfill shall be per cubic yard with separate items for stone and flowable fill. Cost shall include all compaction, hauling, material, labor, testing, and equipment necessary.

500- Concrete and Masonry Work

501 Concrete Pavement Construction

A) Concrete shall be placed uniformly requiring minimal rehandling. Plastic concrete shall not be segregated during placement. Dowel bars and assemblies shall not be displaced during placement of concrete.

B) Concrete shall be thoroughly consolidated against the faces of all forms or adjacent concrete surfaces utilizing immersion vibrators or vibratory screeds.

C) Hand-placed concrete shall be thoroughly consolidated with the use of a vibrator. Vibrators shall not be operated excessively in any one location to avoid aggregate from sinking to the bottom of the slab. Vibrators shall not come in contact with dowel bar assemblies, subgrade, subbase, or forms.

D) Utilize class “A” concrete complying with item 1004 for all flat work unless otherwise specified by the plans.

E) Reinforcing steel shall comply with item 1006.

F) Tie reinforcing steel in accordance with item 1006.

G) Utilize manufactured rebar chairs to maintain reinforcing steel in the position indicated in the plan. If not indicated on the plan, place rebar no closer than 2 inches from grade or forms and within the bottom 1/3 of the slab.

H) Finish surfaces as indicated on plans, if not indicated finish surfaces as follows:

1) Sidewalks - Broom finish perpendicular to path of travel, edge radius 1/4 inch.
2) Pavement - Use transverse tining with the following repeated spacing between grooves:
    i. 5/8” – 1” – 7/8” – 5/8” – 1-1/4” – 3/4” – 1” – 1” – 1” – 1” – 3/4” – 7/8” – 1-3/4” – 7/8” – 3/8” – 1” – 1” – 1-1/4” – 1-1/2” – 7/8” – 1” – 7/8” – 1”
3) Driveways - Finish to match existing driveway, otherwise broom finish.

I) Concrete work shall have expansion and contraction joints as specified in the plans.

J) Payment shall include labor, material, delivery, finishing, curing, joints, forming, and all ancillary work necessary to furnish in place.

502 Curbing

A) Concrete curb and combination curb and gutter may be installed using forms or may be slip-formed.

B) Types of Curb (See Muncie Standard Construction Details: EC-500 series
   1) Curb and Gutter
   2) 6-inch Curb
   3) 8-inch Curb
   4) 4-inch Sloping Curb
   5) Rolled Curb and Gutter
   6) Concrete Medians (4-inch, 6-inch, 8-inch)

503 Truck Aprons

A) Truck Aprons will be finished with stamping. Colored concrete may also be used in place of stamping to delineate a truck apron from pavement.

B) A rolled curb and gutter (Section 502) shall be used at a truck apron to discourage use by passenger cars.

504 Commercial and Private Concrete Drives (with Curb)

A) Concrete and Asphalt work shall be in accordance with Sections 501 and 605.

B) Subgrade treatment shall be in accordance with Section 601.

C) Curbing will be constructed per Section 502.

D) Commercial and Private drives should be designed to the Muncie Standard Construction Details: EC-500 series.

505 Sidewalks, Curb Ramps, Steps, and Handrails

A)

Sidewalks, curb ramps, and stairs shall be constructed according to Section 501. Materials shall conform to materials Sections 1003, 1004, 1005, 1006, and 1007.

B) Sidewalks, curb ramps, and steps should be designed to the Muncie Standard Construction Details: EC-500 series.

C) ADA standards of The Muncie Standard Construction Details and the Public Right-of-way Accessibility Guide (PROWAG).

D) Sidewalk, curb ramps, and stairs – Broom finish perpendicular to path of travel, edge radius ¼ inch.

E) For curb ramps – Detectable warming surfaces (DWS) should be the full width of the curb ramp and the border width shall not exceed 2 inches. DWS shall contrast visually from the adjacent surfaces and truncated domes shall align in a square or radial pattern as shown on the plans and standard drawings.

F) Handrails shall be straight and true to grade. Posts shall be vertical and railings parallel to the walk surface or plane of the stairs.

600- Asphalt Paving and Patching

601 Subgrade Treatment and Preparation

A) Subgrade Treatment Types

1) The subgrade treatment type shall be as specified on the contract plans. If required, the subgrade foundation shall be corrected as directed by the City Engineer prior to subgrade treatment.
2) Following subgrade treatment types may be used. The subgrade treatment will be recommended by the geotechnical engineer.

Table 601-1: Subgrade Treatments

Type	Subgrade Description
I	24” of compacted soil
IBC	14” chemical soil modification using cement
IBL	14” chemical soil modification using lime
IC	12” coarse aggregate No. 53
ID*	12” coarse aggregate with Type 2B geotextile
II	6” coarse aggregate No. 53
IV	12” coarse aggregate No. 53 with Type IB geogrid
IVA	12” coarse aggregate with geocell confinement system
V	3” of subgrade excavated and replaced with 3” coarse aggregate No. 53

*Type ID subgrade treatment shall be constructed with 9 inches of coarse aggregate No. 53 over 3 inches of coarse aggregate No. 5 or No. 8 Geotextile.

602 Geosynthetics

A) Geosynthetics shall meet requirements and recommendations from the geotechnical engineer if required.

603 Base Stone Preparation

A) Base stone shall be placed as shown on the plans or in accordance with the pavement sections in the standard drawings.

B) Only place stone on prepared subgrade once it has passed proof roll and all areas of concern noted by the City Engineer or their representative have been repaired.

C) Base stone shall comply with the standard material requirements.

D) Base stone shall be graded such that it has positive drainage and conforms with the lines and grades of the approved plans.

E) Place base stone in lifts no greater than 6 inches to the depth indicated in the plans.

F) If a failure is noted in the base stone, remove at least 18 inches and fill failure with #2 stone or shot rock as specified in Item 1003 to within 8 inches of the surface. Fill the remainder with crusher run stone. Compact in no more than 6-inch lifts.

G) Payment for base stone shall be per ton placed and compacted. Cost shall include all hauling, grading, compaction, labor, equipment, and material. No additional cost shall be allowed for repair of sections that fail proof roll.

604 Proof Roll

A) Perform proof roll with a fully loaded tandem dump truck with a gross weight in excess of 50,000 lbs. with tires that are properly inflated to not less than 100 PSI.

B) Perform proof roll at a walking speed between 2 and 4 miles per hour.

C) Payment for proof rolling shall be included in the cost of other 600 items and will not be paid for separately

D) If deflection of subgrade exceeds more than 1/2 inch measured from a 4-foot straight edge to the lowest point the area shall be reworked or excavated not less than 24 inches and backfilled with #2 crushed stone or shot rock complying with Item 1003 to within 6 inches of the surface which shall then be backfilled with select fill material complying with Item 1001.

E) If deflection of base stone exceeds more than 1/4 inch measured from a 4-foot straight edge to the lowest point the area shall be reworked or excavated not less than 18 inches and backfilled with #2 crushed stone or shot rock complying with Item 1003 to within 8 inches of the surface which shall be backfilled with crusher run Item 1003 and compacted at the discretion of the City Engineer or their representative.

605 Asphalt Paving

A) The INDOT Standard Specifications, Section 402 shall apply with the exceptions as noted herein. The current version of the INDOT Specifications, Recurring Special Provisions, and Supplemental Specifications are applicable.

B) Unless otherwise specified on the plans all local roads and collectors (with truck traffic <5 percent) shall utilize a Type B mixture per Standard Specification 402.

C) Unless otherwise specified on the plans all arterials and collectors (with truck traffic >5 percent) shall utilize a Type C mixture per Standard Specification 402.

D) The finished thickness of any course should be at least 2 times but not more than 5 times the maximum particle size as shown on the Design Mix Formula (DMF).

E) Include safety edges on all uncurbed HMA roads at locations without guardrail. See Muncie Standard Construction Details: AP-600 series for safety edge details.

F) Geosynthetic pavement fabrics shall be based on pavement design recommendations and current manufacturer specifications.

G) General

1) Paving shall not begin until the subgrade has been inspected by the City Engineer or their representative and the subgrade has been primed per Item 603.
2) Utilizing a self-propelled paving machine equipped with a heated vibratory screed lay the asphalt mixture specified in the plans to the depth, grades, slopes, and lines indicated.
3) Additional lifts shall be placed only after inspection by the City Engineer or their representative and the lift has been tack coated per Item 605.
4) Subgrade shall be dry, free of deleterious material, and primer cured prior to paving.
5) Place asphalt base with binder grade PG 70-22 in lifts no greater than 4 inches.
6) Place asphalt surface (grades C, D, OGFC) in lifts no greater than 3 inches
7) Deviations of more than 1/8 inch measured from a 10-foot straight edge shall be corrected prior to payment at no additional cost.

B) Asphaltic Concrete Mix

1) Unless otherwise specified asphalt mix shall be PG 70-22.
2) Mix shall comply with the requirements set forth in Item 1008.

C) Delivery and Placement

1) Asphalt mix shall be placed at a temperature of not less than 270 degrees Fahrenheit as measured by an infrared thermometer from the hopper of the paving unit.
2) Asphalt shall be delivered in a dump truck or trailer fitted with a tarp that is free of deleterious materials and that is lined or coated such that asphalt does not clump or cling when depositing it.
3) Ambient air temperature shall be 50 degrees Fahrenheit and rising with no moisture present on the surface to be paved. If precipitation is likely paving shall be postponed.
4) Low spots behind the paver or surface defects shall be corrected utilizing hand tools mounded at least 1/4 inch above the surface of the mat to account for compaction.

D) Joints

1) Offset longitudinal joints by 6 inches for the placement of pavement markings.

E) Rolling

1) Paving machine shall be followed by a “paving train” of rollers consisting of at least one “breakdown” flat wheel roller with vibratory capability and a

smoothing roller. Rollers should be capable of compactive effort equivalent of a 10-ton static wheel roller.

2) For vibratory rollers, the lowest amplitude setting should be used unless the mat is greater than 3 inches in thickness. Rollers shall not be operated with the vibratory mode on lifts less than 1 inch.
3) For high-traffic roadways an additional rubber tire roller capable of not less than an 85 PSI ground pressure should be included as intermediate roller. Roadways designated as Major or above shall have a three-roller paving train.
4) All rollers shall be capable of moistening roll wheels and self-cleaning.
5) Rollers shall operate continuously behind the paver while asphalt mix is still tender; rollers should be no more than 400 feet from paving unit at any time.
6) When operating on the paving mat, rollers should work from outside shoulder inward toward the centerline overlapping passes by not less than 1 foot. Rollers should turn slowly when operating on the hot mat to reduce roller marks and rutting. Roller marks and ruts shall be repaired by heating, adding material, and rerolling until an acceptable surface is achieved. Rollers shall not exceed 2 mph while operating on uncured mat and shall not stand (stop) on pavement that is more than 140 degrees Fahrenheit.

F) Prior to surface paving adjust all castings, boxes, and other appurtenances to be flush or depressed no more than 3/8 inch of the finish surface.
G) Prime coat in accordance with Item 603 prior to paving on aggregate surfaces.
H) Tack coat in accordance with Item 605 prior to paving on asphaltic concrete or cementitious concrete surfaces.
I) Remove excess asphaltic concrete from the right of way.
J) Leave paved areas free of loose material, excess overspray, and trash.
K) Work transition areas such as driveways and intersections to provide positive drainage from the center of the roadway and slopes that are traversable by typical traffic.
L) Payment for paving shall be on a per-ton basis based on the gradation and performance grade of the asphaltic concrete and type of roadway (e.g. PG 70-22, Grade D, Major). Cost shall include placement, compaction, material, equipment, labor, casting adjustment, clean up, hauling, surface repairs, defect repair, and driveway and intersection adjustment. Tack coat and prime coat shall be paid under Items 603 and 604, respectively. Repair of failures in existing pavements shall be paid under Items 609 or 612, respectively.

606 Tack Coat

A) Tack coat shall be applied prior to paving all asphaltic courses and surfaces.
B) The tack coat application rate shall be based on the type of surface as follows:

Surface Type	Application Rate (gallons/square yd)
New asphalt	0.05 to 0.08
Existing Asphalt	0.06 to 0.11
Milled Asphalt	0.06 to 0.12
PCCP	0.05 to 0.08

607 Prime Coat

A) Utilizing a calibrated distributor, apply prime coat to base stone following proof roll.

B) Emulsion shall be of type CSS-1 or SS-1 as specified in Item 1008.

C) Prime coat shall be applied at a rate not less than 0.1 gallons per square yard.

D) Prime coat shall only be applied on dry prepared surface. If moisture is present as indicated by either visible accumulation or staining of surface stone, then no priming shall occur until the surface has been thoroughly dried.

E) Prime coat shall only be applied when the air temperature is 50 degrees Fahrenheit and rising.

F) Prime coat shall be applied to the vertical surfaces of curb, storm structures, and manholes; any excess on horizontal surfaces that would be visible after topping shall be removed.

G) Cover sewer lids, water vault boxes, and other appurtenances that need to remain clear of prime coat with appropriate masking that can be removed cleanly.

H) Prime coat once applied shall be allowed to cure for not less than 24 hours with no traffic allowed on it. Once cured, light-duty traffic such as pickup trucks may use the roadway but heavy-duty traffic, such as dump trucks and tracked equipment, shall be prohibited except as necessary for the paving train.

I) Prior to beginning priming, the City Engineer or their representative may request the distributor be calibrated by spraying emulsion at the prescribed rate on a prepared medium such as tar paper, then weighing a 1-square foot sample, less tare weight, to determine application rate.

J) Payment for prime coat shall be on a per-gallon basis. Cost shall include all material, storage, placement, and labor. No subtractions shall be made for manholes, water boxes, or other appurtenances in the roadway.

K) Engineer or their representative.

L) Payment for proof rolling shall be included in the cost of Item 601.

608 Milling

A) Furnish equipment and personnel to provide for dust control, sweeping, material transfer, clean up, and loading as necessary.

B) Utilizing a self-propelled machine of appropriate size in relation to the job to be performed, cold plane (mill) asphaltic concrete to the grade, line, depth, width, and cross slope indicated on the plans.
C) Maximum longitudinal vertical edge allowed is 1-1/4 inches for any open travel lanes.
D) Minimum transverse slope at transitions from milled to existing is 1:12 for traveled roadways.
E) Operate the machine at an appropriate speed to maintain a uniform and smooth texture.
F) Utilizing a self-propelled machine of appropriate size in relation to the job to be performed, cold plane (mill) asphaltic concrete to the grade, line, depth, width, and cross slope indicated on the plans.
G) After milling, surface shall be of uniform texture, conform to grade and cross section, and be free of significant defects that would affect ride quality.
H) After milling, any cracks 0.25 inches wide or wider shall be sealed before tack coat is applied. The material used to fill cracks shall be PG 94-22 only, no emulsion shall be used. The sealed cracks shall not be overbanded.
I) Make repairs to castings, manholes, storm inlets, and sound roadway as necessary.

609 Asphalt Patching and Base Repair

A) The INDOT Standard Specifications, Section 304 shall apply with the exceptions as noted herein. The current version of the INDOT Specifications, Recurring Special Provisions, and Supplemental Specifications are applicable.
B) Saw-cut the damaged area square at least 6 inches from the edge of the portion of roadway to be repaired.
C) Excavate at least 18 inches from the roadway surface removing asphaltic concrete up to the edge of the saw cut lines leaving the edges square and vertical.
D) If subgrade material is unsound, excessively moist, or contaminated, continue excavation until sound material is encountered.

Trench patches shall be constructed per details shown on Muncie Standard Construction Details: EC-405.

610 Trench Patching

E) Saw cut pavement 6 inches beyond anticipated trench width.
F) Excavate material to the line, depth, and grade indicated on the plans or as necessary for the work to be accomplished.
G) Cleanly remove any broken asphalt such that a vertical face from the saw cut is present.

H) Crushed #5, #8, #9, #11, #12, #53, or #73 stone may be utilized as structural fill so long as it complies with item in no more than 6-inch lifts.
I) Backfill trench to within 6 inches of the final surface.
J) Liberally coat all vertical asphalt surfaces and horizontal stone surface with tack oil.
K) Backfill final 6 inches with B- modified Grade C- PG 64-22, mounding the asphalt at least 3/8 inch above roadway surface.
L) Compact asphalt in not more than 4-inch lifts utilizing a vibratory compactor or roller.
M) Protect hot asphaltic concrete utilizing either an approved detour or road plates for not less than 24 hours.
N) Payment for trench patching shall be on a square foot basis bracketed in 3-foot depth intervals (e.g., sf 0-3', sf 3'-6', etc.). Trench patching shall only be paid for items under existing roadways. Item shall include all labor, material, equipment, hauling, compaction, traffic control (ancillary to Item 210), road plating, tack oil, and asphaltic concrete.

611 Roadway Repair (Base Failure and Potholes)

A) Saw cut the damaged area square at least 6 inches from the edge of the portion of roadway to be repaired.
B) Excavate at least 18 inches from the roadway surface removing asphaltic concrete up to the edge of the saw cut lines leaving the edges square and vertical.
C) If subgrade material is unsound, excessively moist, or contaminated, continue excavation until sound material is encountered.
    1) Alternatively, fill with not less than 6 inches of class A concrete complying with Item 1004.
    2) Allow concrete to cure not less than 24 hours before placing backfill.
    3) Protect concrete with road plates or other appropriate traffic-rated measures.
D) Backfill and compact crusher run stone complying with Item 1003 in 6-inch lifts until within 6 inches of the roadway surface.
E) Liberally coat all vertical asphalt surfaces and horizontal stone surface with tack oil.
F) Back fill final 6 inches with B- modified PG 64-22 Grade C-, mounding the asphalt at least 3/8 inch.
G) Compact asphaltic concrete in not more than 4-inch lifts utilizing a vibratory compactor or roller.
H) Protect hot asphaltic concrete utilizing either an approved detour or road plates for not less than 24 hours.
I) Payment for Roadway Repair shall be on a square foot basis with alternates A and B (Item 609A and Item 609B) for over excavation and concrete backfill

respectively. Item shall include all labor, material, equipment, hauling, compaction, traffic control (ancillary to Item 210), road plating, tack oil, and asphaltic concrete.

612 Chip Seal (Tar and Chip) Paving

A) Aggregate should meet requirements of Section 1003 and be of Size No. 8, 9, 11, or 12.
B) Asphalt materials shall meet the requirements of Section 1008.
C) Chip seal should be allowed to set for 1 hour before traffic is placed on the newly sealed surface
D) Surface shall be swept prior to installation and after final rolling before opening to traffic.
E) The aggregate shall be rolled with 3 passes. The first two rolls shall occur within two minutes of placing the aggregate and the last roll shall occur within 30 minutes of placement.

613 Undercutting

A) In areas of unsuitable soil, additional excavation shall occur to get to suitable soil.
B) Excess excavation shall be replaced with suitable soil per Section 407 or replaced with additional stone meeting the requirements of Section 601.

700- Stormwater

701 Introduction, Policies, & Procedures

A) Introduction
   1) This Stormwater Design and Specification Chapter provides guidance and technical standards to support proper stormwater management and design of drainage facilities in compliance with current stormwater and drainage ordinances, permits, and policies currently in place within the City of Muncie.
   2) This chapter is intended to establish policies relating to hydrologic and hydraulic calculations and methods, design of drainage facilities, erosion control standards, water quality standards, materials specifications, and requirements, as well as to provide standardized stormwater specifications and pay items for projects taking place within the City of Muncie.
   3) Additionally, this chapter outlines submittal policies and review requirements for construction plans, design documentation, and drainage permits within the City of Muncie.

4) This chapter applies to all projects that generate “land alterations,” as defined in the City of Muncie Storm Drainage and Sediment Control Ordinance and Section 000 of this manual.

B) Policies and Procedures

1) Minimally, all land alterations will require the following items:
   a) Drainage Permit Application approved by the City Engineer
   b) Construction Site Sediment & Erosion Control Permit approved by the Muncie Sanitary District
2) Policies and procedures for the Drainage Permit Application and Construction Site Sediment & Erosion Control Permit are outlined in the following sections. Additional permitting by local, state, and/or federal agencies may be required based on the scope and nature of the project.
3) Drainage Permit Application
   a) The Drainage Permit Application shall be submitted to the Office of the City Engineer for review and approval and shall consist of items listed in Section 701-B Item 4. The City Engineer shall be empowered to require additional information to be included in the drainage permit as necessary to evaluate and determine the adequacy of the proposed drainage facility. One digital and one hard copy of the application shall be submitted. The application and associated documentation shall be reviewed in 30 days.
4) Professionally Prepared and Certified Drainage Plans
   a) Drainage plans shall be certified by a registered professional engineer, land surveyor, or architect engaged in stormwater and drainage design, under whose supervision the plans were prepared. Drainage plans shall include:
      (i) Commonly used scale.
         (i) North arrow.
         (ii) Land contours at necessary intervals for clarity.
         (iii) A benchmark determined by USGS datum.
         (iv) A map that includes the location and vicinity of the proposed land alteration.
         (v) Locations of all existing and proposed drainage facilities.
         (vi) Locations of existing and proposed utilities.
         (vii) Direction of flow, elevation of inverts, gradient, size, and capacity of existing and proposed storm sewers and pipes (if applicable).
         (viii) Plan and profile information for any constructed flow lines.
            1. Where a storm sewer and/or pipe is located within the existing or proposed edge of pavement or shoulder, the centerline grade of the road shall be shown.

2. Where a storm sewer and/or pipe is located outside the existing or proposed edge of pavement or shoulder, the existing and proposed ground elevations over the storm sewer shall be shown.

(ix) Right-of-way and easement lines.

(x) Stormwater Pollution Prevention Plan (SWPPP).

5) Technical Narrative and Design Calculations

a) A technical narrative shall include a summary of design methodology, supporting design calculations, and results corresponding with the Drainage Plans. The following information shall be included when applicable:

(i) Written technical narrative summarizing methods, calculations, modeling, and other pertinent project information.

(ii) Hydrologic calculations

(i) Drainage area map with hydraulic flow path, labeled contours, north arrow, and scale.

(ii) Soil map.

(iii) Weighted curve number or runoff coefficient computations.

(iv) Time of concentration computations.

(v) Estimation of stormwater runoff and/or modeling results.

(iii) Hydraulic calculations

(i) Stormwater Storage Facilities.

- Modeling output reports.

(ii) Storm Sewers

- Pipe capacity calculations or modeling output reports.
- Hydraulic Grade Line calculations or modeling output reports and/or profiles.
- Inlet spacing and allowable spread calculations.

(iii) Culverts

- Modeling output reports.

(iv) Open Channels

- Calculations or modeling results and tables.
- Channel stability analysis (if applicable).

6) Drainage Permit Certificates and Form A

a) The following certificates and Form A shall be completed and submitted with the Drainage Permit Application. Certificates shall be certified by a registered professional engineer, land surveyor, or architect engaged in stormwater and drainage design, under whose supervision the plans were prepared. The Certificates and Form A can be accessed at the City of Muncie website Document Center.

(i) Certificate of Sufficiency of Plan.
(ii) Certificate of Obligation to Observe.
(iii) Certificate of Completion and Compliance.
(iv) Muncie City Engineer's Office Drainage Plan Permit Application Form A.

7) Construction Site Sediment & Erosion Control Permit
   a) The Construction Site Sediment & Erosion Control Permit shall be submitted to the Muncie Sanitary District Stormwater Inspector for review and approval. Erosion and sediment control practices shall be consistent with practices summarized in Section 704 of this manual, and as stipulated in the Indiana Stormwater Quality Manual. Based on the scope, size, and nature of the project, erosion and sediment control practices shall also follow all other applicable federal, state, and local stormwater requirements.
   b) All land-altering projects are required to submit a Construction Site Sediment & Erosion Control Permit for review, regardless of the amount of land disturbance on the project site.
   c) For land-altering projects with land disturbance of one acre or more, a Construction Stormwater General Permit approved by IDEM is also required. A SWPPP Review by Muncie Sanitary District is required as part of the Construction Stormwater General Permit process.
   d) Applications for the Construction Site Sediment & Erosion Control Permit and SWPPP Review can be accessed at the Muncie Sanitary District Stormwater Management website.
   e) Additional guidance for compliance with erosion and sediment control permitting processes and SWPPP review can be found in Section 704 of this manual.

702 Hydrology

A) Introduction

1) This section will cover the hydrologic methods and resources used to determine volume of stormwater flow which are used in designing drainage systems. This includes descriptions of how to calculate the time of concentration, how to use the rational method, the use of the NRCS curve number and runoff hydrograph, and how to find rainfall characteristics. These calculations should be used and included in the Drainage Permit Application as outlined in Section 701.
2) Hydrologic Models
   a) Time of Concentration
      (i) The time of concentration (Tc) is defined as the duration required for runoff to travel from the hydraulically farthest point in the watershed to a specific point of interest within the same watershed. Tc significantly

impacts the shape and peak of the runoff hydrograph. Water moves through a watershed as sheet flow, shallow concentrated flow, open channel flow, or some combination. Refer to Chapter 3 of Technical Release 55 (TR-55) Urban Hydrology for Small Watersheds for additional background information and the accepted Tc calculation method.

(ii) All Tc calculations shall follow the TR-55 methodology and shall be documented in a spreadsheet format. An example Tc spreadsheet is provided in Reference Figure 702-1. Manning's n values for sheet and channel flow are included in Reference Tables 702-2 and 702-3. Additionally, the following requirements will apply to Tc calculations:
   (i) The minimum Tc shall be 5 minutes.
   (ii) The maximum sheet flow length shall be 100 feet.
   (iii) Travel time through a lake or reservoir shall be assumed as zero.

b) Rational Method
   (i) The Rational Method is a simple peak flow determination method that assumes:
      (i) The recurrence interval of the peak discharge is the same as that of the rainfall intensity.
      (ii) The rainfall intensity is uniform over the entire watershed during the entire storm duration.
      (iii) The storm duration associated with the peak discharge is equal to the Tc of the watershed.
   (ii) The Rational Method is based upon the following equation: $Q = C \cdot i \cdot A$
   Where:
      (i) Q = peak discharge (cfs)
      (ii) C = the runoff coefficient, or the ratio of peak runoff rate to average rainfall rate over the watershed during the Tc
      (iii) i = the rainfall intensity (inches/hour)
      (iv) A = the contributing area of watershed under consideration (acres)
   (iii) The runoff coefficient (C) represents land use characteristics of the watershed, summarized in Reference Table 702-3 and 702-4. When more than one runoff coefficient is applicable, a weighted average (composite C value) shall be computed as follows:

$$C_{comp} = \frac{C_1 * A_1 + C_2 * A_2 + \cdots C_n * A_n}{A_{total}}$$

   (iv) The Rational Method may be utilized in the following situations:
      (i) Land-altering projects of less than or equal to 5 acres.
      (ii) Land-altering projects that do not require stormwater storage.

(iii) Contributing watershed areas of less than or equal to 50 acres.

c) NRCS Dimensionless Unit Hydrograph Method

(i) Hydrographs visually represent variation in volume and discharge over the duration of a storm event. The unit hydrograph method assumes that discharge at any time is proportional to the volume of runoff and that time factors affecting hydrograph shape are constant.

(ii) The NRCS Dimensionless Unit Hydrograph was developed from many natural unit hydrographs with watersheds of varying sizes and geography. The NRCS Dimensionless Unit Hydrograph uses a standard unit conversion of 484, and the peak discharge equation is defined as:

$$q_p = \frac{484 * A * Q}{T_p}$$

Where:

(i) Qp = peak discharge (cfs)
(ii) A = drainage area (square miles)
(iii) Q = direct runoff (inches)
(iv) Tp= time to peak (hours)

(iii) The National Engineering Handbook Part 630 Chapter 16 should be consulted for additional information regarding the NRCS Unit Hydrograph derivation, as well as the hydrograph ordinate values for time, discharge, and mass curve ordinates that are expressed as dimensionless ratios.

(iv) Hydrologic modeling software utilizing the NRCS Dimensionless Unit Hydrograph Method is required to calculate runoff hydrographs. Common modeling software including the NRCS Dimensionless Unit Hydrograph include TR-20, HydroCAD, HEC-HMS, and others. Runoff hydrograph generation is required for the following situations:

(i) Land-altering projects greater than 5 acres.
(ii) Land-altering projects that require stormwater storage.
(iii) Land-altering projects with significant depressional storage.
(iv) Contributing watershed areas greater than 50 acres.

d) NRCS Curve Number Method

(i) The NRCS Curve Number (CN) Method is utilized to determine the runoff volume resulting from a specific precipitation amount, by considering factors such as basin soil and cover types, rainfall depth, and antecedent moisture condition. CN Values can also be used in conjunction with the NRCS Unit Hydrograph Method to determine the peak discharge for a watershed.

(ii) The runoff volume is determined by the following equation:

$$R(t) = \frac{(P(t) - 0.2S)^2}{P(t) + 0.8S}$$

Where:

(i) R(t) is the cumulative runoff volume

(ii) P(t) is the cumulative rainfall in inches

(iii) The ultimate abstraction, S, is an abstraction of soil characteristics used to determine runoff volume. The relationship between S and the curve number is:

$$S = \frac{1000}{CN} - 10$$

3) Soil Group Characteristics

a) Curve Numbers are assigned in Reference Table 702-5 based on land use and soil characteristics.

(i) A – Soils in this category have a high infiltration rate even when thoroughly wetted and consist mainly of deep, well-to-excessively drained sands or gravels. (Lowest runoff potential).

(ii) B – Soils in this category have moderate infiltration rates when thoroughly wetted and consist of moderately deep to deep, moderately well to well-drained soils with moderately fine to moderately coarse textures.

(iii) C – Soils in this category have slow infiltration rates when thoroughly wetted and consist mainly of soils with a layer that impedes downward movement of water, or soils with moderately fine to fine textures.

(iv) D – Soils in this category have a very slow infiltration rate when thoroughly wetted and consist mainly of clay soils with high swelling potential, soils with a permanently high water table, soils with a clay or clay layer at or near the surface, and shallow water over nearly impervious material. (Highest runoff potential)

b) Once the soil classification is known, a curve number CN can be found given the type of cover in the watershed. To determine the suitable Curve Number (CN) for the specific soil and cover type in the watershed, refer to Reference Table 702-5. Higher curve numbers correspond to higher impervious covers and soils with slower infiltration rates.

c) In cases where the basin comprises various soil types and/or land uses, a composite or weighted CN can be calculated as follows:

$$CN_{comp} = \frac{(CN_1A_1 + CN_2A_2 + \cdots CN_nA_n}{A_1}$$

Where CN_1, $CN_2 \ldots CN_n$ are the curve numbers associated with component areas A_1, A_2,... A_n

4) Rainfall
   a) Data Sources
      (i) For rainfall data, the standard reference shall be NOAA Atlas 14, Volume 2. The rainfall data utilized should correspond to the weather station nearest to the project site. Depending on the specific hydrologic method being employed, select the appropriate precipitation intensity or depth from the Data Description section of NOAA Atlas 14.
   b) Rainfall Distributions
      (i) To compute runoff hydrographs, the Huff storm distribution with a 50 percent probability shall be utilized. It is necessary to conduct a critical storm duration analysis to determine peak discharges and flood stages accurately. This analysis should encompass the calculation of peak discharges and maximum flood stages for each storm duration specified in NOAA Atlas 14, ranging from 5 minutes to 24 hours.
      (ii) The critical design storm refers to the duration that yields the highest peak discharges and flood stages corresponding to the appropriate design storm Annual Exceedance Probability (AEP). To determine the appropriate Huff distribution ordinates, Tables 702-6 and 702-7 can be referenced.
5) Reference Figures and Tables.

Figure 702-1 Time of Concentration Calculation Spreadsheet (download from City of Muncie website)

Table 702-1: Roughness Coefficients (Manning's n) for Sheet Flow [1]

Surface Description	n-value
Smooth surfaces (concrete, asphalt, or bare soil)	0.011
Fallow (no residue)	0.05
Cultivated soils Residue cover <=20 percent Residue cover >20 percent	 0.06 0.17
Grass Short grass prairie Dense grass Bermudagrass	 0.15 0.24 0.41
Range (natural)	0.13
Woods Light underbrush	 0.40

Surface Description	n-value
Dense underbrush	0.80

[1] Adapted from Natural Resource Conservation Service Technical Release 55, 1986

Table 702-2: Roughness Coefficients (Manning's n) for Open Channel Flow [2]

Channel Type and Description	Minimum	Average	Maximum
Natural Streams			
1. Clean, straight, full stage, no rifts or deep pools	0.025	0.030	0.033
2. Same as 1, with more stones and weeds	0.030	0.035	0.040
3. Clean, winding, some pools and shoals	0.033	0.040	0.045
4. Same as 3, with some weeds and stones	0.035	0.045	0.050
5. Same as 3, lower stages, more ineffective slopes and sections	0.040	0.048	0.055
6. Same as 4, with more stones	0.045	0.050	0.060
7. Sluggish reaches, weedy, deep pools	0.050	0.070	0.080
8. Very weedy reaches, deep pools or floodways with heavy timber or underbrush	0.075	0.100	0.150
Floodplains			
Pasture, no brush			
1. Short grass	0.025	0.030	0.035
2. High grass	0.030	0.035	0.050
Cultivated areas			
1. No crop	0.020	0.030	0.040
2. Mature row crops	0.025	0.035	0.045
3. Mature field crops	0.030	0.040	0.050
Brush			
1. Scattered brush, heavy weeds	0.035	0.050	0.070
2. Light brush and trees in winter	0.035	0.050	0.060
3. Light brush and trees in summer	0.040	0.060	0.080
4. Medium to dense brush in winter	0.045	0.070	0.110
5. Medium to dense brush in summer	0.070	0.100	0.160
Trees			
1. Dense willows, summer, straight	0.110	0.150	0.200
2. Cleared land with stumps, no sprouts	0.030	0.040	0.050
3. Same as above, with heavy sprout growth	0.050	0.060	0.080
4. Heavy stand of timber, a few down trees, little undergrowth, flood stage below branches	0.080	0.100	0.120
5. Same as above, with flood stage reaching branches	0.100	0.120	0.160

[2] Adapted from the Delaware County General Drainage Standards

Table 702-3: Urban Runoff Coefficients for Rational Method [3]

Description of Area	Runoff Coefficients
Business	
Downtown	0.70 to 0.95
Neighborhood	0.50 to 0.70
Residential	
Single-family	0.30 to 0.50
Multi-units, detached	0.40 to 0.50
Multi-units, attached	0.60 to 0.75
Industrial	
Light	0.50 to 0.80
Heavy	
Parks, cemeteries	0.10 to 0.25
Playgrounds	0.20 to 0.35
Railroad Yard	0.20 to 0.35
Unimproved	0.10 to 0.30
Pavement	
Asphalt and Concrete	0.70 to 0.95
Brick	0.70 to 0.85
Roofs	0.75 to 0.95
Water Impoundment	1.00

Table 702-4: Rural Runoff Coefficients for Rational Method [3]

Vegetation and Topography	Soil Texture		
	Open Sandy Loam	Clay and Silt Loam	Tight Clay
Woodland			
Flat 0-5 percent slope	0.10	0.30	0.40
Rolling 5-10% slope	0.25	0.35	0.50
Hilly 10-30% slope	0.30	0.50	0.60
Pasture			
Flat	0.10	0.30	0.40
Rolling	0.16	0.36	0.55
Hilly	0.22	0.42	0.60
Cultivated			
Flat	0.30	0.50	0.60

Rolling	0.40	0.60	0.70
Hilly	0.52	0.72	0.82

[3] Adapted from the Indiana LTAP Stormwater Drainage Manual, 2015

Table 702-5: Curve Numbers [3]

Cover type and Hydrologic Condition	Curve Numbers for Hydrologic Soil Group			
	A	B	C	D
Cultivated Land				
Without conservation treatment	72	81	88	91
With conservation treatment	62	71	78	81
Pasture or Range Land				
Poor Condition	68	79	86	89
Good Condition	39	61	74	80
Meadow	30	58	71	78
Wood or Forest Land				
Thin stand, poor cover, no mulch	45	66	77	83
Good cover	25	55	70	77
Open space (lawns, parks, golf courses, cemeteries)				
Poor condition (grass cover <50 percent)	68	79	86	89
Fair condition (grass cover 50 percent to 75 percent)	49	69	79	84
Good condition (grass cover >75 percent)	39	61	74	80
Impervious Areas				
Paved parking lots, driveways, roofs	98	98	98	98
Gravel	76	85	89	91
Dirt	72	82	87	89
Urban Districts				
Commercial and Business (85% impervious)	89	92	94	95
Industrial (72% impervious)	81	88	91	93
Residential				
1/8 acre or less, townhouses	77	85	90	92
1/4 acre	61	75	83	87
1/3 acre	57	72	81	86
1/2 acre	54	70	80	85
1 acre	51	68	79	84
2 acres	46	65	77	82
Newly graded (no vegetation)	77	86	91	94

[3] Adapted from the Indiana LTAP Stormwater Drainage Manual, 2015

Table 702-6: Huff Distribution Quartiles [3]

Quartile	Storm Duration (d)
1st	0 < d ≤ 6.0 hours
2nd	6.0 < d ≤ 12.0 hours
3rd	12.0 < d ≤ 24 hours
4th	d > 24 hours

Table 702-7: 50 percent Huff Curve Ordinates [3]

Cumulative Storm Time (percent)	Cumulative Storm Rainfall (percent)			
	1st Quartile	2nd Quartile	3rd Quartile	4th Quartile
0	0.00	0.00	0.00	0.00
10	20.00	6.50	5.26	6.67
20	40.80	18.13	11.55	14.25
30	54.95	35.85	17.06	20.00
40	62.50	52.94	24.24	26.09
50	68.75	67.86	37.78	33.33
60	76.67	76.52	58.33	40.00
70	83.05	83.81	78.03	50.00
80	89.70	90.67	88.68	68.57
90	95.00	95.89	95.29	88.37
100	100.00	100.00	100.00	100.00

[3] Adapted from the Indiana LTAP Stormwater Drainage Manual, 2015

703 Hydraulics

A) Introduction

1) This section provides hydraulic analysis methodologies that should be utilized for design of stormwater facilities in the City of Muncie, including storage systems, storm sewers, culverts, and open channel systems. Results from hydraulic calculations and modeling should be included in the Drainage Permit Application as outlined in Section 701.

B) Stormwater Storage Facility Design

1) Determination of Allowable Release Rates and Required Storage Volumes

a) The required storage volume shall be dictated by the allowable release rates from the project area. For land-altering projects, the post-developed peak discharge must not exceed the pre-developed peak discharge based on hydrologic calculations for the 2-year, 10-year, and 100-year storm

events. The allowable release rates for land-altering projects are summarized as follows:

(i) Q2 post ≤ Q2 pre
(ii) Q10 post ≤ Q10 pre
(iii) Q100 post ≤ Q100 pre

b) Allowable release rates shall apply to all outlets from the project area. That is, if a project area has more than one outlet for stormwater runoff in the pre-developed condition, the corresponding pre-developed peak discharge shall be used to determine the post-developed release rate for each outlet.

c) Pre- and post-developed peak discharges shall be calculated using the runoff hydrograph methodology outlined in Section 702 B – Hydrologic Methods. The required storage volume shall be determined utilizing stormwater modeling software capable of generating runoff hydrographs and stormwater routing. Modeling output reports shall be submitted with the Drainage Permit Application.

2) Offsite Runoff

a) In cases where offsite runoff drains through the project area, this flow may be bypassed around the storage facility without attenuation. Offsite runoff may also be routed through the storage facility, provided a separate, secondary outlet is included. It should be noted that the storage facility efficiency may be affected if the ratio of the offsite to onsite drainage area is greater than five (5) to one (1). If this ratio is greater than 5:1, it is not recommended that offsite flow be routed through the storage facility.

3) Storage Design Requirements

a) Stormwater storage facilities can come in many forms but generally fall into two categories: detention and retention. Detention facilities, or “dry-bottom” facilities, temporarily store excess stormwater runoff and fully drain between storm events. Retention facilities, or “wet-bottom” facilities, retain runoff for an indefinite time period. The following sections provide requirements for design of both wet-bottom and dry-bottom storage facilities.

(i) General Storage Design Requirements

- All storage facilities shall be separated by more than 50 feet horizontally from any building or structure to be occupied. A minimum of 2 feet of vertical freeboard is also required between the peak 100-year storage water surface elevation and the lowest ground elevation next to any building or structure to be occupied.
- Screens or bars shall be placed over all inlets and outlets greater than 6 inches for safety and to collect debris.

- Outlet control structures shall be designed to operate as simply as possible and shall require little to no maintenance and/or attention for proper operation. Outlet structures should be accessible if maintenance is necessary. Access to outlet control structures shall be provided for routine maintenance activities.
- Outlet invert elevations shall be set a minimum of 0.5 feet above the normal water level of the receiving water body.
- If an orifice is used to restrict the discharge, the minimum allowable orifice diameter shall be 6 inches, even if the 6-inch diameter orifice results in a discharge greater than the allowable release rate. The orifice should be sized by the engineer such that the drawdown for a 2-year event is accomplished in less than 72 hours.
- An emergency overland flow facility, such as but not limited to a spillway or weir, shall have a design capacity of 1.25 times (125 percent) the peak inflow resulting from the 100-year post-developed storm event draining to the storage facility. The overland flow facility shall be designed so that its operation is automatic and does not require manual attention. A minimum of 1 foot of freeboard is required between the maximum flow elevation through the emergency overland flow facility and the top of bank elevation.
- Outlets that discharge overland shall be provided with protection to prevent erosion. Erosion control systems shall be installed as soon as possible during site development.
- Debris and trash removal and other necessary maintenance shall be performed on a regular basis to ensure continued operation in conformance with design.
- Side slopes shall be no steeper than 3 (horizontal) to 1 (vertical) for safety, erosion control, stability, and ease of maintenance.
- To maximize water quality, inlets and outlets should be located on opposite ends of the facility to provide maximum opportunity for settling.

(ii) Detention Facility Design Requirements

- When slopes to the detention facility outlet are less than 1 percent, an underdrain shall be provided at a size designed to accommodate the design storm, with a minimum diameter of 6 inches.
- The detention facility bottom and side slopes shall be finished with at least 4 inches of topsoil and seeded or sodded using a variety capable of withstanding periodic inundation
- The maximum draw-down time for detention facilities is 48 hours unless additional storms occur within that period.

(iii) Retention Facility Design Requirements

- Retention facilities shall have a surface area of at least 1/2 acre and a minimum depth of 10 feet over at least 25 percent of the total area. The average depth of the remaining area shall be at least 5 feet to inhibit insect breeding and weed growth. Additional maintenance may still be necessary.
- A 4- to 6-foot safety ledge shall be installed 1 foot below the normal water elevation.
- Retention facilities shall be designed with an additional 6 percent of available storage capacity to allow for sediment accumulation and to permit the basin to function for reasonable periods of time between maintenance.
- To maximize water quality, inlets and outlets should be located on opposite ends of the facility to provide maximum opportunity for settling.
- A controlled positive outlet will be required to maintain the design water level and provide required detention storage above the design water level. A means of maintaining the design water level during prolonged periods of dry weather is required.
- Retention facilities can be developed to provide a wetland environment. Every effort should be made to aesthetically integrate the facility with the surrounding area.

C) Storm Sewer Design

1) Manning's Equation

a) Storm sewers consist of a network of pipes, inlets, manholes, catch basins, and other structures that collect and convey stormwater runoff. Storm sewers that drain by gravity can generally be designed using Manning's Equation defined as follows:

$$Q = \left(\frac{1.486}{n}\right) * \left(R^{\frac{2}{3}}\right) * \left(S^{\frac{1}{2}}\right) * A$$

Where:

- Q = Capacity, or peak discharge (cfs)
- V = mean velocity of flow (ft/s)
- A = cross-sectional area of flow (ft2)
- R = hydraulic radius (ft)
- S = slope of the energy grade line (ft/ft)
- n = Manning's "n" or roughness coefficient

The hydraulic radius (R) is defined as the cross-sectional area of flow divided by the wetted perimeter. Manning's n-values are included in Reference Table 703-1 for typical storm sewer pipe materials.

2) Storm Sewer Calculation and Capacity Requirements

a) Storm sewer capacity may be determined manually or by using stormwater modeling software. If determined manually, design calculations shall utilize the Rational Method and Manning's Equation and be submitted in a spreadsheet format with the Drainage Permit Application. Reference Figure 703-1 provides an example spreadsheet format that may be used for storm sewer capacity calculations. Storm sewer modeling software may be used in place of manual calculations, provided output reports containing similar information to Reference Figure 703-1 are submitted with the Drainage Permit Application.

b) Storm sewer pipes shall be sized to contain the peak flow rate from the 10-year storm within the pipe. Peak flow rates may be determined using the Rational Method as discussed in Section 702-B-2.

c) The storm sewer system shall also be designed to contain the hydraulic grade line (HGL) from the 50-year storm event below the top of casting for each manhole, inlet, catch basin, or other structure. The HGL shall be determined utilizing the methodology as listed in Chapter 7 of the Federal Highway Administration (FHWA) Hydraulic Engineering Circular No. 22 (HEC-22). Given the complexity of determining the HGL with manual calculations, the use of storm sewer modeling software is recommended. Manual calculations or storm sewer modeling software output reports and profiles displaying the HGL shall be submitted with the Drainage Permit Application.

3) General Storm Sewer Design Requirements

a) The minimum pipe size shall be 12 inches in diameter. Pipe sizes shall increase in the downstream direction and as warranted by capacity and HGL calculation results.

b) Minimum cover of 3 feet over the top of the pipe shall be maintained, measured from the top of the pipe to the top of the pavement or final grade.

c) Minimum and maximum allowable slopes shall be those capable of producing velocities of 2.5 ft/sec and 10.5 ft/sec, respectively, when the sewer is flowing full. Designs including slopes that results in a velocity greater than 10 ft/s shall include scour calculations and energy dissipation design included in the Drainage Permit Application.

d) Manholes shall be placed wherever there is a junction, a change in grade, or a change in direction. A catch basin or inlet may be used if it has sufficient size. The maximum spacing between manholes and other structures is defined in Reference Table 703-2.

e) Inlets shall be placed at all low points, or sag points, in the grade of the gutter and at intersections to reduce potential of stormwater flowing across traffic lanes and crosswalks.

4) Inlet Spacing and Allowable Spread Requirements
   a) Several factors must be considered simultaneously when designing inlet locations including the allowable spread, inlet capacity, cross and longitudinal slope of the roadway, peak flow, and velocity of flow. Inlet spacing design is an iterative process that generally utilizes the Rational Method, modified Manning's Equation, and weir and orifice equations. Inlet spacing design shall follow the methodology included in Chapter 4 of the FHWA HEC-22. Reference Figure 703-2 contains an example spreadsheet format that may be used to determine inlet locations, utilizing the HEC-22 methodology. Storm sewer modeling software may be used in place of manual calculations, provided output reports containing similar information to Reference Figure 703-2 are submitted with the Drainage Permit Application.
   b) The allowable spread is defined as the amount of water that may spread into the travel lane based on roadway classification. Reference Table 703-3 includes allowable spread requirements for roadway classifications in the City of Muncie.
   c) For all roadway classifications, the 100-year storm event shall not exceed the height of the curb. For roadways that include parking, the maximum allowable spread is 12 feet, including the parking lane. For roadways that do not meet the general classification criteria listed in this Section, coordination with the City Engineer is required.

D) Culvert Design
1) For hydraulic analysis, a culvert is considered a structure with a span length of less than 20 feet. Computer models such as FHWA HY-8 and the HEC-RAS culvert module may be utilized to design culverts. Model output reports shall be submitted with the Drainage Permit Application. Reference Table 703-4 provides culvert design requirements based on roadway classification and design storm event.
2) Culverts shall be designed to accommodate runoff such that a roadway remains serviceable, and overtopping does not occur during the design storm event corresponding with the roadway classification listed in Table 703-4. Serviceability freeboard is defined as the vertical distance measured from the edge of the travel lane elevation to the headwater elevation at the upstream side of the culvert. Energy dissipators, such as riprap, shall be sized according to the outlet velocity design storm event listed in Table 703-4.
3) For replacement culvert designs, no culvert shall be sized to carry less than the existing culvert capacity, regardless of requirements listed in Table 703-4.
4) Culverts with upstream drainage areas of 1 square mile or larger are also under the jurisdiction of the IDNR. A Construction in a Floodway permit will be

required for construction of such culverts, and the culvert design shall address all requirements specified by the permit.

E) Open Channel Design

1) Open channels can generally be organized into two categories: artificial (or constructed) channels and natural channels. Artificial open channels are man-made channels including a typical geometric cross-section, such as ditches and swales. Natural channels have been formed over time by nature including irregular cross-section geometry, such as creeks, streams, and rivers.

a) Open Channel Capacity and Design Method Requirements

(i) Minimally, all open channels shall accommodate the peak runoff from the 10-year storm event. Additional capacity may be required or desirable, based on the proposed function of the open channel system, upstream and downstream obstructions and restrictions, and proximity to nearby buildings and structures.

(ii) Uniform sections of artificial open channels may be designed using Manning's Equation, as listed in Section 703-C-1. Calculation results shall be submitted with the Drainage Permit Application.

(iii) Natural channels and non-uniform sections of artificial channels shall be designed utilizing the Step Backwater Method, or Standard Step Method. Computer programs such as HEC-RAS shall be utilized for completing hydraulic analysis of channels requiring the Step Backwater Method. Modeling results and tables shall be submitted with the Drainage Permit Application.

b) Open Channel Geometry and Stability Requirements

(i) The channel cross-section and grade are generally determined by the design capacity. A minimum channel depth may be necessary to provide adequate outlets for pipe outfalls, tributary ditches, subsurface drains, and to control backwater effects on upstream systems.

(ii) The channel grade, or slope, shall be such that the design velocity reduces potential for both siltation and erosion. The minimum design velocity is 1.5 ft/sec to avoid siltation. Reference Table 703-5 includes maximum design velocities based on type of vegetation lining the channel.

(iii) Channel side slopes shall be no steeper than 3 (horizontal) to 1 (vertical) for safety, erosion control, stability, and ease of maintenance.

(iv) Characteristics of a stable channel are as follows:

- It neither aggrades nor degrades beyond tolerable limits.
- The channel banks do not erode to the extent that the channel cross section is changed appreciably.
- Excessive sediment bars do not develop.

- Excessive erosion does not occur around culverts, bridges, or elsewhere.
- Gullies do not form or enlarge due to uncontrolled surface flow to the channel.

(v) Channel stability shall be evaluated for an aged condition. The velocity shall be based on the design flow or the bank full flow, whichever is greater. The bank full flow is defined as the maximum flow that a stream channel can carry without overflowing.

(vi) Channel stability shall also be evaluated for a post-construction condition. The velocity shall be based on the 10-year peak flow or the bank full flow, whichever is smaller. The allowable velocity in newly constructed channels may be increased by a maximum of 20 percent to reflect the effects of vegetation to be established under the following conditions:

- The soil and site in which the channel is to be constructed are suitable for rapid establishment and support of erosion controlling vegetation.
- Species of erosion controlling vegetation adapted to the area and proven methods of establishment are shown.
- The channel design includes detailed plans for establishment of vegetation on the channel side slopes.

(vii) Reference Table 702-2 includes n-values to be used for open channel analysis, including channel stability. The n-value for newly constructed channels in fine grained soils and sands shall not exceed 0.025.

c) Additional Coordination for Open Channel Design

(i) If a project involves channel relocation and/or restoration, coordination with the City Engineer and Delaware County Surveyor's Office is required. Coordination with additional state and federal agencies may also be required based on the scope and nature of the project.

(ii) Coordination with the Delaware County Surveyor's Office is required for any proposed impacts to open channels or subsurface drains recorded as Regulated Drains.

(iii) Open channels with upstream drainage areas of 1 square mile or larger are also under the jurisdiction of the IDNR. A Construction in a Floodway permit may be required based on the scope and nature of the project. The project design shall address all requirements specified by all permits required by the project.

F) Reference Figures and Tables:

Table 703-1 Manning's n for Closed Conduits [1]

Closed Conduit Material	Minimum	Average	Maximum
Steel			
1. Lockbar and welded	0.010	0.012	0.014
2. Riveted and spiral	0.013	0.016	0.017
Cast Iron			
1. Coated	0.010	0.013	0.014
2. Uncoated	0.011	0.014	0.016
Corrugated Metal	0.021	0.024	0.030
Concrete	0.011	0.013	0.014
Vitrified Clay			
1. Drainage Tile	0.011	0.014	0.020
2. Sewer	0.013	0.015	0.017
Brick	0.012	0.015	0.017

[1] Adapted from the Delaware County General Drainage Standards

Table 703-2: Maximum Structure Spacing

Pipe Size	Maximum Structure Spacing
12" – 42" diameter	400'
48" diameter and larger	600'

Table 703-3: Allowable Spread Requirements

Roadway Classification	Number of Travel Lanes	Design Storm Frequency	Allowable Spread
Local	2	10-year	4' into travel lane
Collector	2	10-year	3' into travel lane
Arterial	4	10-year	6' into travel lane

Table 703-4: Culvert Design Requirements

Roadway Classification	Roadway Serviceability Design Storm Event	Serviceability Freeboard	Energy Dissipator Outlet Velocity Design Storm Event
Local	25-year	0 feet	25-year
Collector	50-year	1 foot	25-year
Arterial	100-year	2 feet	50-year

Table 703-5 Maximum Channel Design Velocities based on Vegetation Lining [1]

Channel Cover Category	Slope Range (percent)	Permissible Velocities (ft/sec)
Bermuda Grass	0 – 5 5 – 10 Over 10	6.0 5.0 4.0
Bahia, Buffalo grass, Kentucky Bluegrass, Blue Gama	0 – 5 5 – 10 Over 10	5.0 4.0 3.0
Grass mixtures, Reed Canarygrass	0 – 5 5 – 10	4.0 3.0
Lespediza sericea, Weeping lovegrass, Yellow bluestem, Redtop, Alfalfa, Red fescue	0 – 5	2.5
Common lespedeza, Sudangrass	0 – 5	2.5

[1] Adapted from the Delaware County General Drainage Standards

Figure 703-1 Storm Sewer Pipe Capacity Calculation Spreadsheet (available for download on the City of Muncie website)

Figure 703-2 Storm Sewer Inlet Spacing Calculation Spreadsheet (available for download on the City of Muncie website)

704 Erosion Control

A) Purpose and Background

1) This section outlines key principles, techniques, and standards for stormwater management, pollution prevention, erosion control, and sediment control. Stormwater management aims to reduce the amount of water flowing over

disturbed areas. Pollution prevention is intended to reduce the introduction of sediment, trash, biological waste, and external chemicals such as concrete washout and gasoline into the environment. Erosion control is intended to keep soil in place. Sediment control aims to capture sediment after it has been displaced and keep it out of waterways and pipes. This section will cover all such measures to be taken during construction, while Section 705 will cover post-construction.

2) As mentioned in Section 701, all land-altering projects are required to submit a Construction Site Sediment & Erosion Control Permit to the Muncie Sanitary District (MSD) Stormwater Inspector for review, regardless of the amount of land disturbance on the project site.
3) For land-altering projects with land disturbance of one acre or more, a Construction Stormwater General Permit (CSGP) approved by IDEM is also required. A SWPPP review by the MSD Stormwater Inspector or Delaware County SWCD is required as part of the CSGP process.
4) Applications for the Construction Site Sediment & Erosion Control Permit and SWPPP Review can be accessed at the MSD Stormwater Management website. Reference Figure 704-1 includes a flowchart outlining the permitting and SWPPP review process. Sections 704-B – 704-D provide additional resources and information to assist with design of erosion and sediment control measures and SWPPP preparation.

B) References and Resources

1) MSD Construction Stormwater Resources
   a) The Muncie Sanitary District provides updates on guidance related to stormwater and construction.
2) Indiana Storm Water Quality Manual
   a) The Indiana Storm Water Quality Manual (ISWQM) provides guidelines and specific storm water quality measures for controlling soil erosion; controlling and treating the nonpoint source pollution associated with sediment-laden run-off; and the management and treatment of pollutants associated with post-construction land uses. Adhering to these guidelines and properly applying appropriate storm water quality measures will help minimize the adverse impacts that land disturbance, construction activity, and development can have on soil and water resources, and ultimately, the cost of those impacts to society as a whole. In addition to a variety of storm water quality measures, the manual also discusses the philosophy and planning procedures critical to developing an effective storm water pollution prevention plan.
3) INDOT Storm Water Management Field Guide

a) The INDOT Storm Water Management Field Guide provides guidance on the critical factors of management, understanding, setup, inspection, maintenance, and removal of storm water control features. The guide is organized to provide an effective process for use of BMPs for effective stormwater management, including communication, work management, stormwater management, erosion control, and sediment control.

C) Standard Measures and Details

1) This section includes summaries of standard stormwater management, pollution prevention, erosion control, and sediment control measures that are commonly used throughout the City of Muncie. Corresponding standard details are available for each standard measure. Standard details are available in Appendix A of this Manual.

2) Stormwater Management

a) Pump Around:

(i) A pump around should be used as a method of diverting water, typically from a surface stream, around a work area. Pump arounds are typically used when an existing stream or storm system is disturbed. By utilizing pumps, the excess water can be safely conveyed to an appropriate location around the construction site.

b) Diversion Dikes:

(i) Diversion dikes are berms and/or ditches that divert runoff from steep slopes or streambanks. Runoff is then discharged into a stable area or BMP. Standard side slopes and grades should be used similar to traditional ditches.

c) Temporary Slope Drains:

(i) Temporary slope drains are conduits that convey stormwater down disturbed slopes and prevent erosion. They typically also have outlet protection. They collect runoff from a large area at the top of the slope and discharge at the toe of the slope. Slope drains are typically piped rather than open.

d) Cofferdams:

(i) Cofferdams are temporary structures built to keep water and/or soil out of an excavation or construction site. Once enclosed, the area within the cofferdam is dewatered and a platform or foundation is typically built within it. Cofferdams must be impermeable and unable to erode.

3) Pollution Prevention

a) Concrete Washout:

(i) Concrete wastewater arises from various sources such as concrete truck washouts, road construction, sidewalk construction, and many more. To prevent potential environmental hazards, concrete washout

areas are specifically designated zones that can either be prefabricated units or constructed measures. The primary purpose of these areas is to effectively confine and contain concrete slurry. It is crucial to note that uncured concrete and its associated liquids possess high alkalinity. Failure to properly contain these substances can result in leaching, potentially contaminating the soil and posing a risk to groundwater or nearby water bodies by causing elevated pH levels that are harmful. Additionally, heightened pH levels in the soil can impede the growth of vegetation. In addition to concrete slurry, concrete wash water such as water used to clean tools should also be stored in concrete washout containers.

b) Check Dams:
   (i) A check dam is a temporary stone and geotextile barrier constructed across a ditch or channel. They reduce erosion by decreasing the velocity of channel flow. Check dams should be linearly spaced such the weir of the downstream dam is level with the toe of the upstream dam. The weir should be placed in the center of the check dam.

c) Dewatering
   (i) Dewatering is the process of removing water from an excavated area or material. This is typically done on many bridge, storm sewer, and pond construction projects. Water that results from this process should be filtered and outletted in a stabilized area.

4) Erosion Control

a) Turf Reinforcement Mat:
   (i) Turf reinforcement mats (TRMs) are synthetic, non-biodegradable mats used for permanent applications to prevent erosion and promote vegetation growth. TRMs can be made from a variety of materials including wood fiber, coconut fiber, straw, or synthetic materials.

b) Erosion Control Blanket:
   (i) Erosion control blankets are a manufactured surface protection product that act as a specialized mulching material and are normally used on long or steep slopes and in concentrated flow channels. Erosion control blankets are used for temporary applications and can prevent erosion by protecting the soil from rainfall impact, overland water flow, concentrated runoff, or wind. The blankets may also be anchored with pins in critical areas.

c) Temporary Seeding:
   (i) Temporary seeding can stabilize bare soil and is intended to last up to several months. This is one of the least expensive erosion control

measures and can significantly reduce dust, mud, and sediment. As soon as possible, this should be replaced with permanent seeding.

d) Outfall Protection:
   (i) Outfalls at the downstream end of culverts or pipes should have headwalls, riprap, or some other form of armoring to prevent erosion around them. Geotextile should be used under the riprap, which should be placed such that water flows through the middle of the armored area. Riprap should also not be placed so high that sediment will block the waterway.
e) Sod:
   (i) Sod may also be used to establish grass growth in a disturbed area and prevent erosion. Sod is typically intended to be permanent. Permanent vegetation stabilizes areas and minimizes the need for maintenance. Gaps between sod edges should be minimized.

5) Sediment Control
   a) Construction Entrance:
      (i) A construction entrance serves as a designated access point to a construction site and is constructed using geotextile layered under stone. The primary objective of a construction entrance is to facilitate the movement of vehicles in and out of the site while minimizing the tracking of mud and sediment onto public roadways.
   b) Silt Fence:
      (i) Silt fences are geotextiles or plastic sheets supported by posts. They are often used around the perimeter of a disturbed area to capture sheet flow and allow silt to deposit. They are only to be used in sheet flow conditions. They should be constructed in a J shape with the excess on the bottom facing upstream and entrenched.
   c) Temporary Inlet Protection:
      (i) Inlet protection temporarily blocks or covers an inlet that leads to a storm sewer, preventing sediment from entering a storm system while land is disturbed. Inlet protection can take many forms, such as filter bags, rock rings, fiber mats, silt fences, block and gravel, filter socks, and more. Filter bags are textile bags that cover the top of the inlet. Rock rings are rocks that surround the inlet. Filter socks are defined above.
   d) Culvert Inlet Protection:
      (i) Like other inlets, culverts must be protected from sediment to prevent it from entering waterways. Culvert inlet protection can include such practices as rock rings and filter socks.
   e) Filter Sock:

(i) Filter Socks are typically used as berms or perimeter protection. They consist of a mesh tube or coir roll filled with organic material such as straw and are attached to the ground. Their primary purpose is to effectively reduce the velocity of runoff water, filter sediment, and temporarily retain small volumes of water. They may be a practical alternative in situations where tree clearing or roots would hinder silt fences.

f) Sediment Traps:

(i) Sediment traps reduce sediment release by allowing water to pool and sediment to settle out of it. Sediment traps should be placed near the downstream end of a construction site or just upstream of a waterway. Sediment traps typically hold runoff from up to 5 acres.

g) Dust Control

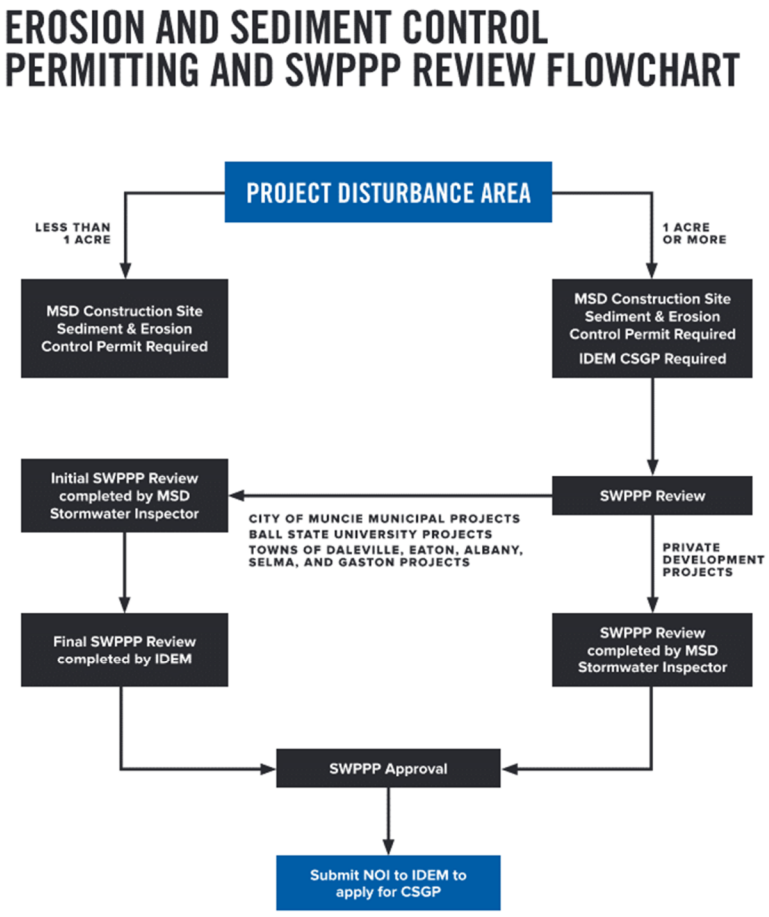
(i) Wind erosion can also play a part in sediment release. It can be reduced by applying water, polymer, mulch, or seeding, or by street sweeping.

h) Buffers:

(i) Vegetative buffers can be above or below a construction site and often consist of preexisting vegetation that has been preserved for this purpose. They can filter sediment, reduce runoff volume and velocity, and promote infiltration. They are most effective in flat areas.

D) References Figures and Tables

Figure 704-1 MSD Permitting and SWPPP Review Process



705 Post Construction Stormwater Management Standards

A) Purpose and Background

1) This section focuses on strategies and measures aimed at effectively managing stormwater runoff from developed areas after construction activities are completed. Post-construction BMPs play a crucial role in mitigating the impacts of urbanization on water quality and quantity, ensuring the long-term sustainability of our natural water resources. The use of these BMPs is necessary for compliance with the CSGP and City of Muncie MS4 General Permit.

2) Types of BMPs vary widely but primarily can be grouped into three categories: structural, non-structural, and green infrastructure. Structural BMPs are physical structures that can improve stormwater quality and quantity. Non-structural BMPs are actions that can reduce, but not completely replace, the need for structural BMPs. Green infrastructure can be similar to structural BMPs but incorporates nature-based elements to assist in improving water quality and controlling water quantity.

B) Post-Construction Stormwater Management Requirements

1) Water Quality

a) Per the CSGP and City of Muncie MS4 General Permit, it is required that post-construction BMPs treat the water quality volume (WQV), which is the volume of water resulting from the initial one inch of rainfall, also known as the “first flush”. This volume can be determined by multiplying the depth of one inch of rainfall by the volumetric runoff coefficient (Rv) and the site area. The WQV can be calculated as follows:

$$WQv = \frac{(R_v)(P)(A)}{12}$$

Where:

- WQv = water quality volume for each site’s outlet (acre-feet)
- P = 1 inch
- Rv = volumetric runoff coefficient
- A = area in acres
- The volumetric runoff coefficient is a measure of imperviousness for the contributing area, and is calculated as:

  Rv = 0.05 + 0.009(I)

Where:

- I is the percent impervious cover

2) Water Quantity

a) Water quantity control is a critical component of stormwater management that focuses on mitigating the impacts of increased peak flows caused by development. According to the CSGP, Post-developed peak flow should not exceed pre-developed peak flow based on 2-, 10-, & 100-year storms. This is generally accomplished through stormwater storage facilities, such as retention and detention, described in Section 703.

C) Recommended Post-Construction Best Management Practices

1) Structural

a) Table 705-1 summarizes recommended structural post-construction BMPs. It is important to note that not all BMPs are capable of both controlling water quantity and treating the water quality volume. Therefore, the type of performance is also indicated in Table 705-1.

Table 705-1: Recommended Structural Post-Construction BMPs

BMP	Description	Controls Water Quantity	Treats Water Quality Volume
Wet Retention Pond	Stormwater storage systems including permanent pools of water.	Yes	Yes
Dry Detention Basin	Temporarily stores stormwater runoff following rain events.	Yes	Yes
Vegetated Swale	Open channel with grass or similar vegetation capable of infiltrating and filtering.	No	Yes
Filter Strip	Strip of vegetation that filters sheet flow.	No	Yes
Proprietary Device	Hydrodynamic separators and other engineered systems that can filter water in many different ways.	No	Yes
Underground Storage	Underground structures that temporarily store stormwater runoff following rain events.	Yes	Yes

b) Wet Retention Ponds

(i) Wet retention ponds are graded areas designed to hold water at a certain level permanently and retain even more during and after storm events before eventually draining to their usual level. They typically

feature pipes in and out, sometimes with a control structure controlling the flow rate out. See Chapter 3 for specific design guidance.

c) Dry Detention Basins
   (i) Dry detention basins are similar to wet retention ponds, except they do not retain water permanently. They drain fully during dry periods. See Chapter 3 for specific design guidance.

d) Vegetated Swales
   (i) Vegetated swales are vegetated channels that capture and treat stormwater runoff, often with check dams or other obstructions separating cells. These swales typically have shallow slopes to allow for more infiltration and settling of sediment. They are also usually only used in areas with little impervious area.

e) Filter Strips
   (i) A filter is a vegetated strip of land with heavy vegetation and uniform grading that infiltrates and filters sheet flow. They are typically placed along wide but hydraulically short areas such as parking lots.

f) Proprietary Devices
   (i) Some proprietary devices, such as hydrodynamic separators, can treat the water quality volume through settling and/or cyclonic separating functions. Refer to the City of Indianapolis Stormwater Quality Unit (SQU) Selection Guide for more information including unit sizing and treatment capabilities.

g) Underground Detention
   (i) Underground detention can come in many forms and can improve water quantity by providing temporary storage and a controlled release rate.

2) Non-Structural

a) Non-structural BMPs focus on reducing the amount and/or impacts of stormwater runoff. Non-structural BMPs generally considered at the design level and are an indirect way of reducing runoff and impacts. They area not to be substituted for BMPs that directly affect quality and quantity. Some examples are listed below.
   - Minimizing total disturbed area
   - Minimizing soil compaction
   - Re-vegetating/re-foresting disturbed areas, especially with native species
   - Street sweeping
   - Reducing street and parking impervious area
   - Clustering uses on each site
   - Trash cleanup
   - Minimizing fertilizer application

- Not stockpiling mulch or sediment on pavement

3) Green Infrastructure

Similar to structural BMPs, green infrastructure has the ability to store and treat stormwater runoff by incorporating low-impact solutions that combine engineered and nature-based stormwater management methods. Table 705-2 provides a summary of recommended green infrastructure BMPs.

Table 705-2: Recommended Green Infrastructure Post-Construction BMPs

BMP	Description	Controls Water Quantity	Treats Water Quality Volume
Bioretention	Similar to a detention basin, but with a focus on infiltrative soils and plants. Typically small, like a rain garden.	Yes	Yes
Stormwater Wetland	Similar to a retention pond, but with a focus on infiltrative soils and plants.	Yes	Yes
Bioswale	Similar to a vegetated swale, but with a focus on native, infiltrative plants.	No	Yes
Permeable Pavement	Pavement or pavers with the capacity to infiltrate water.	Yes	Yes
Infiltration Basin	A stormwater storage facility in which water is absorbed on-site and does not include a surface outlet.	Yes	Yes
Green Roofs	Vegetated roof including storage to capture stormwater runoff on-site.	Yes	Yes

a) Bioretention Areas

(i) Bioretention areas are graded areas containing vegetation and infiltrative soils. They typically drain between rain events. They are typically small areas, such as roadside rain gardens. Construction documents shall include plan and profile views, grading plans, design storm ponding elevations, vegetation specifications, planting specifications, soil specifications, and outlet structure details.

b) Stormwater Wetlands

(i) Stormwater wetlands are artificial wetlands that improve water quality and control water quantity. Construction documents shall include plan and profile views, grading plans, design storm ponding elevations, vegetation specifications, planting specifications, soil specifications, and outlet structure details.

c) Bioswales

(i) Bioswales are similar to vegetated swales as described above. Bioswales focus more on native, infiltrative plantings to promote drainage and natural habitats. Construction documents shall include grading plans, typical sections, planting specifications, and soil specifications.

d) Permeable Pavement/Pavers

(i) Pervious pavement is pavement made of a porous material that promotes drainage. Permeable pavers are pavers separated by loose, porous aggregate. Permeable articulating concrete blocks are pavers separated by small outcroppings that create void space between the blocks. These types of pavement and pavers are typically used in parking areas, sidewalks, and walkways and can be useful when both infiltration and pavement are needed. Underdrains are required. Construction documents shall include pavement or paver details, grading plans, pavement specifications, aggregate specifications, underdrain details, and outlet structure details.

e) Infiltration Basin

(i) Infiltration basins are similar to detention ponds, but instead of discharging water downstream, water is designed to infiltrate into the ground. Infiltration basin design shall include infiltration testing using the Double Ring Infiltrometer Method. Construction documents shall include infiltration testing results, geotechnical information, grading plans, soil specifications, and planting specifications.

f) Green Roofs

(i) Green roofs include soil and plantings on roofs to decrease peak runoff from roofs. Rooftop areas can contribute a significant amount of runoff, so by decreasing peak flows from them, the need for infrastructure within the right of way can be reduced. Construction documents shall include plan and profile details, planting specifications, soil specifications, outlet structure, and roof drainage details.

800- Water

801 Water Line Excavation

A) Refer to Indiana-American Water Pipeline Specifications (November-2019 or latest) for water line excavation requirements.

B) Payment for water line excavation shall be on a C.Y. basis as either unclassified or rock. Cost shall include all necessary labor, equipment, material, shoring, trench boxes, and dewatering necessary to perform the work

802 Pipe Bedding and Support

A) Refer to Indiana-American Water Pipeline Specifications (November-2019 or latest) for water pipe bedding and support requirements.

B) Payment for pipe bedding shall be included in Item 804.

803 Pipe Backfill

A) Refer to Indiana-American Water Pipeline Specifications (November-2019 or latest) for water pipe backfill requirements.

B) Payment for pipe backfill shall be made on a per ton basis for crushed stone backfill and an in-place cubic yard basis for select fill. Cost shall include all necessary labor, material, equipment, hauling, and compaction necessary to furnish in place.

804 Pipe Laying

A) Refer to Indiana-American Water Pipeline Specifications (November-2019 or latest) for water pipe laying requirements.

B) Payment for the installation of water line shall be on a linear foot basis by type of pipe (e.g. 12-inch ductile iron, 8-inch PVC, etc.). Cost shall include all labor, material, bedding, equipment, shoring, testing, disinfection, and supports necessary to furnish pipe in place

805 Pipe Fittings and Appurtenances

A) Refer to Indiana-American Water Pipeline Specifications (November-2019 or latest) for water pipe fittings and appurtenances requirements

B) Payment for the installation of pipe fittings and appurtenances shall be on a per each basis by fitting type (e.g. 12-inch ductile iron 45-degree bend). Cost shall include all labor, material, bedding, equipment, shoring, testing, disinfection, and supports necessary to furnish fitting in place.

806 Surface Water Crossings

A) Refer to Indiana-American Water Pipeline Specifications (November-2019 or latest) for surface water crossing requirements for water pipe

900- Sewer

901 Sewer Site Clearing and Rough Grading

A) Work Included

1) Clear site of brush and vegetation.
2) Remove all debris including but not limited to logs, stumps, rubbish, sludge, and other perishable matter.

3) Remove trees designated by the drawings to be removed. Removal shall also include the stump and roots.
4) Remove sidewalks and street pavement within the limits of required trenching as trenching progresses.
5) Remove completely all tanks required to be removed.
6) Remove large boulders.
7) Excavate topsoil and when applicable stockpile for later reuse.
8) Excavate subsoil and when applicable stockpile for later reuse.
9) Rough grade site.

B) Project Record Documents
1) Accurately record location of utilities discovered by horizontal dimensions, elevations or inverts, and slope gradients.

C) Protection
1) Protect trees and shrubs that do not interfere with the construction and trees and shrubs not designated to be removed.
2) Protect all above or below grade utilities. (See Section 204 under Existing Conditions and Site Preparation).
3) Carefully maintain existing benchmarks, monuments, and other reference points.
4) Repair any damage.

D) Materials
1) Topsoil: Excavated material, graded free of roots, rocks larger than 1 inch, subsoil, debris, and large weeds.
2) Subsoil: Excavated material, graded free of lumps larger than 6 inches, rocks larger than 3 inches, and debris.

E) Preparation
1) Identify required lines, levels, and other location datum.
2) Identify known below grade utilities. Stake and flag locations.
3) Identify and flag above grade utilities.
4) Maintain and protect existing utilities.
5) Notify utility companies concerning removal and relocation of utilities requiring removal or relocation (See Section 204 under Existing Conditions and Site Preparation).
6) Upon discovery of unknown utility or concealed conditions, discontinue affected work and notify the Engineer (see Section 200- Existing Conditions and Site Preparation).

F) Topsoil Excavation
1) Excavate topsoil from areas to be further excavated and when applicable stockpile on site. Remove excess topsoil from site.

G) Subsoil Excavation

1) Excavate subsoil from designated areas and where applicable stockpile on site for later use as fill material where common fill material is permitted. Remove excess subsoil from site.

H) Removal of Sidewalks and Pavement

1) Sidewalks and pavement shall be removed as trenching progresses. No more than 100 feet of trench ahead of constructed sewer shall be open at any time unless written approval is given by the City Engineer.
2) Openings in streets and sidewalks shall be saw cut with straight, neat, vertical edges, and square corners.
3) Openings shall be made so that there is no section of adjacent existing pavement with a dimension of less than 18 inches unless written approval is given by the City Engineer.
4) Methods used in removal of pavement material shall not cause damage to the adjacent pavement.
5) Where existing pavement contains reinforcing steel; the steel shall not be cut with pneumatic hammers but shall be cut by sawing or gas cutting.
6) All asphalt and concrete shall be removed from the site.
7) Before cutting any street or sidewalk within the public right of way the Contractor shall obtain a Right of Way permit from the City of Muncie Public Works Department.
8) The Contractor shall comply with all the requirements contained in the Right of Way permit in addition to the requirements of the Contract Documents.

I) Payment for Sewer line excavation shall be on a B.C.Y basis as either unclassified or rock. Cost shall include all necessary labor, equipment, material, shoring, trench boxes, and dewatering necessary to perform the work

1) Quantities for sewer line excavation shall be determined based on the following
   a) Sewer Line- Pipe Length x Pipe Depth x (Normal Trench Width)

Allowable Trench Width (Inches)			
Pipe Dia.	Min	Max	Normal
6	9	30	19.5
8	12	32	22
12	18	36	27
15	22.5	39	30.75
18	27	42	34.5
21	31.5	45	38.25

24	36	48	42
30	45	54	49.5
36	54	60	57

b) Manholes- (Manhole exterior diameter + 3) * pi * (Depth of manhole from final grade to base elevation + 6 inches)

902 Sewer Line Trenching

A) Work Included

1) All open cut excavation for main sewers, laterals, manholes, and catch basins.
2) All applicable requirements of 29 CFR Part 1926 (Safety and Health Regulations for Construction) Subpart P – Excavations (Standard Number 1926.650).
3) All required dewatering.
4) All backfilling and compaction in addition to that called for by other sections.

B) Tests

1) In addition to any soils information provided by explorations and reports included in the Contract Documents, the Contractor shall be responsible for the determination of the angle of repose for the various soils encountered in the Work. These tests and reports shall be provided by accepted qualified professionals.

C) Protection

1) Notify Safety, Health, and Public Agencies. (See Section 100- General Notes and Requirements).
2) Walkways, runways, and sidewalks shall be kept clean of excavated material or other obstructions and no sidewalk shall be undermined unless shored to carry a minimum live load of 125 pounds per square foot.
3) If planks are used for raised walkways, runways, or sidewalks, they shall be laid parallel to the length of the walk and fastened together against displacement. Planks shall be uniform in thickness and all exposed ends shall be provided with beveled cleats to prevent tripping. Raised walkways, runways, and sidewalks shall be provided with plank steps on strong stringers.
4) When the excavation approaches the estimated location of underground installations (sewer, telephone, water, fuel, electric lines, field drains, etc.) the exact location shall be determined and when it is uncovered, proper supports shall be provided for the existing installation. (See also Section 204 under Existing Conditions and Site Preparation).
5) Trees, boulders, and other surface encumbrances, located so as to create a hazard to employees involved in excavation work or in the vicinity thereof at

any time during operation, shall be removed or made safe before excavation has begun.

6) Notify the Engineer of unexpected subsurface conditions and discontinue work in affected area until notification to resume work. (See Section 200- Existing Conditions and Site Preparation).
7) Specific Trenching Requirements:
   (i) Where adjacent buildings and walls are endangered by excavation, shoring, bracing or underpinning shall be provided as necessary to ensure their safety. Such shoring, bracing, or underpinning shall be inspected daily and as conditions warrant by a competent and experienced representative of the Contractor.
   (ii) Banks more than 5 feet high shall be shored, laid back to a stable slope, or some other equivalent means of protection shall be provided where employees may be exposed to moving ground or cave-ins. Refer to 29 CFR Part 1926 Subpart P, Appendix B (§ 1926.652(b)(2) as a guide in sloping banks.
   (iii) Trenches less than 5 feet in depth shall also be effectively protected when examination of the ground indicates hazardous ground movement may be expected.
   (iv) Sides of trenches in unstable or soft material, 5 feet or more in depth shall be shored, braced, sloped, or otherwise supported by means of sufficient strength to protect the employees working within them. Refer to 29 CFR Part 1926 Subpart P, Appendices A thru F.
   (v) Sides of trenches in hard or compact soil, including embankments shall be shored or otherwise supported when the trench is more than 5 feet in depth and 8 feet or more in length.
   (vi) Portable trench boxes or sliding trench shields may be used for protection of personnel in lieu of a shoring system or sloping. Where such trench boxes or shields are used, they shall be designed, constructed, and maintained in a manner that will provide protection equal to or greater than the sheeting or shoring required for the trench.
   (vii) Materials used for sheeting and steel piling, bracing, shoring, and underpinning, shall be in good serviceable condition, and timbers used shall be sound and free from large or loose knots and shall be designed and installed so as to be effective to the bottom of the excavation.
   (viii) Additional precautions by way of shoring and bracing shall be taken to prevent slides or cave-ins when excavations or trenches are made in locations adjacent to backfilled excavations, or where excavations are subject to vibrations from railroad or highway traffic, the operation of machinery, or any other source.

(ix) Backfilling and removal of trench supports shall progress together from the bottom of the trench. Jacks or braces shall be released slowly and, in unstable soil, ropes shall be used to pull out the jacks or braces from above after employees have cleared the trench.

8) Support systems shall be planned and designed by a registered professional engineer or other duly licensed or recognized authority when the excavation is in excess of 20 feet in depth, adjacent to structures or improvements, or subject to vibration or ground water.
9) When employees are required to be in trenches 4 feet deep or more, an adequate means of exit, such as a ladder or steps, shall be provided and located so as to require no more than 25 feet of lateral travel.
10) Blasting and the use of explosives shall be performed in accordance with 29 CFR Part 1926, SubPart U (§1926.900) and all existing laws, ordinances, and regulations. All blasting shall be done under the direction of an authorized and qualified person to handle and use explosives.
11) Excavation or other material shall not be stored nearer than 4 feet from the edge of any excavation.
12) Diversion ditches, dikes, or other suitable means shall be used to prevent surface water from entering an excavation and to provide adequate drainage of the area adjacent to the excavation. Water shall not be allowed to accumulate in an excavation.
13) All costs for the protection work described above shall be borne by the Contractor.

D) Granular Fill Materials
1) See Section 904 Sewer Line Backfill.

E) Common Fill Materials
1) Excavated subsoil free from stones larger than 3 inches, debris, spongy, yielding of frozen materials, stumps, roots, all or part of trees, brush, weeds, and other perishable materials.

F) Excavation
1) Trenches for pipe sewers, manholes, house connections, and other structures up to and including 33 inches internal diameter or width shall be excavated to a width that will provide for side clearance of not less than 6 inches nor more than 9 inches on each side of the pipe, manhole or structure. Trenches for pipe or structures larger than 33 inches internal diameter or width shall be excavated to a width that will provide for a side clearance of not less than 6 inches or more than 12 inches.
2) Unless otherwise directed or permitted by the Engineer in writing, not more than 100 feet of any trench shall be excavated in advance of the end of a completed sewer line. Unless approval to the contrary is given, a trench in dry

ground shall be excavated within 6 inches of the required full depth for a distance of at least 30 feet in advance of pipe laying.

3) Side walls of pipe trenches shall be vertical from a point 6 inches below the required depth of the bottom of the pipe to a point 12 inches above the top of the pipe. No additional costs will be allowed for backfill where trenches are excavated beyond the limits described in these specifications and by the drawings.
4) Where soft, yielding, or other unsuitable material is encountered in trench bottoms, the unsuitable material shall be removed and the depression resulting from this removal shall be filled with satisfactory material and compacted to conform with the surrounding trench bottom surface.
5) Where rock is encountered in a trench, the Contractor shall open the trench to full depth for at least 50 feet in advance of completed sections of sewers. The minimum dimensions of the excavation in rock for a manhole, catch basin, or flush tank shall be those of a prism having a vertical depth 6 inches deeper and horizontal widths 12 inches wider than the smallest prism that will contain such structures centered therein. Rock shall be excavated 6 inches below the required depth of the bottom of sewer pipe. All completed sections of sewers shall be backfilled with at least 12 inches of granular material above the pipe prior to any blasting and the end of the completed sewer, together with as much of the barrel as cannot be conveniently covered with fill, shall be protected by sandbags to prevent damage.

903 Sewer Jacking, Boring, and Tunneling

A) Work Included
   1) All Jacking, Boring, or Tunneling where shown on drawings or required by permit(s). Unless otherwise expressly indicated; sewers shall be jacked or tunneled under all railroads.
   2) All required sheeting, shoring, and bracing.
   3) All required dewatering.
   4) Installation of sewer pipe in steel casing or tunnel.
   5) All backfilling and compaction in addition to that called for by other sections.

B) Tests
   1) In addition to any soils information provided by explorations and reports included in the Contract Documents, the Contractor shall make all arrangements for and pay all costs involved for additional soil testing. These tests and reports shall be provided by accepted and qualified professionals.

C) Protection
   1) The Contractor shall comply with all rules, regulations, and practices of any agency (i.e. Indiana State Department of Highways, Railroads, Muncie

Engineering Department, Delaware County Engineer, or Utility) whose property is involved in this work.

2) Approach trenches for jacking, boring, or tunneling under railroads shall not be excavated closer to any outside rail than a horizontal distance equal to the required depth of the sewer invert below the base of the rail.
3) Sheeting, shoring, and bracing shall be provided as necessary to provide protection to the agency's property.
4) Sides of trenches shall be shored, sheeted, and braced to protect employees working within them in accordance with 29 CFR Part 1926 Subpart P.

D) Steel Casing

1) Steel casing shall conform to the requirements of ASTM A53, Type E or S Grade B, Or ASTM A 139 Grade B with a yield strength of 35,000 PSI and tensile strength of 60,000 PSI.
2) Minimum wall thickness of casing shall be as follows:

Outside Diameter (inches)	**Railway Crossing Wall Thickness (inches)**	**Highway Crossing Wall Thickness (inches)**
12 or less	.250	.250
14-16	.281	.250
18	.312	.250
20	.344	.312
24	.406	.312
30	.500	.375
36	.532	.500
42	.563	.500
48	.625	.625

3) Steel casing wall thickness shall meet the requirements of INDOT and jurisdictional railroads when applicable.
4) Steel casing shall have a diameter to accommodate the designated size of pipe sewer and provide a minimum clearance inside the casing at any point of 4 inches.

5) Casing joints shall be welded in accordance with requirements of Indiana Department of Transportation (INDOT) Standard Specifications. Joints shall be full penetration and water-tight.
6) Manufactured casing spacers or wood blocking spacers are required on the bottom and top to prevent pipe from “floating” during grout filling procedure. Casing spacers should be at 6-foot maximum, center-to-center. Grout filling of annular space is required.

E) Tunnel Liners
1) Tunnel liners shall be formed steel of a recognized type produced by a reputable manufacturer for this purpose. Tunnel liners shall be of such size as to provide for a minimum clearance between the liner and the outside of the pipe sewer of 3 inches at any point.

F) Granular Fill Materials
1) See Section 904 Sewer Line Backfill.

G) Common Fill Materials
1) Excavated subsoil free from stones larger than 3 inches, debris, spongy, yielding of frozen materials, stumps, roots, all or part of trees, brush, weeds, and other perishable materials.

H) Plan Submittal
1) Prior to the beginning of this work, the Contractor shall submit to the Engineer, plans and details describing the materials and methods that he proposes to use, and he shall not proceed with the work until such plans and methods have been approved by the Engineer and any agency involved. The approval of the Engineer of any plan or method shall not relieve the Contractor of his responsibility.

I) Jacking
1) This method shall consist of pushing steel casing into the embankment.
2) All pipe shall be handled, unloaded, and stacked so as to prevent any damage to the ends of the pipe.
3) Excavation shall be undertaken within a steel cutting edge or shield attached to the front section of the casing to form and cut the required opening for the casing. Excavation shall be undertaken with the shield and shall not be carried ahead of the casing far enough to cause loss of soil. When jacking in loose, granular, or running soils, the shield shall have the means for inserting steel baffle plates and shelves for the purpose of preventing voids.
4) Excavation ahead of the liner shall not exceed the distance required to install a single section of liner insofar as is practicable. All voids outside the liner shall be packed full with sand-cement grout mixture placed by grout openings placed and installed in the liner by the manufacturer thereof.

5) The Contractor shall remove from the jacking site all excavated material as the work advances.
6) The Contractor's superintendent and/or engineer experienced in pipe-jacking techniques shall be present at all times while the work is proceeding and shall be responsible for checking line and grade.
7) The thrust wall shall be adequate for installation of jacked pipe. It shall be constructed normal to the proposed line of the thrust.
8) A suitable lubricant, such as bentonite, may be applied to the outside surface of the jacked casing to reduce frictional forces. This shall be accomplished by the use of pressure equipment which pumps the lubricant to the outside of the shield on the lead section or the lubricant may be pumped to the outside surfaces of the casing through grout holes.

J) Boring

1) This method shall consist of pushing the casing into fill with a boring auger rotating within the casing to remove the spoil. Advancement of the cutting head ahead of the casing will not be permitted except for that distance to permit the cutting head teeth to cut clearance for the casing. In the event granular, loose, or unstable soils are encountered during the boring operation, the cutting head shall be retracted into the casing a distance that permits a balance between pushing pressure and the ratio of casing advancement to quality of spoil to assure no voiding is taking place.
2) The use of water or liquids to soften or wash the face will not be permitted. Water may be used in sticky clays to facilitate spoil removal provided water is introduced behind the cutting head.
3) Lubricating agents, such as bentonite, may be used to lubricate the casing and reduce the friction between the casing and the embankment.

K) Tunneling

1) Tunnel lining shall be installed accurately to the line necessary to permit the installation of the pipe sewer at the line and grade shown on the drawings and from the outside of the pipe sewer at least 3 inches from the liner at all joints.
2) Excavation ahead of the liner shall not exceed the distance required to install a single section of liner insofar as practicable. All voids outside the liner and all voids caused by the tunneling operation shall be packed full with sand-cement grout mixture placed by pressure grouting equipment through suitable grout openings placed and installed in the liner by the manufacturer thereof. Grouting shall be placed as the tunnel line installation progresses so as to prevent, insofar as possible, any initial settlement of the material over the tunnel. In soft, unstable ground, various methods of advancing the tunnel are to be used such as the "shield"; "poling plate"; "poling board" or "splinter";

"benching" and "needle beam" method. These may be used singly or in combination depending on ground conditions and the size of the tunnel.

3) The Contractor shall be responsible for the removal of the excavated material as the work progresses.

L) Sewer Pipe

1) Jointing of sewer pipes shall be as specified in Section 1013 Sewer Pipe and Fittings.
2) As the work of installing the pipe sewer progresses, the Contractor shall fill the space between casing or liner and the pipe sewer in accordance with the details shown on the drawings.
3) All shoring, bracing, and sheeting shall be removed and all crevices filled in all pits and trenches.

904 Sewer Line Backfill

A) Refer to details SS-913 through SS-915 for sewer line bedding and backfill information.

B) Granular Fill Material

1) Coarse crushed stone meeting the requirements of INDOT Standard Specifications Section 904, latest edition, shall apply with the following limits:

Sieve Size	No. 5 Percent Passing	No. 11 Percent Passing
1-1/2"	100	
1"	85-98	
3/4"	60-85	
1/2"	30-60	100
3/8"	15-45	75-95
No. 4	0-15	10-30
No. 8	0-10	0-10

2) In lieu of coarse crushed stone the material used between Class "B" Bedding and pavement replacement shown on the Muncie Standard Construction Details and for replacement of soft, yielding, or other unsuitable material encountered in trench bottoms shall be as follows: This material shall be of acceptable quality, free from large or frozen lumps, stones larger than 2 inches in any dimension, wood or other extraneous matter and shall be known as "B" BORROW. It shall consist of suitable sand, gravel, crushed stone, blast furnace slag, or other approved material. Unless otherwise specified; "B" BORROW shall conform to one of the following gradations.

Nominal Sizes

Percent Passing						
Sieve Sizes	**2"**	**1-1/2"**	**1"**	**1/2"**	**No. 4**	**No. 30**
2-1/2"	100					
2"		90-100	100			
1-1/2"	70-100	90-100	100	100		
1"	55-95	70-100	85-100			
3/4"	45-90	55-95	70-100			
1/2"	35-85	40-90	55-95	85-100	100	100
No. 4	20-65	20-70	25-75	45-85	90-100	
No. 8	10-50	10-55	15-60	25-75	75-100	
No. 30	3-35	3-35	3-35	5-45	15-70	70-100
No.200	0-8	0-8	0-8	0-8	0-8	0-8

C) Common Fill Material

1) Excavated subsoil free from stones larger than 3 inches, and debris, spongy, yielding, or frozen materials, stumps, roots, all or parts of trees, brush, weeds, and other perishable materials.

D) Payment for pipe backfill shall be made on a per ton basis for crushed stone backfill and an in-place cubic yard basis for select fill, the cost of deep installations shall be figured as a combination of the stone and fill. Cost shall include all necessary labor, material, equipment, hauling, and compaction necessary to furnish in place.

905 Standard Manhole

A) Work Included

1) Construction of manholes and related items, shown or specified, necessary to complete pipe sewer work.

B) References

1) ASTM C478 – Pre-cast Reinforced Concrete Manhole Sections.
2) ASTM A48 - Gray Iron Castings.
3) ASTM C443 - Joints for Circular Sewer and Culvert Pipe, Using Rubber Gaskets.

C) Manholes shall be constructed by one of the following methods:

1) Reinforced, pre-cast, base sections, riser sections, grade rings, cones and/or flat slab tops;
2) Reinforced Cast-in-Place bases, used in combination with pre-cast riser sections, cones, and/or flat slab tops;
3) Reinforced Cast-in-Place bases, risers, and flat slab tops; or

4) Cast-in-Place bases and unit masonry structure (special concrete block or brick).

D) Precast structures

1) Pre-cast sections shall conform to the requirements of ASTM C478 where 1 line of steel reinforcement is used.
2) Pre-cast Sections shall be steam cured and shall not be shipped from the point of manufacture for at least five days after having been cast.
3) The bottom of the structures shall have pre-cast bottoms or bottoms poured in place with reinforcement as shown on the drawings. All bottoms shall be at least 8 inches thick at the least dimension. Pre-cast or cast-in-place bases shall be constructed of 4000 PSI concrete.

E) Cast-in-Place Structures

1) Cast-in-place structures shall conform to the detailed drawings, except that the structure may be made square instead of round in its horizontal cross-section, with the diameter shown being the side of the square. All concrete shall be a minimum of 4,000 PSI, per the Muncie Sanitary District Standard Drawings. Structures shall be reinforced as indicated on shop drawings submitted by the Contractor and approved by the Engineer.

F) Special Structures

1) Special structures shall correspond in dimensions called for in the Special Details. The blocks shall be thoroughly wetted immediately before being laid. Each block shall be laid separately in a full and close joint of mortar on its bed. Care shall be taken to have every joint full of mortar and slushing in afterwards will not be allowed. All joints shall be trowel struck. Special care shall be taken to ensure a smooth and even surface. Excess mortar is to be scraped off entirely. No joint shall exceed 1/2 inch in thickness. The interiors and exteriors of special structures shall be plastered with 1/2 inch thickness of concrete plaster. The interiors and exteriors of special structures shall be painted with two coats of an approved bituminous waterproofing compound.

G) Castings

1) Manhole castings shall be of good quality gray iron castings conforming to ASTM A48, Class 30B or better. The combined weight of manhole castings shall not be less than 400 pounds.
2) All castings shall be Neenah R-1772, heavy-duty frame and self seal lid, or as approved by the Engineer.
3) Casting to be installed as indicated on the drawings and per detail SS-917.
4) Cones, Risers, and Transition Sections
    1) Transition sections used to change from a manhole base greater than four feet in diameter shall have a minimum length of 16 inches. The transition

section shall be eccentric and shall be reinforced in accordance with the largest diameter of the transition section.

2) Pre-cast manhole risers and cones shall conform to the requirements of ASTM C478. The riser sections shall be a minimum of 48 inches in diameter. The cone sections shall taper from a 48-inch diameter at the bottom to a minimum opening of 24 inches at the top.

H) Payment for manholes shall be by the vertical linear foot based on manhole diameter. Cost shall include all labor, equipment, and material necessary to furnish in-place manholes as described. This includes shaping of inverts, joint material, oakum, sealing, and other ancillary items as necessary to provide a watertight manhole.

906 Manhole Backfill

A) Refer to detail SS-905 for manhole bedding and backfill requirements. Manhole backfilling and compaction shall comply with the requirements as specified for the adjacent sanitary sewer.

B) Payment for backfill of manholes shall be on a per ton basis for roadway installation and on a per cubic yard compacted in place for standard installations. Cost shall include all labor, equipment, material, hauling, and compaction necessary to furnish in place

907 Drop Manholes

A) Where a sanitary sewer or sanitary lateral enters a manhole 24 inches or more above the invert of the outgoing sewer, the incoming sewer shall be connected to the manhole by means of a drop connection.

B) The incoming sewer shall be connected by means of an interior drop connection only. No exterior drop connections shall be made.

C) The drop pipe shall be a minimum of 6 inches in diameter with typical sizing equal to the incoming sewer minus 2 inches. Drop connections shall be secured to the interior wall of the manhole and provide access for cleaning.

D) Payment for drop manholes shall be secondary and additional to payment for standard manholes. Payment shall be based on drop pipe diameter and length of drop pipe. Cost shall include all labor, equipment, and material necessary to install the drop pipe to a standard manhole.

1000- Materials

1001 Soils

A) The INDOT Standard Specifications Section 903 shall apply with the exceptions as noted herein. The current version of the INDOT Specifications, Recurring Special Provisions, and Supplemental Specifications are applicable.

B) Select Fill

1) Fine, sound, loose earth properly conditioned such that it may be compacted to not less than 95 percent maximum density.
2) Shall be free of all organic or otherwise objectionable material.
3) Shall not contain stone, concrete, or pavement that measures more than 5 inches in any given plane.

C) General Fill

1) Generally clean soil that may contain solid debris such as concrete, asphalt, soft crushed stone, or clay clods that can be compacted to not less than 90 percent of maximum density.
2) Shall not contain solid material greater than 8 inches in any given plane.
3) Shall be free of organic material greater than 2 inches in diameter.
4) Shall not be composed of more than 10 percent organic mulch or material if located within 10 feet of a structure or roadway.

1002 Hydraulic Cement

A) The INDOT Standard Specifications Section 901 shall apply with the exceptions as noted herein. The current version of the INDOT Specifications, Recurring Special Provisions, and Supplemental Specifications are applicable.

1003 Aggregates

A) The INDOT Standard Specifications Section 904 shall apply with the exceptions as noted herein. The current version of the INDOT Specifications, Recurring Special Provisions, and Supplemental Specifications are applicable.

1004 Concrete

A) The INDOT Standard Specifications Section 901 shall apply with the exceptions as noted herein. The current version of the INDOT Specifications, Recurring Special Provisions, and Supplemental Specifications are applicable.

1005 Concrete Joint Material

A) The INDOT Standard Specifications Section 901 shall apply with the exceptions as noted herein. The current version of the INDOT Specifications, Recurring Special Provisions, and Supplemental Specifications are applicable.

1006 Reinforcing Steel

A) The INDOT Standard Specifications Section 910 shall apply with the exceptions as noted herein. The current version of the INDOT Specifications, Recurring Special Provisions, and Supplemental Specifications are applicable.

1007 Concrete Curing Materials and Admixtures

A) The INDOT Standard Specifications Section 912 shall apply with the exceptions as noted herein. The current version of the INDOT Specifications, Recurring Special Provisions, and Supplemental Specifications are applicable.

1008 Asphalt Materials

A) The INDOT Standard Specifications Section 902 shall apply with the exceptions as noted herein. The current version of the INDOT Specifications, Recurring Special Provisions, and Supplemental Specifications are applicable.

1009 Pavement Marking Materials

A) The INDOT Standard Specifications Section 921 shall apply with the exceptions as noted herein. The current version of the INDOT Specifications, Recurring Special Provisions, and Supplemental Specifications are applicable.

1010 Water Pipe, Fittings, and Appurtenances

A) All new water mains for public water distribution systems shall meet the requirements of the Indiana-American Water Pipeline Specifications (November-2019 or latest).

1011 Water Meters

A) All water meters for water distribution systems shall meet the requirements of the Indiana-American Water Pipeline Specifications (November-2019 or latest).

1012 Sewer Manholes

A) All sewer manholes shall be constructed by one of the following methods:

1) Reinforced, pre-cast, base sections, riser sections, grade rings, cones, and/or flat slab tops;
2) Reinforced cast-in-place bases, used in combination with pre-cast riser sections, cones, and/or flat slab tops;
3) Reinforced cast-in-place bases, risers, and flat slab tops; or
4) Cast-in-place bases and unit masonry structure (special concrete block or brick).

B) Pre-cast sections shall:

1) Conform to the requirements of ASTM C478 where 1 line of steel reinforcement is used.

2) Be steam cured and shall not be shipped from the point of manufacture for at least 5 days after having been cast.
3) The bottom of the structures shall have pre-cast bottoms or bottoms poured in place with reinforcement as shown on the drawings. All bottoms shall be at least 8 inches thick at the least dimension. Pre-cast or cast-in-place bases shall be constructed of 4000 PSI concrete.

C) Cast-in-Place structures shall:

1) Conform to the detailed drawings, except that the structure may be made square instead of round in its horizontal cross-section, with the diameter shown being the side of the square. All such structures shall be a minimum of 4,000 PSI, per the Muncie Sanitary District Standard Drawings. Structures shall be reinforced as indicated on shop drawings submitted by the Contractor and approved by the Engineer.

1013 Sewer Pipe and Fittings

A) Reinforced Concrete Pipe ASTM C76 Class III or IV Wall B may be used for all sewers 12 inches in diameter and larger unless otherwise specified. Where 2 lines of steel reinforcement are required in reinforced concrete pipe, a single line placed elliptically shall not be accepted. Concrete pipe shall also meet the following requirements:

1) Concrete shall be steam cured, and shall not be shipped for at least 5 days after having been cast.
2) Lift holes will not be permitted in reinforced concrete pipe.
3) Reinforced concrete pipe joints shall be one of the following:
    (i) O-ring rubber gasketed joint material and method of manufacture and jointing shall comply with ASTM C443. The O-ring rubber gasket shall be confined in a notch in the spigot end of the concrete joint and shall be the sole element depended upon to make the joint flexible and watertight.
    (ii) Joints for tongue and grove concrete pipe shall be sealed with rubber gaskets and an external pipe gasket. The rubber gasket shall be similar and equal to "Press Seal" or "Tylox" of the shape and size required. The joints of the pipe shall be made to close tolerances so the rubber gaskets are uniformly compressed around the periphery of each joint when the pipes are drawn together. The external pipe gasket shall consist of a special cold flow sealant coating on a ribbed butyl rubber extrusion and installed according to the manufacturer's recommendations.
4) For approved pipe designed for a mortar seal, Type I cement with an approved admixture shall be used. The admixture shall be "Pozzolith" as manufactured by Master Builders or approved equal.

5) Absorption shall not exceed 5 percent of the dry weight.
6) Pipe shall have a minimum laying length of 4 feet except as otherwise approved by the Engineer for closure or similar conditions.
7) The date of manufacture shall be clearly marked on the inside of the pipe at the grooved end by the use of metal marking dies in letters 3/4 inch high.
8) Variations of the position of reinforcement shall not exceed 1/2 inch from the position provided in the design and clear cover on the reinforcement shall not be less than 1 inch at any point.

B) PVC Type PSM SDR 35 conforming to ASTM D3034 for sizes 6 inches through 15 inches. Minimum laying length of 12.5 feet and maximum of 20 feet. Material shall be classified 12454-A, 12454-B, or 12454-C as defined in Tables 1 and 2 in ASTM D1784. Pipe to be clearly marked at intervals of 5 feet or less as follows:
1) Manufacturer's name or trademark and code.
2) Nominal pipe size.
3) The PVC cell classification, for example 12454-B
4) The legend "Type PSM SDR-35 PVC Sewer pipe, and,
5) This designation is "Specification D-3034".

C) PVC plastic drain, waste, and vent pipe conforming to ASTM D2665 for diameters up to 6 inches. (Must have transition joint to use with PVC Type PSM SDR-35 ASTM D-3034).

D) PVC Plastic Pipe Schedules 40, 80, 120 ASTM D1785 for pressure sewers. Fittings shall conform with ASTM D2466 and ASTM D2467. Marking of the pipe shall include the following, spaced at intervals of not more than 5 feet:
1) Nominal pipe size,
2) Type of plastic pipe material in accordance with the designation code prescribed in 4.5 ASTM C1785,
3) Schedule (40, 80, or 120 whichever is applicable) and the pressure rating in pounds per square inch for water at 73 degrees Fahrenheit shown as a number followed by PSI. When the indicated pressure rating is lower than that calculated in accordance with 4.4 ASTM D1785, this shall be indicated by placing a star after the pressure rating,
4) ASTM designation D1785, with which the pipe complies, and
5) Manufacturer's name (or trademark) and code.

E) PVC Pressure-Rated Pipe SDR 21 for Pressure Sewers ASTM D2241. Material shall be classified 12454-A, 12454-B, or 12454-C as defined in ASTM D1784. Pipe to be clearly marked at intervals of 5 feet or less as follows:
1) Nominal pipe size.
2) The outside diameter system (IPS or PIP) on sizes 14 inches and over.
3) Type of plastic pipe material in accordance with the designation code given in 4.6 ASTM D2241.

4) Standard thermoplastic pipe dimensions ratio in accordance with the designation code given in 4.2 ASTM D2241 (for example, SDR21), or the pressure rating in pounds per square inch for water at 73 degrees Fahrenheit shown as a number followed by PSI except that when intended for pressure applications the pressure rating shall be shown. When the indicated pressure is lower than that calculated in accordance with 4.5 ASTM D2241, the SDR shall also be included in the marking code.
5) ASTM designation D2241, and
6) Manufacturer's name (or trademark) and code. Manufacturer's code to include year, month, day, shift, plant, and extruder of manufacturer.

F) Belled PVC Pressure Pipe. Pipe to be manufactured in accordance with ASTM D1785 or ASTM D2241.

G) PVC large-diameter plastic gravity sewer pipe and fittings conforming with ASTM F679 may be used for sewers having a diameter of 18 inches through 27 inches. The Contractor shall be responsible for furnishing actual loading capacity for the pipe. Actual load conditions shall not exceed loading capacity. Pipe is to be clearly marked at intervals of 5 feet or less as follows:
1) Manufacturer's name or trademark and code.
2) Nominal pipe size.
3) PVC minimum cell classification.
4) Pipe stiffness designation, and,
5) ASTM F679.
6) Fittings in compliance with this specification shall be clearly marked with the following information.
7) Manufacturer's name or trademark and code.
8) Nominal size,
9) Material designation: "PVC", and,
10) This designation: "ASTM F679".

H) PVC Corrugated Sewer Pipe with Smooth Interior and Fittings conforming with ASTM F949 may be used for sewers having a diameter of 4 inches through 8 inches. Pipe sizes of this type do not match sizes of other pipe. An approved transition shall be required if pipe types are mixed. Pipe in compliance with this specification shall be marked on the barrel at intervals not exceeding 5 feet with the following:
1) Manufacturer's name, trade name, or trademark.
2) Nominal pipe size.
3) This designation "ASTM F949".
4) Type of Plastic "PVC" and minimum cell classification, and,
5) Extrusion code, including date and location of manufacture.

6) Fittings in compliance with the specifications shall be marked with the following:
    (i) Manufacturer's name, trade name, and trademark.
    (ii) Nominal size.
    (iii) This designation "ASTM F949", and,
    (iv) Material designation "PVC".

I) PVC Large Diameter Ribbed Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter. (Not to be used without written approval - see 1.04 A. above). Pipe in compliance with this specification shall be marked by the producer per the following example at intervals of 5 feet or less:
1) Manufacturer's name, trade name or trademark, and code.
2) Nominal pipe size in inches.
3) The PVC minimum cell classification as listed in Table 1, specification D1784.
4) The legend "PS 46 PVC Sewer Pipe" or "PS 10 PVC Sewer Pipe", and,
5) This designation, “ASTM F794.”
6) Fittings in compliance with this specification shall be marked with the following:
    (i) Manufacturer's name or trademark and code.
    (ii) Nominal size in inches.
    (iii) The material designation "PVC", and,
    (iv) This designation, “ASTM F794.”
    (v) Manufacturer's code to include day, month, year, shift, plant, and extruder of manufacturer. The markings shall be applied to the pipe in such a manner that they remain legible after installation and inspection have been completed.

J) Ductile Iron Gravity Sewer Pipe
1) ASTM A746 Ductile Iron Gravity Sewer Pipe shall be used wherever the drawings or contract documents specify ductile iron pipe or the abbreviation D.I.P. except where specified as force main or pressure pipe.
2) Except where otherwise specified, joints for this type of material shall be of the rubber gasket push-on type conforming to ANSI specification A21.11 or AWWA C-111. Rubber gaskets of recognized proprietary designs such as the "Super Bell-Tite" and "Grip-Tite" joint may be used where provided by the manufacturer of the pipe and where approved by the Engineer.

K) Gray Iron and Ductile Iron Pressure Pipe
1) ASTM A377 Ductile Iron Pressure Pipe shall be used wherever specified or called for as Ductile Iron Force Main. Pipe furnished under this classification shall also conform to one of the following designations"
    (i) ANSI A21.51 Ductile Iron Pipe, or,

(ii) AWWA C151 Ductile Iron Pipe.

2) Unless otherwise specified, joints for ductile iron pressure pipe shall be of the rubber gasket push-on type. Rubber gaskets of recognized proprietary designs such as the "Super Bell-Tite" and "Grip-Tite" joint may be used where provided by the manufacturer of the pipe and where approved by the Engineer as set forth under General Conditions, Section 6.7 “Substitutes and/or Equal" items.

L) HDPE (High Density Polyethylene) Sewer Pipe Type “S”, double-walled, smooth bore for sizes 12 inches to 30 inches. Triple-walled, smooth bore for sizes 36 inches to 60 inches.

1) HDPE Pipe called for as storm sewer to conform to ASTM F2306 for double- and triple-walled pipe with joints conforming to ASTM F477.

M) HDPE, DR 11 Pressure pipe shall conform to ASTM F714 for dimensions based on outside diameters of 90 mm (3.5 in) and larger. Pipe in compliance with this specification shall be marked by the producer per the following example at intervals of 5 feet or less:

1) Manufacturer's name, trade name or trademark, and code.
2) Nominal pipe outside diameter in inches in accordance with Table 5, Table 6, or Table 7, and the designated sizing system.
3) Pipe test category in accordance with Table 3.
4) Dimensional ratio, pressure rating, or both.
5) The letters PE followed by the cell classification number (D3350) of the raw material compound used.
6) This designation, “ASTM F714.”

N) All pipe shall be furnished new and in good condition

O) Other materials as specified on Contract Documents

1014 Sewer Valves

A) Air Release Valves for Pressure Sewers

1) Shall be of the combination air release/vacuum breaker design.
2) Each valve shall be equipped with stainless steel trim and floats to minimize corrosion
3) Each valve shall be designed/sized according to system operating pressure and g.p.m.
4) Valves shall be manufactured by A.R.I., or approved equal.

B) Plug and Shut-off Valves

1) Plug and shut off valves shall be Buna-N or nitrile rubber coated eccentric plug or cam centric plug.
2) Valves shall be designed for raw sewage with full round, straight through port when open, Valmatic, Drum-Owen, Dezurik, or approved equal.

C) Valve Boxes

1) All buried valves shall be provided with three-piece, cast iron, extension sleeve type valve boxes.
2) Valve boxes shall not be less than 5 inches in diameter, shall have a minimum thickness of 3/16 inch at any point, and shall be provided with suitable cast iron bases and covers.
3) Covers shall have cast thereon an appropriate name designating the service for which the valve is intended. All parts of valve boxes, bases, and covers shall be heavily coated with a suitable bituminous finish.

D) Pressure Sewer Service Assemblies

1) Each service line from the pressure sewer main to the individual customer at the edge of the right-of-way, property line, or easement shall include a redundant check valve and isolation ball valve installed in a meter box.
2) Meter box shall be rectangular, of high density polypropylene construction, with a bolt-down lid. PVC ball valves shall be of true union design with permanently lubricated Teflon seats and elastomer "O"-ring seals.
3) The valves are to be opened and closed with a quarter turn. Working pressure at 70 degrees Fahrenheit shall be 150 pounds per square inch.
4) Connection assembly shall include a redundant check valve for installation in the discharge line between the grinder pump and the sewer force main to ensure maximum protection against backflow in the event of sewer service line break.
5) The check valve shall be 1-1/4-inch E-1 (Environment One Corporation) glass-lined check valve.

1015 Sewer Lift Stations

A) Design, installation, and testing of sanitary sewer lift stations within the City of Muncie shall require coordination and approval from Muncie Sanitary District. Sewer lift station requirements and materials indicated in Section 1015 shall be considered the minimum requirements, and coordination with the City of Muncie may result in additional requirements and design considerations.

B) Furnish and install sanitary sewage lift station as shown on the plans, as approved by the City of Muncie and meeting all current City of Muncie Design Manual specifications noted hereafter.

C) Additional Requirements:

1) Lift station shall be located within a fenced area with manually operated gates having a total minimum opening width of 16 feet. The fence shall be 7 feet tall (minimum height) chain link fence. The completed fence assembly shall be grounded in accordance with the National Electrical Safety Code, and installed per manufacturer’s requirements.
2) A single exterior site light shall be mounted 12 feet above ground on an aluminum pole set in a concrete base.

3) Each lift station shall be accessed by a paved driveway and be provided with a paved parking area. Driveway shall be heavy-duty rated bituminous or concrete surface, minimum 16-foot wide providing access directly adjacent to the wet well and valve vault. Provide enough turnaround and parking area for one vehicle if requested.
4) Each lift station shall include a passive odor control system, if required by City of Muncie. The passive odor control system shall include:
    1) Odor control canister with activated carbon. The canister shall be secured to a 4-inch concrete pad and be in close proximity to the lift station wet well.
    2) Silencer.
    3) Inlet PVC SCH 40 pipe to be sized by Engineer.
5) Each lift station shall have, as a minimum, two pumps. Station shall be designed to provide the design peak hour flow with the largest pump out of service (firm capacity).
6) Electrical requirements:
    1) The service entrances and all equipment shall be properly grounded in accordance with Article 250 of the National Electrical Code utilizing a ground triangle.
    2) The Contractor shall install the electrical meter (provided by the power company) as specified by the electrical utility company.
    3) All conductors shall be routed in conduit.
    4) The junction boxes shall have epoxy conduit seals between the junction box and control panel.
    5) The lift station controls enclosure, pumps power, wet well level device, float switches, control junction boxes, and fused disconnect switch enclosure shall be mounted a minimum of eighteen inches above the wet well vent outlet and five feet horizontally from all openings.

D) Applicant shall provide the following:
1) Buoyancy calculations demonstrating that the wet well and valve vault will remain submerged given saturated soil conditions and using a safety factor of 1.5 shall be completed by the Engineer and be provided to the Muncie Sanitary District.
2) Pump sizing calculations completed by the Engineer, shall be provided to the Muncie Sanitary District, including design average and peak flow rates, total dynamic head, pump cycle times, and wet well detention time. Calculations shall indicate the service area tributary to the lift station, including the number and nature of existing, planned, and future units to be served by the lift station.
3) Pump selection documentation completed by the Engineer, shall be provided to the Muncie Sanitary District and is to include pump efficiency, impeller

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diameter, design peak flow rate (in gallons per minute), horsepower, and design RPMs. Provide pump and system curves.

4) After plan approval, and prior to construction, applicant shall provide shop drawings to Muncie Sanitary District's Engineer for the following:
    1) Wet well top slab, bottom slab, and risers, including reinforcing steel.
    2) Valve Vault.
    3) Selected lift station equipment.
    4) Lift station controls electrical power and control diagrams indicating all control components, component sizes, ratings, and functions.
5) After construction, applicant shall provide Operation and Maintenance Manuals: Contractor shall submit two Operation and Maintenance Manuals to Owner. Manuals shall include, at a minimum, the following:
    1) Warranty Statement;
    2) Pump down test procedures and results from the start-up tests;
    3) Operation Instructions;
    4) Maintenance Instructions;
    5) Recommended spare parts list;
    6) Lubrication schedules;
    7) Structural diagrams;
    8) As-built wiring diagrams;
    9) Piping and Instrumentation Drawings (P&ID); and
    10) Bill of materials.

E) FACTORY TESTS

Each pump to be delivered under this Section shall be tested for performance at the pump manufacturer's factory to determine head versus capacity, efficiencies, and kilowatt draw required for the operating points that are specified. All tests shall be run in accordance with the latest edition of the American Hydraulic Institute Standards and Submersible Wastewater Pump Association and at the appropriate voltage and frequency.

F) Manufacturing Requirements

1) Contractor shall provide the listed manufacturer(s) unless written approval is given by Owner prior to bidding. "Owner approved equal" means that for a specific project, Owner has given written approval that a different manufacturer or model may be used.
2) Electrical system and components in the raw sewage wet well must comply with NEC requirements for Class I, Group D, Division 1 locations.

G) Sizes of Material and Additional Material Requirements

1) Where specific sizes of materials are not listed in paragraphs below, sizes will be shown on the Drawings.
2) Contractor shall verify all field dimensions.

3) Refer to City of Muncie Standard Details for additional dimension and material requirements.

H) Sewage Pumps

1) Furnish and install submersible non-clog sewage pumps capable of passing a 3-inch diameter spherical solid. Pump suction and discharge openings shall be 4-inch or greater in diameter. Pumps shall be Flygt, or Owner approved equal.
2) Pump Lift-Out Assembly. For each pump, the discharge connection elbow shall be permanently installed in the wet well along with the discharge piping. The pump(s) shall be automatically connected to the discharge connection elbow when lowered into place and shall be easily removed for inspection and service. There shall be no need for personnel to enter the wet well. A simple linear downward motion of the pump shall accomplish sealing of the pumping unit to the discharge connection. A stainless-steel sliding guide bracket shall be an integral part of the pump unit. Two stainless steel guide rails shall guide the entire weight of the pumping unit. Provide stainless steel lifting chain of appropriate diameter for pump size, length as required for the installation (minimum of 50 feet), for each pump. Provide a stainless-steel hook underneath the access cover for attaching the cables.

I) Access Covers:

1) Access covers shall be aluminum, designed and constructed to withstand water intrusion, and sized to accommodate removal of equipment when maintenance or inspection is necessary. Access hatches are to be Halliday Model W1S single leaf or W2S multi-leaf or Owner approved equal. Wet well access shall be multi-leaf to provide adequate access for pumps.
2) All wet well hatches shall be provided with a safety grate which allows visual inspection of the wet well with the grate in place. The grate shall have a separate hold-open door latch that engages when fully opened to 90 degrees. The door latch shall have a release mechanism. Safety grate and latches shall be made from stainless steel or aluminum and be resistant to sewage, sewer gasses, and moisture.

J) Wet Wells and Valve Vaults

1) Construct wet wells of precast reinforced concrete sections. Wet wells constructed of steel are not allowed.
2) Bases shall be one-piece precast base or cast-in-place concrete base section constructed to the dimensions shown on the Drawings and in accordance with ASTM standards. Steel reinforcement shall be as delineated on the Drawings and in accordance with ASTM Standards.
3) Risers shall be precast reinforced concrete riser sections in accordance with ASTM C478, constructed to the dimensions shown on the Drawings and in

accordance with ASTM Standards. Riser shall be the same dimensions as the base. Riser steel reinforcement shall be designed for the designated depth of the structure per ASTM standards. At each joint between precast manhole sections, provide a permanent, flexible, watertight, full perimeter external joint wrap in accordance with ASTM C-877, Type II and passing ASTM C-1244 vacuum test.

4) Gaskets for seating precast sections shall be preformed gaskets conforming to Federal Specifications SS-S00210, Type I Rope Form, or Kent Seal Mastic.
5) Resilient gasket pipe-to-manhole connectors, manufactured in accordance with ASTM C-923, shall be provided.
6) Risers shall not have through-wall lift holes. All lift holes in precast sections shall be wetted and completely filled with non-shrink grout, smoothed.
7) Top slabs shall be one-piece precast concrete, constructed to the dimensions shown on the Drawings and in accordance with ASTM standards. Top slab steel reinforcement shall be designed for the designated surface load of the structure per ASTM Standards.
8) Manhole exteriors shall be coated with bituminous waterproofing material to ensure water tightness.
9) Furnish and install manhole steps at 16 inches on center in the valve vault. Provide plastic steps with steel bar reinforcement.
10) Provide a 2-inch minimum PVC drain from the valve vault to the wet well. Equip the drain with a check valve in the wet well to prevent backflow into the valve vault. Slope the floor of the valve vault to drain.

K) Valves

1) Check valves shall be Swing-Flex Check Valve or Owner approved equal. Valve shall be equipped with a manual backflow actuator for manual backflow operation.
2) Isolation valves shall be resilient seat wedge type with a square actuator nut for operation, as manufactured by Val-Matic, Mueller, Clow, or Owner-approved equal. Valve shall be designed for wastewater operations. The operating stem for the valve shall extend close to the top of the valve vault. The vault shall have a monument box installed and centered over the valve nut, so that the valve may be operated from the surface.

L) Portable Pump Connections

1) The valve vault shall contain a 6-inch bypass ductile iron riser that extends above the pad on the valve vault with a cam-lok fitting. Isolation valves for bypass pumping should be accessible from on top of the pad.
2) A 6-inch ductile iron suction pipe shall be installed in the wet well for use in emergency pumping situations. The suction pipe shall be supported off the wall of the lift station and terminate above the pad with a cam-lok fitting.

M) Control Panel

1) The control panel(s) shall be constructed in compliance with Underwriter's Laboratories Categories 698A and 913 standards – “Enclosed Industrial Control Panel Relating to Hazardous Locations with Intrinsically Safe Circuit Extensions”.
2) Provide a NEMA 4X, 14 gauge, stainless steel enclosure with dead front door. Enclosure shall be of appropriate dimensions for the equipment provided. The panel shall be supplied by pump manufacturer, or Owner-approved equal.
3) Provide the following equipment in the power section of the enclosure:
    1) Main circuit breaker or disconnect.
    2) Branch circuit breakers for each pump motor.
    3) NEMA Size motor starters with Type 10 overload relays for each pump motor.
    4) Low voltage relay for single-phase electrical service applications or phase failure relay for three-phase electrical service applications, each with integral surge protection, to provide motor and control equipment protection in the event of low voltage, voltage unbalance, phase loss, or phase reversal.
    5) Phase/Voltage monitor.
    6) Lightning Arrestor.
    7) Incoming power terminal block.
    8) Ground fault interruption protection shall be provided to de-energize the circuit in the event of any failure in the electrical integrity of the cable to each motor.
    9) LED Panel Light.
    10) Site lighting circuit breaker.
    11) Control Power Transformer with Primary Fuses.
    12) Control Power Circuit Breaker and Fuse.
    13) Motor heat sensor circuits.
    14) Individual pump ammeter.
4) Provide the following equipment in the control section of the enclosure:
    1) Telemetry circuit, 15A, single pole circuit breaker 120V GFI.
    2) Spare circuit 20A, single pole circuit breaker, and 20A, 120V GFI duplex receptacle.
    3) Control circuit, 15A, single pole circuit breaker for controls.
    4) Circuit breakers as required for all other power needs.
    5) Level controller with isolation transformer.
    6) Hand-Off-Automatic (H-O-A) switches for each pump.
    7) Run lights (green) push-to-test for each pump.
    8) Run failure lights (red) push-to-test for each pump.

9) Seal failure lights (amber) push-to-test for each pump.
10) Elapsed time meters (99999.9 hours) for each pump.
11) Primary transducer, intrinsically safe, 4-20 Ma output.
12) Back-up float control relay intrinsically safe, to automatically operate the pumps in the event of level controller failure. This relay shall also activate the high water alarm and alarm light.
13) Panel heater with thermostat.
14) Omni-site Crystal Ball Micro RTU, Wireless Alarm Monitor, with 12V DC power supply and battery backup, if requested by Owner.
15) A digital data logger shall be installed in the control cabinet, if requested by Owner.
16) Red alarm light, test push button (NO HORN).
17) 22 mm LED Indicating Lights, NEMA Type 4/4x/13 IP66 suitable for wash down environments.
18) 22mm oil-tight lenses.
19) ETMs (elapsed time meters).
20) Solderless, marked terminals shall be used for control wiring. Mount control devices on the inner door within the enclosure. The seal failure sensor shall be wired to relays to activate seal failure lights. The heat-sensing thermostat in the motor windings shall be wired in series to the motor starters.

5) On the outside of the enclosure mount the following:
1) High Water Alarm LED Light, red in color.

N) Pump Station Controller

1) Furnish a NE250 (VFD pump controller) or NE152 (non-VFD pump controller) general-purpose pump controller designed to control up to 2 pumps in pump down applications. The controller shall have an integral programmable logic controller (PLC) and human-machine interface (HMI) unit in one.
2) The controller shall be manufactured by N.E. Controls LLC (315) 299-5161 https://www.necontrols.com/ (7048 Interstate Island Rd Syracuse, NY 13209) or Owner-approved equal.
3) The pump controller shall be a standard, cataloged product of a water and wastewater pumping automation equipment manufacturer regularly engaged in the design and manufacture of such equipment.
4) The pump controller shall be furnished with a user-friendly touchscreen operator interface allowing adjustment and viewing of all system parameters and status required by the Muncie Sanitary District. The operator interface shall be NEMA 4X rated suitable for front door mounting including locations requiring wash-down and moisture protection.

O) Level Device System

1) The liquid level of the wet well shall be sensed by a submersible level pressure transducer device, or as directed by Owner.

P) Redundant Float Back-up

1) An independent high level alarm and redundant pump control capability shall be provided in addition to the specified primary control system. It shall be powered by a 120 VAC circuit breaker.
2) The high level alarm shall be a float system that activates when the float rises 45 degrees.
3) The contractor shall furnish, install, and wire the float switches as shown on the drawings.
4) Float switches shall be provided by the control panel supplier. They are to be a cataloged item of the control panel manufacturer. The float bracket shall be made of stainless steel.

Q) Alarm/Data Monitoring

1) A microprocessor-based monitor unit shall be provided for monitoring and control of the lift station based on alarm contact closures, universal voltage input signals, 4-20mA signals, and relay outputs.
2) The microprocessor-based monitor shall be a standard, cataloged product of a water and wastewater equipment manufacturer regularly engaged in the design and manufacture of such equipment.

R) Site Requirements

Site layout shall meet the minimum requirements of the Pump Station Site Layout standard drawing, and shall incorporate additional requirements as specified by the Muncie Sanitary District Engineer.

S) Execution of the work

1) Refer to Section 900 of the Muncie Design Manual for applicable requirements regarding site preparation, sewer and water separation requirements, trench excavation and maintenance, bedding and backfill, pipe laying, and site cleanup and restoration.
2) Install lift station, alarms, electrical work, and controls in accordance with manufacturer's instructions and applicable standards.
3) All wires shall be labeled.

T) Pumps

1) Set pump discharge elbows level and plumb for proper pump operation. Install guide rails plumb to prevent binding of pump upon removal.
2) Install piping plumb and level. Support valves and piping in wet well and valve vault as indicated in the standard details.

U) Lift Station Testing

1) The force main and all gravity sanitary sewers constructed as part of the project shall have passed all required tests prior to the startup and final acceptance of the lift station.
2) Wet Well Leakage Testing shall be performed according to Section 1112 of the Muncie Design Manual.
3) All equipment testing shall be observed by the Owner during the lift station's final inspection.
4) Equipment: The Contractor or manufacturer shall provide all necessary equipment to safely complete all the tasks necessary to test and accept the lift station.
    1) Testing Procedures: The test shall verify all equipment performs in accordance with the design and the requirements of this Specification. Procedures for each component shall be determined by the Owner at the time of startup.
    2) Calibration: All measuring equipment supplied for the lift station shall be calibrated prior to acceptance. Calibration test results shall be made available upon request.
5) Determination of Lift Station Acceptance: If the station performs to the satisfaction of the Owner, as designed, and per the requirements of this Specification, the lift station shall have passed the test.
6) Determination of Lift Station Failure: If the station does not perform to the satisfaction of the Owner, as designed, and per the requirements of this Specification, the lift station shall have failed the test. The Contractor shall be required to correct all deficiencies and retest.

V) Lift Station Warranty

1) Warranties for lift station and all equipment, except for the pumps, shall be 3 years from the date of acceptance. Pump warranty shall be provided by the pump manufacturer and shall warrant the units against defects in workmanship and materials for a period of 5 years under normal use, operation, and service.

W) Post-construction requirements include the following:

1) Record drawings to include field location and elevation of all above-ground improvements, including but not limited to wet well, valve vault and meter vault rims, driveway and parking area, concrete slabs, buildings and enclosures, fencing, and other above-ground improvements.
2) Record drawings to include actual float switch elevations.
3) Record drawings to include wet well and valve vault inside diameters and bottom elevations.
4) Testing to include testing pumps, controls, and alarms in accordance with manufacturer instructions, to include one full pump cycle of each pump and each alarm as a minimum.

5) Spare parts as recommended by manufacturer(s).

1016 Grinder Pumps

A) All grinder pumps shall be manufactured by E/One, or City Engineer-approved equal

B) All grinder pumps shall be manufactured as a complete unit, and installed with the manufacturer-recommended control panel.

C) Grinder pumps are to be installed per the manufacturer standards and specifications, unless otherwise noted on the plans.

1100- Materials Testing and Startup

1101 Hydrostatic Testing

A) Pressure and leakage tests shall be performed in accordance with AWWA C600.

1102 Disinfection of Water Mains

A) Refer to Indiana-American Water Pipeline Specifications (November-2019 or latest) for disinfection requirements for new water mains, and cutting into or repairing existing water mains.

1103 Testing of Gravity Sewers

A) New gravity sewers shall be required to pass either an air pressure test, or an exfiltration test. The air pressure test shall be the standard, and the exfiltration test may only be conducted with written approval of the Engineer. All new manholes must pass a vacuum test.

B) Methods used during all tests shall be subject to the approval of the Engineer. The completed sewer shall be tested for leakage and inspected for damaged materials and improper installation including straightness of line before any services are connected to the sewer.

C) Each section of sewer shall meet the requirements of the following tests.

1) Low pressure air test.
2) Deflection testing (flexible pipe only).
3) Video inspection.
4) Manhole vacuum testing.

D) The testing logs for the low pressure air test, the deflection test, and the manhole vacuum test are at the end of this section.

E) All defects exposed by these tests and by inspection shall be repaired by the Contractor to the satisfaction of the Engineer at no cost to the Owner. The

Contractor shall be required to provide all materials, equipment, and labor required to repair defects exposed by testing.

1104 Exfiltration Test

A) Prior to using this test procedure, the Contractor shall determine the height of the groundwater above the top of pipe. If it is greater than 2.0 feet above the top of pipe then an infiltration test shall be performed. An exfiltration test shall be performed by closing all other openings in the upper manhole and plugging the line where it enters the lower manhole of the section to be tested, filling the line and the upper manhole to the top with water and measuring the water required to keep the manhole full. If a manhole or stub-out is not included in the section tested, a standpipe must be provided at one end of the pipe section so that a minimum internal pressure of 5 feet can be maintained above the higher of either the top of pipe or groundwater level.

B) The total exfiltration shall not exceed 100 gallons per inch of nominal diameter per mile of pipe per day for each section tested. For determining maximum allowable leakage, manholes shall be considered as sections of pipe of equal inside diameter. The exfiltration tests shall be maintained on each section for at least one hour, and as much longer as the Engineer considers necessary to locate all leaks. If the leakage in any section exceeds the allowable maximum, it shall be retested after the leaks are repaired.

1105 Air Pressure Test

A) Air pressure testing shall conform to the following ASTM Designations:
   1) ASTM C 924-89 – Reinforced Concrete Pipe (RCP)
   2) ASTM F 1417-92 – Plastic Gravity Sewer Pipe (PVC)

B) The section of sewer to be tested shall be isolated with pneumatic plugs that have a sealing length greater than the diameter of the pipe and are capable of resisting test pressure without external bracing or blocking. The sewer shall be pressurized to 4 PSI gauge greater than the average back pressure of any ground water pressure over the pipe. This pressure shall be maintained until the temperature of the pipe and the air have equalized, but not less than two minutes. After the temperature has stabilized, the air supply shall be disconnected, and the pressure allowed to drop. The time in minutes required for the pressure to drop from 3.5 PSI to 2.5 PSI shall not be less than as calculated using the following chart:

Minimum Specified Time Required for a 1.0 Psig Pressure Drop and Multiplier for Calculating Time by Length of Pipe (L)

Pipe Diameter (inches)	Minimum Time (Min:Sec.)	Maximum Length for Minimum Time (feet)	Time for Longer Length (sec.)
4	3:46	597	0.380 L
6	5:40	398	0.854 L
8	7:34	298	1.520 L
10	9:26	239	2.374 L
12	11:20	199	3.418 L
15	14:10	159	5.342 L
18	17:00	133	7.692 L
21	19:50	114	10.470 L
24	22:40	99	13.674 L
27	25:30	88	17.306 L
30	28:20	80	21.366 L
33	31:10	72	25.852 L
36	34:00	66	30.768 L

Column 1 is the diameter of the pipe to be tested. Column 2 is the minimum time permitted for any length of pipe up to and including the length listed in column 3. If the length of the pipe to be tested is greater than the length listed in column 3, multiply the length of the pipe to be tested by the number in column 4. The result is the test time in seconds

1106 Vacuum Testing

A) Manholes shall be air tested in accordance with ASTM C1244/C1244M-20, Standard Test Method for Concrete Sewer Manholes by the Negative Air Pressure (Vacuum) Test. Testing shall be done after complete assembly of manhole, including the manhole frame. Testing prior to backfilling is highly recommended to facilitate corrective measures in case of test failure. Contractor shall plug all pipe openings, taking care to securely brace both the plugs and the pipes. The test head shall be placed at the top of the manhole in accordance with the manufacturer's recommendations. A vacuum of 10 inches of mercury shall be drawn on the manhole, the valve on the vacuum line of the test head closed, and the vacuum pump shut off. The time shall be measured for the vacuum to drop to 9 inches of mercury. The manhole shall pass if the time for the vacuum reading to drop from 10 inches of mercury to 9 inches of mercury meets or exceeds the values indicated in the following table, or 1.5 minutes,

whichever is greater. If the inspector finds a noticeable leak, he may immediately declare the test to have failed.

Minimum Time to Drop 1 Inch of Mercury

Manhole Diameter (inches)									
	30	33	36	42	48	54	60	66	72
Depth	**Time in Seconds**								
8	11	12	14	17	20	23	26	29	33
10	14	15	18	21	25	29	33	36	41
12	17	18	21	25	30	35	39	43	49
14	20	21	25	30	35	41	46	51	57
16	22	24	29	34	40	46	52	58	67
18	25	27	32	38	45	52	59	65	73
20	28	30	35	42	50	53	65	72	81
22	31	33	39	46	55	64	72	79	89
24	33	36	42	51	59	64	78	87	97
26	36	39	46	55	64	75	85	94	105
28	39	42	49	59	69	81	91	101	113

B) If the manhole fails the initial test, necessary repairs shall be made by an approved method. The manhole shall then be re-tested until a satisfactory test is obtained.

1107 Roundness Testing Gravity Sewers

A) Contractor shall test all PVC gravity sewer utilizing a 9-arm mandrel sized at 95 percent of the actual pipe inside diameter.

B) The maximum allowable deflection shall be no more than 5 percent.

C) Test shall not be conducted prior to one week after installation and backfill.

1108 Deflection Testing

A) For any vertical or horizontal deflection test, the pipe shall be defined as 5 percent or greater deflection of the internal pipe diameter when testing with a rigid ball or mandrel of no less than 95 percent of the base inside diameter of the pipe being tested. The Contractor shall perform a deflection test of all flexible main sewer pipe after the final backfill has been in place for 30 days. The test

is a go/no-go procedure in which the mandrel will be hand-pulled without any type of mechanical assistance. Any pipe which is found to have failed by deflection shall be replaced by the Contractor, at no cost to the owner, including the re-testing of the replaced pipe.

1109 Smoke Testing

A) The Muncie Sanitary District reserves the right to conduct sewer testing with a pressure smoke test when it is considered necessary or desirable to conduct such test to facilitate locating suspected improper connections to the sewer system.

1110 Television Inspection

A) Before final acceptance, all new gravity sewers shall be televised by the Muncie Sanitary District. The contractor shall ensure that all new sewers have been jet-cleaned and all debris removed from the sewer and manholes prior to televising by the owner. The first run televising shall be conducted after all other testing and cleaning is complete. Contractor must give 72 hours (excluding weekends or holidays) notice to the Muncie Sanitary District for scheduling the televising.

1111 Testing of Force Main Sewer

A) All force mains shall be pressure and leak tested in accordance with one of the following methods:

1) AWWA standard C600-17, AWWA Standard for Installation of Ductile-Iron Water Mains and Their Appurtenances.
2) AWWA standard C602-23, AWWA Standard for Cement-Mortar Lining of Water Pipelines-4 In. (100 mm) and Larger-In Place.
3) AWWA standard C605-21, AWWA Standard for Underground Installation of Polyvinyl Chloride (PVC) and Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe and Fittings.
4) AWWA standard C606-22, AWWA Standard for Grooved and Shouldered Joints.

Pressure test shall be in pounds per square inch (PSI) at 1.5 times the shut-off head of the pump.

1112 Testing of Wet Well

A) Tests on wet wells shall take place under the supervision of Muncie Sanitary District. This shall be an exfiltration test performed in the following manner:

1) The test shall be made prior to placing any backfill material. If the water table has been allowed to rise above the bottom of the wet well, it shall be lowered for the duration of the test. Any points of visible inflow/infiltration shall be plugged by use of OCTOPLUG (IPA Systems, Inc., www.ipasvstems.com), or

an approved equal. All pipes and other openings into the wet well shall be suitably plugged by means of pneumatic plugs that have a sealing length greater than the diameter of the pipe and are capable of resisting test pressure without external bracing or blocking.

2) The wet well shall then be filled to the top with water. If the excavation has not been backfilled and there is no visible or measurable indication of leakage after one hour, the wet well shall be considered to be satisfactorily water-tight.

B) If the test as described above is not satisfactory, or if the wet well excavation has been backfilled, the following test shall be performed:

1) A period of time up to 24 hours shall be permitted to allow for absorption. At the end of this period, the wet well shall be refilled to the top and the measuring period of at least 8 hours begins. At the end of this test period, the amount of loss can be calculated by measuring and calculating the volume lost, or the wet well can be filled to the top while measuring the required volume of water to do so. This amount shall be extrapolated to a 24-hour rate.

C) Calculation of allowable loss in 24 hours for wet wells shall be similar to that of pipe and manholes, which shall not exceed 100 gallons per inch of nominal diameter per mile of pipe per day.

1) To calculate allowable loss in gallons for circular wet wells:
   a) Multiply wet well diameter in inches times 100 gallons times depth in fractional miles (depth in feet divided by 5280).
2) To calculate allowable loss in gallons for rectangular wet wells:
   a) Multiply wet well perimeter in inches (2 x L plus 2 x W) times 100 gallons/π times depth in fractional miles (depth in feet divided by 5280).

D) If the wet well does not meet allowable leakage rate, repairs by approved methods may be made as directed by the Owner to bring the leakage within the allowable rate. No adjustment to the leakage allowance will be made for unknown causes, such as leaking plugs, absorption, evaporation, etc. It will be assumed that all loss of water during the test is a result of leaks through the joints or through the walls.

The contractor shall take necessary measures to ensure that the water table remains below the bottom of the wet well throughout the test.

Air Testing Log Sheet

Muncie Sanitary District

Project: _____ Date: _____

Contractor: _____ Pipe Material: _____ Max. Pressure Drop: _____ (psig)

Test No.	MH# to MH#	Dia & Length of Main	Dia. & Length of Laterals	Time Required* (min:sec)	Ground Water Level above Pipe	Raised Initial Pressure to: (psig)	Time Pressure to Stabilize (minutes)	Start Test Pressure (psig)	Stop Test Pressure (psig)	Actual Time for Test (min:sec)	Pass/ Fail

* see back of log sheet for quick reference table of times allowed for pressure loss

If a Section fails, the following items should be compeleted:

Identify Section(s) that failed: _____ leak (was) or (was not) located. Method used: _____

Description of the leakage found (what and where): _____

Description of corrective action taken: _____

For test results after the repair refer to Test No. _____ on sheet ____ of ____

Observer's Signature: _____

AirTest 082014

SHEET _____ OF _____

Air Testing Log Sheet

Muncie Sanitary District

TIME ALLOWED FOR PRESSURE TO DROP FROM 3.5 PSIG TO 2.5 PSIG												
Pipe Diam. (inches)	Min. Time (min:sec)	Length for min. time (feet)	Time for Longer Length (sec/ft)	Specification Time for Length (L) shown (min:sec)								
				100 ft	150 ft	200 ft	250 ft	300 ft	350 ft	400 ft	450 ft	500 ft
6	5:40	398	0.854	5:40	5:40	5:40	5:40	5:40	5:40	5:42	6:25	7:07
8	7:33	298	1.519	7:33	7:33	7:33	7:33	7:36	8:52	10:08	11:24	12:40
10	9:27	239	2.374	9:27	9:27	9:27	9:54	11:52	13:51	15:50	17:48	19:47
12	11:20	199	3.419	11:20	11:20	11:20	14:15	17:06	19:57	22:48	25:39	28:30
15	14:10	159	5.342	14:10	14:10	17:48	22:16	26:43	31:10	35:37	40:04	44:31
18	17:00	133	7.692	17:00	19:14	26:39	32:03	38:28	44:52	51:17	57:42	64:06
21	19:50	114	10.470	19:50	26:11	34:54	43:38	52:21	61:05	69:48	78:32	87:15
24	22:40	99	13.670	22:40	34:11	45:35	56:59	68:23	79:47	91:10	102:34	113:58
27	25:30	88	17.300	25:30	43:16	57:42	72:07	86:33	100:58	115:24	129:49	144:14
30	28:20	80	21.360	28:20	53:25	71:14	89:02	106:51	124:39	142:28	160:16	178:05

Use this area for any calculations: (print clearly)

AirTest 082014

SHEET _____ OF _____

Mandrel Testing Log Sheet

Muncie Sanitary District Engineering

Project:					Date:		
Contractor:				Pipe Material:		Type Mandrel:	
Test No.	MH# to MH#	Cleaned?	Pipe Diameter (inches)	Length (feet)	Date Pipe Installed	# Days Pipe Installed	Pass/ Fail

If a Section fails, the following items should be completed:

Identify Section(s) that failed:

Failure (was) (was not) located and description of failure:_____

Description of corrective action taken:_____

For test results after repair, refer to Test No. _____ on sheet ____ of _____

Comments:

Observer's Signature:

Form MandrelTest 082014

SHEET _____ of _____

Manhole Vacuum Test Log Sheet

Muncie Sanitary District

Project:					Date:		
Contractor:				Pipe Material:		Type Mandrel:	
Test No.	MH#	Diameter (inches)	Depth (feet)	Time (sec)	Start Head (inches Hg)	Stop Head (inches Hg)	Pass/ Fail
If a Manhole fails, the following items should be completed:							
Identify Manhole(s) that failed:							
Failure (was) (was not) located and description of failure:_____							
Description of corrective action taken:_____							
For test results after repair, refer to Test No. _____ on sheet ____ of _____							
Comments:							
Observer's Signature:							

1300- Right-of-Way (ROW) Landscaping Requirements

A) For street tree and ROW landscaping requirements, refer to Article XXX, Section 6 Development Standards, subsection 3 Standards Landscaping Screening, Planting, and Preservation.

B) rohibited plant species, Per Article XXX, Section 6, Development Standards. 3 Standards Landscaping Screening, Planting, and Preservation, sub-subsection 1), the following list of tree, bush, and plant species are prohibited within Muncie's corporate limits:

1) Acer negundo, box elder;
2) Acer saccharinum, silver maple;
3) Populus deltoides, cottonwood; and
4) All plants included on the Indiana Invasive Species Council's list of invasive plants.

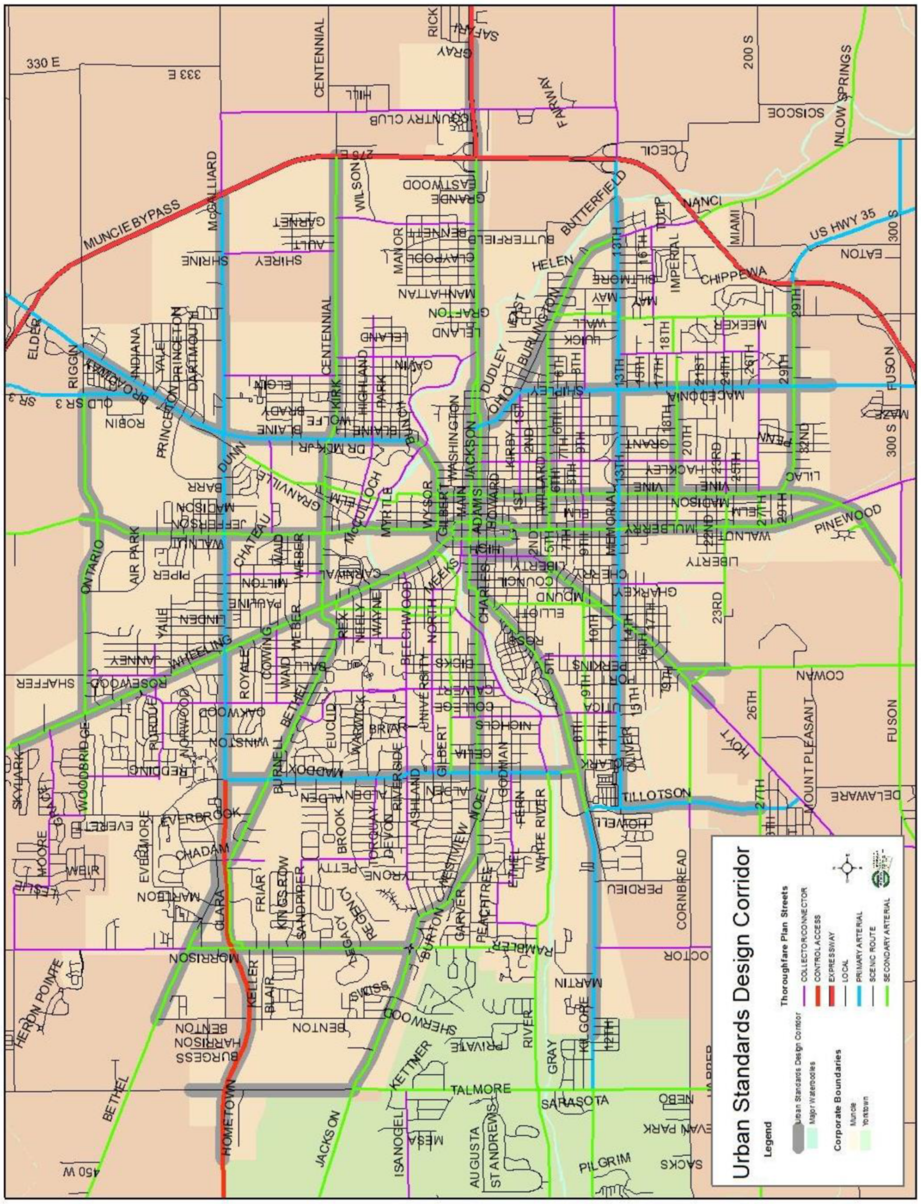
1400- Alternative Right-of-Way Dimensions

A) Article XXX, Section 7 of the City on Muncie Zoning Ordinance requires alternative right-of-way dimension adjacent to the following corridor segments (and as depicted on the map "Urban Corridor Design Standards[1]" below):

Corridor	Description – From (N & W points) and To (S & E points)[2]
Bethel Avenue	West Corporate Limits to Centennial Avenue
Broadway Avenue	Riggin Road to McGalliard Road
Burlington Drive	Macedonia Avenue to Memorial Drive
Centennial Avenue	Bethel Avenue to Muncie By-Pass
Cowan Road	Hoyt Avenue to South Corporate Limits
Dr. Martin Luther King Blvd.	McGalliard Road to the White River
Hoyt Avenue	Liberty Street to South Corporate Limits
Jackson Street/SR 32	Nebo Road to East Corporate Limits
Kilgore Avenue	West Corporate Limits to Jackson Street
Liberty Street	Main Street to Hoyt Avenue
Macedonia Avenue	Ohio Street to South Corporate Limits

[1] https://www.co.delaware.in.us/egov/documents/1670512437_29728.pdf
[2] https://www.co.delaware.in.us/egov/documents/1670512437_29728.pdf

Corridor	Description – From (N & W points) and To (S & E points)[2]
Madison Street	Wysor Street to South Corporate Limits
Main Street	Kilgore Avenue to E. Jackson Street
McGalliard Road	West Corporate Limits to Muncie By-Pass
Memorial Drive	Tillotson Avenue to Muncie By-Pass
Morrison Road	Bethel Avenue to Jackson Street
Nebo Road	North Corporate Limits to Jackson Street
Ohio Street	Main Street to Macedonia Avenue
Old State Road 3	Riggin Road to Broadway Avenue
Riggin Road	Wheeling Avenue to Old SR 3
Tillotson Avenue	McGalliard to Kilgore & Memorial to S. Corp. Limits
Walnut Street	Riggin to Washington & Downtown Roundabout to Madison
Wheeling Avenue	North Corporate Limits to High Street Bridge
Willard Street	Walnut Street to Burlington Drive
Wysor Street	High Street to the White River
18th Street	Walnut Street to Macedonia Avenue
29th Street	Madison Street to Muncie By-Pass


Urban Standards Design Corridor
Legend
Urban Standards Design Corridor
Major Waterbodies
Thoroughfare Plan Streets
COLLECTOR/CONNECTOR
CONTROL ACCESS
EXPRESSWAY
LOCAL
PRIMARY ARTERIAL
SCENIC ROUTE
SECONDARY ARTERIAL
Corporate Boundaries
Muncie
Yorktown

1) Rights-of-way within these identified street segments requires the typical road dimensions to conform to the appropriate Typical Road section as shown in Design Standards DS-301 through DS-305.

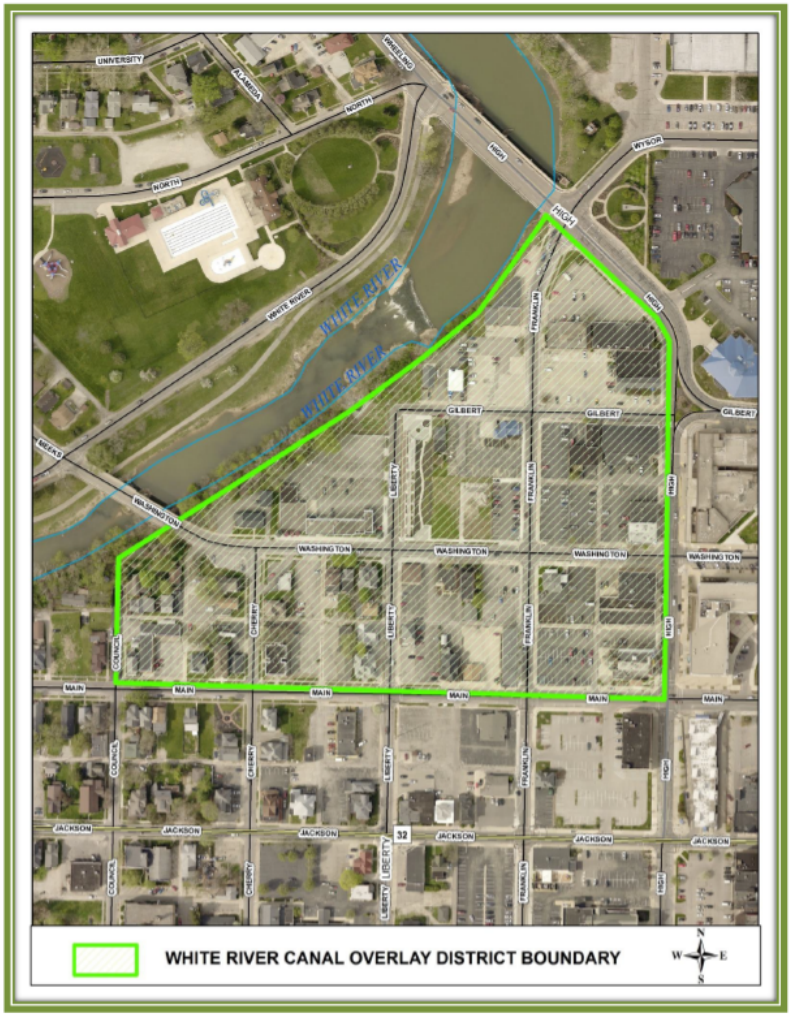
B) Article XXX, Section 8, University Village Overlay, of the City on Muncie Zoning Ordinance requires alternative right-of-way dimensions in the area identified I the University Village Overlay District Boundary Map[3] below:

Boundary Map

[3] https://www.co.delaware.in.us/egov/documents/1670512437_29728.pdf

1) Rights-of-way within the University Village Overlay District requires the typical road dimensions to conform to the University Village – Overlay District Diagram in Design Standards details RW-1401-1403.

C) Article XXX, Section 9, University Village Overlay, of the City on Muncie Zoning Ordinance requires alternative right-of-way dimensions in the area identified in the White River Canal Overlay District Boundary W. Main Street Diagram conform to the dimensions shown in Design Standard RW-1404.



1) Rights-of-way within the University Village Overlay District requires the typical road dimensions to conform to the White River Canal – Overlay District Washington Street Diagram in the Design Standard RW-1405.

1500- Street Lighting Design Requirements

1501 Introduction

A) The purpose of the Street Lighting Design Section is to assist engineers in street lighting design for facilities owned and maintained by the City of Muncie by documenting illumination standards and design considerations used within the City of Muncie. This manual is intended to bet used in conjunction with the latest versions of the following documents: City of Muncie Design Manual, City of Muncie Standard Construction Details, the American National Standards Institute/Illuminating Engineering Society Recommended Practice No. 8 (ANSI/IES RP-8), and the National Electric Safety Code (NESC).

B) This Section does not attempt to cover all scenarios that engineers will encounter. The Engineer sealing the plans is responsible for all project details and should use good engineering judgement consistent with local practices.

1502 Illumination Requirements

A) Purpose

1) Street lighting is provided for major, collector, and local roadways, where pedestrians and cyclists are generally present during hours of darkness. The primary purpose of street lighting is to help the motorist identify obstacles, provide adequate visibility of pedestrians and cyclists, and assist in visual search tasks, both on and adjacent to the street. Good street lighting has been shown to significantly reduce the proportion of crashes that occur at night, especially on urban freeways and on major streets.

B) Illumination Criteria

1) Roadway Illumination

a) The street lighting system for public roadways shall be designed to provide the average maintained horizontal illuminations values as provided in the table below. Any deviation from these recommended values due to unique circumstances must be approved by the City of Muncie. The horizontal illumination shall be measured at the roadway and sidewalk surfaces and be provided in foot-candles (fc). The intent of the sidewalk illumination is for sidewalks immediately adjacent to the roadway.

Roadway Classification	Pedestrian Area Classification	Average Roadway Illumination (fc)	Roadway Uniformity Ratio (Avg/Min)	Average Sidewalk Illumination (fc)	Sidewalk Uniformity Ratio (Avg/Min)
Arterial/Downtown/Major	High	1.7	3:1	1.0	4:1
	Medium	1.3	3:1	0.5	4:1
	Low	0.9	3:1	0.4	4:1
Collector	High	1.2	4:1	1.0	4:1
	Medium	0.9	4:1	0.5	4:1
	Low	0.6	4:1	0.3	6:1
Local	High	0.9	6:1	1.0	4:1
	Medium	0.7	6:1	0.5	4:1
	Low	0.4	6:1	0.3	6:1

b) Roadway Classification shall be based on roadway functional classification.

c) Pedestrian Area classification are generally described in ANSI/IES RP-8. General guidelines are as follows:

- High - Over 100 pedestrians per hour
- Medium - From 10 to 100 pedestrians per hour
- Low - Fewer than 10 pedestrian per hour

2) Intersection Illumination

a) Intersections should be lit proportionally to the sum of the illumination values for each intersecting roadway classification. For example, it is recommended that the intersection of two arterial roadways with high pedestrian area classifications be lit to 3.4 foot-candles, given that each roadway has an average illumination of 1.7 foot-candles.

3) Roundabout Illumination

a) Roundabout should be designed to provide the average maintained horizontal illuminations values as provided in the table below.

C) Photometric Calculations

1) Photometrics shall be calculated using VISUAL software, developed by Acuity Brands or AGi32, by Lighting Analysts. The engineer shall select the luminaire that provides the best lighting performance for the project and provide a design using this luminaire. The contractor may elect to use a different luminaire for construction but will be required to provide photometrics that show the alternate luminaire meets the performance of the design luminaire. All luminaires shall meet one of the City standards.

2) Light Loss Factor (LLF) used in photometric layout calculations shall be the product of luminaire direct depreciation (LDD) and the manufacturer's

projected Lamp Lumen Depreciation (LLD) at 100,000 hours at 25°C ambient temperature. LDD shall be assumed as 0.85 for UV stabilized acrylic optics and 0.90 for glass optics. It is the responsibility of each manufacturer to provide a calculation of LLD. Lumen maintenance shall be a minimum of 70 percent over 100,000 hours of life when operating at temperatures of 40°C (104°F) or less.

3) Luminaire distribution patterns shall be selected to optimize lighting performance to meet the above illuminance values. Light trespass outside of public right-of-way shall be mitigated through the use of distribution patterns and house shields.

D) Luminaire and Pole Standards

1) The following LED luminaires have been approved for use on City projects at the direction of the City. Should the contractor choose to substitute on the basis of design, the chosen luminaire must meet all target illumination criteria as specified by the project and must be approved by the City of Muncie.

- 14ft Twin Arm Ornamental Post Top Assembly by Sternberg Lighting – Model 2A-D650SRLED-5P-4ARC45T3-MDL03-A/BAPT/5414FP6-.250/BK
  Supplier Contact: ESL Spectrum Attn.: Gina Williams - gwilliams@esl-spectrum.com (317) 951-2300
- 12ft-6in Ornamental Post Top Assembly by VISCO – Model D4-60W-40K-V-MBS-LED/V1-C21-1-F/12’6”
  Supplier Contact: Techlite Attn: Steve Bates- steveb@techlitecorp.com (317)-578-2626
- 18ft Ornamental Pendant Assembly by Sun Valley - Manufacturer Description CS-6742
  Supplier Contact: Techlite Attn: Steve Bates- steveb@techlitecorp.com (317)-578-2626

E) Electrical System

1) The standard lighting system voltage for the City of Muncie street lighting circuits is 120/240 volts. Voltage drop calculations shall be calculated for each street light circuit per the Indiana Design Manual Section 502. The maximum allowable drop per circuit is 10 percent from the nominal voltage.

1503 Design Considerations

A) Street Lighting Facility Placement

1) All new or replaced City of Muncie street lighting infrastructure should be located in the right-of-way with consideration given to aerial components. Any facilities placed outside the right-of-way will require approval from the City of Muncie. If this approval is granted, an Indiana Registered Professional

Surveyor will be required to prepare all legal descriptions and documents necessary to acquire easements or right-of-way.

B) Code Governance

1) The design and construction of all City of Muncie street light systems shall be governed by the NESC.

C) Pole Placement

1) Determination of street light pole placement shall be based on the following design considerations:
    - Project photometrics shall be the primary factor in street light pole placement.
    - Poles should be placed at or near property lines wherever possible.
    - Poles may be placed in sidewalks provided that the proper Americans with Disabilities Act (ADA) accessible route clearances are maintained. Poles within sidewalks shall have the top of foundation flush with the top of the sidewalk.
    - Poles should be placed on the inside of roadway curves where possible. Pole spacing may need to be closer than typical on curves to provide desired illumination levels.
    - Poles without a crash tested breakaway base shall be located in accordance with Section 502-4.03(02) of the Indiana Design Manual. Offsets shall be measured from the edge of the pole.
    - The ground elevation at the base of the pole should be taken into consideration as elevation differences between the roadway and pole base can affect the luminaire mounting height.
    - Poles shall be placed a minimum of 5 feet from a driveway or property entrance. Poles should not be placed in the middle island of a right-in-right out driveway.

D) Roundabout Pole Placement

1) Design practices described in most recent publication of ANSI/IES RP-8 shall be used. Light poles shall be placed in advance of pedestrian crosswalks so pedestrians are not black lit. Light poles inside the center island is Prohibited and poles placed in the radius between the entry and exit islands should be avoided. Additional light poles should be provided as required to meeting photometric criteria.

E) Bracket Arm Length/Orientation

1) The bracket arm length shall be selected based on pole location and photometric requirements. Bracket arms should be positioned perpendicular to the curb line.

F) Adjacent Lighting

1) The engineer should consider lighting from adjacent roadways when calculating the illumination levels of the roadway being designed.

G) Combination Street Lighting/Traffic Signal Supports

1) Combination lighting and signal supports shall only be used in the downtown business district or at the direction of the City of Muncie, City Engineer, or appointed designee.
2) When used, luminaires mounted on traffic signal supports shall be powered by the same power source used for the traffic signal installation. All traffic signal/combination lighting shall be routed through traffic signal conduits back to the traffic signal controller cabinet. Combination lighting cable shall not enter any adjacent street lighting conduit system. In addition, no adjacent street lighting circuits shall be installed in the traffic signal support, signal conduit system, or the traffic signal cabinet. Adjacent street lighting systems and all combination lighting/signal circuits shall remain separate at all times.

H) Underground Lighting Circuit

1) When designing new underground street lighting for the City of Muncie, the circuit should be 120/240 volt, two phase, 4-wire (Black, Red, Neutral, Ground) per INDOT Standard Drawing 807-LTWR. New lighting being connected to an existing circuit must be the same electrical configuration as the existing circuit that it is being connected to.
2) When servicing a large area, the engineer should use all branches of the circuit originating from the controller and balance loads across all branches as evenly as practical. The total load should not exceed the controller's capacity.

I) Service and Control Point

1) Control Point, Type 1 per INDOT Standard Drawing 807-LTSP. Pad-mounted controllers shall be located within 5 feet of the transformer or power pole. Pad mount controllers shall NOT be installed between the sidewalk and the curb.
2) Each street light circuit will be controlled by one photoelectric control which shall be located on the first pole after the controller.
3) City of Muncie maintained street lighting systems shall be isolated from all other electrical systems. No other electrical systems shall be installed in street light controllers.

J) Handhole

1) Handhole boxes should be located on both sides of a street crossing if there is no light pole near the crossing. Other locations selected should facilitate construction or maintenance activities.

K) Clearance Requirements

1) All underground street lighting facilities shall be located a minimum of 3 feet clear horizontally and 18 inches vertically from all other utilities. Clearances are measured outside diameter to outside diameter. Facilities may be located closer with both City of Muncie and other utility owner approval.

1504 Submittal Requirements

A) All plans shall be prepared under the direct supervision of an Indiana Registered Professional Engineer.

B) Proposed street lighting work shall be shown clearly using heavier line weights in a manner such that street lighting facilities are the most prominent features on the lighting plan sheets.

C) All field marked utilities shall be field surveyed and shown on the plans. Proposed street lighting facilities shall be designed in a manner to avoid marked locations of adjacent utilities.

D) Provide a legend clearly depicting all symbols and line types used on the project.

E) The minimum plan scale shall be 1 inch=40'. Other larger scales may be used to show greater detail in areas with higher existing utility density with prior City approval.

F) All applicable plan sheets shall have a north arrow clearly shown. The north arrow orientation should be the same for all applicable plan sheets.

G) Plan set shall include photometrics summary table showing the illumination levels throughout the project. A summary schedule depicting the average illumination for each statistic zone with the corresponding uniformity ratio. The target illumination value should be noted in the summary schedule as well.

H) Engineer shall provide any specialty construction details or as per plan notes that are not covered by existing INDOT or City Standards.

I) Street light facilities shall be shown on separate, dedicated street lighting sheets for clarity. The street light facilities should be shown in the darkest line weight on these sheets, with other plan elements in the background with lighter line weights. Items such as right-of-way, edge of pavement, and sidewalks must be shown clearly in relation to the street light facilities. Utility conflicts should be noted with any special construction requirements such as potholing or hand excavation.

J) Technical Submittals for Visual software output files, or compatible files from similar software package as well as a PDF of the calculations shall be provided for the project.

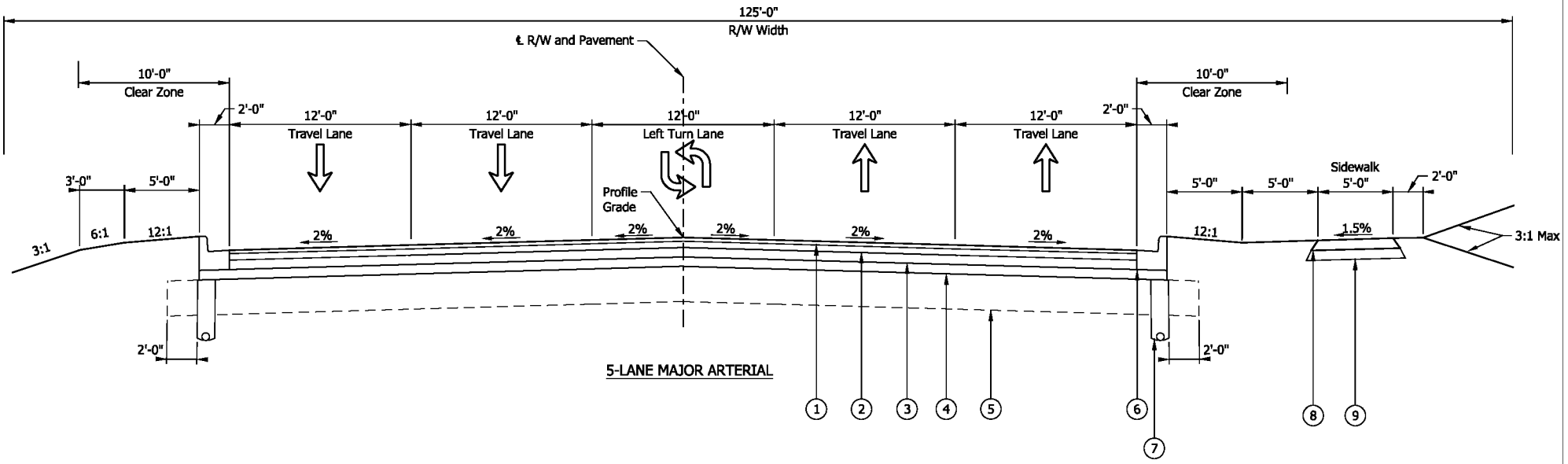
Appendix A

Standard Construction Details

CITY OF MUNCIE - STANDARD DETAIL CHECKLIST	
ROAD DETAILS	
Detail No.	Detail Description
DS-301	TYPICAL SECTION - MAJOR ARTERIAL
DS-302	TYPICAL SECTION - MINOR ARTERIAL
DS-303	TYPICAL SECTION - MINOR ARTERIAL
DS-304	TYPICAL SECTION - MINOR COLLECTOR
DS-305	TYPICAL SECTION - LOCAL ROAD
EC-401	ALTERNATE RESTORATION FOR ARTERIAL OR COLLECTOR ASPHALT & CONCRETE STREETS
EC-402	ALTERNATE RESTORATION FOR LOCAL OR RESIDENTIAL ASPHALT & CONCRETE STREETS
EC-403	TRENCH AND CURB PATCH
CM-501	CURB AND GUTTER
CM-502	ROLL CURB AND DEPRESSED CURB
CM-503	STANDARD MEDIAN CURBS
CM-504	SIDEWALK CONSTRUCTION JOINTS
CM-505	CURB, GUTTER, AND WALK CURB CUTS
CM-506	CURB RAMP DRAWING INDEX AND GENERAL NOTES
CM-507	PERPENDICULAR CURB RAMP TYPICAL PLACEMENT
CM-508	PAIRED PERPENDICULAR CURB RAMPS TYPICAL PLACEMENT
CM-509	PERPENDICULAR CURB RAMP COMPONENT DETAILS
CM-510	ONE-WAY DIRECTIONAL PERPENDICULAR CURB RAMP TYPICAL PLACEMENT
CM-511	ONE-WAY DIRECTIONAL PERPENDICULAR CURB RAMP COMPONENT DETAILS
CM-512	PAIRED PARALLEL CURB RAMPS AND MIDBLOCK CROSSING CURB RAMP TYPICAL PLACEMENT
CM-513	PARALLEL CURB RAMP COMPONENT DETAILS
CM-514	BLENDED TRANSITION CURB RAMP, DEPRESSED CURB RAMP AND DIAGONAL CURB RAMP TYPICAL PLACEMENT
CM-515	BLENDED TRANSITION CURB RAMP COMPONENT DETAILS
CM-516	MEDIAN CUT-THROUGH AND MEDIAN PERPENDICULAR CURB RAMP TYPICAL PLACEMENT
CM-517-518	DETECTABLE WARNING SURFACE PLACEMENT AND CONFIGURATION
CM-519	DETECTABLE WARNING SURFACE DETAILS
CM-520-522	SIDEWALK CHASE
CM-523	DRIVEWAY APRON DETAILS
CM-524-525	CROSSPAN TYPE 1
CM-526	RESIDENTIAL ACCESS TO UN-CURBED STREET/ALLEY
CM-527	RESIDENTIAL ACCESS TO CURBED STREET/ALLEY
CM-528	COMMERCIAL ACCESS TO CURBED STREET/ALLEY
CM-529	ALLEY ACCESS PARKING
CM-530	CUL-DE-SAC / ALLEY TERMINATION
CM-531	ON-STREET PARKING
AP-601	SAFETY EDGE

STORMWATER & EROSION CONTROL DETAILS	
Detail No.	Detail Description
DN-701	STANDARD CATCH BASIN
DN-702	STANDARD LARGE CATCH BASIN
DN-703	STANDARD CATCH BASIN (24"x36")
DN-704	STANDARD INLET
DN-705	STANDARD INLET (24"x36")
DN-706	STANDARD MANHOLE
DN-707	APPROVED CASTINGS
DN-708	PERFORATED PIPE BEDDING
DN-709	END SECTION PRECAST CONCRETE
DN-710	END SECTION METAL
DN-711	RIPRAP DITCH OR RIVER BED
DN-712	RIPRAP APRON
DN-713	ROCK CHECK DAM
DN-714	SILT FENCE INLET FILTER
DN-715	TEMPORARY CONSTRUCTION ENTRANCE
DN-716	EROSION CONTROL BLANKET AND TURF REINFORCEMENT MAT
DN-717	PUMP AROUND PRACTICE
DN-718	SILT FENCE
DN-719	INLET PROTECTION DEVICE
DN-720	ROCK DONUT
DN-721	CONCRETE WASHOUT
DN-722	PERIMETER FILTER SOCK
SANITARY SEWER DETAILS	
Detail No.	Detail Description
SS-901	MANHOLE REHABILITATION
SS-902	FLAT TOP MANHOLE
SS-903	SMALL DIEAMETER MANHOLE
SS-904	MANHOLE CUT-OUT OVER EXISTING SEWERS
SS-905	SANITARY MANHOLE
SS-906	SANITARY SEWER RESIDENTIAL SERVICE
SS-907	LARGE DIAMETER MANHOLE WITH REDUCER CAP
SS-908	MANHOLE OVER LARGE BRICK SEWER
SS-909	INTERIOR DROP MANHOLE
SS-910	CONNECTION TO EXISTING MANHOLE
SS-911	CONFLICT MANHOLE
SS-912	SANITARY SERVICE LATERAL INSTALLATION
SS-913	CLASS "B" BEDDING (NON-PAVED AREAS)
SS-914	CLASS "B" BEDDING (PAVED AREAS)
SS-915	FLOWABLE FILL (PAVED AREAS)
SS-916	CONCRETE ENCASEMENT

SS-917	WATER-TIGHT MANHOLE CASTING
SS-918	CASTING ADJUSTMENT
SS-919	GREASE INTERCEPTOR
SS-920	COMBINATION AIR RELEASE VALVE
SS-921	SANITARY SERVICE LATERAL RELOCATION
SS-922	SANITARY FORCE MAIN THRUST BLOCKING
SS-923	SANITARY SEWER AND WATER MAIN SEPARATION
SS-924	PIPE SEAL THROUGH EXTERIOR WALL
SS-925	CASING PIPE FOR BORE
SS-926	SANITARY SEWER DIRECT CONNECTION TO SOLID WALL SEWER
SS-927	CLEANOUT - BACKWATER VALVE (YARD SURFACE)
SS-928	CLEANOUT - BACKWATER VALVE (HARD SURFACE)
SS-929	CLEANOUT
SS-930	OIL AND PARTICLE SEPARATOR
SS-931	CONCRETE CRADLE
SS-932	PUMP STATION SITE LAYOUT
SS-933	PUMP STATION CONTROL PANEL
SS-934	DUPLEX PUMP STATION (PLAN AND SECTION)
SS-935	FLUSING CONNECTION - TYPE 1
SS-936	GRINDER PUMP CONNECTION
SS-937	GRINDER PUMP CURB STOP ASSEMBLY
SS-938	GRINDER PUMP
SS-939	GRINDER PUMP INSTALLATION
OVERLAY DISTRICT DETAILS	
Detail No.	Detail Description
RW-1401	UNIVERSITY VILLAGE - OVERLAY DISTRICT - AREA 1 - W UNIVERSITY AVE
RW-1402	UNIVERSITY VILLAGE - OVERLAY DISTRICT - AREA 2,3,5
RW-1403	UNIVERSITY VILLAGE - OVERLAY DISTRICT - AREA 4 - W JACKSON ST
RW-1404	WHITE RIVER CANAL - OVERLAY DISTRICT - W MAIN ST
RW-1405	WHITE RIVER CANAL - OVERLAY DISTRICT - WASHINGTON ST
TRAFFIC AND LIGHTING DETAILS	
Detail No.	Detail Description
LT-1501	14FT ORNAMENTAL POLE ASSEMBLY (STERNBERG)
LT-1502	12FT-6IN ORNAMENTAL POLE ASSEMBLY (VISCO)
LT-1503	18FT ORNAMENTAL POLE ASSEMBLY (SUN VALLEY)
LT-1504	LIGHT POLE FOUNDATION (24IN DIA X 6FT)



HMA Pavement

1. 1.5" - 165 lb/syd QC/QA-HMA, 2, 64, Surface, 9.5 mm, on
2. 2.5" - 275 lb/syd QC/QA-HMA, 2, 64, Intermediate, 19.0 mm, on
3. 3.75" - 413 lb/syd QC/QA-HMA, 2, 64, Base, 25.0 mm, on
4. 3.75" - 413 lb/syd QC/QA-HMA, 2, 64, Base, 25.0 mm, on
5. 14" - Type IBC, or
   12" - Type IC
6. Curb and Gutter, Vertical (Catch)
7. 6" - Underdrain
8. 4" - PCCP, on
9. 4" - Compacted Aggregate, No. 53

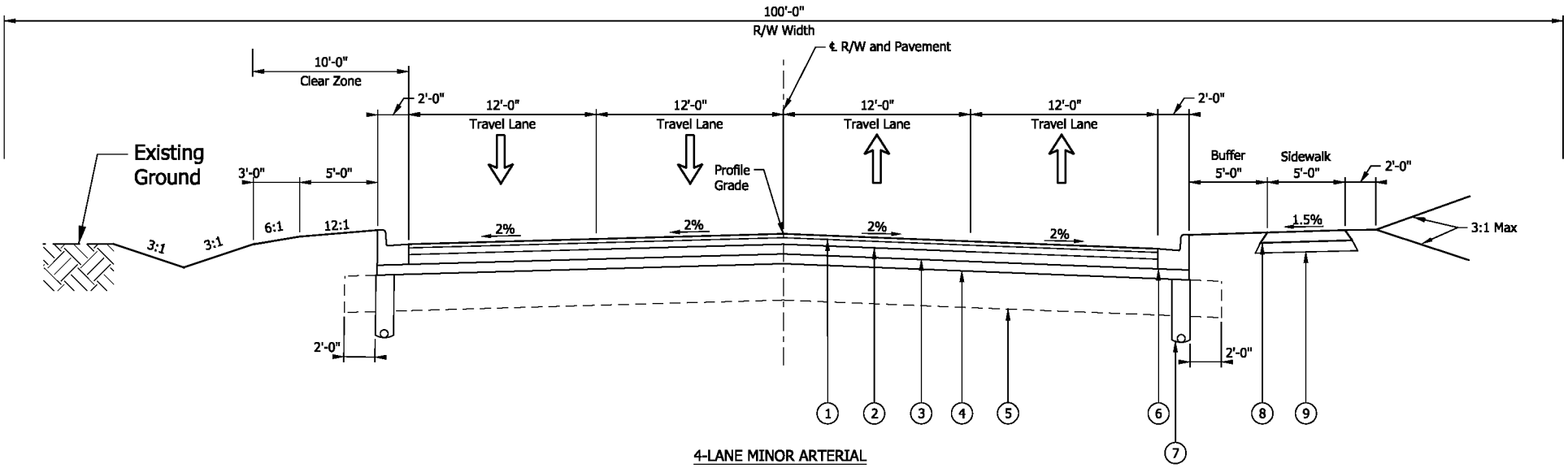
MUNCIE PUBLIC WORKS

TYPICAL SECTION - MAJOR ARTERIAL

APPROVED: XX/XX/20XX

REVISED: XX/XX/20XX

STANDARD: **DS-301**



4-LANE MINOR ARTERIAL

HMA Pavement

1. 1.5" - 165 lb/syd QC/QA-HMA, 2, 64, Surface, 9.5 mm, on
2. 2.5" - 275 lb/syd QC/QA-HMA, 2, 64, Intermediate, 19.0 mm, on
3. 3.75" - 413 lb/syd QC/QA-HMA, 2, 64, Base, 25.0 mm, on
4. 3.75" - 413 lb/syd QC/QA-HMA, 2, 64, Base, 25.0 mm, on
5. 14" - Type IBC, or
   12" - Type IC
6. Curb and Gutter, Vertical (Catch)
7. 6" Underdrain
8. 4" - PCCP, on
9. 4" - Compacted Aggregate, No. 53

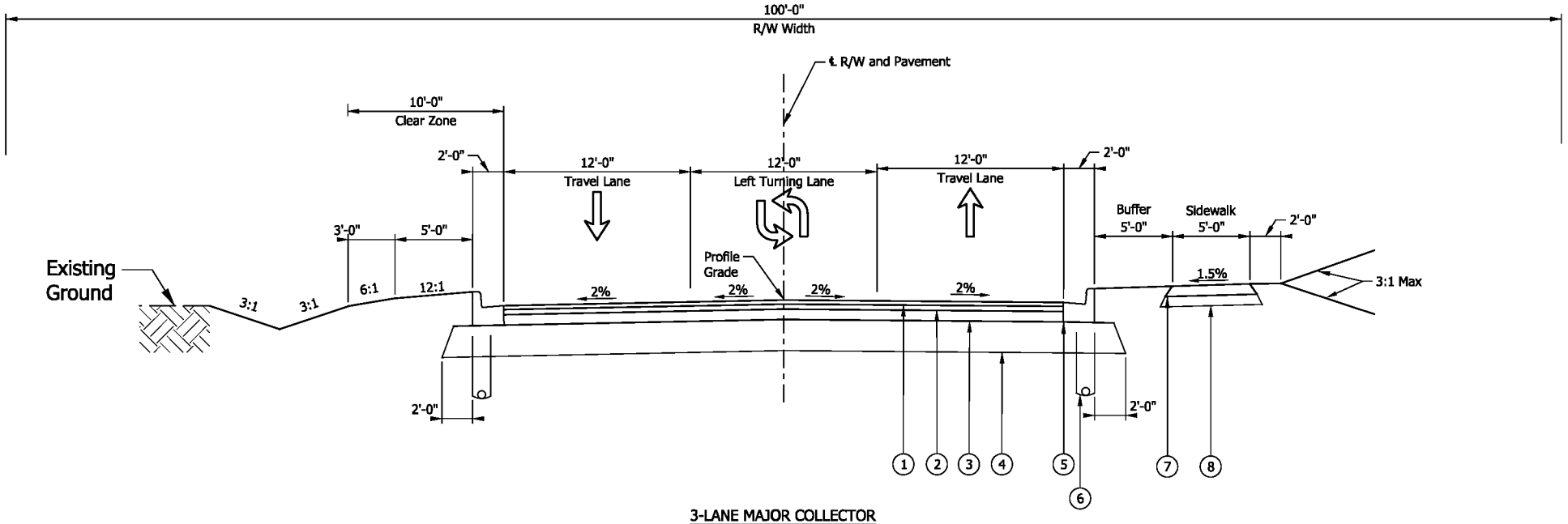
MUNCIE PUBLIC WORKS

TYPICAL SECTION - MINOR ARTERIAL

APPROVED: XX/XX/20XX

REVISED: XX/XX/20XX

STANDARD: **DS-302**



3-LANE MAJOR COLLECTOR

HMA Pavement Option

1. 1.5" - 165 lb/syd QC/QA-HMA, 2, 64, Surface, 9.5 mm, on
2. 2.0" - 275 lb/syd QC/QA-HMA, 2, 64, Intermediate, 19.0 mm, on
3. 4.00" - 413 lb/syd QC/QA-HMA, 2, 64, Base, 25.0 mm, on
4. 12" - Compacted Aggregate, No. 53 (Type IC), on
5. Curb and Gutter, Vertical (Catch)
6. 6" - Underdrain
7. 4" - PCCP, on
8. 4" - Compacted Aggregate, No. 53

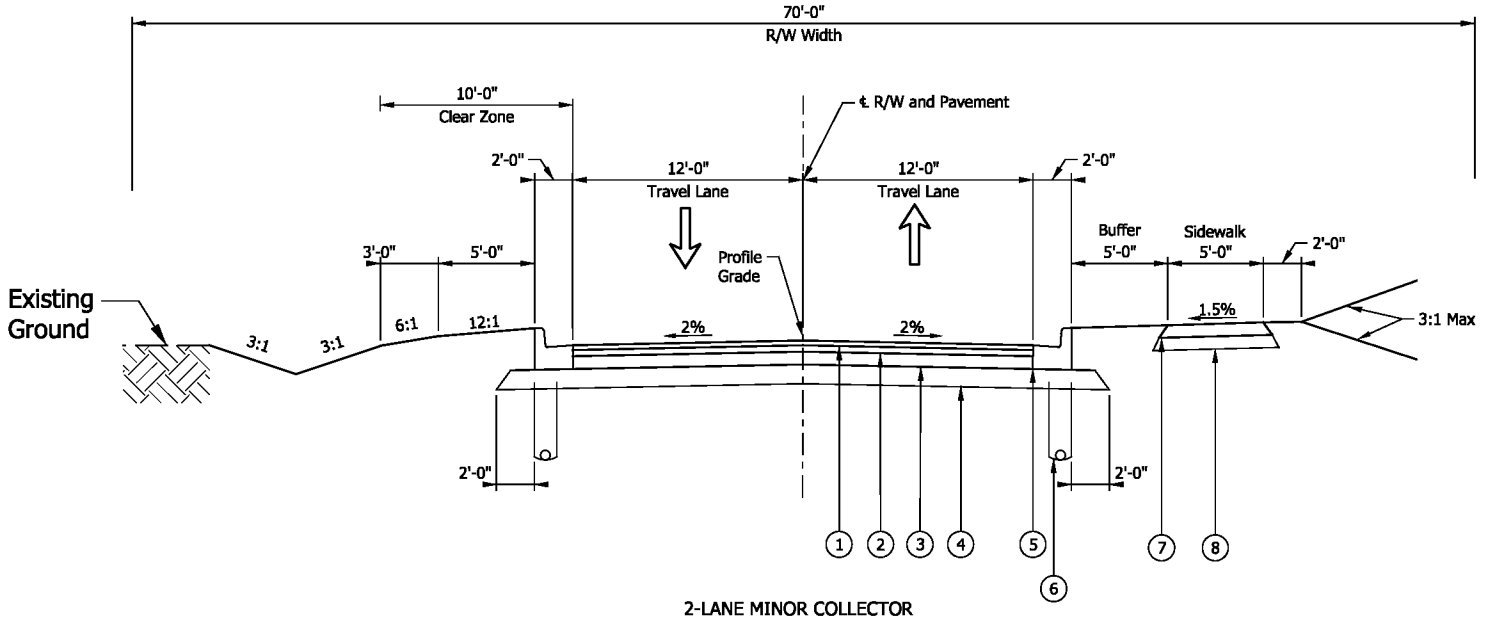
MUNCIE PUBLIC WORKS

TYPICAL SECTION - MINOR ARTERIAL

APPROVED: XX/XX/20XX

REVISED: XX/XX/20XX

STANDARD: **DS-303**



2-LANE MINOR COLLECTOR

HMA Pavement Option

1. 1.5" - 165 lb/syd QC/QA-HMA, 2, 64, Surface, 9.5 mm, on
2. 2.0" - 275 lb/syd QC/QA-HMA, 2, 64, Intermediate, 19.0 mm, on
3. 4.00" - 413 lb/syd QC/QA-HMA, 2, 64, Base, 25.0 mm, on
4. 6" - Compacted Aggregate, No. 53 (Type II), on
5. Curb and Gutter, Vertical (Catch)
6. 6" - Underdrain
7. 4" - PCCP, on
8. 4" - Compacted Aggregate, No. 53

MUNCIE PUBLIC WORKS

TYPICAL SECTION - MINOR COLLECTOR

APPROVED: XX/XX/20XX

REVISED: XX/XX/20XX

STANDARD: **DS-304**

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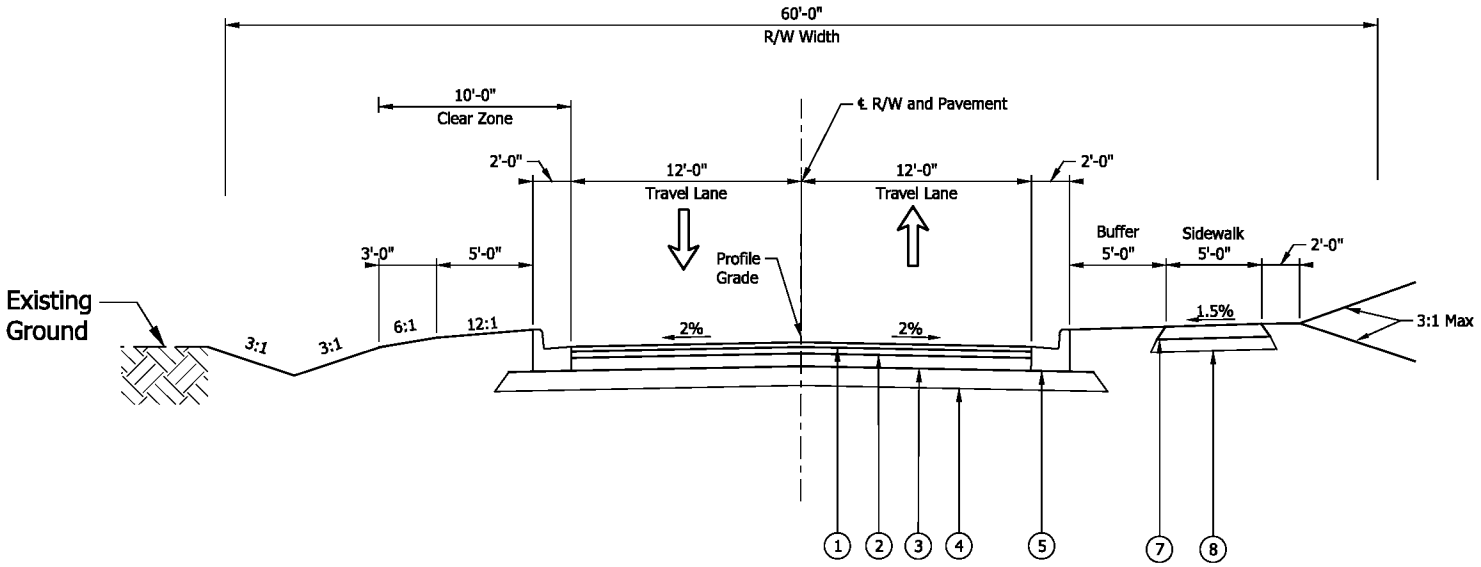


2-LANE LOCAL ROAD

HMA Pavement Option

1. 1.5" - 165 lb/syd QC/QA-HMA, 2, 64, Surface, 9.5 mm, on
2. 2.0" - 275 lb/syd QC/QA-HMA, 2, 64, Intermediate, 19.0 mm, on
3. 4.00" - 413 lb/syd QC/QA-HMA, 2, 64, Base, 25.0 mm, on
4. 6" - Compacted Aggregate, No. 53 (Type II), on
5. Curb and Gutter, Vertical (Catch)
7. 4" - PCCP, on
8. 4" - Compacted Aggregate, No. 53

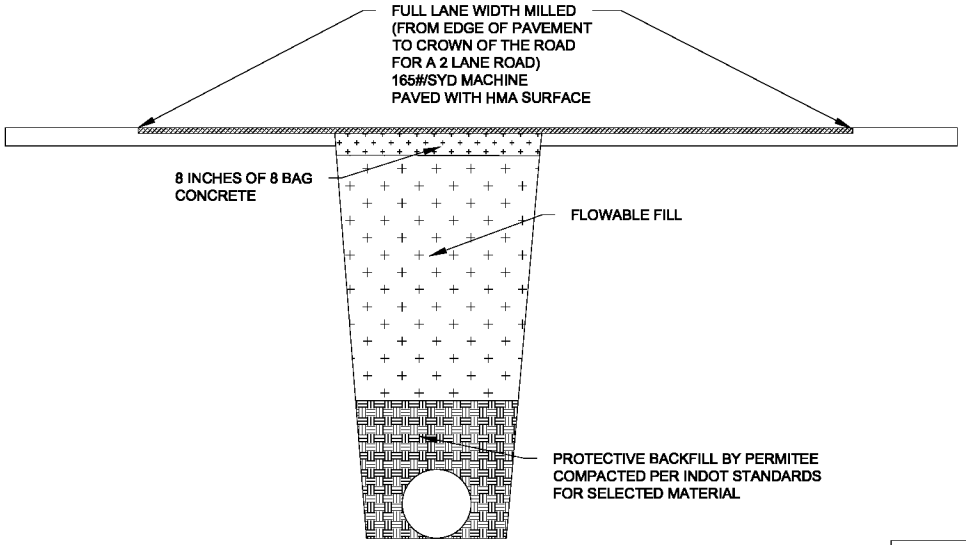
MUNCIE PUBLIC WORKS

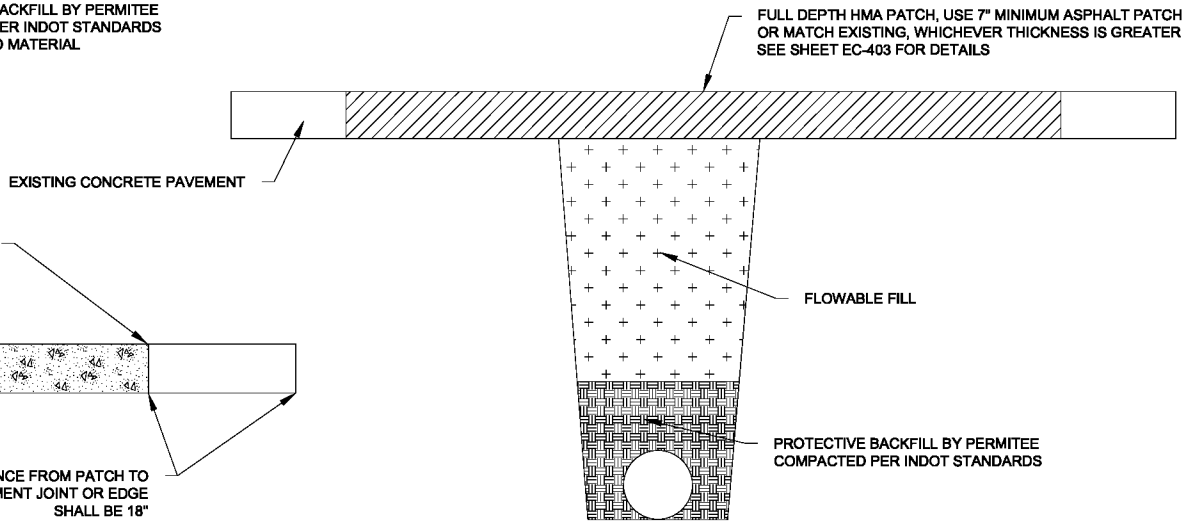
TYPICAL SECTION - LOCAL ROAD

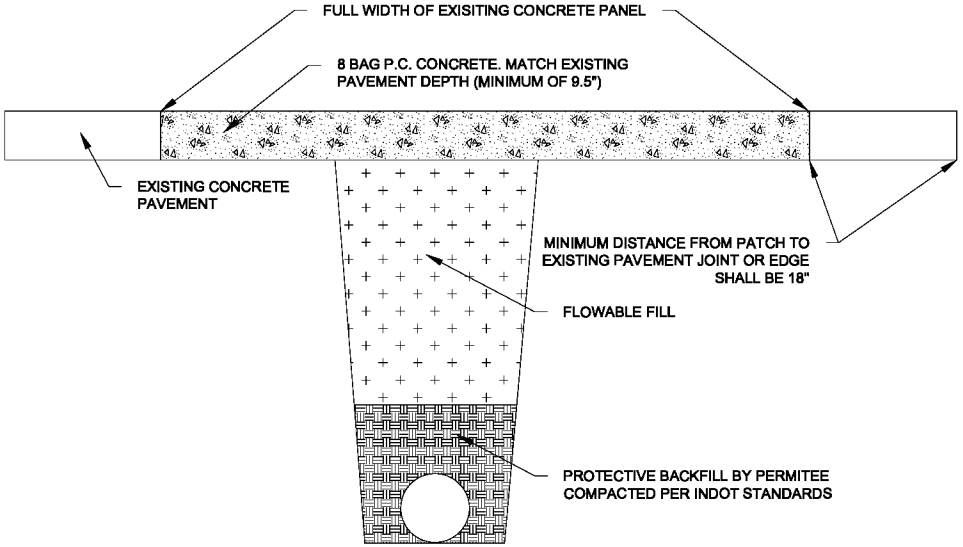
APPROVED: XX/XX/20XX

REVISED: XX/XX/20XX

STANDARD: **DS-305**







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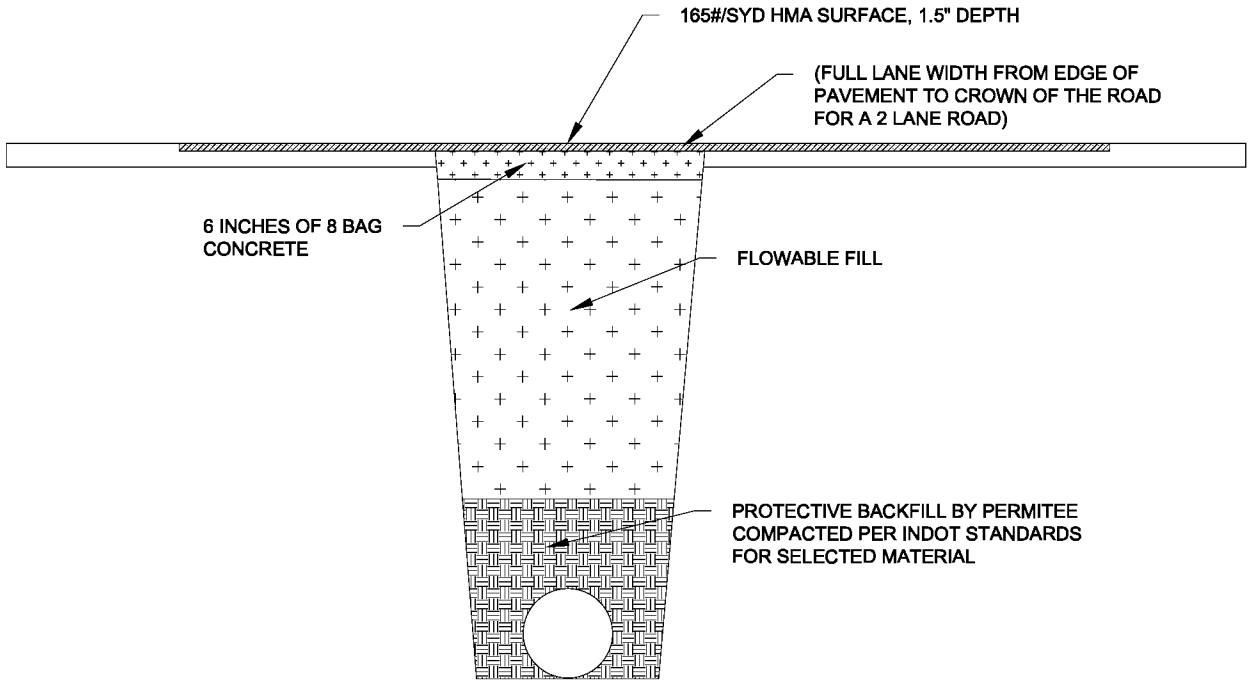
MUNCIE PUBLIC WORKS

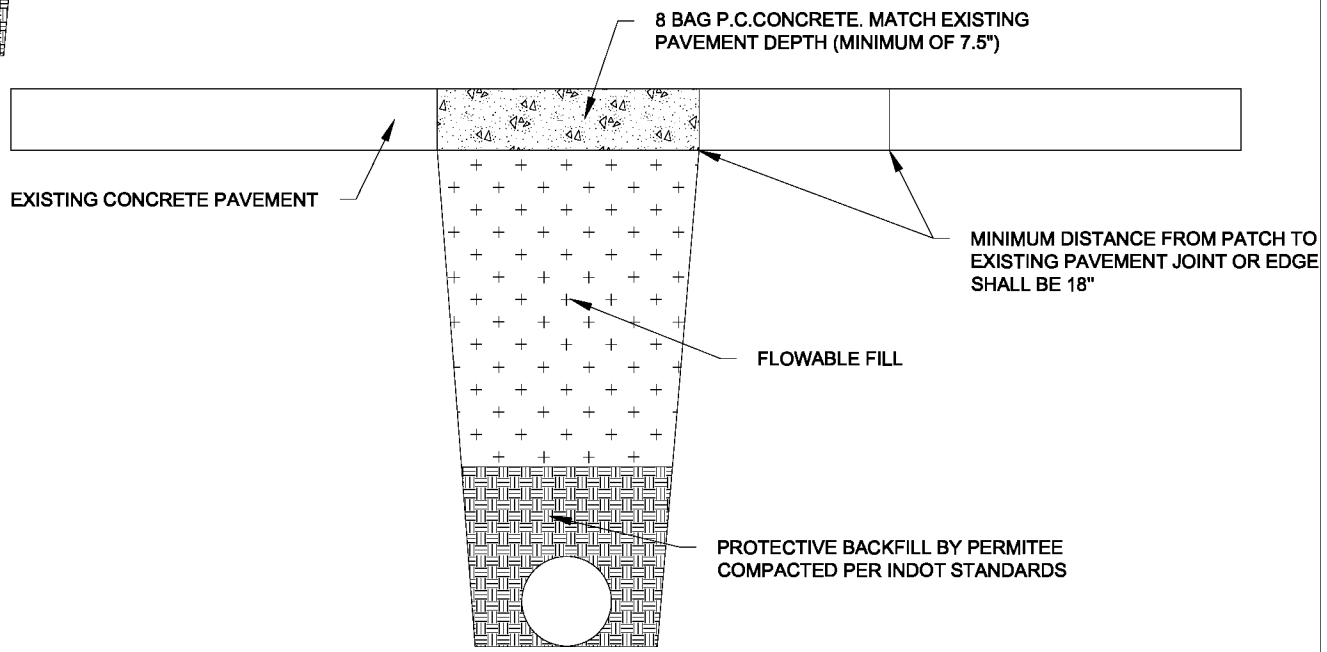
ALTERNATE RESTORATION SPECIFICATIONS FOR ARTERIAL OR COLLECTOR ASPHALT & CONCRETE STREETS

APPROVED: XX/XX/20XX

REVISED: XX/XX/20XX

STANDARD: **EC-401**





ALTERNATE RESTORATION SPECIFICATIONS FOR LOCAL & RESIDENTIAL ASPHALT & CONCRETE STREETS

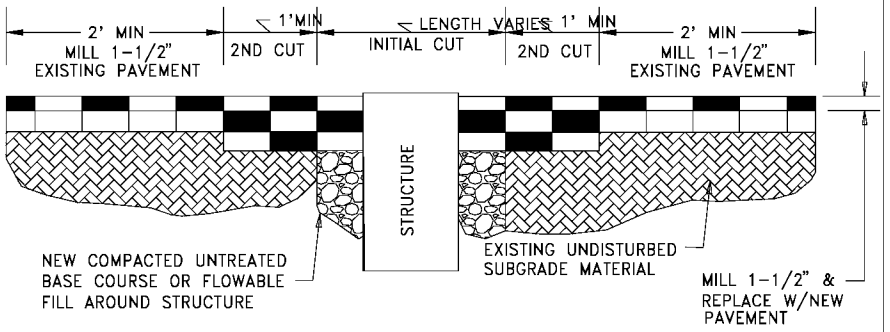
APPROVED: XX/XX/20XX

REVISED: XX/XX/20XX

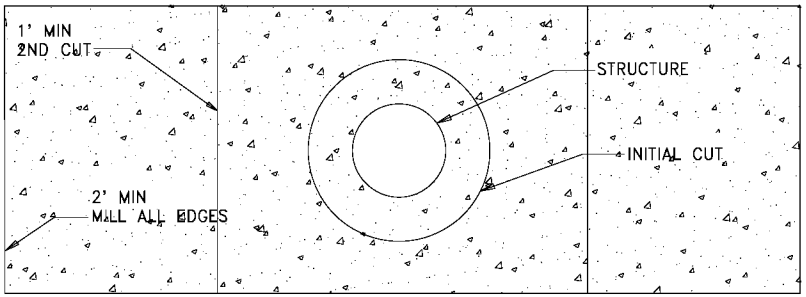
STANDARD: EC-402

NOTE:

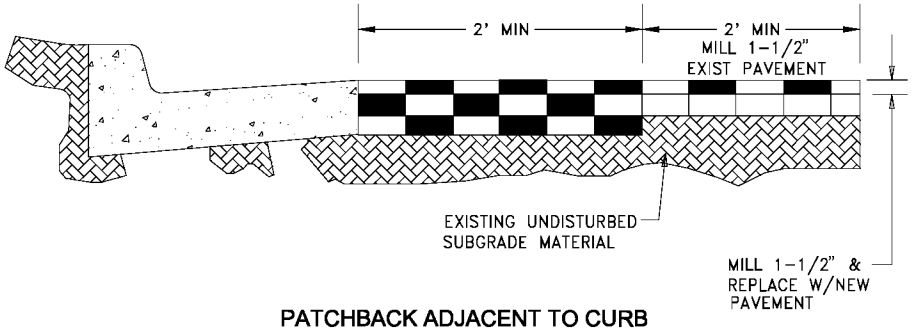
1. IF ASPHALT PATCH THICKNESS IS NOT IDENTIFIED ON PLANS USE 7" MIN ASPHALT PATCH OR MATCH EXISTING, WHICH EVER THICKNESS IS GREATER.
2. MINIMUM DEPTH OF SURFACE COURSE IN PATCH SHALL BE 2".
3. MINIMUM DEPTH OF INTERMEDIATE COURSE SHALL BE 2" WITH MINIMUM BASE UNDER INTERMEDIATE SHALL BE 3".
4. PATCH SHALL BE PLACED AND COMPACTED IN LIFTS A MAXIMUM OF 3" IN DEPTH.
5. APPLY TACK COAT TO EXISTING ASPHALT AND/OR CONCRETE VERTICAL SURFACES.
6. TRENCHES LESS THAN 2' IN WIDTH MUST RECEIVE PRIOR APPROVAL FROM THE CITY OF MUNCIE ENGINEERING DEPARTMENT AND SHALL BE FLOW-FILLED.
7. PROVIDE 28 DAY 60 PSI CONTROLLED LOW STRENGTH FLOWABLE FILL AS SPECIFIED. USE FILL THAT FLOWS EASILY AND VIBRATION IS NOT REQUIRED. CURE TO INITIAL SET BEFORE PLACING NEW UNTREATED BASE COURSE OR NEW ASPHALT PAVEMENT. USE FLOWABLE FILL IN EXCAVATION THAT ARE TOO NARROW TO RECEIVE COMPACTION EQUIPMENT.
8. REMOVE ADDITIONAL PAVEMENT TO A PAINTED LANE STRIPE, A LIP OF GUTTER, A CURB, AN EXISTING PAVEMENT PATCH, OR AN EDGE OF THE PAVEMENT IF SUCH STREET FEATURE IS WITHIN TWO FEET OF THE SECOND SAW CUT.
9. PROVIDE UNTREATED BASE COURSE MATERIAL. DO NOT USE GRAVEL OR WASHED ROCK. PLACE NEW MATERIAL IN LIFTS NOT EXCEEDING 8" AFTER COMPACTION. COMPACT TO A MODIFIED PROCTOR DENSITY OF 95% OR GREATER.
10. STRAIGHT SAWCUT OR BLADECUT THE EXISTING ASPHALT PAVEMENT WHEN JOINING WITH NEW ASPHALT PAVEMENT.
11. IF FOUR (4) OR MORE CUTS PER A BLOCK, OR 20% OF THE ROAD SURFACE OF ANY BLOCK IS DISTURBED, RESTORATION OF THE ENTIRE BLOCK WILL BE REQUIRED INCLUDING THE MILLING AND RESURFACING OF THE ENTIRE BLOCK FROM INTERSECTION TO INTERSECTION OF THE IMPACTED SEGMENT OF ROADWAY.



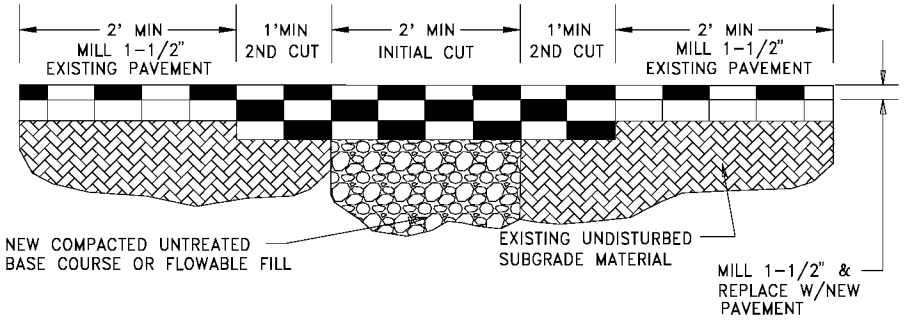
PATCHBACK FOR STRUCTURES (MANHOLES, VALVES ETC)



PLAN VIEW



PATCHBACK ADJACENT TO CURB



PATCHBACK FOR UTILITY AND SERVICE TRENCHES

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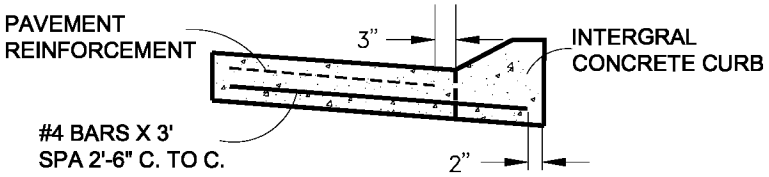
MUNCIE PUBLIC WORKS

TRENCH, CURB AND STRUCTURE PATCH

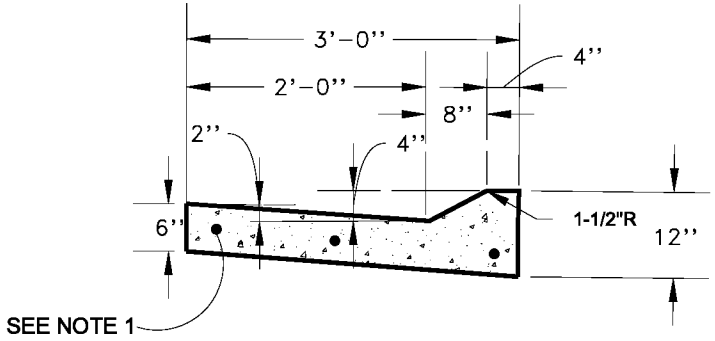
APPROVED: XX/XX/20XX

REVISED: XX/XX/20XX

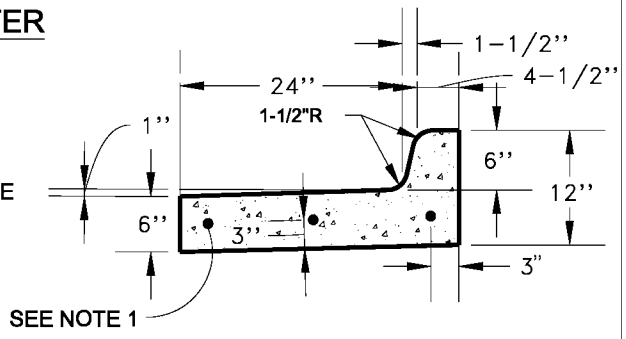
STANDARD: EC-403



TYPICAL MONOLITHIC CURB HEAD & CONCRETE PAVEMENT



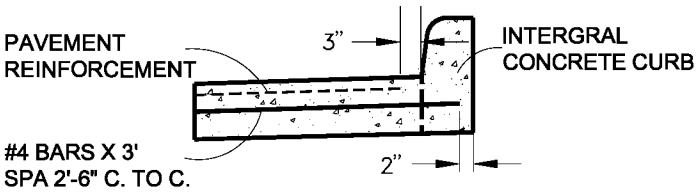
MOUNTABLE CURB AND GUTTER

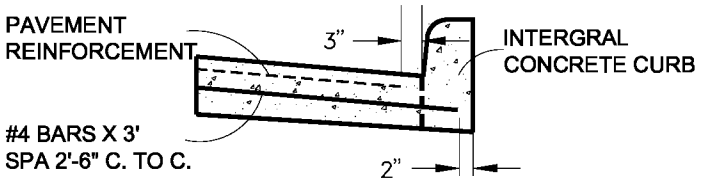


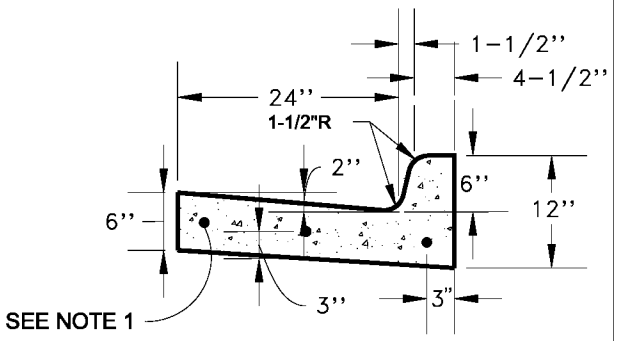
VERTICAL CURB AND GUTTER (SPILL)

NOTES

1. THREE NO. 4 REBARS SHALL BE USED IN ALL CURB RETURNS WITH 25' OR LARGER RADII. THE REBAR SHALL BE USED FROM BEGINNING TO END OF THE CURB RETURN.
2. AT EACH LOW POINT OF EACH MEDIAN CURB, A DRAINAGE SLOT SHALL BE INSTALLED
3. SLIP FORM TEMPLATE FOR VERTICAL CURB AND GUTTER SHALL NOT BE ALLOWED FOR POURING STANDARD MEDIAN CURB.
4. WHERE 6 BAG CONCRETE PAVEMENT IS USED, PLANS SHOULD SHOW MONOLITHIC CURBS.







VERTICAL CURB AND GUTTER (CATCH)

CURB AND GUTTER

APPROVED: XX/XX/20XX

REVISED: XX/XX/20XX

STANDARD: **CM-501**

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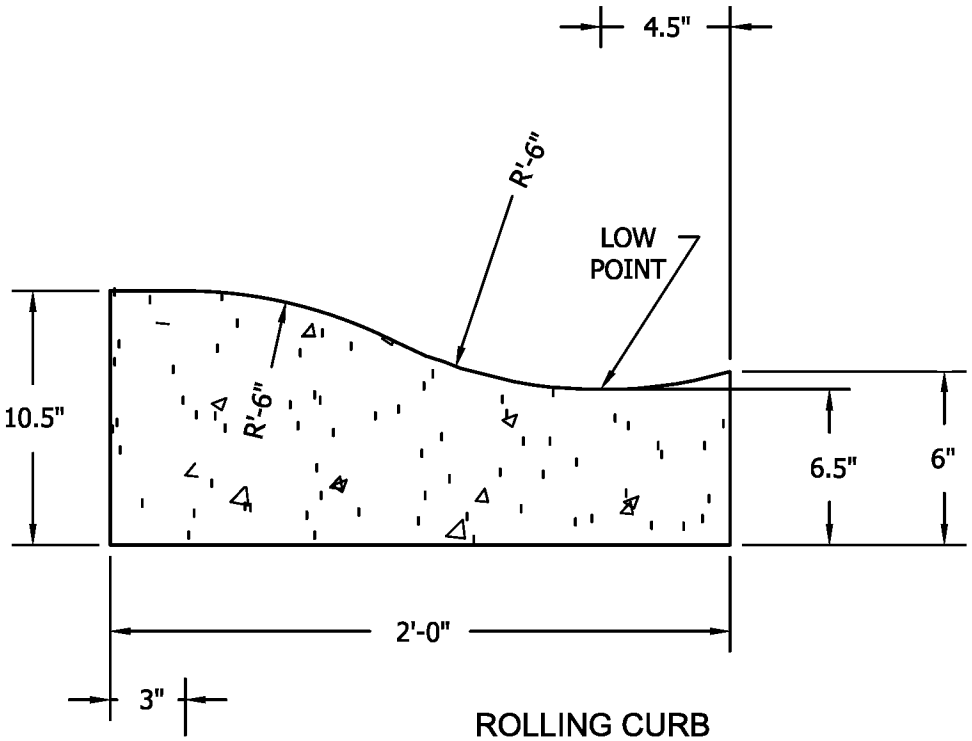
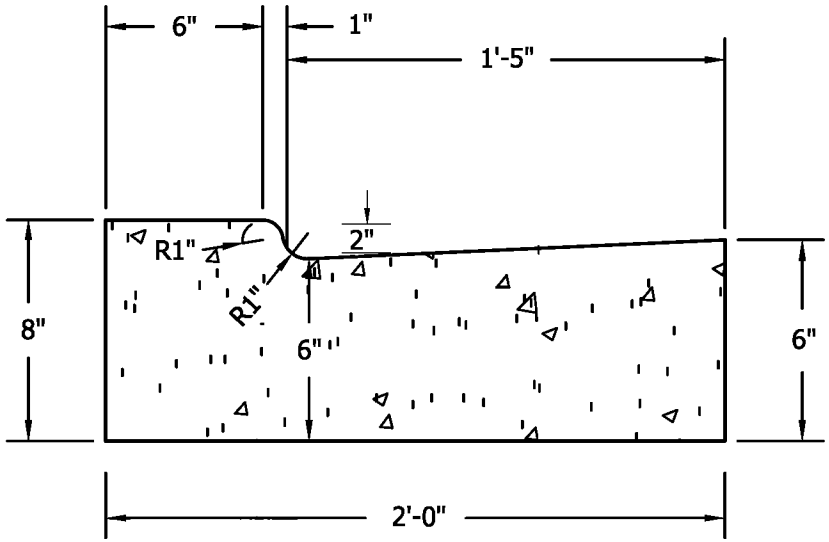


ROLLING CURB



DEPRESSED CURB

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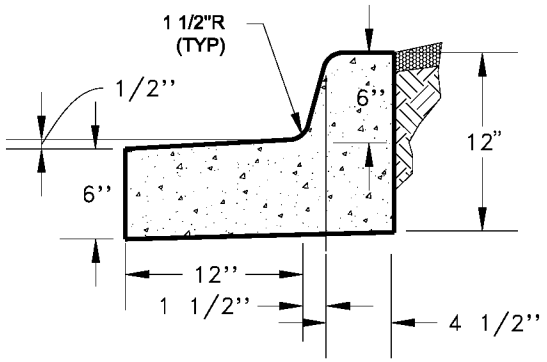
ROLL CURB AND DEPRESSED CURB

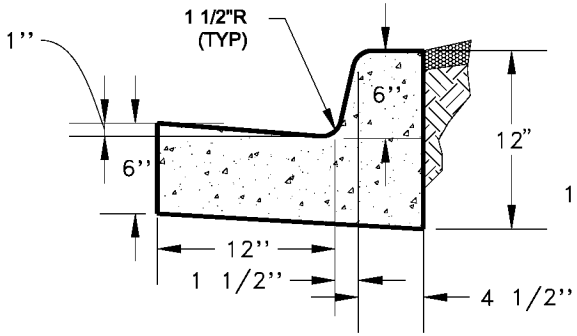
APPROVED: XX/XX/20XX

REVISED: XX/XX/20XX

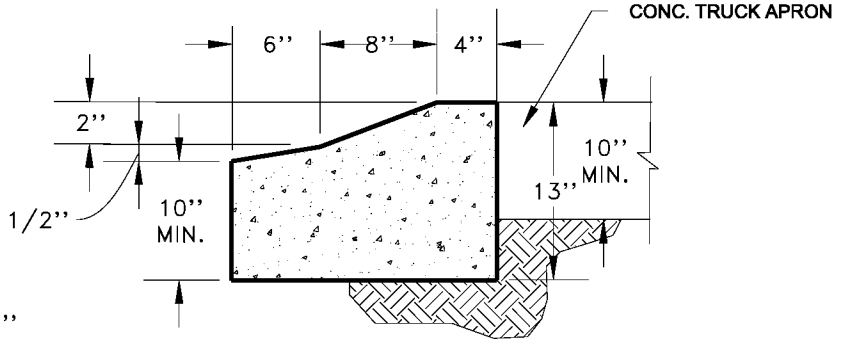
STANDARD: **CM-502**



STANDARD MEDIAN CURB



MEDIAN CATCH CURB



TRUCK APRON MEDIAN
SPILL CURB

NOTES

1. WHERE CONCRETE PAVEMENT IS USED, PLANS SHOULD SHOW MONOLITHIC CURBS.

MUNCIE PUBLIC WORKS

STANDARD MEDIAN CURBS

APPROVED: XX/XX/20XX

REVISED: XX/XX/20XX

STANDARD: **CM-503**

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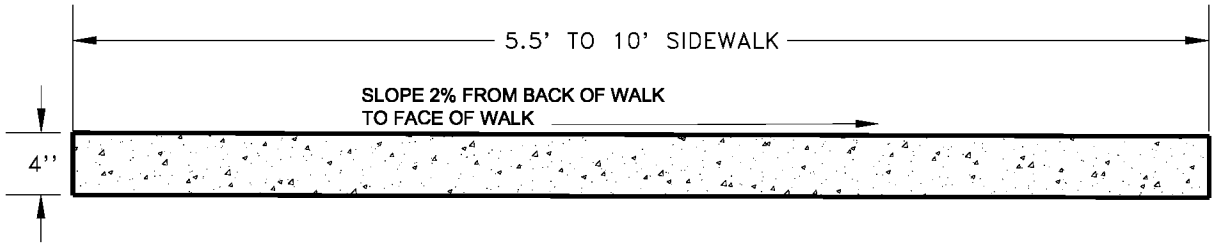
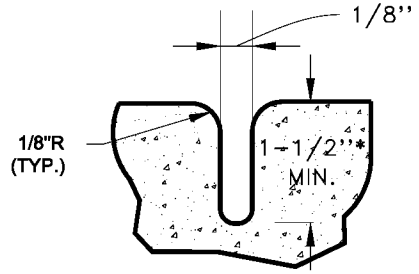


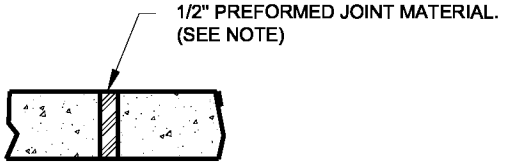
SIDEWALK

NOTE: WHEN WALK IS ADJACENT TO A CURB CUT, MATCH THICKNESS AND REINFORCING WITH CURB CUT. (SEE 16.0)



* 1.5" IF TEMPLATES ARE NOT USED

CONTRACTION OR WEAKNED PLANE JOINT



EXPANSION JOINT

NOTE: IN GUTTER FLOWLINES RECESS EXPANSION JOINT 1/ 2" AND SEAL WITH FLEXIBLE SEALANT.

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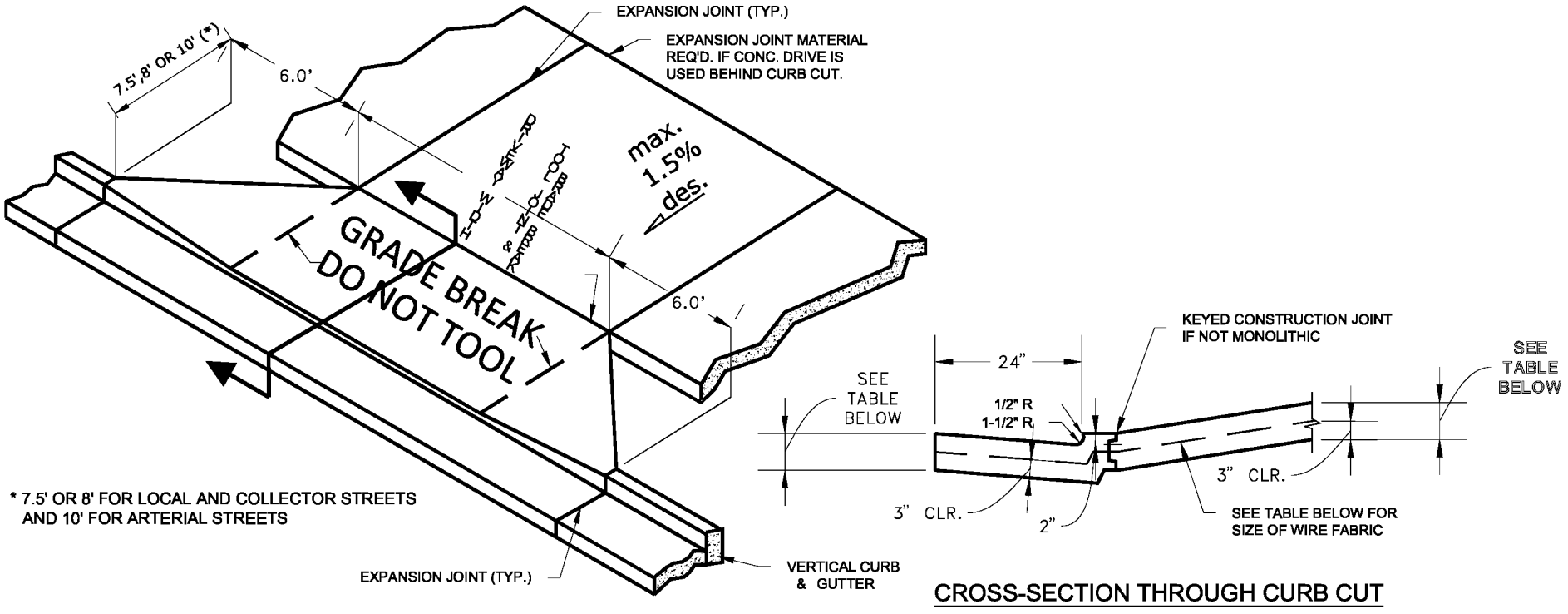
MUNCIE PUBLIC WORKS

SIDEWALK CONSTRUCTION JOINTS

APPROVED: XX/XX/20XX

REVISED: XX/XX/20XX

STANDARD: **CM-504**



CROSS-SECTION THROUGH CURB CUT

* APT. BLDGS. WITH LESS THAN 5 UNITS MAY USE 6" THICKNESS.

1. BACK OF CURB CUT EXTENDS TO BACK OF WALK. IF NO WALK IS PRESENT, EXTEND BACK OF CURB CUT TO BACK OF FUTURE WALK
2. END OF CURB CUT SHALL NOT BE CONSTRUCTED WITHIN 5' OF A PROPERTY LINE OR 20' OF AN INTERSECTING STREET R.O.W UNLESS APPROVED BY THE ENGINEER OF PUBLIC WORKS.
3. CITY ENGINEER SHALL APPROVE LOCATION OF CURB CUT BEFORE CONSTRUCTION.
4. REBAR SHALL BE CONTINUOUS IN CURB CUT AND ADJACENT WALK EXCLUDING SINGLE FAMILY CURB CUTS.
5. WALK ACROSS DRIVEWAY SHALL BE SAME THICKNESS WITH SAME REINFORCEMENT AS CURB CUT.

TYPE OF CUT	WIDTH OF DRIVEWAY	TOTAL WIDTH	MINIMUM THICKNESS	GRADE 60 REBAR
SINGLEFAMILY	10'–20'	26'–32'	6"	-----
MULTIFAMILY*	16'–25'	26'–35'	9"	#4@18",EW.
COMMERCIAL	20'–40'	40'–50'	9"	#4@12",EW.

CURB, GUTTER AND WALK CURB CUTS

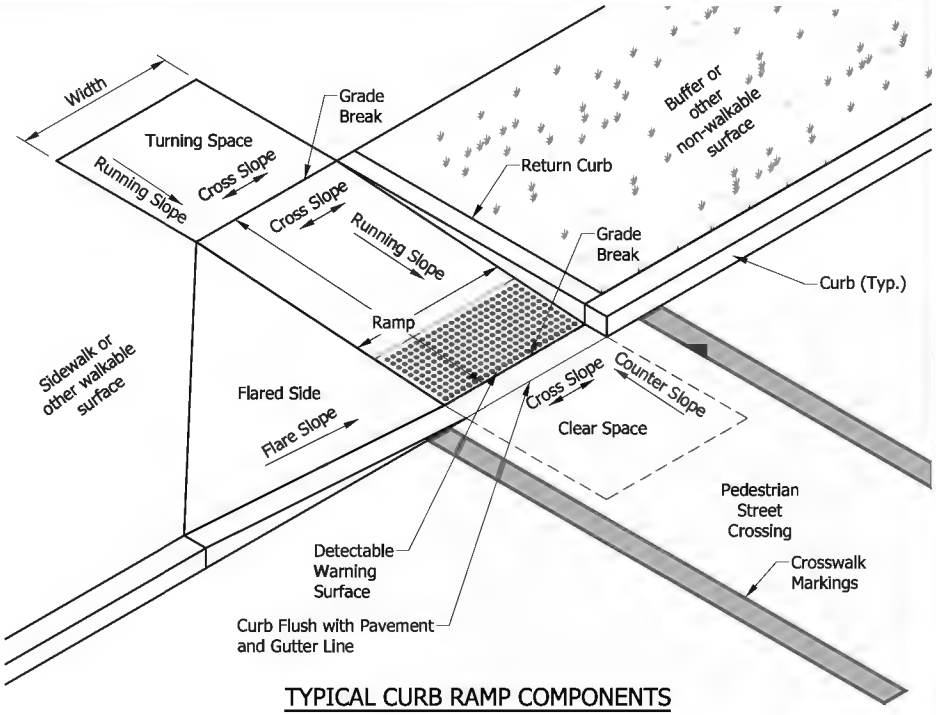
APPROVED: XX/XX/20XX

REVISED: XX/XX/20XX

STANDARD: **CM-505**

GENERAL NOTES:

1. All slopes are absolute rather than relative to the sidewalk or roadway grade. Slopes at least 0.50% less than the maximum are preferred.
2. Ramp or Blended Transition. A ramp or blended transition shall be used to lower or raise the sidewalk to connect with the street or highway.
3. Turning Space. A turning space shall be provided at the top of a perpendicular ramp, bottom of a parallel ramp, or where the pedestrian travel requires a change in direction. A common turning space may be shared by adjacent ramps. The turning space shall have a minimum clear dimension of 4 ft x 4 ft. Where the turning space is constrained at the back of the sidewalk by a curb, retaining wall, building, or feature over 2 inches in height, the minimum clear dimension shall be 4 ft x 5 ft, with the 5-ft dimension in the direction of the ramp running slope.
4. Flared Side. A flared side shall be used adjacent to a walkable surface. A flared side may be used adjacent to a non-walkable surface. A flared side shall have a maximum slope of 10.00% measured parallel to the back of the curb.
5. Return Curb. A return curb is placed perpendicular to the roadway curb. A return curb may be used adjacent to a non-walkable surface. A return curb shall not be used adjacent to a walkable surface. The return curb may be omitted where the non-walkable surface is flared and the curb adjacent the roadway is tapered to meet the flush curb at the bottom of the ramp.
6. Clear Space. A clear space shall be provided beyond the bottom grade break of a curb ramp wholly contained within the crosswalk and wholly outside the parallel vehicular travel path. The clear space shall have a minimum clear dimension of 4 ft x 4 ft.
7. Detectable Warning Surface. A detectable warning surface shall consist of truncated domes and be placed at each street, highway, or railroad crossing. The detectable warning surface shall extend a minimum of 2 ft in the direction of pedestrian travel and be placed the entire width of a ramp, blended transition, or turning space.
8. Running Slope. The running slope of a ramp, blended transition, or turning space shall be measured parallel to the direction of pedestrian travel.
    a. A running slope of 2.00% or less is considered level.
    b. A ramp shall have a maximum running slope of 8.33% but shall not require a ramp length to exceed 15 ft.
    c. A blended transition shall have a maximum running slope of 5.00%.
    d. A turning space shall have a maximum running slope of 2.00%.
9. Width. Unless otherwise noted, minimum width of a ramp, blended transition, or turning space, excluding flared sides or return curb, shall be 4 ft.
10. Grade Break. A grade break at the top and bottom of a ramp, blended transition, or turning space shall be perpendicular to the running slope. Grade breaks shall not be within the ramp, blended transition, turning space, or detectable warning surface. Grade breaks shall be flush. Vertical discontinuities shall not be greater than 1/2 in. Where a discontinuity is greater than 1/4 in. the surface shall be beveled with a slope not steeper than 1V:2H.
11. Cross Slope Exceptions. The cross slope of a ramp, blended transition, or turning space shall be measured perpendicular to the direction of pedestrian travel.
    a. The maximum cross slope at a pedestrian street crossing without posted yield or stop control shall be 5.00%.
    b. The maximum cross slope at a pedestrian street crossing with posted yield or stop control shall be 2.00%.
    c. The maximum cross slope at a midblock crossing shall be the established grade of the adjacent roadway.
12. Counter Slope. A counter slope is the cross slope of the gutter or street adjacent the running slope of the ramp, blended transition, or turning space.
13. Objects such as a utility cover, vault frame, and grating shall be placed outside the curb ramp.
14. Curb ramps shall be placed within the marked crosswalk area.
15. Drainage inlets should be located uphill from a curb ramp to prevent ponding in the path of pedestrian travel.



TYPICAL CURB RAMP COMPONENTS

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MUNCIE PUBLIC WORKS

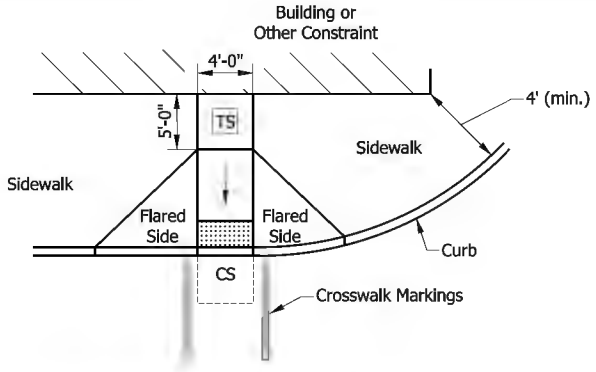
CURB RAMP DRAWING INDEX AND GENERAL NOTES

APPROVED: XX/XX/20XX
REVISED: XX/XX/20XX
STANDARD: **CM-506**

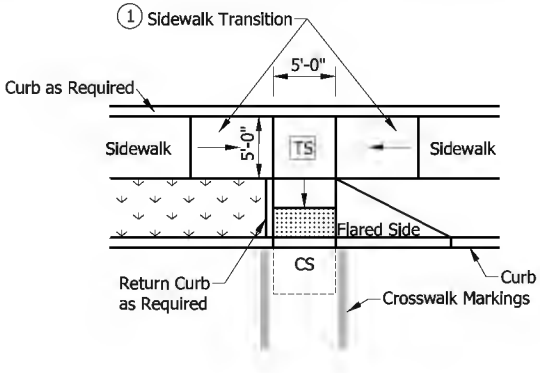
NOTES:

1. Where insufficient width between the curb and back of sidewalk prevent a standard perpendicular curb ramp running slope, a sidewalk transition may be used to lower the sidewalk grade. The sidewalk transition running slope shall not exceed 8.33%.

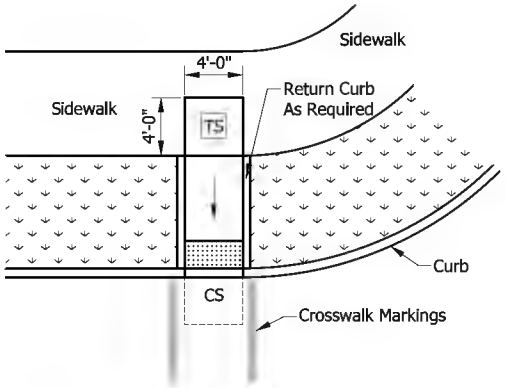
2. The turning space shall have a minimum clear dimension of 4 ft x 4 ft and a running slope of 2.00% maximum. Where the turning space is constrained at the back of the sidewalk, the minimum clear dimension shall be 4 ft x 5 ft, with the 5-ft dimension in the direction of the ramp running slope.



PERPENDICULAR CURB RAMP
ADJACENT WALKABLE SURFACE



TIERED PERPENDICULAR CURB RAMP



PERPENDICULAR CURB RAMP
ADJACENT NON-WALKABLE SURFACE

LEGEND:

- Buffer or Other Non-Walkable Surface
- Ramp
- Detectable Warning Surface
- TS — Turning Space
- CS — Clear Space

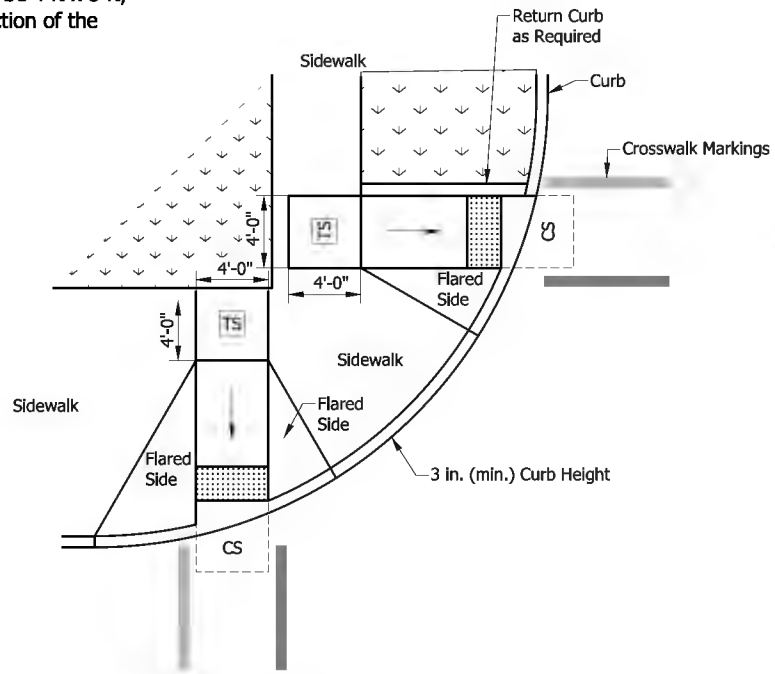
PERPENDICULAR CURB RAMP TYPICAL PLACEMENT

APPROVED: XX/XX/20XX
REVISED: XX/XX/20XX
STANDARD: **CM-507**

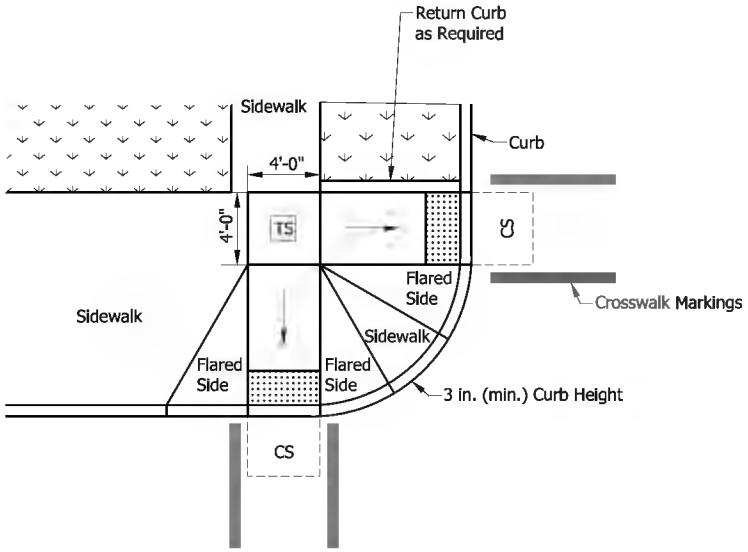
PLOT DATE: 8/11/2023 10:51 AM EDIT DATE: 8/5/2023 EDITED BY: JDAY DRAWING FILE: C:\Users\jday\Desktop\MSD_TBLK (LANDSCAPE).dwg

NOTES:

1. The turning space shall have a minimum clear dimension of 4 ft x 4 ft and a running slope of 2.00% maximum. Where the turning space is constrained at the back ofthe sidewalk, the minimum clear dimension shall be 4 ft x 5 ft, with the 5-ft dimension in the direction of the ramp running slope.



PAIRED PERPENDICULAR
CURB RAMPS AT LARGE RADIUS



PAIRED PERPENDICULAR
CURB RAMPS AT SMALL RADIUS

LEGEND:

- Buffer or Other Non-Walkable Surface
- Ramp
- Detectable Warning Surface
- TS — Turning Space
- CS — Clear Space

PAIRED PERPENDICULAR CURB RAMPS TYPICAL PLACEMENT

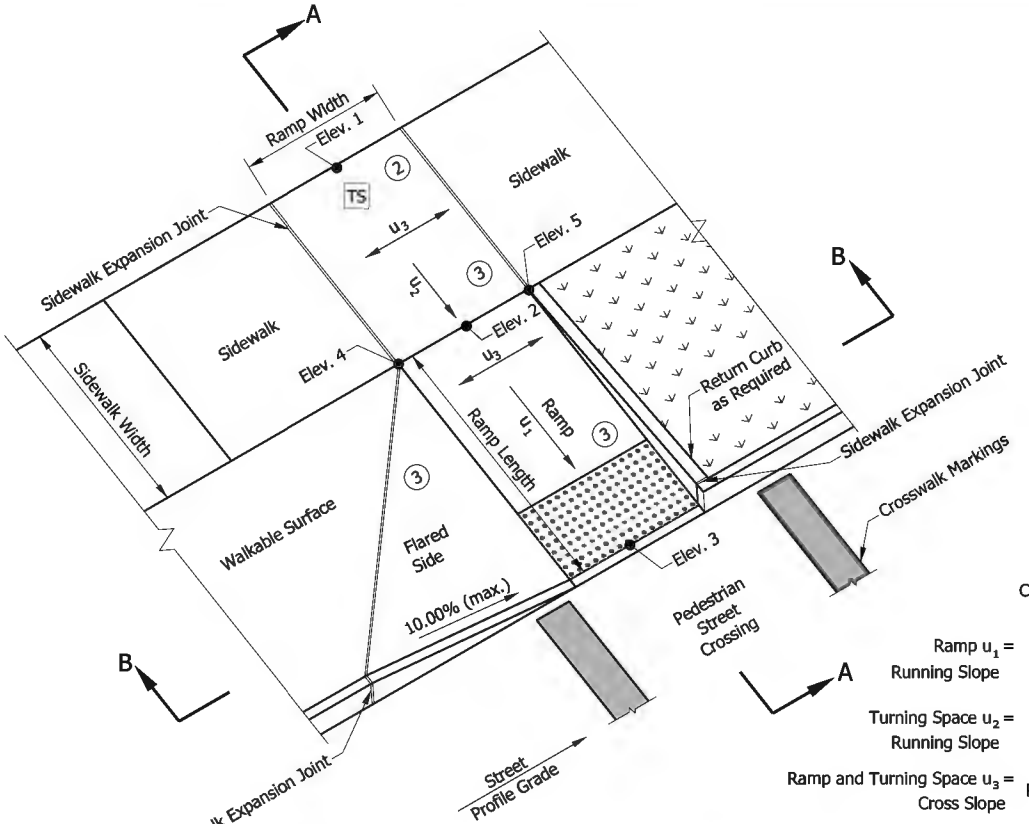
APPROVED: XX/XX/20XX
REVISED: XX/XX/20XX
STANDARD: **CM-508**

NOTES:

1. The bottom edge of the ramp and top of curb shall be flush with the edge of adjacent pavement and gutter line.

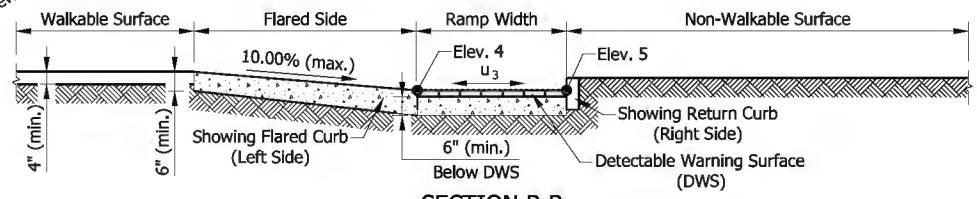
2. The turning space shall have a minimum clear dimension of 4 ft x 4 ft. Where the turning space is constrained at the back of the sidewalk, the minimum clear dimension shall be 4 ft x 5 ft, with the 5-ft dimension in the direction of the ramp running slope. Where a tiered perpendicular curb ramp is used, a constrained turning space shall have a minimum clear dimension of 5 ft x 5 ft.

3. Curb ramp surface shall be coarse broomed transverse to the running slope.

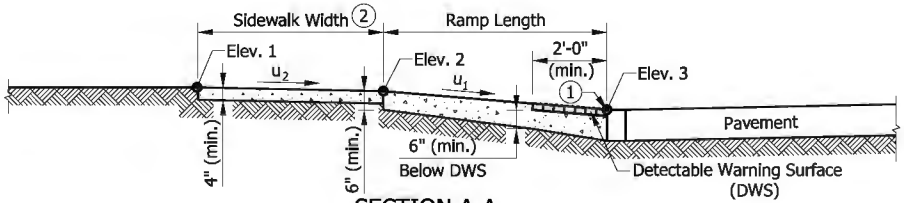


Component Slope Equations:

Ramp u_1 = Running Slope	$\frac{\text{Elev. 2 - Elev. 3}}{\text{Ramp Length}}$	≤ 8.33%
Turning Space u_2 = Running Slope	$\frac{\text{Elev. 1 - Elev. 2}}{\text{Sidewalk Width}}$	≤ 2.00%
Ramp and Turning Space u_3 = Cross Slope	$\frac{\text{Elev. 4 - Elev. 5}}{\text{Ramp or Turning Space Width}}$	≤ 2.00% (4)



SECTION B-B



SECTION A-A

LEGEND:

- Buffer or Other Non-Walkable Surface
- Ramp
- Detectable Warning Surface
- TS — Turning Space

PERPENDICULAR CURB RAMP COMPONENT DETAILS

APPROVED: XX/XX/20XX

REVISED: XX/XX/20XX

STANDARD: **CM-509**

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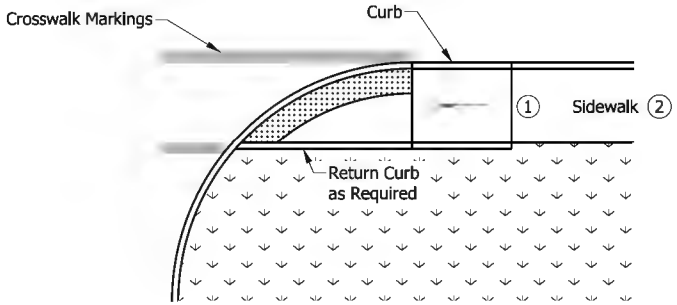
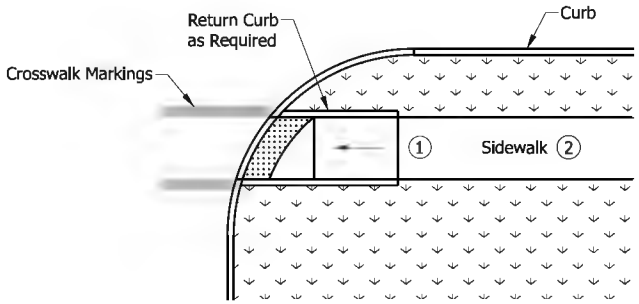
NOTES:

1. A turning space is not required at the top of the ramp for a one-way directional perpendicular curb ramp.

2. Where there is no buffer between the sidewalk and curb the preferred minimum sidewalk width is 6 ft. Where a buffer is placed between the sidewalk and curb, the prefeered minimum sidewalk width is 5 ft.



ONE-WAY DIRECTIONAL PERPENDICULAR CURB RAMP ADJACENT CURB



ONE-WAY DIRECTIONAL PERPENDICULAR CURB RAMP WITH BUFFER

LEGEND:

- Buffer or Other Non-Walkable Surface
- Ramp
- Detectable Warning Surface

MUNCIE PUBLIC WORKS

ONE-WAY DIRECTIONAL PERPENDICULAR CURB RAMP TYPICAL PLACEMENT

APPROVED: XX/XX/20XX

REVISED: XX/XX/20XX

STANDARD: **CM-510**

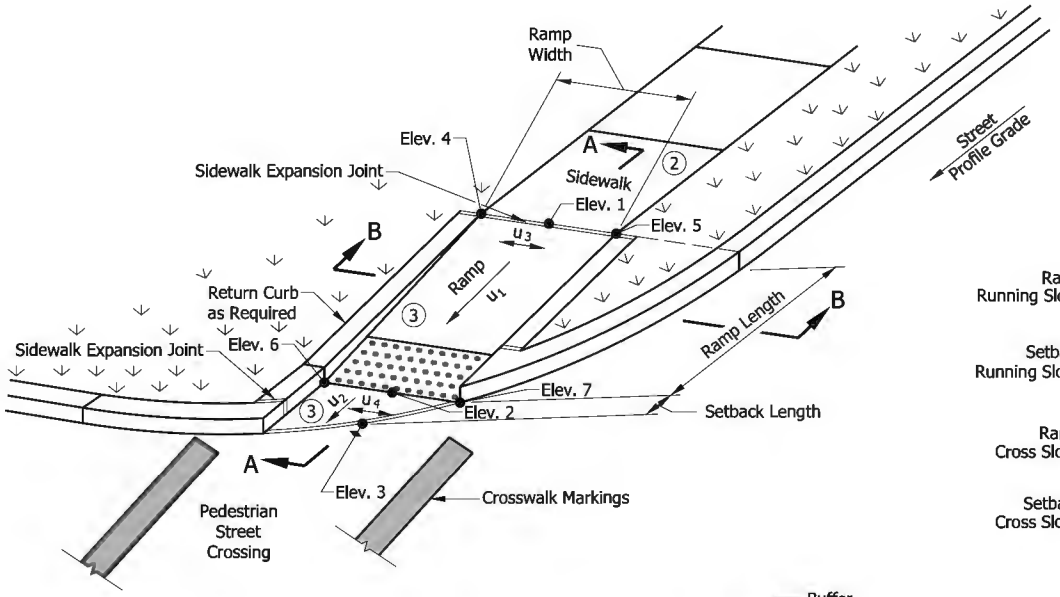
PLOT DATE: 8/11/2023 10:51 AM EDIT DATE: 9/5/2023 EDITED BY: JDAY DRAWING FILE: C:\Users\jday\Desktop\MSD_TBLK (LANDSCAPE).dwg

NOTES:

1. The bottom edge of the ramp or setback and top of curb shall be flush with the edge of adjacent pavement and gutter line.

2. A turning space is not required at the top of the ramp for a one way directional perpendicular curb ramp.

3. Curb ramp surface shall be coarse broomed transverse to the running slope.



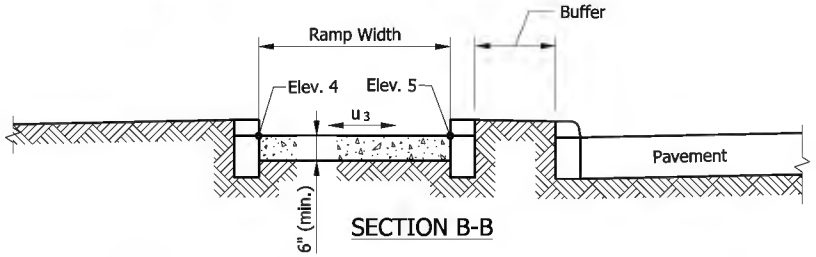
Component Slope Equations:

Ramp Running Slope: $u_1 = \frac{|\text{Elev. 1} - \text{Elev. 2}|}{\text{Ramp Length}} \leq 8.33\%$

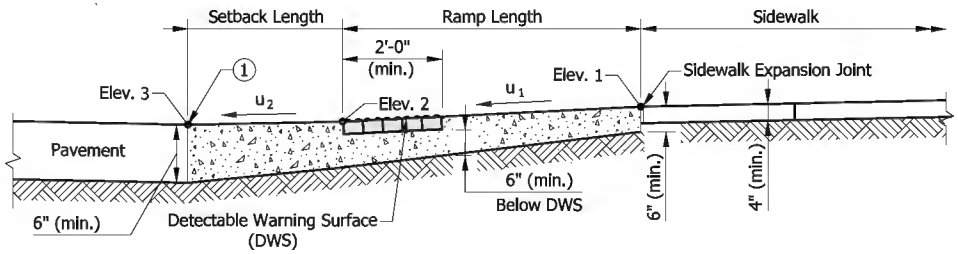
Setback Running Slope: $u_2 = \frac{|\text{Elev. 2} - \text{Elev. 3}|}{\text{Setback Length}} \leq$ Profile Grade of Adjacent Street

Ramp Cross Slope: $u_3 = \frac{|\text{Elev. 4} - \text{Elev. 5}|}{\text{Ramp Width}} \leq 2.00\%$ (4)

Setback Cross Slope: $u_4 = \frac{|\text{Elev. 6} - \text{Elev. 7}|}{\text{Ramp Width}} \leq 2.00\%$ (4)



SECTION B-B



SECTION A-A

LEGEND:

- Buffer or Other Non-Walkable Surface
- Ramp
- Detectable Warning Surface

MUNCIE PUBLIC WORKS

ONE-WAY DIRECTIONAL PERPENDICULAR CURB RAMP COMPONENT DETAILS

APPROVED: XX/XX/20XX

REVISED: XX/XX/20XX

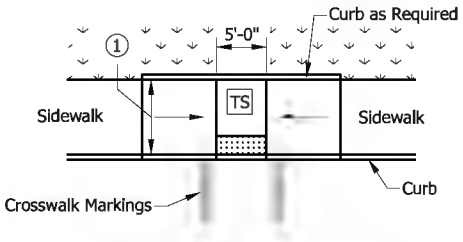
STANDARD: CM-511

PLOT DATE: 8/11/2023 10:51 AM EDIT DATE: 9/5/2023 EDITED BY: JDAY DRAWING FILE: C:\Users\jday\Desktop\MSD_TBLK (LANDSCAPE).dwg

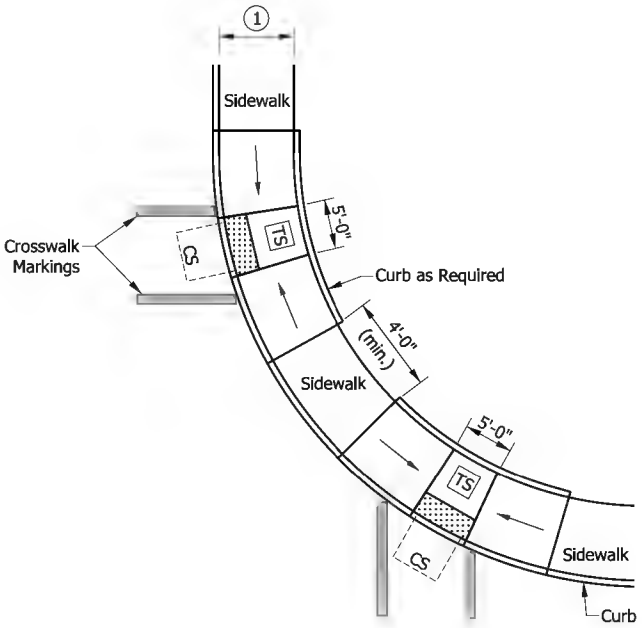
NOTES:

1. Where there is no buffer between the sidewalk and curb the preferred minimum sidewalk width is 6 ft. Where a buffer is placed between the side walk and curb, the preferred minimum sidewalk is 5 ft.

2. The turning space shall have a minimum clear dimension of 4 ft x 4 ft and a running slope of 2.00% maximum. Where the turning space is constrained at the back of the sidewalk, the minimum clear dimension shall be 4 ft x 5 ft, with the 5-ft dimension in the direction of the ramp running slope.



MIDBLOCK CROSSING CURB RAMP



PAIRED PARALLEL CURB RAMPS ALONG LARGE RADIUS

LEGEND:

- Buffer or Other Non-Walkable Surface
- Ramp
- Detectable Warning Surface
- TS — Turning Space
- CS — Clear Space

MUNCIE PUBLIC WORKS

PAIRED PARALLEL CURB RAMPS AND MIDBLOCK CROSSING CURB RAMP TYPICAL PLACEMENT

APPROVED: XX/XX/20XX
REVISED: XX/XX/20XX
STANDARD:
CM-512

PLOT DATE: 8/11/2023 10:51 AM EDIT DATE: 9/5/2023 EDITED BY: JDAY DRAWING FILE: C:\Users\jday\Desktop\MSD_TBLK (LANDSCAPE).dwg

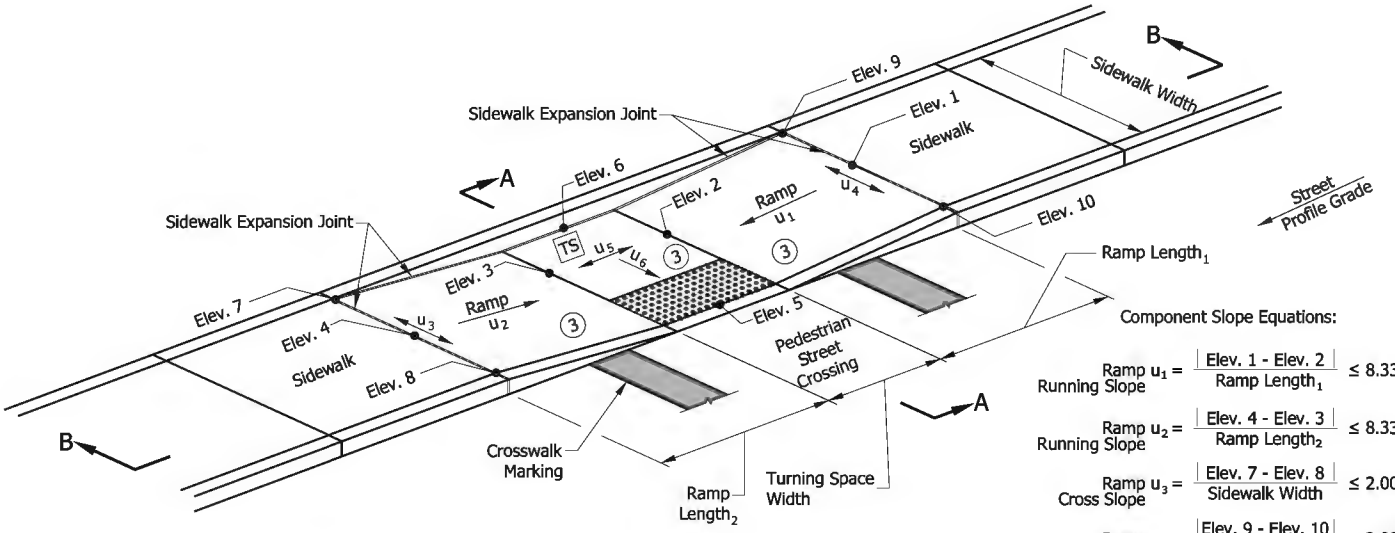
NOTES:

1. The bottom edge of the turning space and top of curb shall be flush with the edge of adjacent pavement and gutter line.

2. The turning space shall have a minimum clear dimension of 4 ft x 4 ft and a running slope of 2.00% maximum. Where the turning space is constrained at the back of the sidewalk, the minimum clear dimension shall be 4 ft x 5 ft, with the 5-ft dimension in the direction of the ramp running slope.

3. Curb ramp surface shall be coarse broomed transverse to the running slope.

4. Where there is no buffer between the sidewalk and curb, the preferred minimum sidewalk width is 6 ft. Where a buffer is placed between the sidewalk and curb, the preferred minimum width is 5 ft.



Component Slope Equations:

$$\text{Ramp Running Slope } u_1 = \frac{|\text{Elev. 1} - \text{Elev. 2}|}{\text{Ramp Length}_1} \leq 8.33\%$$

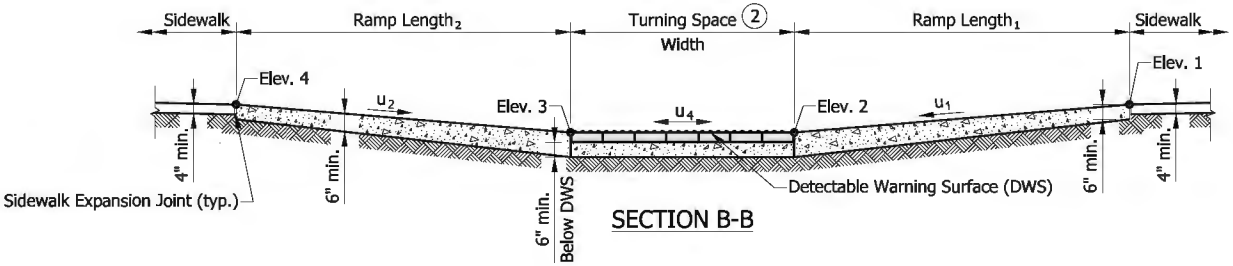
$$\text{Ramp Running Slope } u_2 = \frac{|\text{Elev. 4} - \text{Elev. 3}|}{\text{Ramp Length}_2} \leq 8.33\%$$

$$\text{Ramp Cross Slope } u_3 = \frac{|\text{Elev. 7} - \text{Elev. 8}|}{\text{Sidewalk Width}} \leq 2.00\%$$

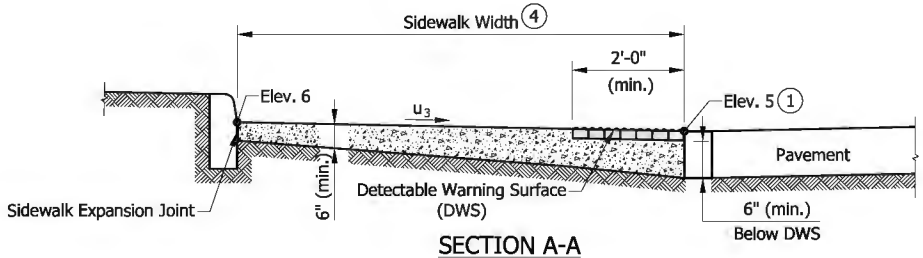
$$\text{Ramp Cross Slope } u_4 = \frac{|\text{Elev. 9} - \text{Elev. 10}|}{\text{Sidewalk Width}} \leq 2.00\%$$

$$\text{Turning Space Cross Slope } u_5 = \frac{|\text{Elev. 2} - \text{Elev. 3}|}{\text{Turning Space Width}} \leq 2.00\% \ (5)$$

$$\text{Turning Space Running Slope } u_6 = \frac{|\text{Elev. 6} - \text{Elev. 5}|}{\text{Sidewalk Width}} \leq 2.00\%$$



SECTION B-B



SECTION A-A

LEGEND:

- Ramp
- Detectable Warning Surface
- TS — Turning Space

MUNCIE PUBLIC WORKS

PARALLEL CURB RAMP COMPONENT DETAILS

APPROVED: XX/XX/20XX

REVISED: XX/XX/20XX

STANDARD: **CM-513**

PLOT DATE: 8/11/2023 10:51 AM EDIT DATE: 9/5/2023 EDITED BY: JDAY DRAWING FILE: C:\Users\jday\Desktop\MSD_TBLK (LANDSCAPE).dwg

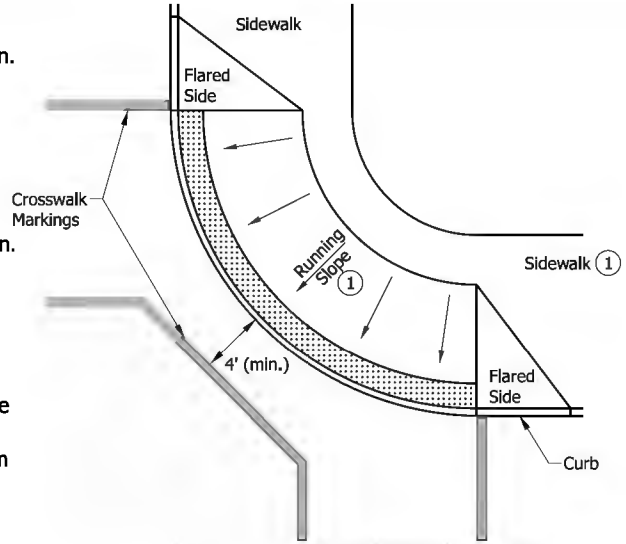
NOTES:

1. Where the running slope is greater than 2.00%, a 4-ft minimum sidewalk shall continue behind the blended transition. The running slope shall not exceed 5.00%.

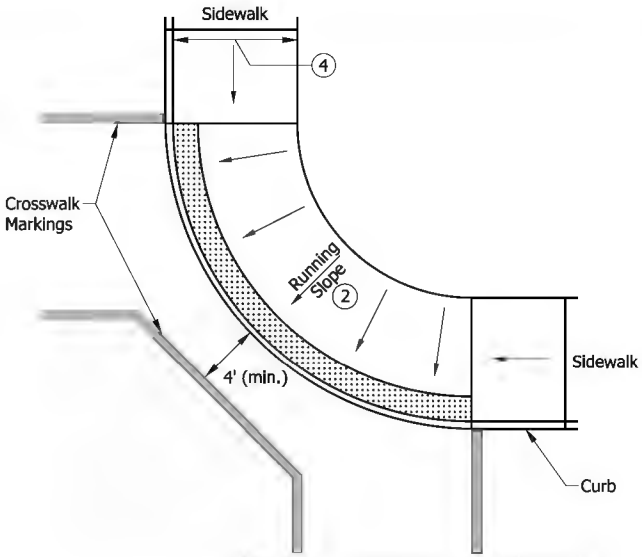
2. Where the running slope is less than or equal to 2.00% a 4-ft minimum sidewalk is not required behind the blended transition.

3. A diagonal curb ramp shall not be used for new construction. For an alteration project, a diagonal curb ramp shall be used only where existing physical conditions prevent paired curb ramps, a blended transition curb ramp, or a depressed corner curb ramp from being provided.

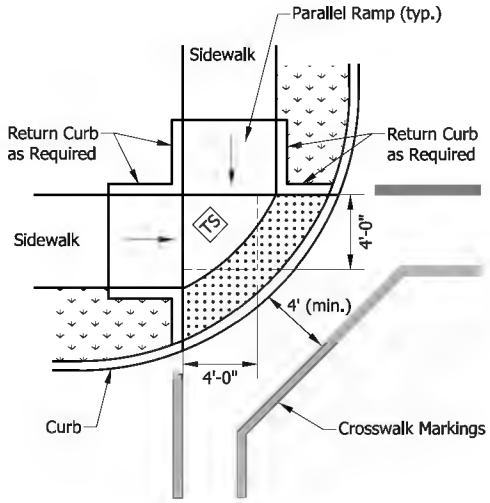
4. Where there is no buffer between the sidewalk and curb the preferred minimum sidewalk width is 6 ft. Where a buffer is placed between the sidewalk and curb, the preferred minimum sidewalk width is 5 ft.



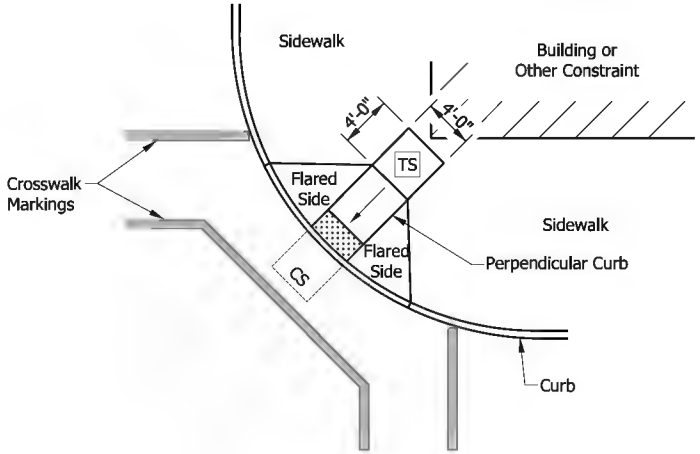
BLENDED TRANSITION CURB RAMP WITH RUNNING SLOPE > 2.00%



BLENDED TRANSITION CURB RAMP WITH RUNNING SLOPE ≤ 2.00%



DEPRESSED CORNER CURB RAMP



DIAGONAL CURB RAMP (3)

LEGEND:

- Buffer or Other Non-Walkable Surface
- Ramp
- Detectable Warning Surface
- TS — Turning Space
- CS — Clear Space

BLENDED TRANSITION CURB RAMP, DEPRESSED CURB RAMP AND DIAGONAL CURB RAMP TYPICAL PLACEMENT

APPROVED: XX/XX/20XX
REVISED: XX/XX/20XX
STANDARD: CM-514

PLOT DATE: 8/11/2023 10:51 AM EDIT DATE: 9/5/2023 EDITED BY: JDAY DRAWING FILE: C:\Users\jday\Desktop\MSD_TBLK (LANDSCAPE).dwg

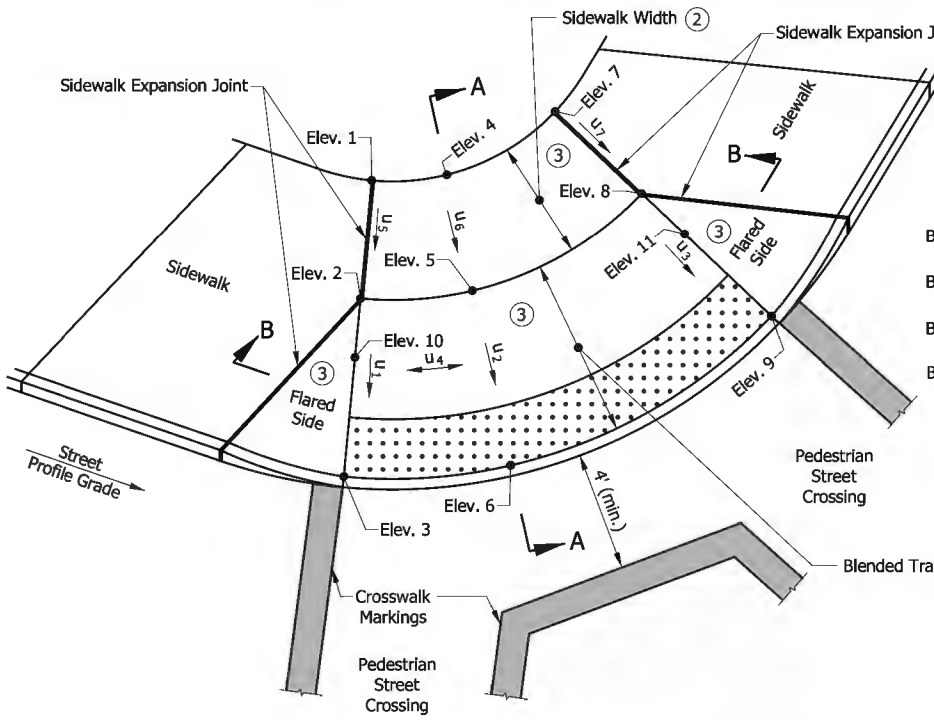
NOTES:

1. Where insufficient width between the curb and back of

1. The bottom edge of the blended transition and top of curb shall be flush with the edge of adjacent pavement and gutter line.

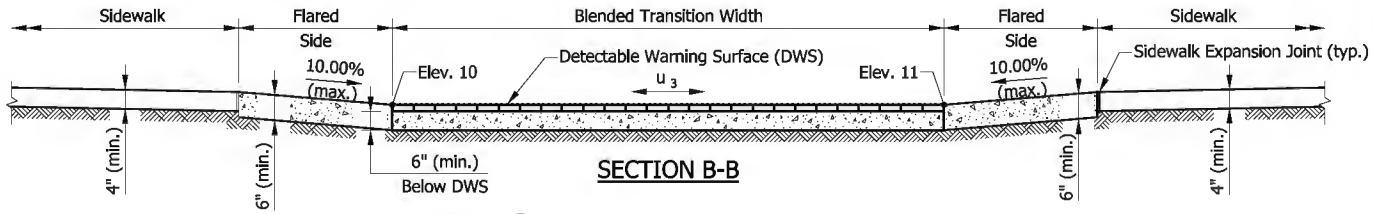
2. Where the running slope is less than or equal to 2.00% a 4-ft minimum sidewalk is not required, behind the blended transition. Where the running slope is greater than 2.00%, a 4-ft minimum sidewalk shall continue behind the blended transition and the running slope shall not exceed 5.00%.

3. Curb ramp surface shall be coarse broomed transverse to the running slope.

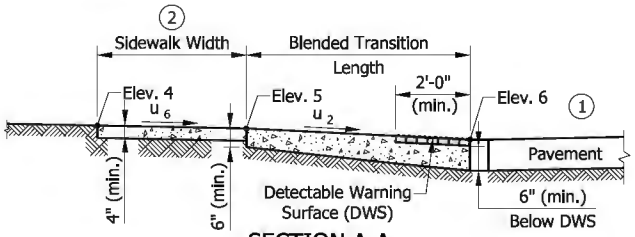


Component Slope Equations:

Blended Transition u_1 = Running Slope	$\frac{\text{Elev. 2 - Elev. 3}}{\text{Blended Transition Length}}$	≤ 2.00% (2)
Blended Transition u_2 = Running Slope	$\frac{\text{Elev. 5 - Elev. 6}}{\text{Blended Transition Length}}$	≤ 2.00% (2)
Blended Transition u_3 = Running Slope	$\frac{\text{Elev. 8 - Elev. 9}}{\text{Blended Transition Length}}$	≤ 2.00% (2)
Blended Transition u_4 = Cross Slope	$\frac{\text{Elev. 10 - Elev. 11}}{\text{Blended Transition Width}}$	≤ 2.00% (4)
Sidewalk u_5 = Cross Slope	$\frac{\text{Elev. 1 - Elev. 2}}{\text{Sidewalk Width}}$	≤ 2.00%
Sidewalk u_6 = Cross Slope	$\frac{\text{Elev. 4 - Elev. 5}}{\text{Sidewalk Width}}$	≤ 2.00%
Sidewalk u_7 = Cross Slope	$\frac{\text{Elev. 7 - Elev. 8}}{\text{Sidewalk Width}}$	≤ 2.00%



SECTION B-B



SECTION A-A

LEGEND:

- Ramp
- Detectable Warning Surface

BLENDED TRANSITION CURB RAMP COMPONENT DETAILS

APPROVED: XX/XX/20XX

REVISED: XX/XX/20XX

STANDARD: **CM-515**

PLOT DATE: 8/11/2023 10:51 AM EDIT DATE: 9/5/2023 EDITED BY: JDAY DRAWING FILE: C:\Users\jday\Desktop\MSD_TBLK (LANDSCAPE).dwg

NOTES:

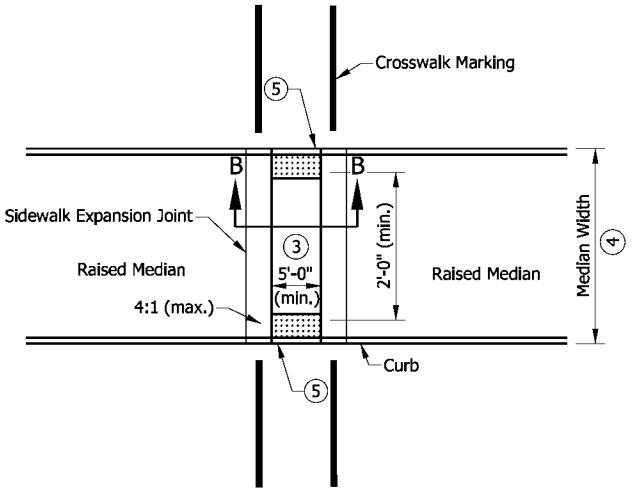
1. The minimum width of a median cut-through and median perpendicular curb ramp shall be 5 ft.

2. Where in-line or offset perpendicular curb ramps are used within a median, the turning space shall have a minimum clear dimension of 4 ft x 5 ft.

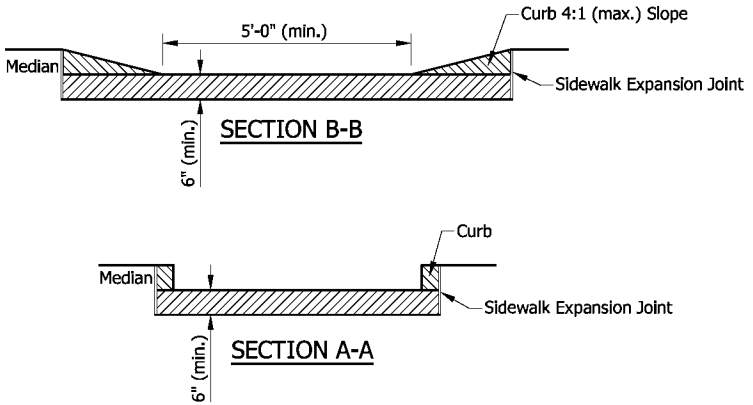
3. Where a median cut through is used the running slope shall be 5.00% maximum.

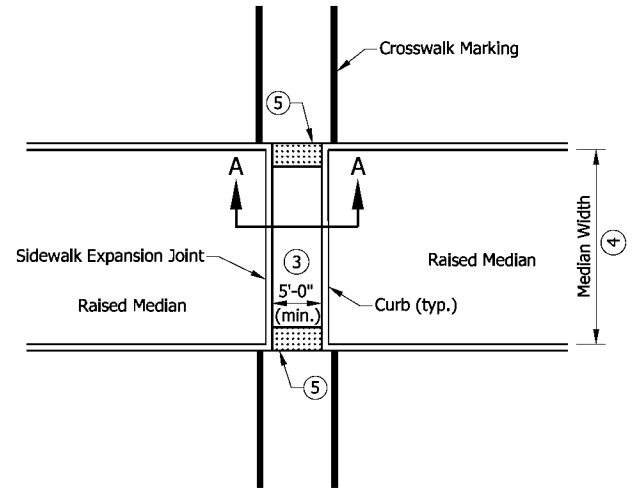
4. Where median widthis less than 6 ft, detectable warning surfaces shall not be placed.

5. The bottom edge of the median cut-through or median perpendicular curb ramp and the top of curb shall be flush with the edge of adjacent pavement guttter line.

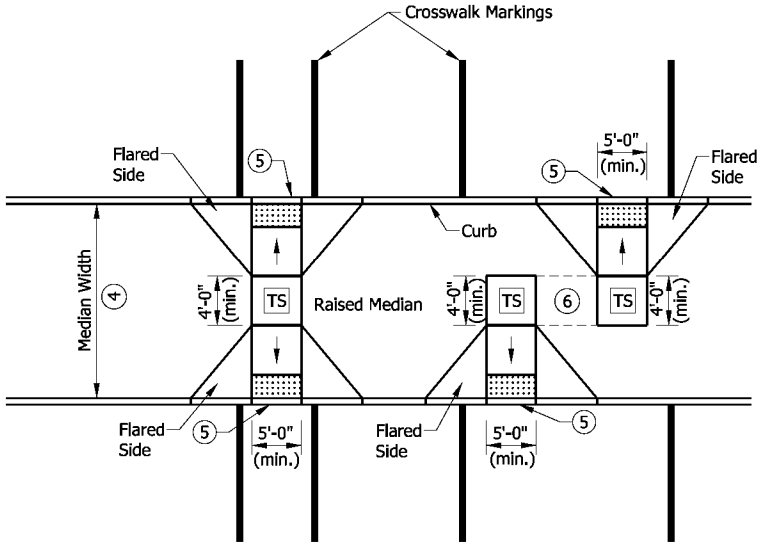


MEDIAN CUT-THROUGH WITH TAPERED CURB





MEDIAN CUT-THROUGH WITH CURB



MEDIAN PERPENDICULAR CURB RAMPS

LEGEND:

- Ramp
- Detectable Warning Surface
- TS — Turning Space

MUNCIE PUBLIC WORKS

MEDIAN CUT-THROUGH AND MEDIAN PERPENDICULAR CURB RAMP TYPICAL PLACEMENT

APPROVED: XX/XX/20XX

REVISED: XX/XX/20XX

STANDARD: **CM-516**

NOTES:

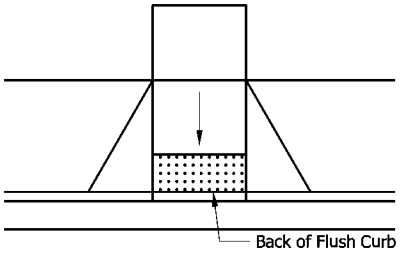
1. A detectable warning surface shall be placed at each street, highway, or railroad crossing.

2. The detectable warning surface shall extend a minimum of 2 ft in the direction of pedestrian travel and extend the full width as shown. The detectable warning surface shallnot be placed across a grade break.

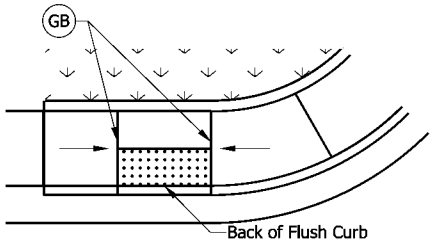
3. Where the distance from the face of the detectable warning surface is 5 ft or less from the back of the curb, the detectable warning surface shall be placed perpendicular to the ramp. Where the distance from the face of the detectable curb is more than 5 ft from the back of the curb, the detectable warning surface shall be placed at the back of the curb as shown or in the alternate placement configuration.

4. The detectable warning surface on a parallel curb ramp shall be placed on the turning space at the flush transition between the street and turning space at the back of the curb.

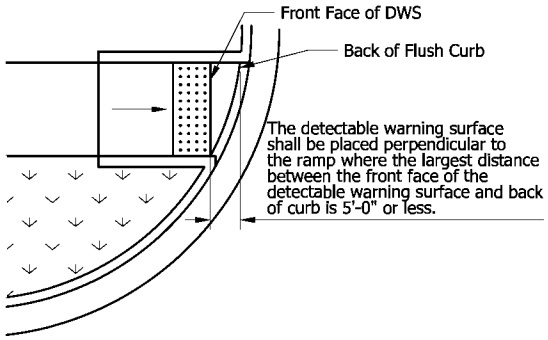
5. The detectable warning surface on a blended transition or depressed corner shall be placed at the back of curb as shown or in an alternative placement configuaration.

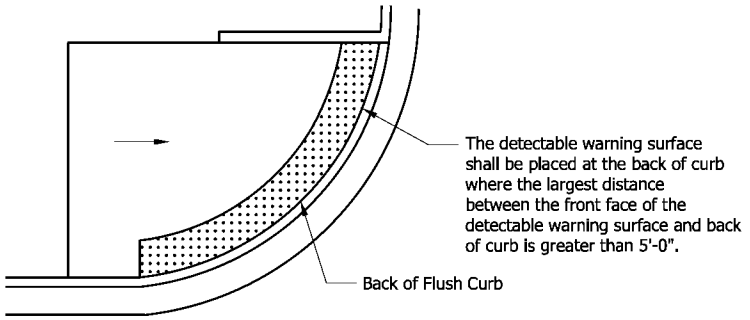


PERPENDICULAR CURB RAMP

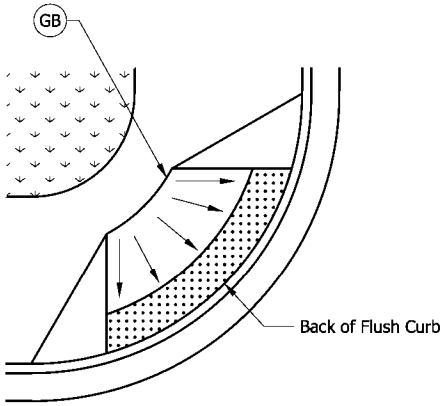


PARALLEL CURB RAMP (4)

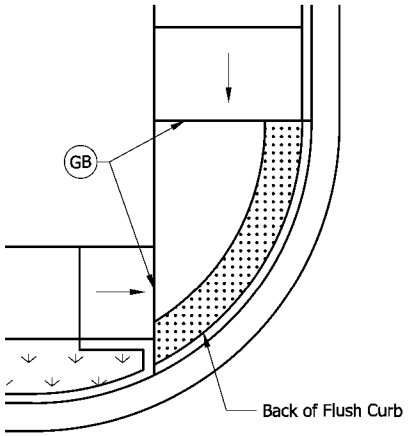




ONE-WAY DIRECTIONAL PERPENDICULAR CURB RAMPS ON A RADIUS (3)



BLENDED TRANSITION CURB RAMP (5)



DEPRESSED CORNER CURB RAMP (5) (7)

LEGEND:

- Buffer or Other Non-Walkable Surface
- Detectable Warning Surface (DWS)
- Ramp
- GB Grade Break

MUNCIE PUBLIC WORKS

DETECTABLE WARNING SURFACE PLACEMENT AND CONFIGURATION

APPROVED: XX/XX/20XX

REVISED: XX/XX/20XX

STANDARD: **CM-517**

PLOT DATE: 8/11/2023 10:51 AM
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NOTES:

1. The detectable warning surface shall extend a minimum length of 2 ft in the direction of pedestrian travel and extend the full width as shown. The detectable warning surface shall not be placed across a grade break. The edges of adjacent panels shall be parallel and tightly abutted.

2. The detectable warning surface on a median cut-through shall be placed at the flush transition between the street and median cut-through. Where a medianis less than 6 ft, a detectable warning surface shall not be placed.

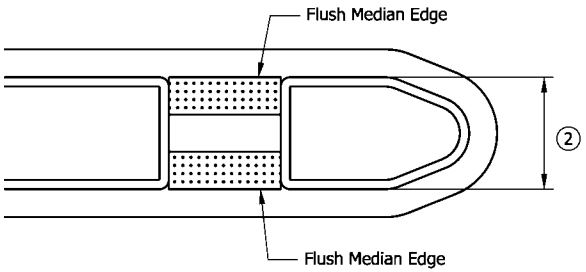
3. Where a pedestrian gate is provided at a railroad crossing, the detectable warning surface shall be placed on the side of the gate opposite the railroad crossing.

4. The detectable warning surface shall be outside of the railroad dynamic envelope, 6 ft min. from the centerline of the nearest rail.

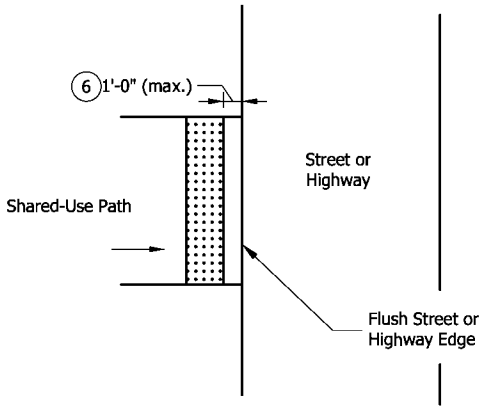
5. The edge of the detectable warning surface shall not be within the dynamic envelope and no greater than 15 ft from the centerline of the nearest rail.

6. Where shared-use path intersects a street or highway, the detectable warning surface shall be placed on the shared-use path within 1 ft of the street or highway edge.

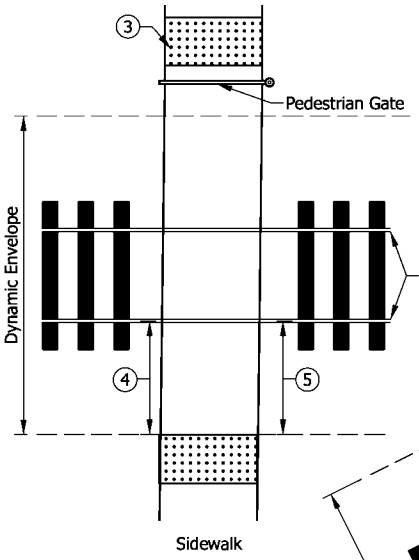
7. DWS panel ends shall be placed at the back of the curb. The distance between the back of the curb and the front face of the detectable warning surface shall not exceed 6 in. between ends.



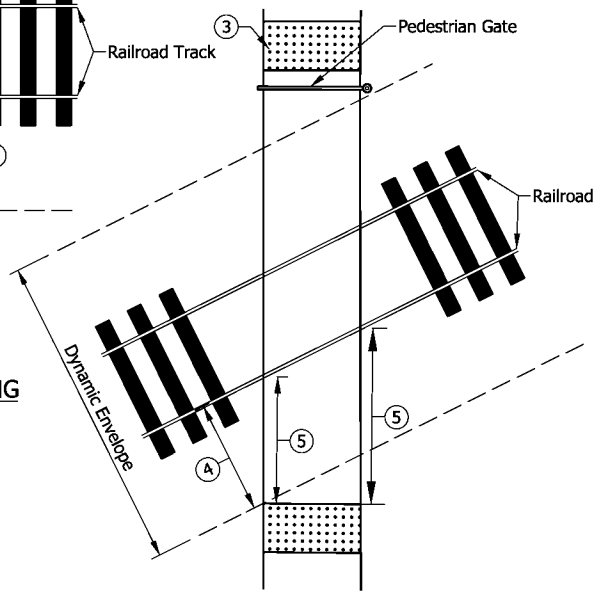
MEDIAN CUT-THROUGH



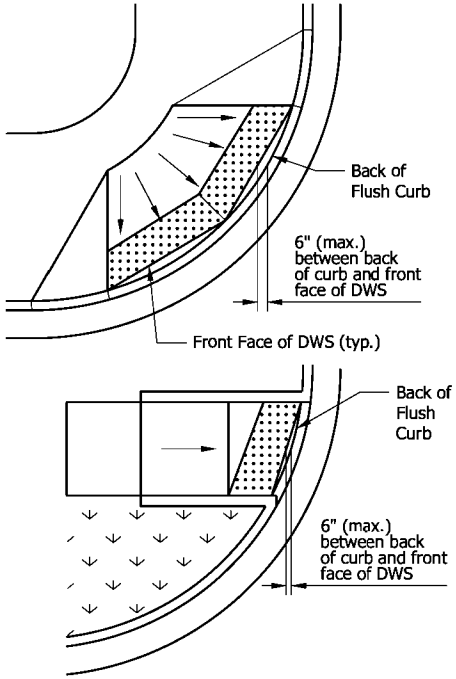
SHARED-USE PATH



PERPENDICULAR RAILROAD CROSSING



SKEWED RAILROAD CROSSING



ALTERNATE DETECTABLE WARNING SURFACE PLACEMENT (7)

LEGEND:

- Buffer or Other Non-Walkable Surface
- Detectable Warning Surface (DWS)
- Ramp
- GB Grade Break

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MUNCIE PUBLIC WORKS

DETECTABLE WARNING SURFACE PLACEMENT AND CONFIGURATION

APPROVED: XX/XX/20XX

REVISED: XX/XX/20XX

STANDARD: **CM-518**

NOTES:

1. Where insufficient width between the curb and back of

1. Detectable warning surface shall consist of truncated domes. Domes shall be aligned in a square or radial grid pattern with diameter and center-to-center spacing within the ranges specified.

2. The detectable warning surfacemay be field cut. Truncated dome spacing between adjacent panels shall be within the ranges specified.

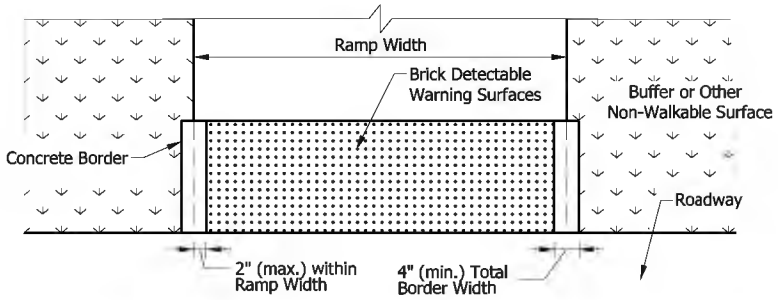
3. The detectable warning surface shall contrast visually with adjacent surfaces, either light-on-dark or dark-on-light.

4. The detectable warning surface shall extend a minimum of 2 ft in the direction of pedestrian travel and extend the full width as shown. The detectable warning surface shall not be placed across a grade break.

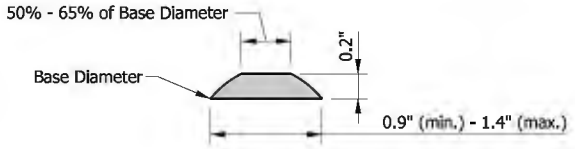
5. The maximum counter slope of the gutter or street at the bottom of the ramp shall be 5.00%. Where the algebraic difference between the running slope and the counter slope exceeds 11%, a 2-ft minimum level strip should be provided at the bottom of the ramp.

6. Where a concrete border is used for forming, the border shall be cast monolithically with the curb ramp concrete. The concrete border shall not reduce the ramp width by more than 2 in. on each side.

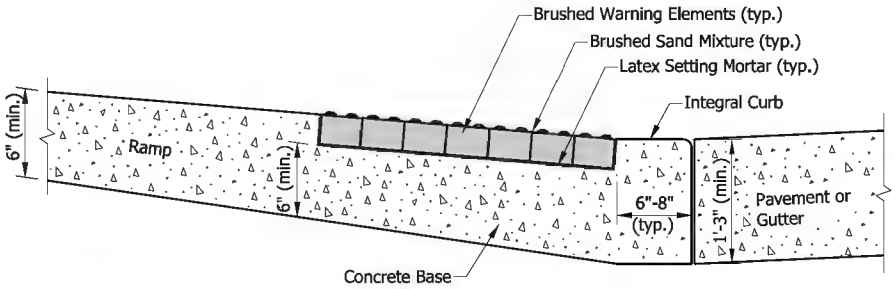
7. Where forming other than a concrete border is used, the edge restraint shall not encroach upon the ramp width.



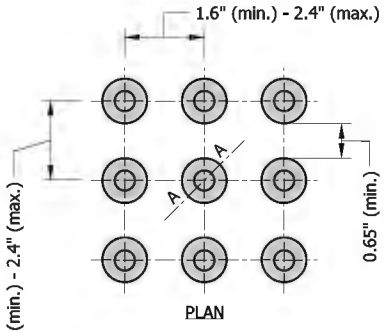
BRICK DETECTABLE WARNING SURFACE WITH CONCRETE BORDER ⑥ ⑦



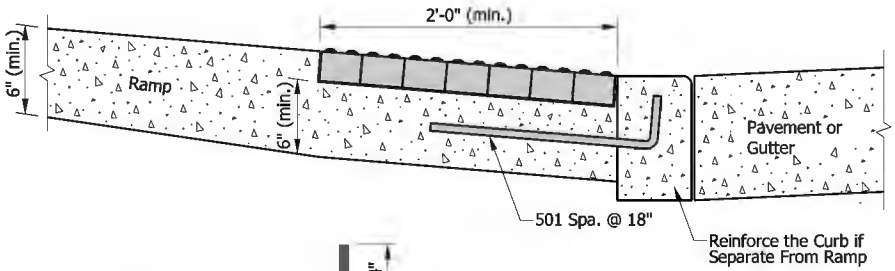
SECTION A-A

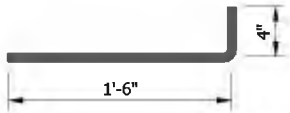


TYPICAL RAMP AND BRICK SURFACE CONSTRUCTION DETAIL



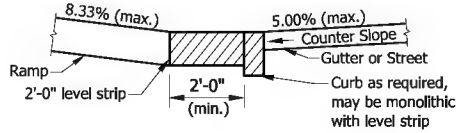
TRUNCATED DOMES





501 x 1'-10"

ALTERNATE CURB CONSTRUCTION



CHANGE OF GRADE > 11% ⑤

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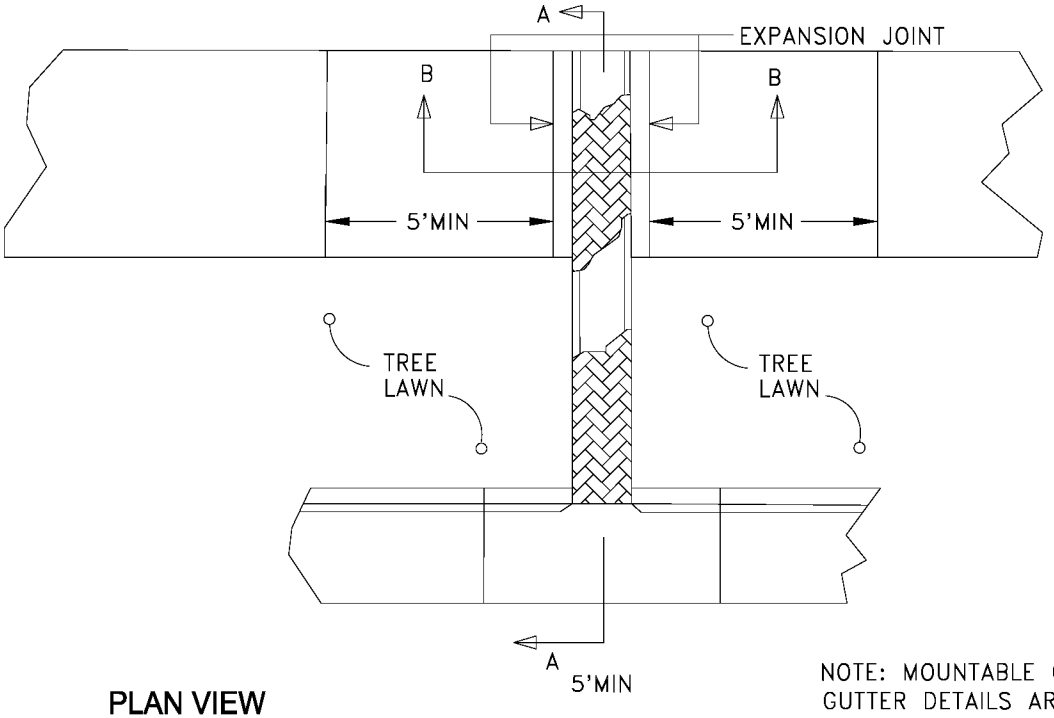
MUNCIE PUBLIC WORKS

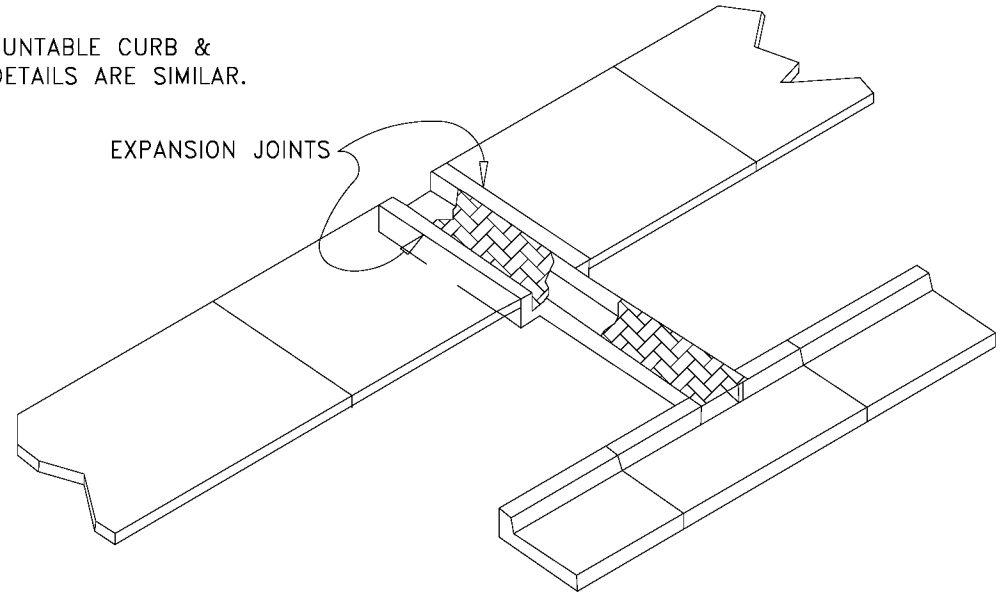
DETECTABLE WARNING SURFACE DETAILS

APPROVED: XX/XX/20XX
REVISED: XX/XX/20XX
STANDARD:
CM-519



PLAN VIEW

NOTE: MOUNTABLE CURB & GUTTER DETAILS ARE SIMILAR.



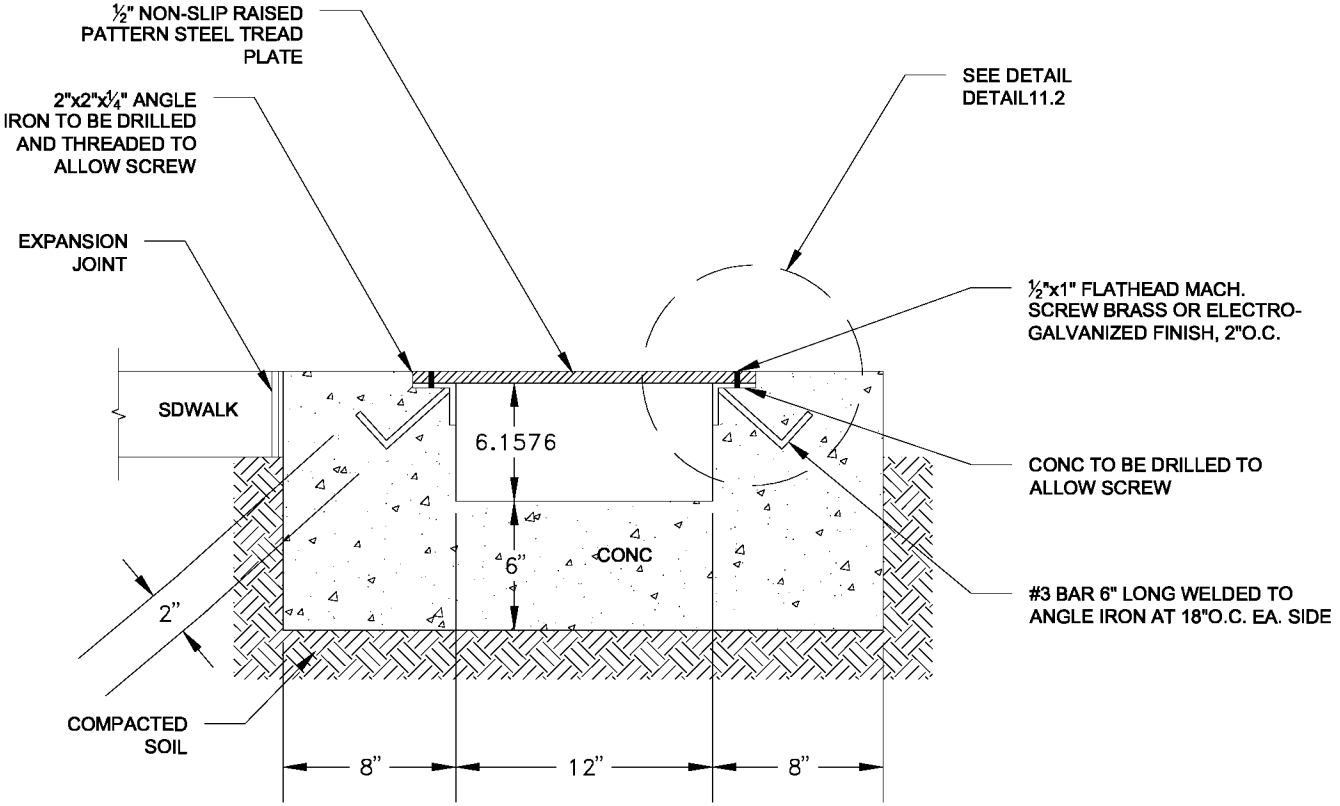
ISOMETRIC VIEW

SIDEWALK CHASE

APPROVED: XX/XX/20XX

REVISED: XX/XX/20XX

STANDARD: CM-520



*VARIES FOR TYPE OF CURB & GUTTER, SEE DETAIL 11.2

SECTION B-B

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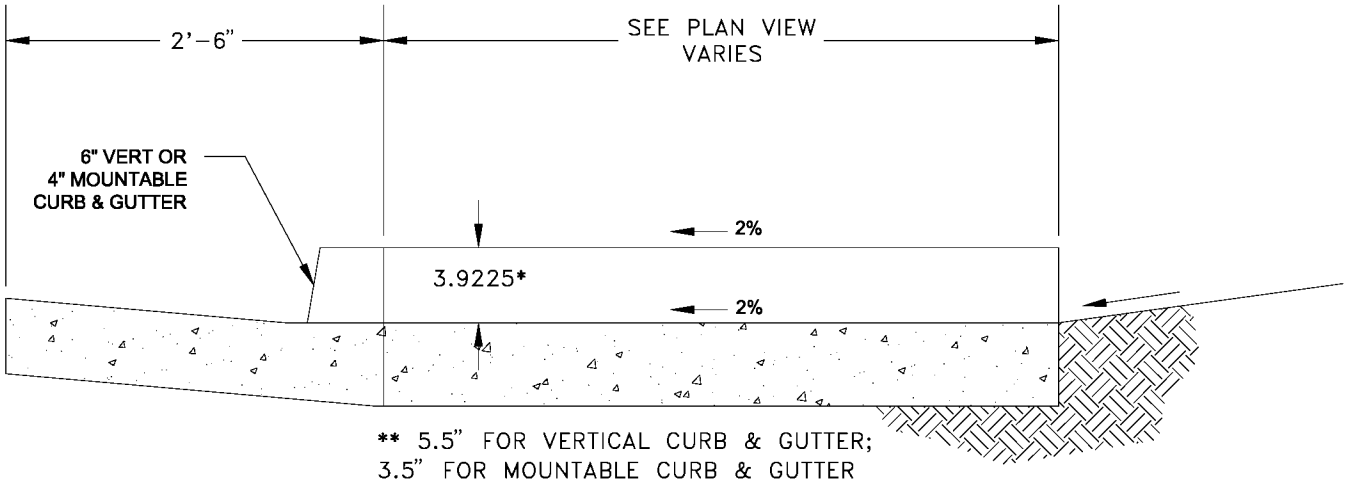
MUNCIE PUBLIC WORKS

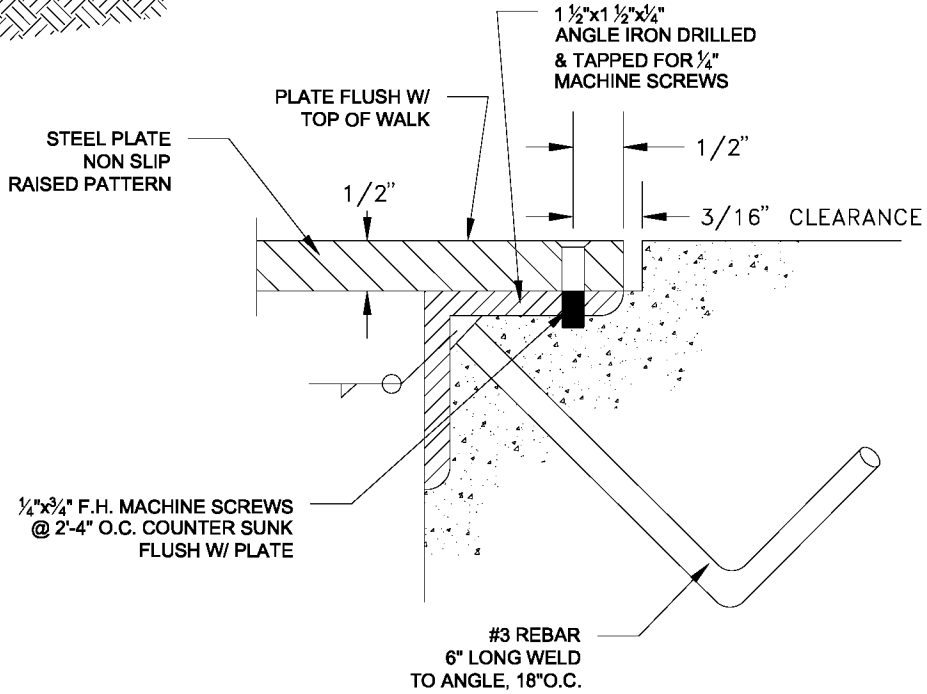
SIDEWALK CHASE

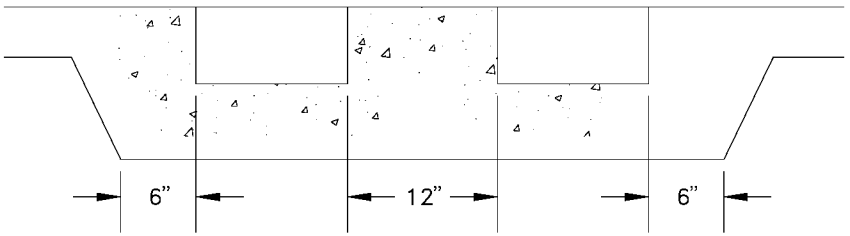
APPROVED:	XX/XX/20XX
REVISED:	XX/XX/20XX
STANDARD:	CM-521



** 5.5" FOR VERTICAL CURB & GUTTER;
3.5" FOR MOUNTABLE CURB & GUTTER

SECTION A-A





MULTIPLE CHASE

WHEN OPENINGS LARGER
THAN 12" ARE REQUIRED

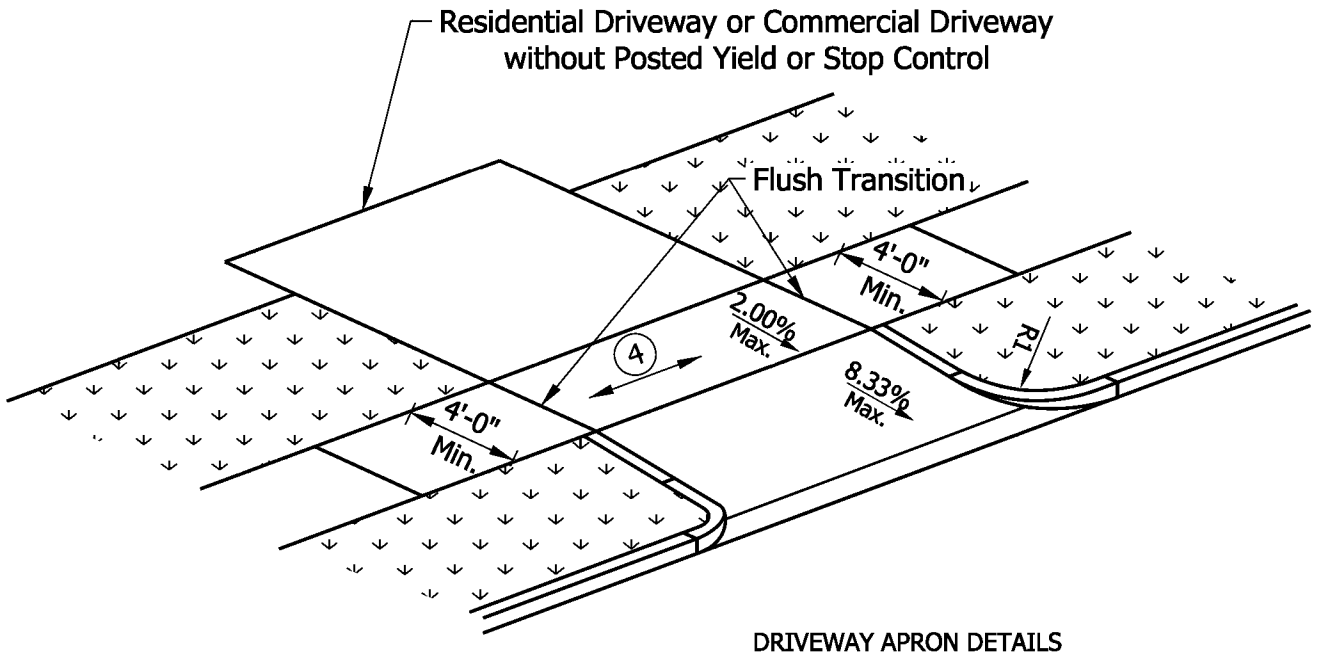
SIDEWALK CHASE

APPROVED: XX/XX/20XX

REVISED: XX/XX/20XX

STANDARD: **CM-522**

PLOT DATE: 8/11/2023 10:51 AM EDIT DATE: 9/5/2023 EDITED BY: JDAY DRAWING FILE: C:\Users\jday\Desktop\MSD_TBLK (LANDSCAPE).dwg



DRIVEWAY APRON DETAILS

NOTES:

1. All slopes are absolute rather than relative to the sidewalk or roadway grade. Slopes at least 0.50% less than the maximum are preferred.
2. A sidewalk driveway crossing shall only be used on a sidewalk at a residential driveway or a commercial driveway without posted yield or stop control. A curb ramp shall be used at all other crossings.
3. Where a sidewalk transition is used to lower or raise the sidewalk to connect with a residential driveway or commercial driveway without posted yield or stop control, the running slope of the transition shall be 8.33% maximum.
4. The grade of the sidewalk across the driveway shall not exceed the grade of the adjacent roadway.
5. The area between the driveway and a flared side or sidewalk transition shall match the driveway profile and transverse slope.
6. A turning space is not required at the top of a sidewalk transition.
7. Objects such as a utility cover, vault frame, and grating shall be placed outside a sidewalk transition.
8. A detectable warning surface shall not be placed at the crossings of a residential driveway. A detectable warning surface may be placed at the crossing of a commercial driveway without yield or stop control.

MUNCIE PUBLIC WORKS

DRIVEWAY APRON DETAILS

APPROVED: XX/XX/20XX

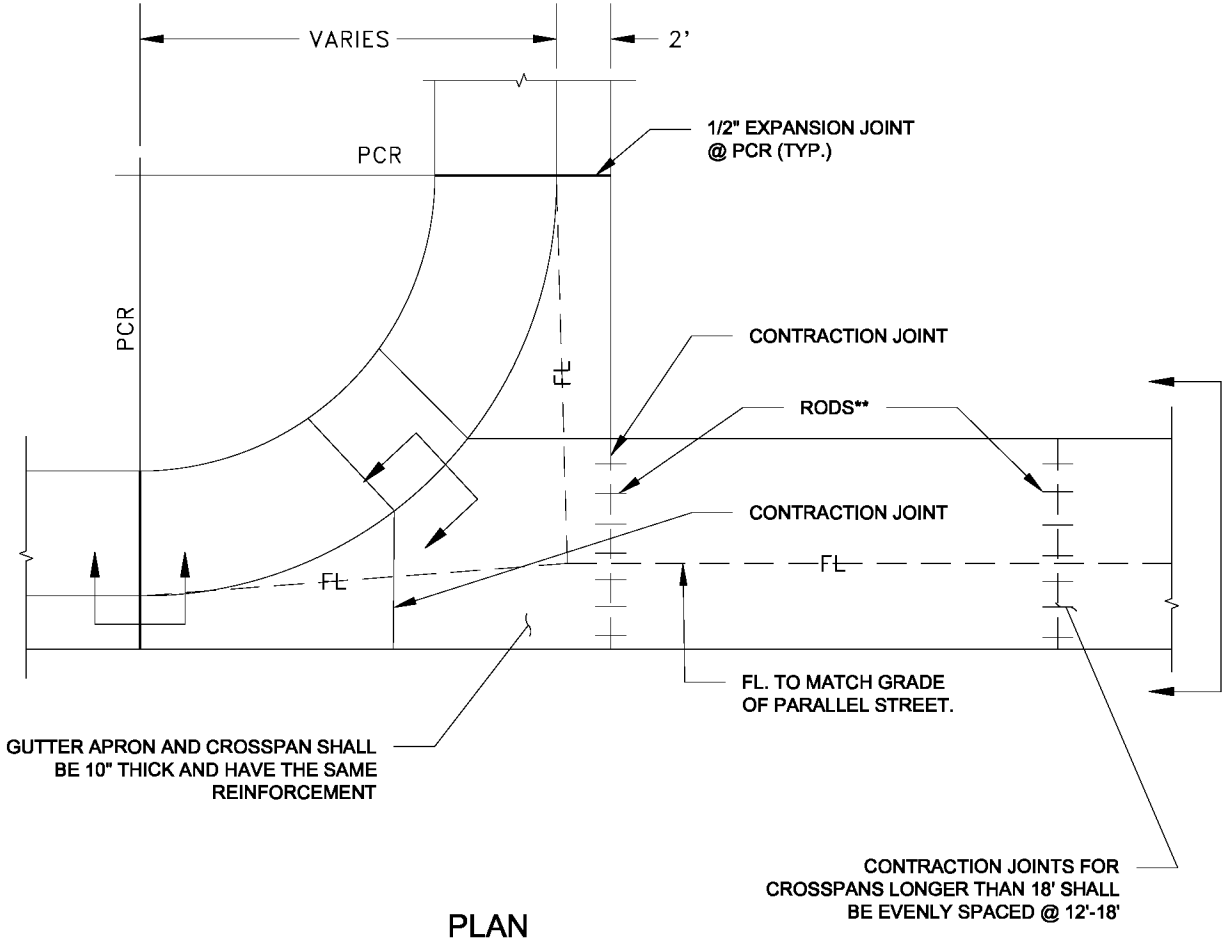
REVISED: XX/XX/20XX

STANDARD: **CM-523**

PLOT DATE: 8/11/2023 10:51 AM EDIT DATE: 8/5/2023 EDITED BY: JDAY DRAWING FILE: C:\Users\jday\Desktop\MSD_TBLK (LANDSCAPE).dwg

NOTE: SPECIAL DETAIL REQUIRED FOR RADII OVER 15'

** #6x18" SMOOTH RODS ON 12" CENTERS WITH ONE END GREASED SHALL BE USED

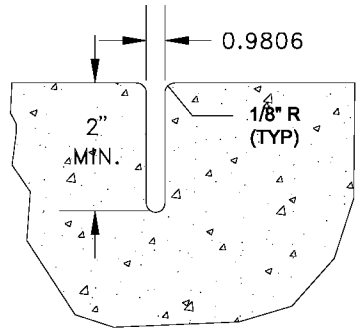


PLAN

PAN LENGTH (LIP TO LIP)	REPLACE WITH GRADE 60 REBAR HAVING AN AREA OF
36'	0.10 SQ. IN./FT.(#4@18"E.W.)
45'	0.13 SQ. IN./FT.(#4@18"E.W.)
64'	0.20 SQ. IN./FT.(#4@12"E.W.)
84'	0.26 SQ. IN./FT.(#4@9"E.W.)

NOTE
GUTTER APRONS AND PANS SHALL BE REINFORCED AS SHOWN IN THE TABLE ABOVE

SECTIONS A–A, B–B & C–C ARE ON STD 12.1



CONTRACTION OR WEAKENED PLANE JOINT

*D/4 IF TEMPLATES ARE NOT USED

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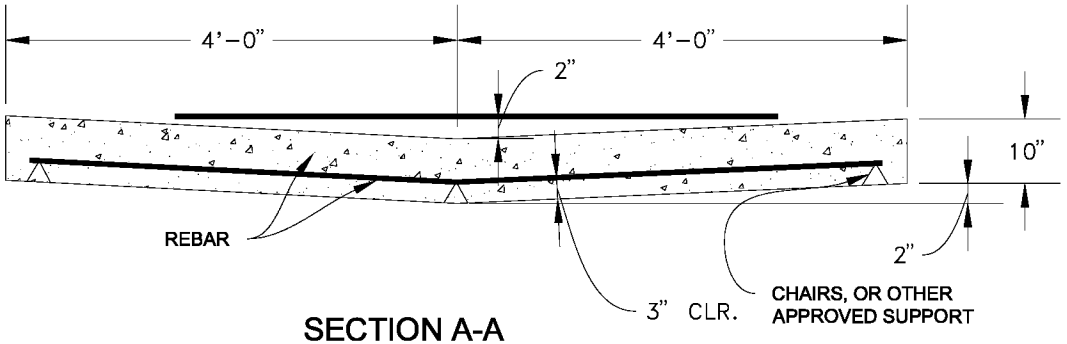
MUNCIE PUBLIC WORKS

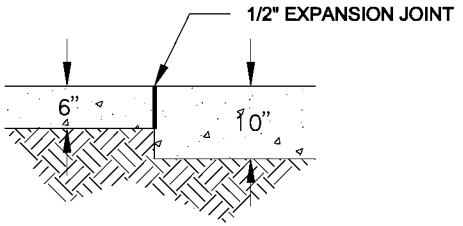
CROSSPAN TYPE 1

APPROVED: XX/XX/20XX
REVISED: XX/XX/20XX
STANDARD: CM-524

CROW SHALL BE TRANSITIONED
OUT OF THE STREET.

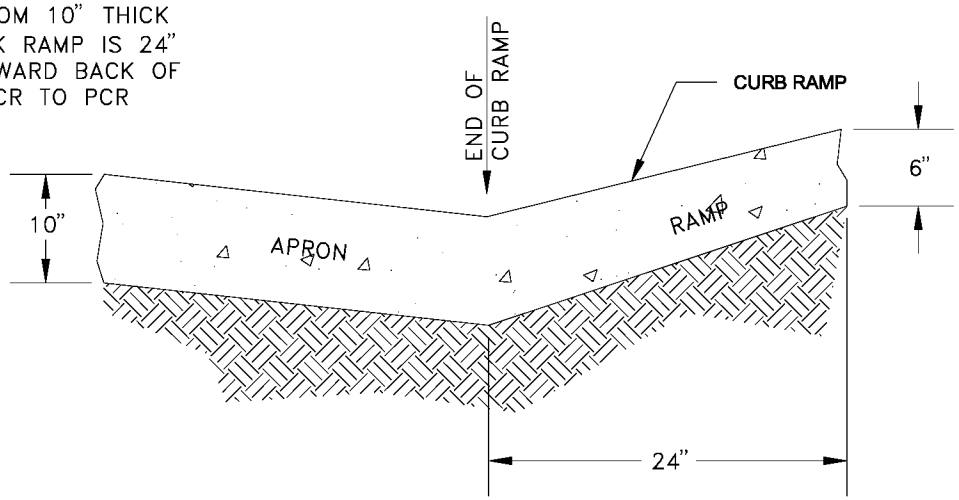


SECTION A-A



SECTION B-B

THE TRANSITION FROM 10" THICK APRON TO 6" THICK RAMP IS 24" FROM FLOWLINE TOWARD BACK OF RAMP AND FROM PCR TO PCR



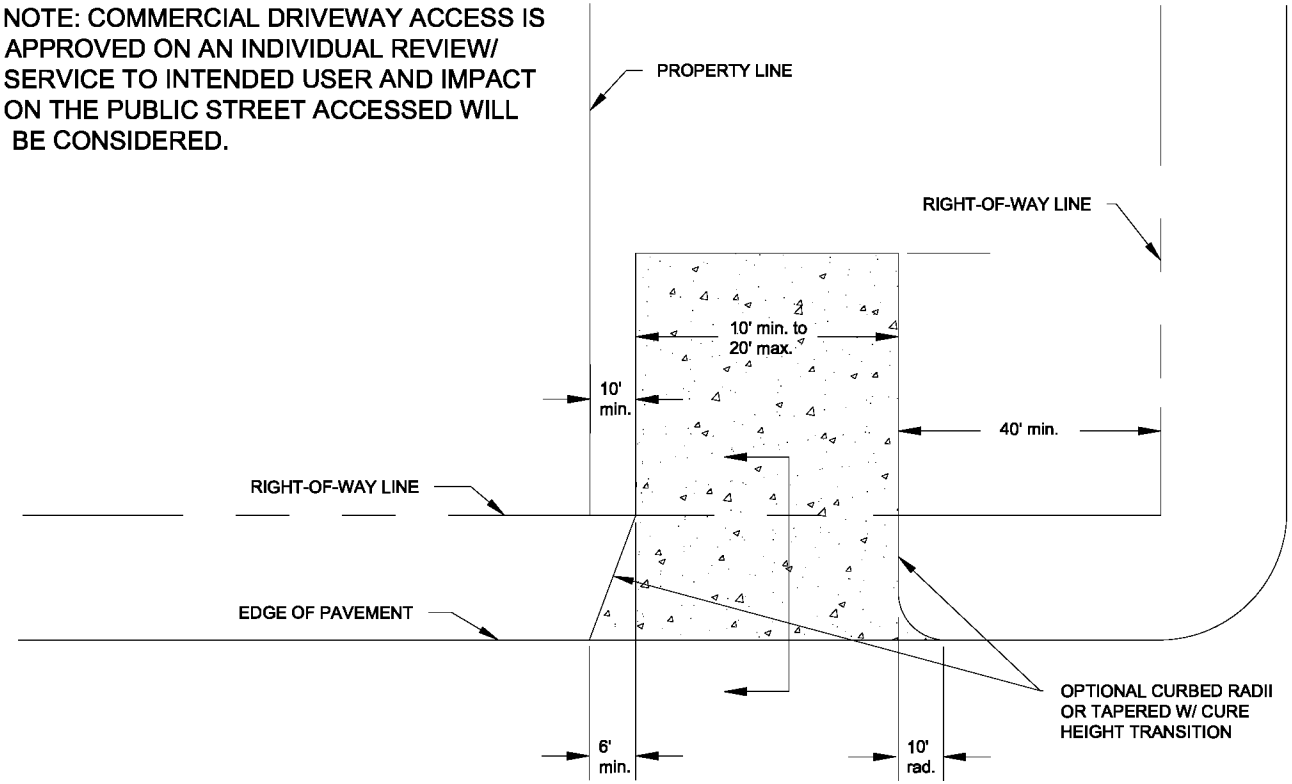
SECTION C-C

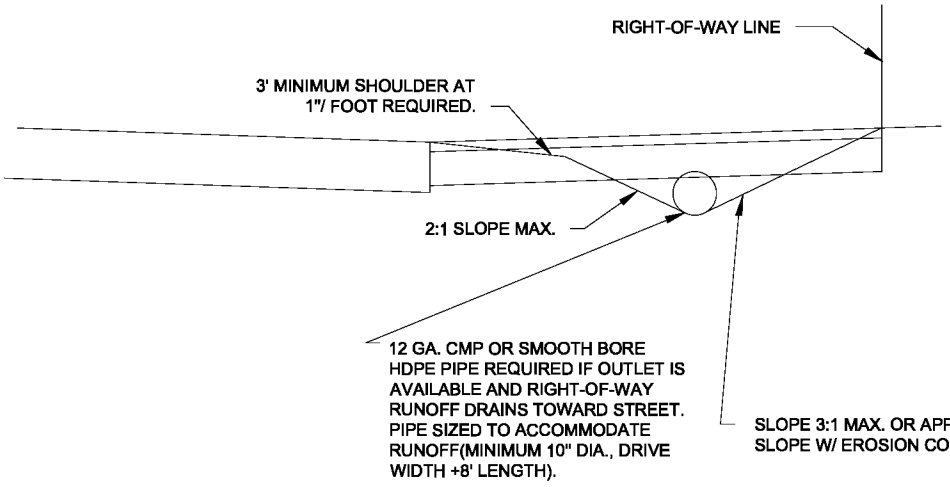
MUNCIE PUBLIC WORKS

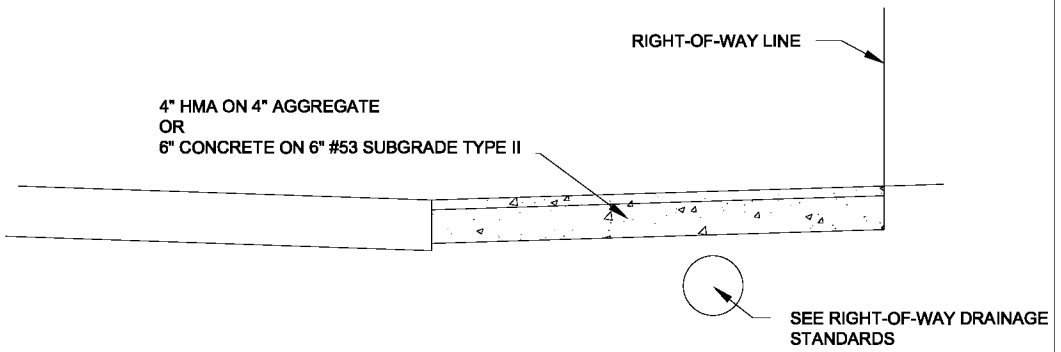
CROSSPAN TYPE 1

APPROVED: XX/XX/20XX
REVISED: XX/XX/20XX
STANDARD: CM-525

NOTE: COMMERCIAL DRIVEWAY ACCESS IS APPROVED ON AN INDIVIDUAL REVIEW/ SERVICE TO INTENDED USER AND IMPACT ON THE PUBLIC STREET ACCESSED WILL BE CONSIDERED.







RESIDENTIAL ACCESS TO UN-CURBED STREET/ALLEY

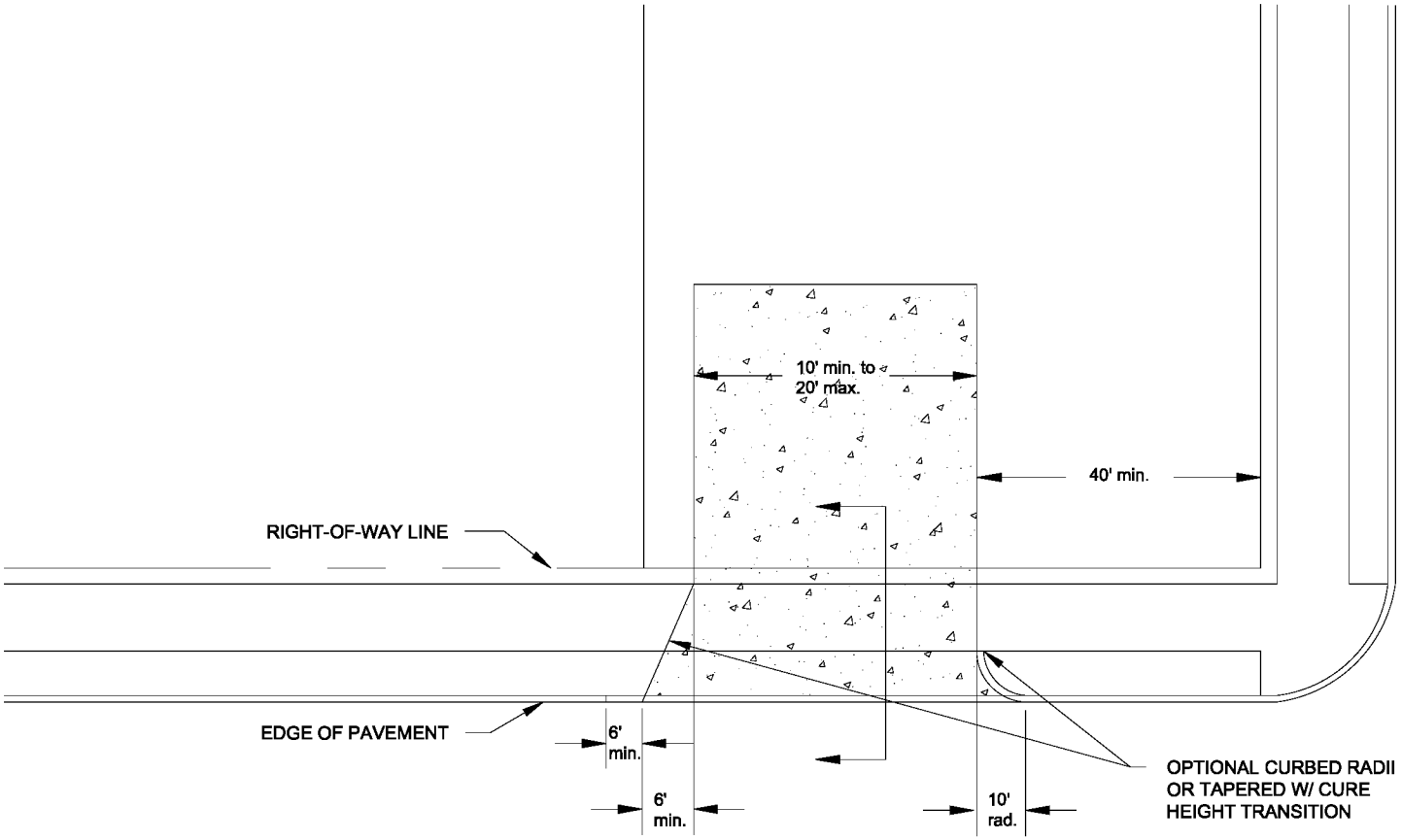
MUNCIE PUBLIC WORKS

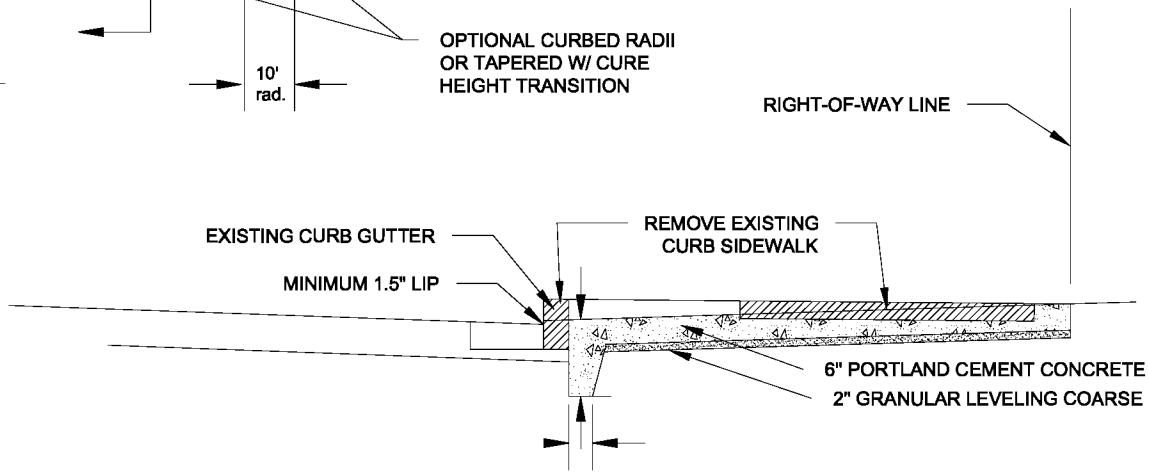
APPROVED: XX/XX/20XX

REVISED: XX/XX/20XX

STANDARD: **CM-526**

PLOT DATE: 8/11/2023 10:51 AM EDIT DATE: 8/5/2023 EDITED BY: JDAY DRAWING FILE: C:\Users\jday\Desktop\MSD_TBLK (LANDSCAPE).dwg

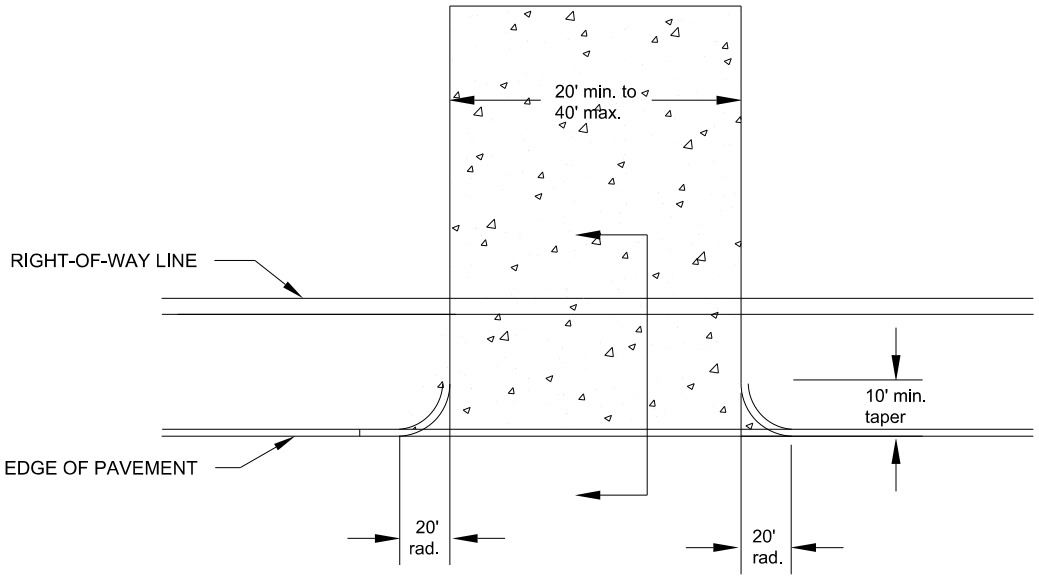


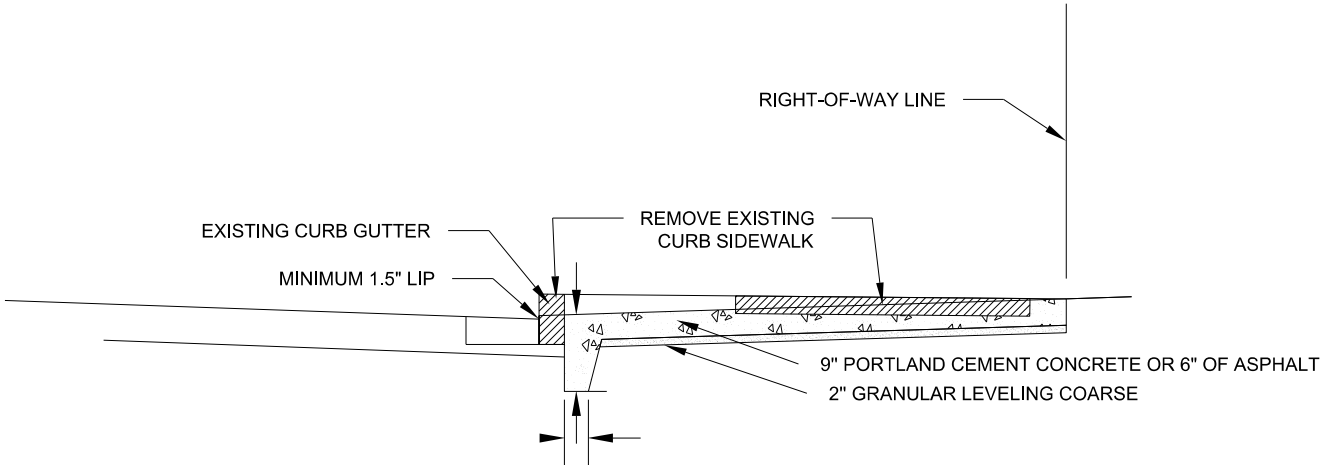


* MINIMUM OF 6" OF #53 AGGREGATE MUST
BE PROVIDED UNDER THE CONCRETE SECTION

RESIDENTIAL ACCESS TO CURBED STREET/ALLEY

APPROVED:	XX/XX/20XX
REVISED:	XX/XX/20XX
STANDARD:	CM-527





* MINIMUM OF 6" OF #53 AGGREGATE MUST
BE PROVIDED UNDER THE CONCRETE SECTION

MUNCIE PUBLIC WORKS

COMMERCIAL ACCESS TO CURBED STREET/ALLEY

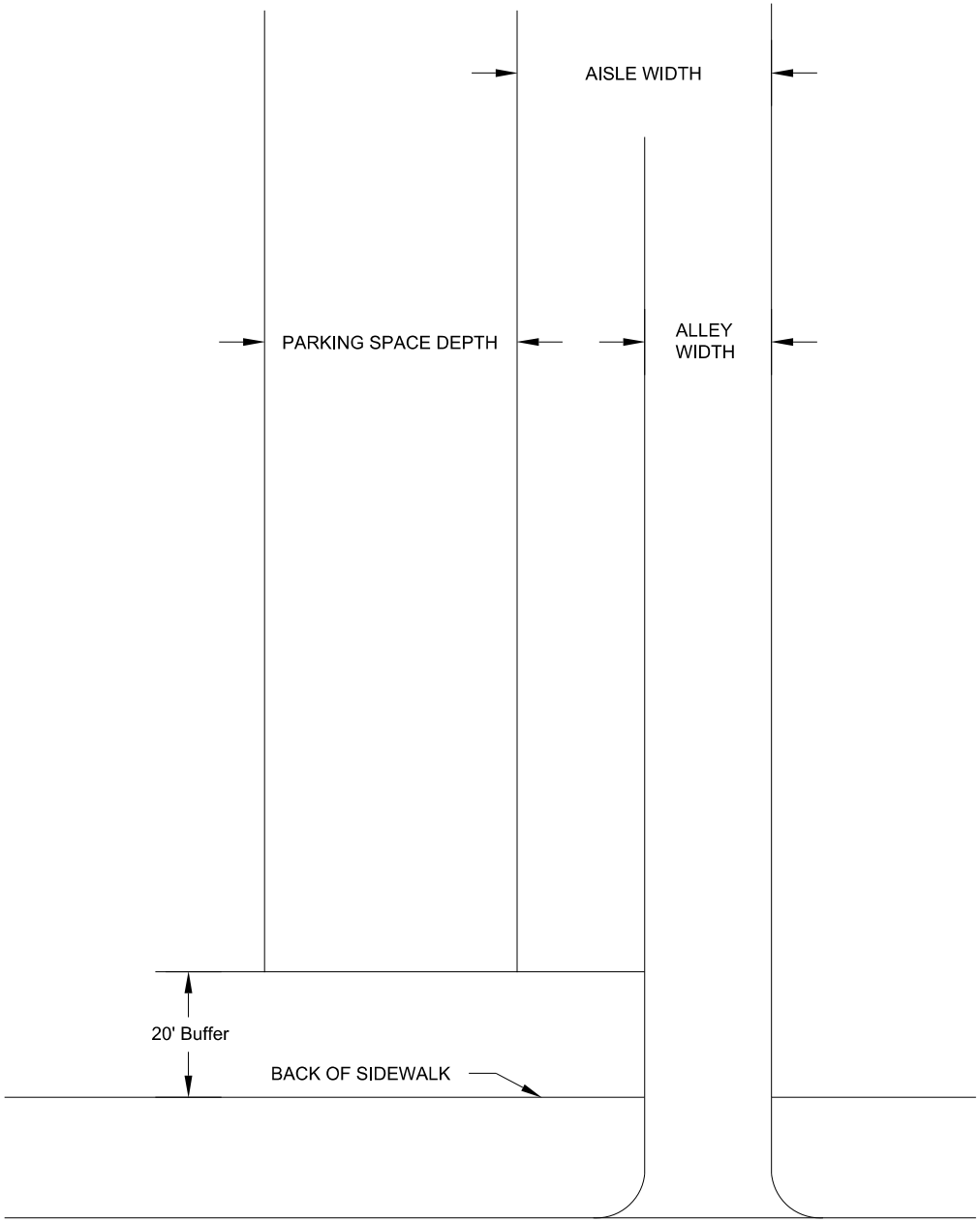
APPROVED: *XX/XX/20XX*

REVISED: *XX/XX/20XX*

STANDARD:

CM-528

PLOT DATE: 8/11/2023 10:51 AM EDIT DATE: 9/5/2023 EDITED BY: JDAY DRAWING FILE: C:\Users\jday\Desktop\MSD_TBLK (LANDSCAPE).dwg



AISLE WIDTH AND PARKING SPACE DEPTH FOR VARIOUS ANGLES OF PARKING		
ANGLE BETWEEN PARKING SPACE AND ALLEY	PARKING SPACE DEPTH	AISLE WIDTH
90 DEGREES	18 FEET	22 FEET
75 DEGREES	19 FEET	20 FEET
60 DEGREES	20 FEET	18 FEET
45 DEGREES	19 FEET	16 FEET

MUNCIE PUBLIC WORKS

ALLEY ACCESS PARKING

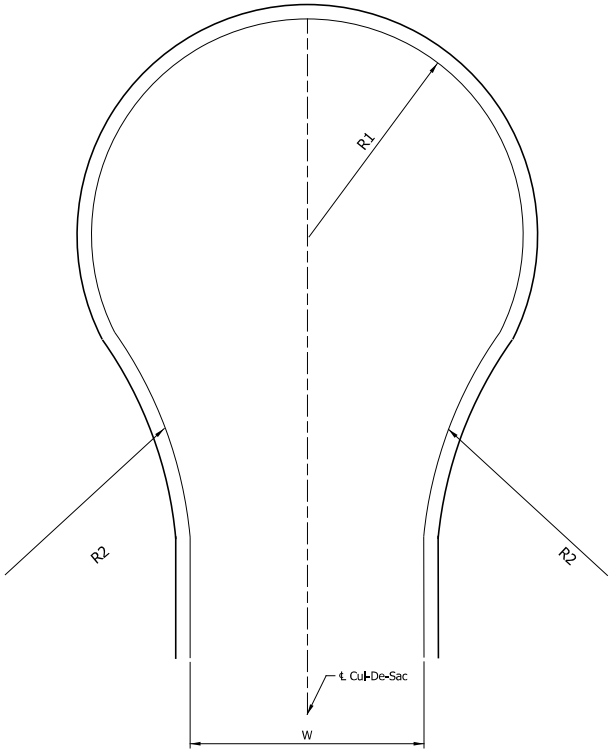
APPROVED: *XX/XX/20XX*

REVISED: *XX/XX/20XX*

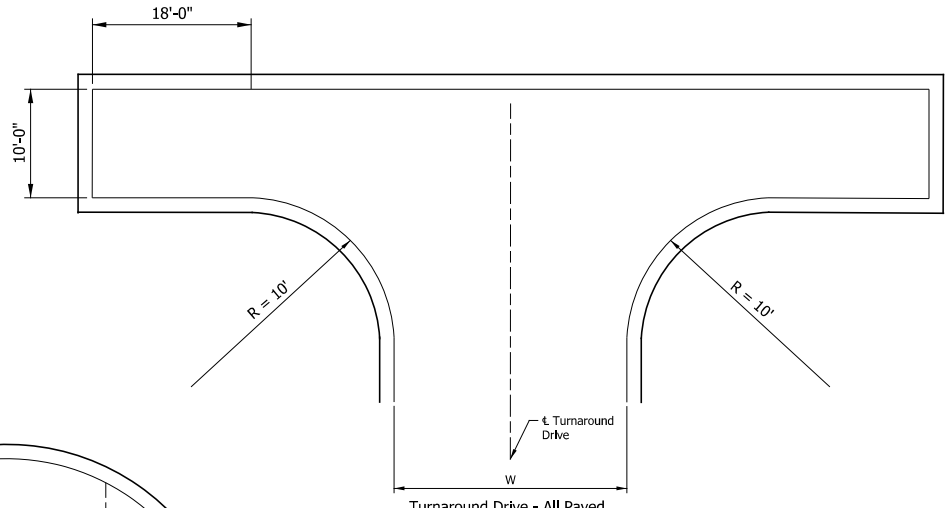
STANDARD:

CM-529

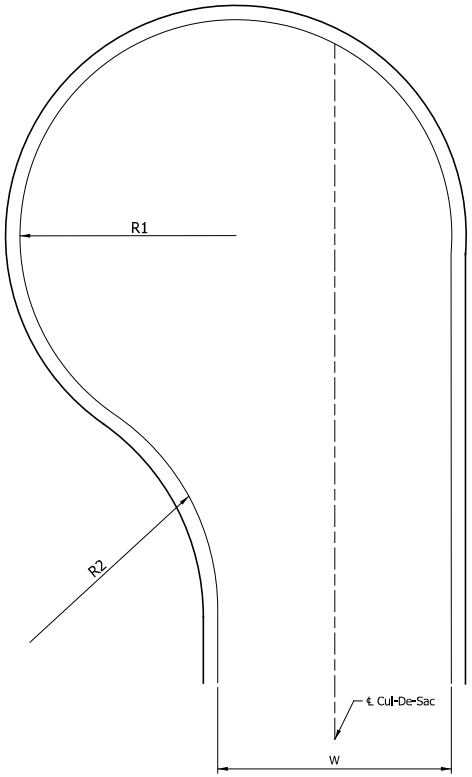
PLOT DATE: 8/11/2023 10:51 AM EDIT DATE: 9/5/2023 EDITED BY: JDAY DRAWING FILE: C:\Users\jday\Desktop\MSD_TBLK (LANDSCAPE).dwg



Circular - All Paved



Turnaround Drive - All Paved



Circular - Offset - All Paved

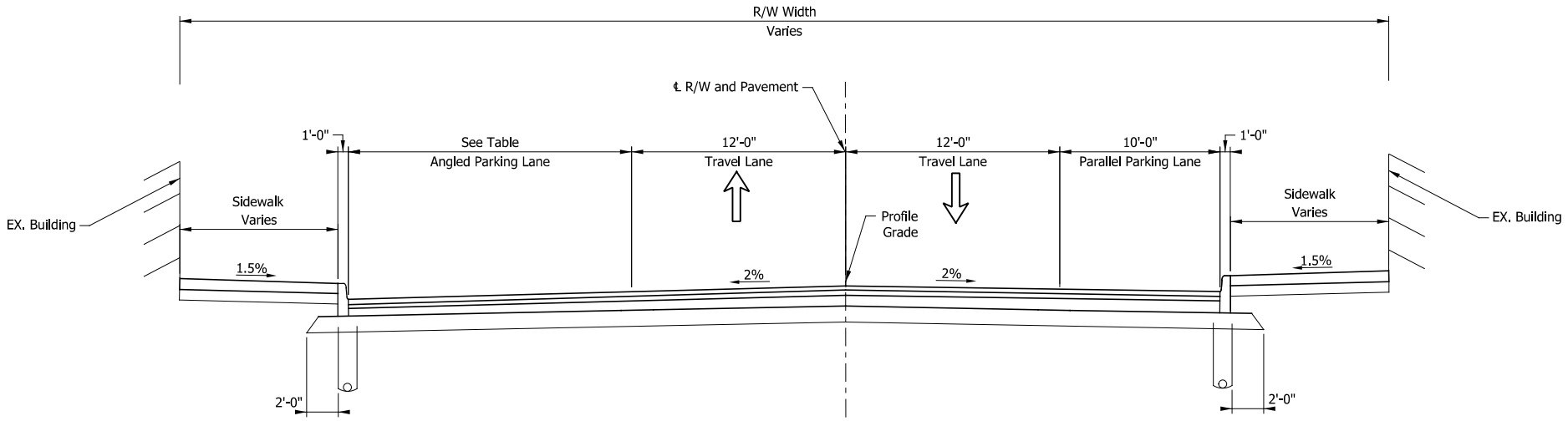
	Radius (ft)		Width (ft)
Design Vehicle	R1	R2	W
P	30	60	24
WB-40 (WB-12)	42	100	24
WB-50 (SU & WB-15)	47	100	30

Cul-De-Sac / Alley Termination

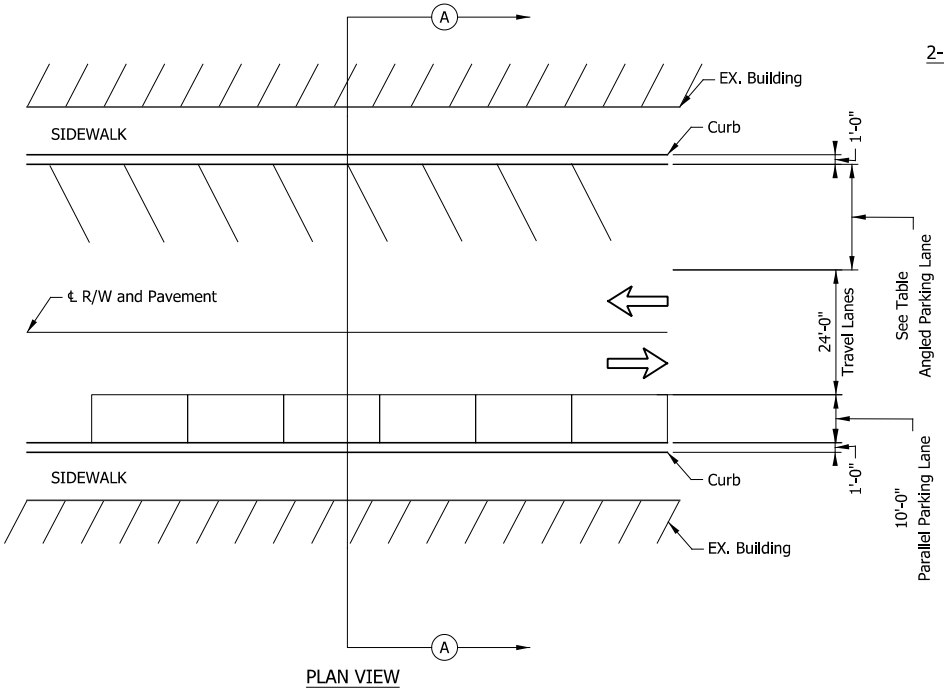
APPROVED: *XX/XX/20XX*

REVISED: *XX/XX/20XX*

STANDARD: **CM-530**



2-LANE MINOR COLLECTOR SECTION A-A



PLAN VIEW

AISLE WIDTH AND PARKING SPACE DEPTH FOR VARIOUS ANGLES OF PARKING		
ANGLE BETWEEN PARKING SPACE AND ROADWAY	PARKING SPACE DEPTH	AISLE WIDTH
90 DEGREES	18 FEET	22 FEET
75 DEGREES	19 FEET	20 FEET
60 DEGREES	20 FEET	18 FEET
45 DEGREES	19 FEET	16 FEET

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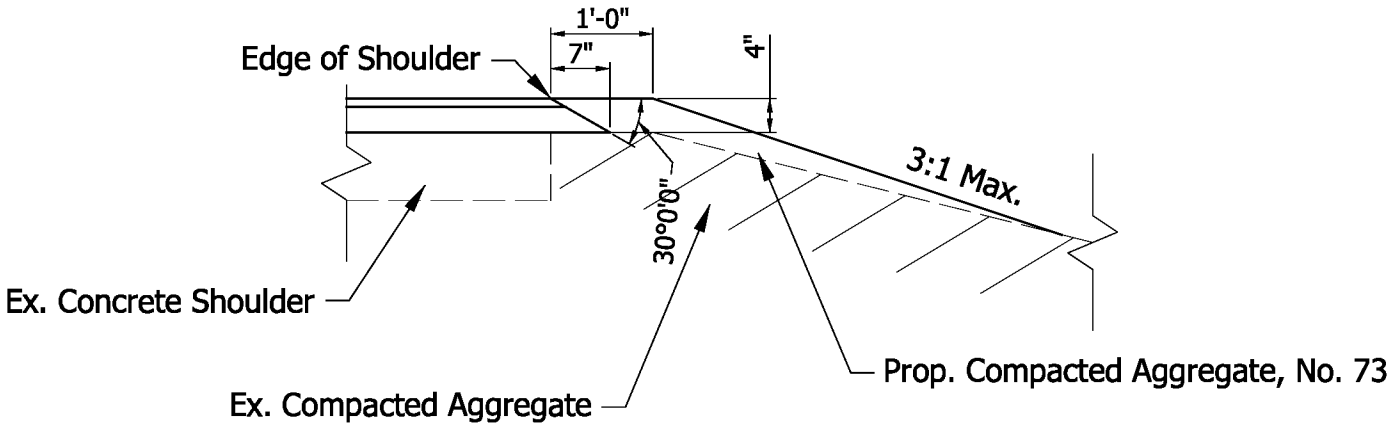
MUNCIE PUBLIC WORKS

ON-STREET PARKING

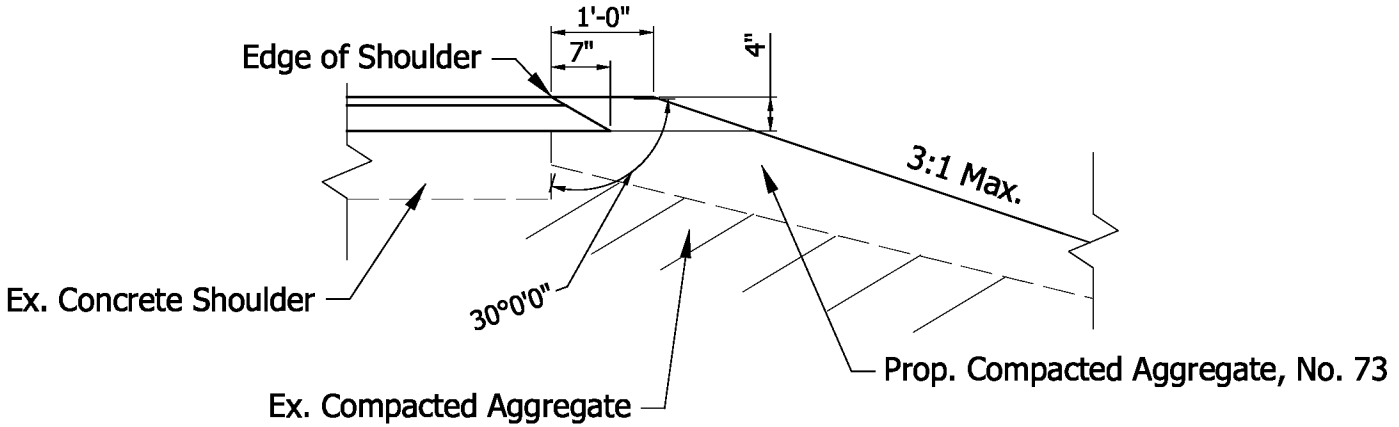
APPROVED: XX/XX/20XX

REVISED: XX/XX/20XX

STANDARD: **CM-531**



HMA PAVEMENT SAFETY EDGE FOR EXISTING SHOULDERS



HMA PAVEMENT SAFETY EDGE FOR PROPOSED SHOULDERS

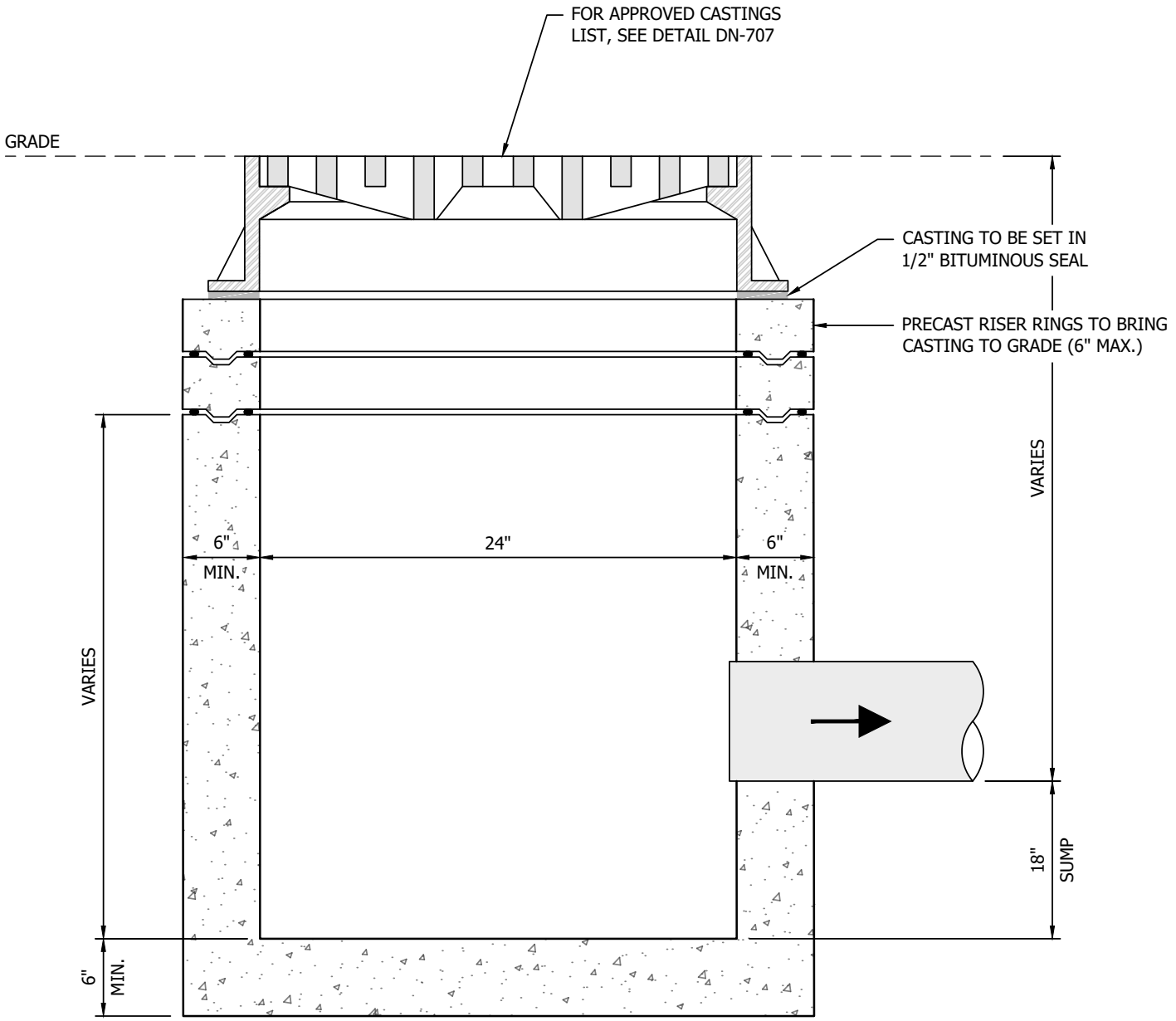
MUNCIE PUBLIC WORKS

Safety Edge

APPROVED: XX/XX/20XX

REVISED: XX/XX/20XX

STANDARD: **AP-601**



NOTES:

1. BASIN TO BE CONSTRUCTED OF SOLID CONCRETE, PRECAST OR POURED-IN-PLACE: ROUND OR SQUARE, WITH OR WITHOUT KNOCKOUT PANELS.
2. CONCRETE STRENGTH: 4,000 psi.
3. REINFORCEMENT: ASTM C-913, BASE AND SIDES, 6" O.C. BOTH WAYS.

Muncie SANITARY DISTRICT

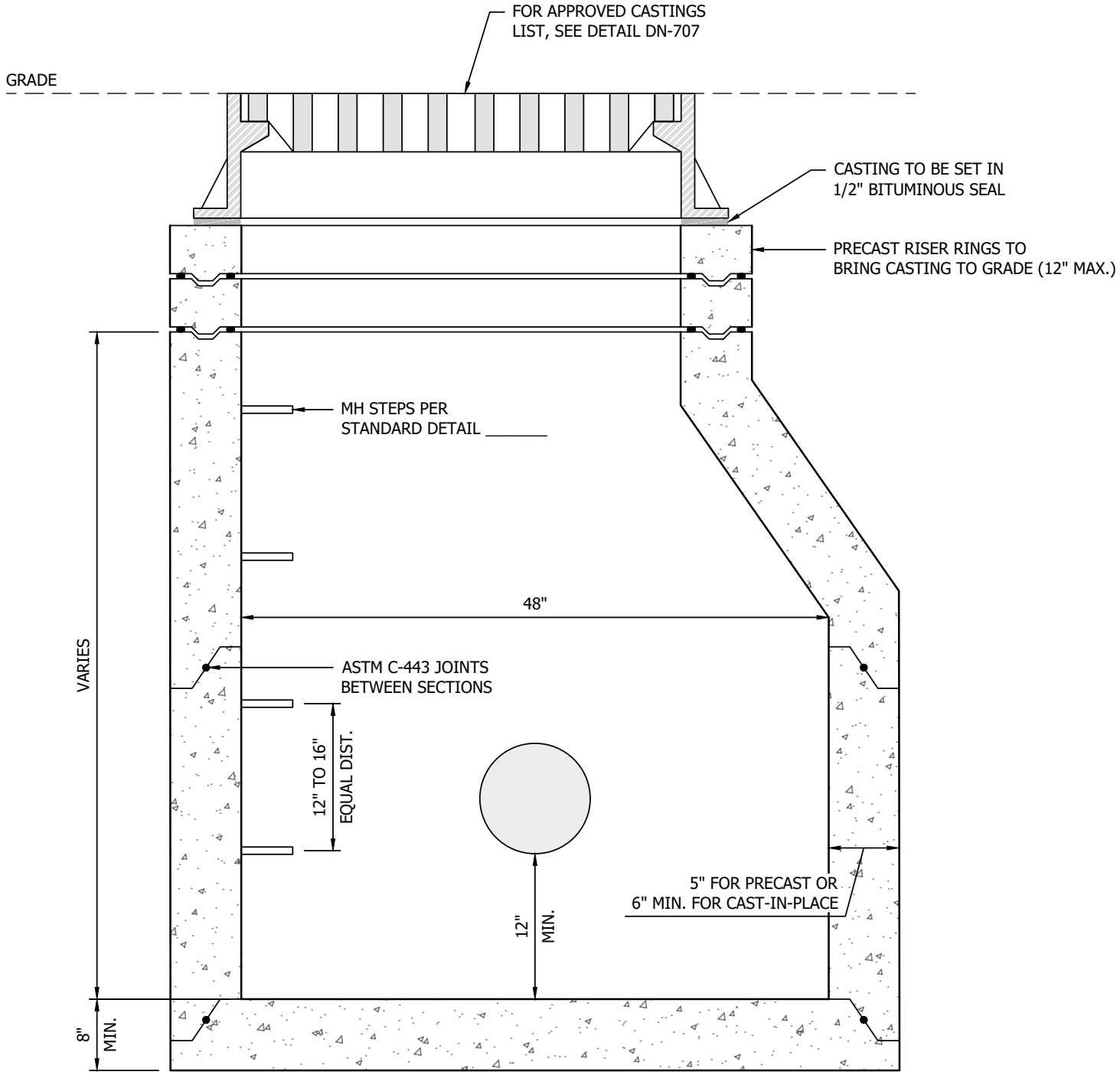
MUNCIE PUBLIC WORKS

STANDARD CATCH BASIN

APPROVED: XX/XX/20XX

REVISED: XX/XX/20XX

STANDARD: DN-701



NOTES:

1. CATCH BASIN TO BE CONSTRUCTED OF 48-INCH PRECAST CONCRETE MANHOLE SECTIONS OR POURED-IN-PLACE CONCRETE. JOINTS TO COMPLY WITH ASTM C-443.
2. CONCRETE STRENGTH: 4,000 psi MINIMUM.
3. REINFORCEMENT: ASTM C-478.

Muncie SANITARY DISTRICT

MUNCIE PUBLIC WORKS

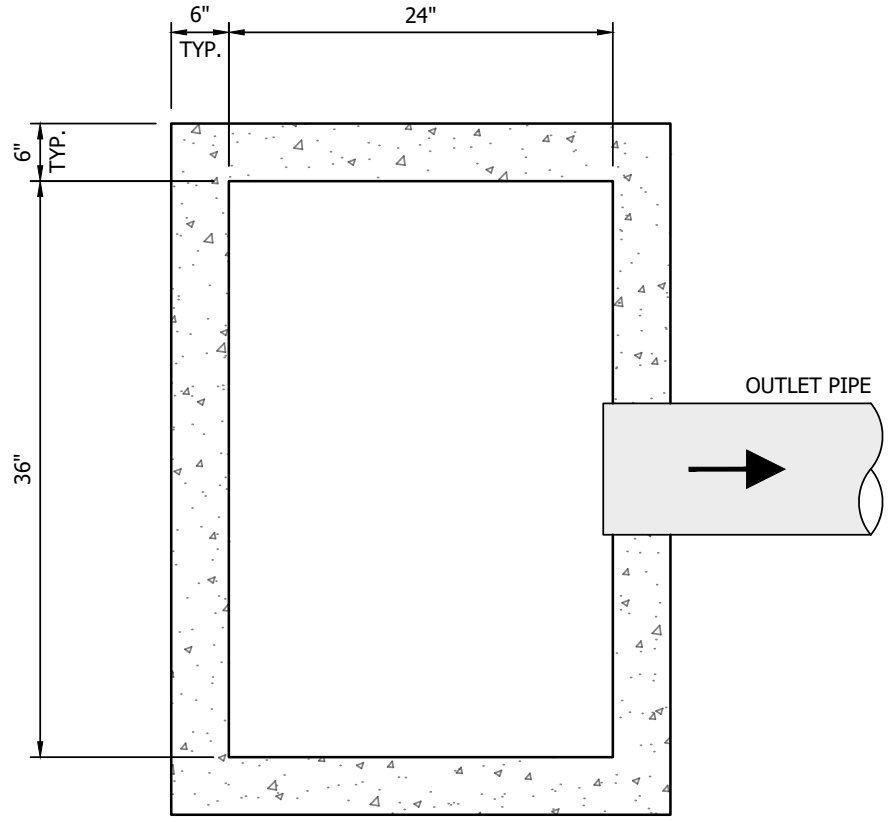
STANDARD LARGE CATCH BASIN

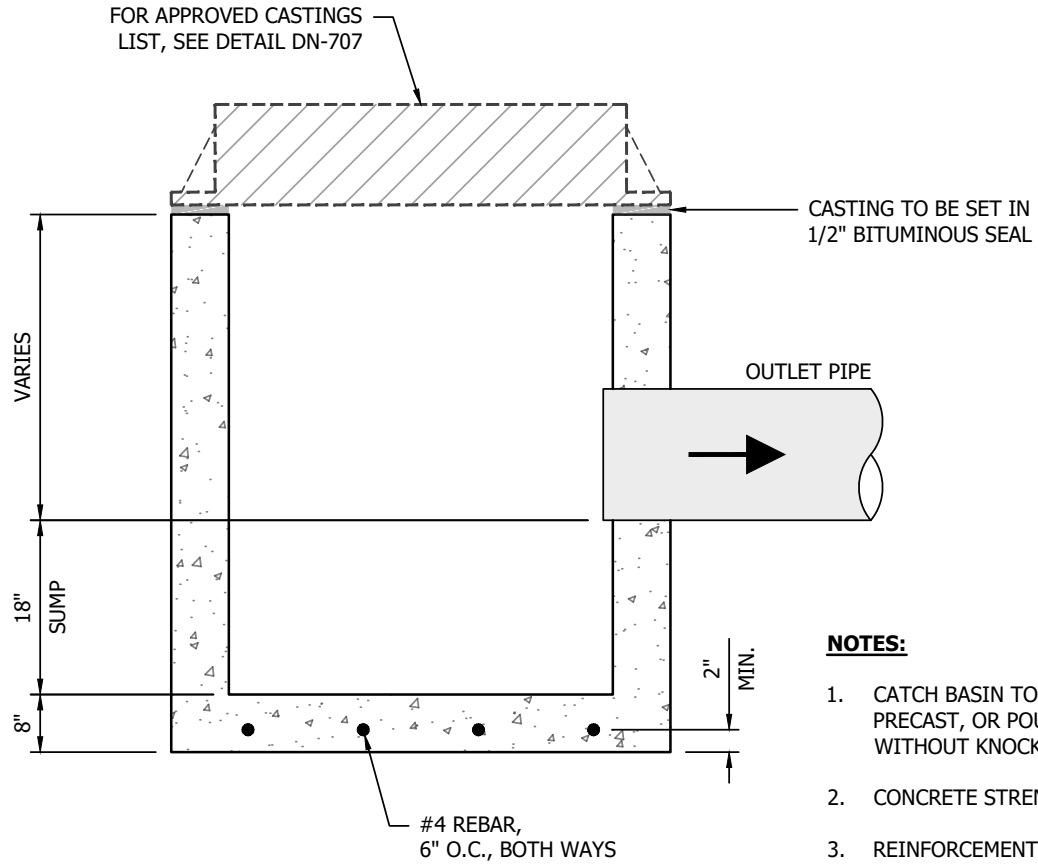
APPROVED: XX/XX/20XX

REVISED: XX/XX/20XX

STANDARD: DN-702

PLOT DATE: 10/16/2023 9:34 AM EDIT DATE: 10/5/2023 EDITED BY: PTRAWINSKI DRAWING FILE: P:\2022\01013D. Drawings\Utility Infrastructure\MSD_DN_702_CATCH BASIN LARGE.dwg





NOTES:

1. CATCH BASIN TO BE CONSTRUCTED OF SOLID CONCRETE, PRECAST, OR POURED-IN-PLACE: RECTANGULAR, WITH OR WITHOUT KNOCKOUT PANELS.
2. CONCRETE STRENGTH: 4,000 psi MINIMUM.
3. REINFORCEMENT: ASTM C-913, BASE AND SIDES, 6-INCH O.C., BOTH WAYS.

Muncie SANITARY DISTRICT

MUNCIE PUBLIC WORKS

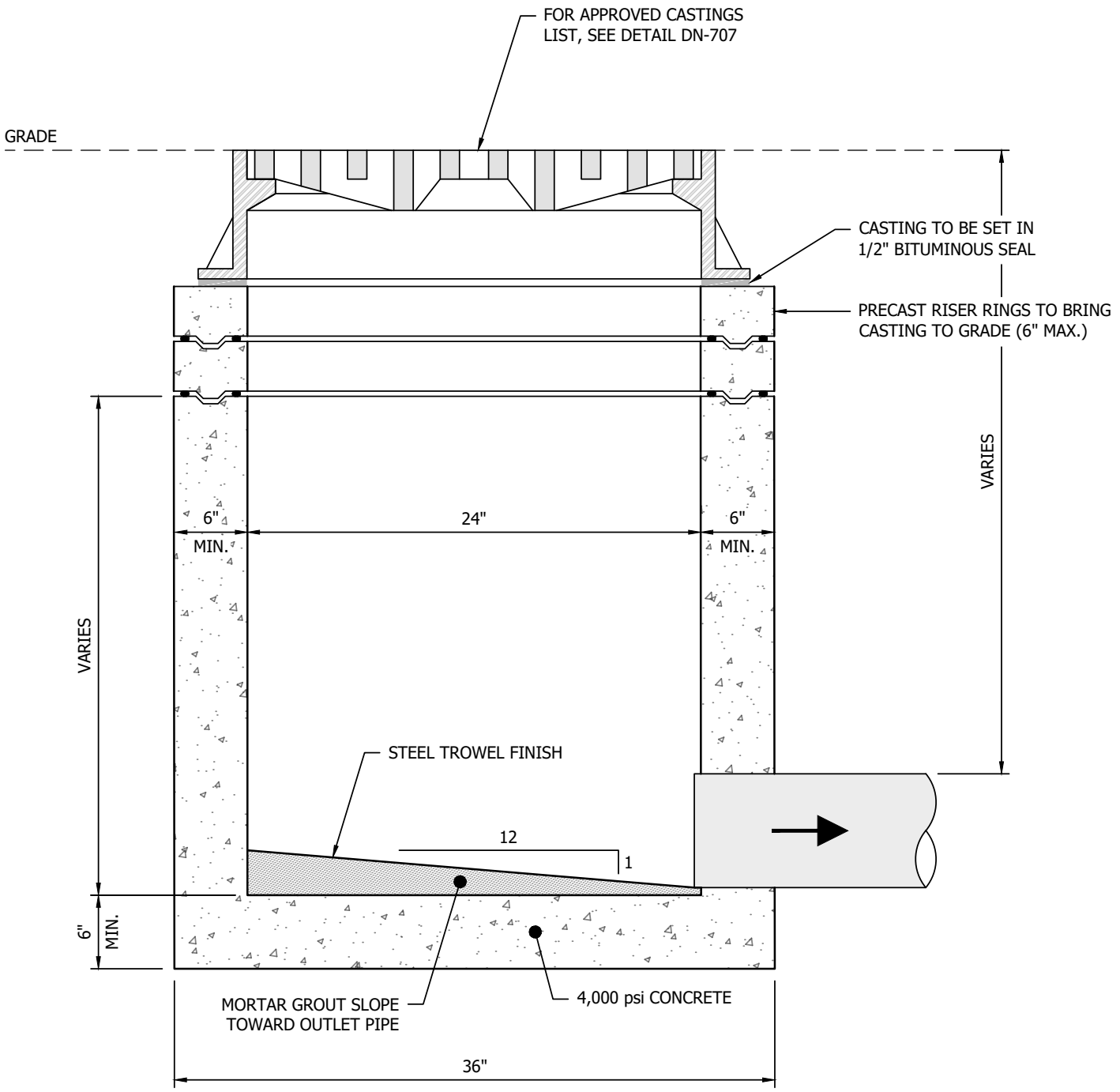
STANDARD CATCH BASIN 24"x36"

APPROVED: XX/XX/20XX

REVISED: XX/XX/20XX

STANDARD: DN-703

PLOT DATE: 10/16/2023 9:34 AM
EDIT DATE: 10/5/2023
EDITED BY: PTRAWINSKI
DRAWING FILE: P:\2022\01013D. Drawings\Utility Infrastructure\MSD_DN_703_CATCH BASIN 24x36.dwg



NOTES:

1. BASIN TO BE CONSTRUCTED OF SOLID CONCRETE, PRECAST OR POURED-IN-PLACE: ROUND OR SQUARE, WITH OR WITHOUT KNOCKOUT PANELS.
2. CONCRETE STRENGTH: 4,000 psi.
3. REINFORCEMENT: ASTM C-913, BASE AND SIDES, 6" O.C. BOTH WAYS.

Muncie SANITARY DISTRICT

MUNCIE PUBLIC WORKS

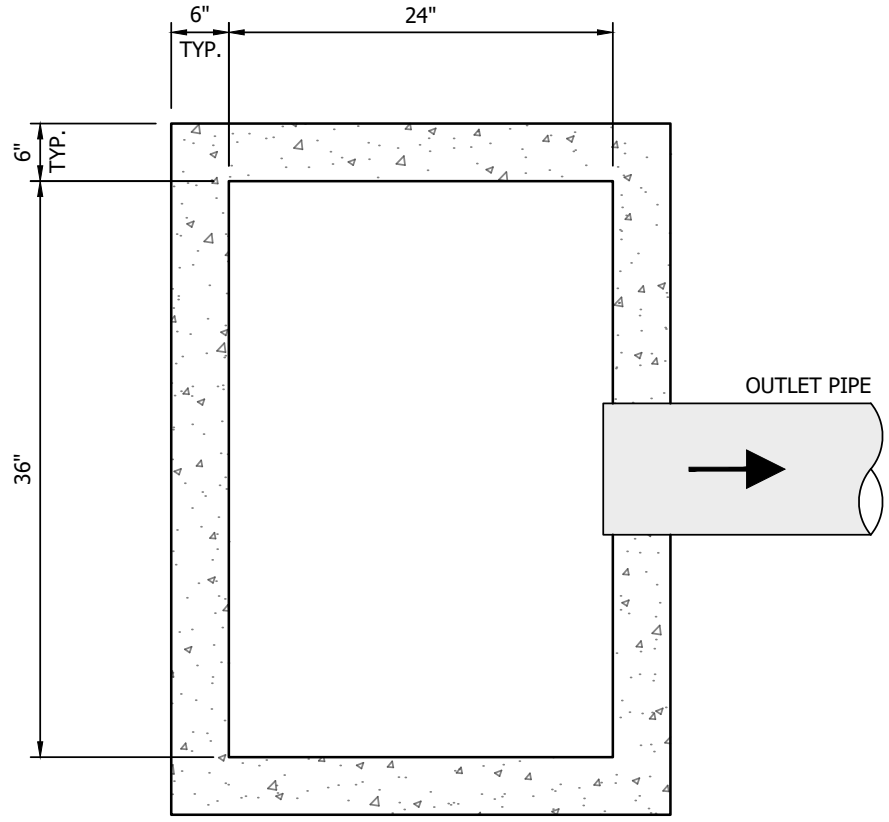
STANDARD INLET

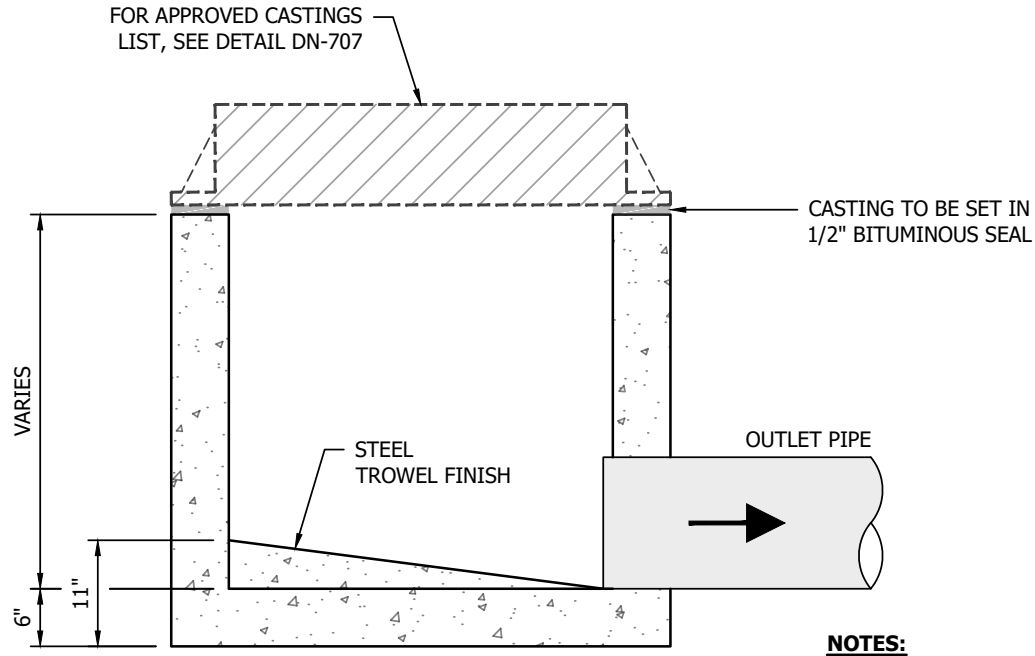
APPROVED: XX/XX/20XX

REVISED: XX/XX/20XX

STANDARD: DN-704

DRAWING FILE: P:\2022\01013D. Drawings\Utility Infrastructure\MSD_DN_704_INLET STANDARD.dwg
EDITED BY: PTRAWINSKI
EDIT DATE: 10/5/2023
PLOT DATE: 10/16/2023 9:34 AM





NOTES:

1. INLET TO BE CONSTRUCTED OF SOLID CONCRETE, PRECAST, OR POURED-IN-PLACE: RECTANGULAR, WITH OR WITHOUT KNOCKOUT PANELS.
2. CONCRETE STRENGTH: 4,000 psi MINIMUM.
3. REINFORCEMENT: ASTM C-913, BASE AND SIDES, 6-INCH O.C., BOTH WAYS.

Muncie SANITARY DISTRICT

MUNCIE PUBLIC WORKS

STANDARD INLET 24"x36"

APPROVED: XX/XX/20XX

REVISED: XX/XX/20XX

STANDARD: DN-705

NOTES:

1. ALL SOFT OR YIELDING SOILS ARE TO BE REMOVED AND A SOLID FOUNDATION OF GRANULAR MATERIAL COMPACTED TO 95% DRY DENSITY SHALL BE PROVIDED BY THE CONTRACTOR PRIOR TO MANHOLE PLACEMENT.

2. ALL CONCRETE MANHOLE SECTIONS ARE REINFORCING STEEL SHALL CONFORM TO ASTM C-478. THE TAPERED CONE SECTION TO BE A MIN OF 30-INCH IN HEIGHT AND THE BOTTOM SECTION SHALL BE 30-INCH IN HEIGHT. ALL CONCRETE SHALL BE A MINIMUM OF 4,000 psi.

3. PRECAST BOTTOMS TO BE CONSTRUCTED WITH THE BASE AND FIRST RISER SECTION AS ONE COMPLETE PRECAST UNIT. MONOLITHIC MANHOLE BASES SHALL BE 6-INCH MINIMUM THICKNESS FOR 48-INCH DIAMETER STANDARD MANHOLES AND 12-INCH THICKNESS FOR ALL OTHER MANHOLES.

4. ALL FACTORY FORMED CONCRETE FOR BASE AND BENCH WALLS SHALL BE MONOLITHICALLY PLACED. BENCH HEIGHT TO BE AT OR ABOVE TOP OF PIPE, TOP TO BE TROWELED, SLOPED TOWARDS CHANNEL.

5. CONCRETE MANHOLE SECTIONS SHALL BE STEAM OR HEAT-AND-MIST CURED AND SHALL NOT BE INSTALLED UNTIL AT LEAST 5 DAYS AFTER BEING CAST.

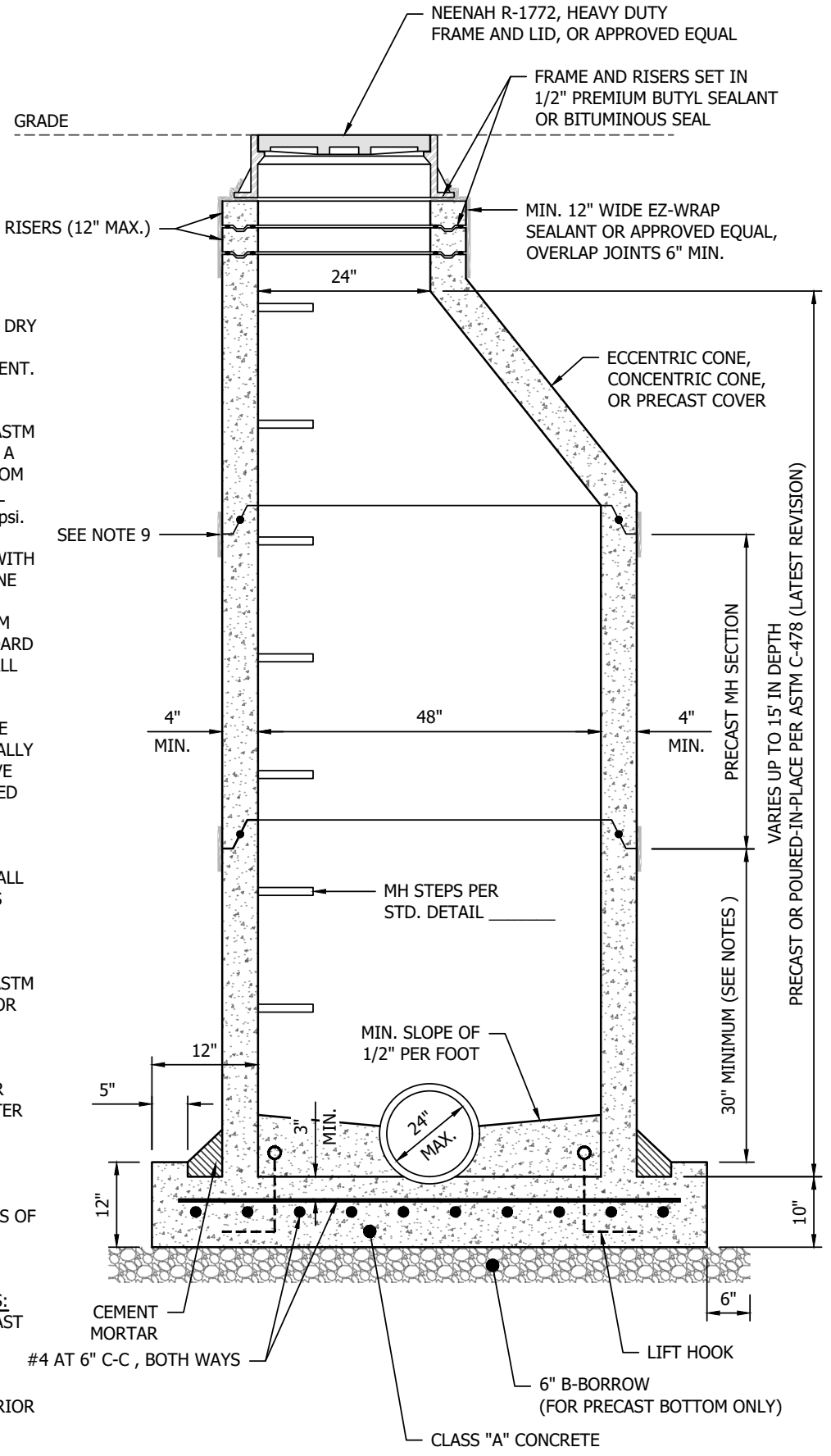
6. JOINTS BETWEEN PRECAST CONCRETE MANHOLE SECTIONS SHALL CONFORM TO ASTM C-443. ALL JOINTS SHALL HAVE AN EXTERIOR JOINT WRAP. THE JOINT WRAP SHALL BE A MINIMUM OF 6-INCHES IN WIDTH.

7. PRECAST REINFORCED CONCRETE REDUCER SECTION REQUIRED FOR MANHOLES GREATER THAN 48-INCH DIAMETER, SEE STANDARD DETAIL_____.

8. <u>PAVEMENT AREAS:</u>
   THE USE OF NOT-TO-EXCEED TWO COURSES OF PRECAST CONCRETE RISER RINGS WILL BE PERMITTED.

   <u>UNPAVED AREAS OR UNIMPROVED STREETS:</u>
   INSTALL TWO TO FOUR COURSES OF PRECAST CONCRETE RISER RINGS TO ALLOW FOR FUTURE ADJUSTMENT.

9. MINIMUM 12" WIDE CONSEAL CS-212 EXTERIOR JOINT WRAP OR APPROVED EQUAL ON ALL BARREL JOINTS.



Muncie SANITARY DISTRICT

MUNCIE PUBLIC WORKS

STANDARD MANHOLE

APPROVED: XX/XX/20XX

REVISED: XX/XX/20XX

STANDARD: **DN-706**

MUNCIE SANITARY DISTRICT
APPROVED CASTINGS LIST

GENERAL DESCRIPTION	NEENAH DESCRIPTION	EAST JORDAN DESCRIPTION	COMPATIBLE DRAINAGE STRUCTURES
MANHOLE FRAME WITH SOLID LID	R-1772 FRAME AND SOLID LID HEAVY DUTY	1022-2 FRAME AND SOLID LID HEAVY DUTY	STANDARD MANHOLE
CATCH BASIN FRAME WITH GRATE LID	R-2502 FRAME AND GRATE LID HEAVY DUTY	1022-2-M1 FRAME AND GRATE (TYPE M1) LID HEAVY DUTY	STANDARD MANHOLE STANDARD CATCH BASIN STANDARD LARGE CATCH BASIN STANDARD INLET
COMBINATION INLET FRAME WITH CURB BOX	R-3010 COMBINATION INLET FRAME GRATE (TYPE A OR S) CURB BOX HEAVY DUTY	7010 CATCH BASIN CURB INLET GRATE (TYPE ME1) LID, TYPE T1 BACK HEAVY DUTY	STANDARD MANHOLE STANDARD CATCH BASIN STANDARD LARGE CATCH BASIN STANDARD INLET
INLET FRAME WITH BEEHIVE GRATE	R-2560-E INLET FOR ROLL TYPE CURB GRATE (TYPE A) HEAVY DUTY	1050-Z1-O2 INLET FRAME AND BEEHIVE GRATE (TYPE O2)	STANDARD MANHOLE STANDARD CATCH BASIN STANDARD LARGE CATCH BASIN STANDARD INLET
ROLL TYPE INLET FRAME WITH GRATE LID	R-3501-N INLET FOR ROLL TYPE CURB GRATE (TYPE A) HEAVY DUTY	7490-M1 CATCH BASIN CURB INLET GRATE (TYPE M1) HEAVY DUTY	24"x36" STANDARD INLET 24"x36" STANDARD CATCH BASIN
INLET FRAME WITH GRATE LID	R-2595-A INLET FRAME AND GRATE (TYPE D) HEAVY DUTY	1020-M1 FRAME AND GRATE (TYPE M1) HEAVY DUTY	STANDARD MANHOLE STANDARD CATCH BASIN STANDARD LARGE CATCH BASIN STANDARD INLET

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EDIT DATE: 10/5/2023
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Muncie SANITARY DISTRICT

MUNCIE PUBLIC WORKS

APPROVED CASTINGS

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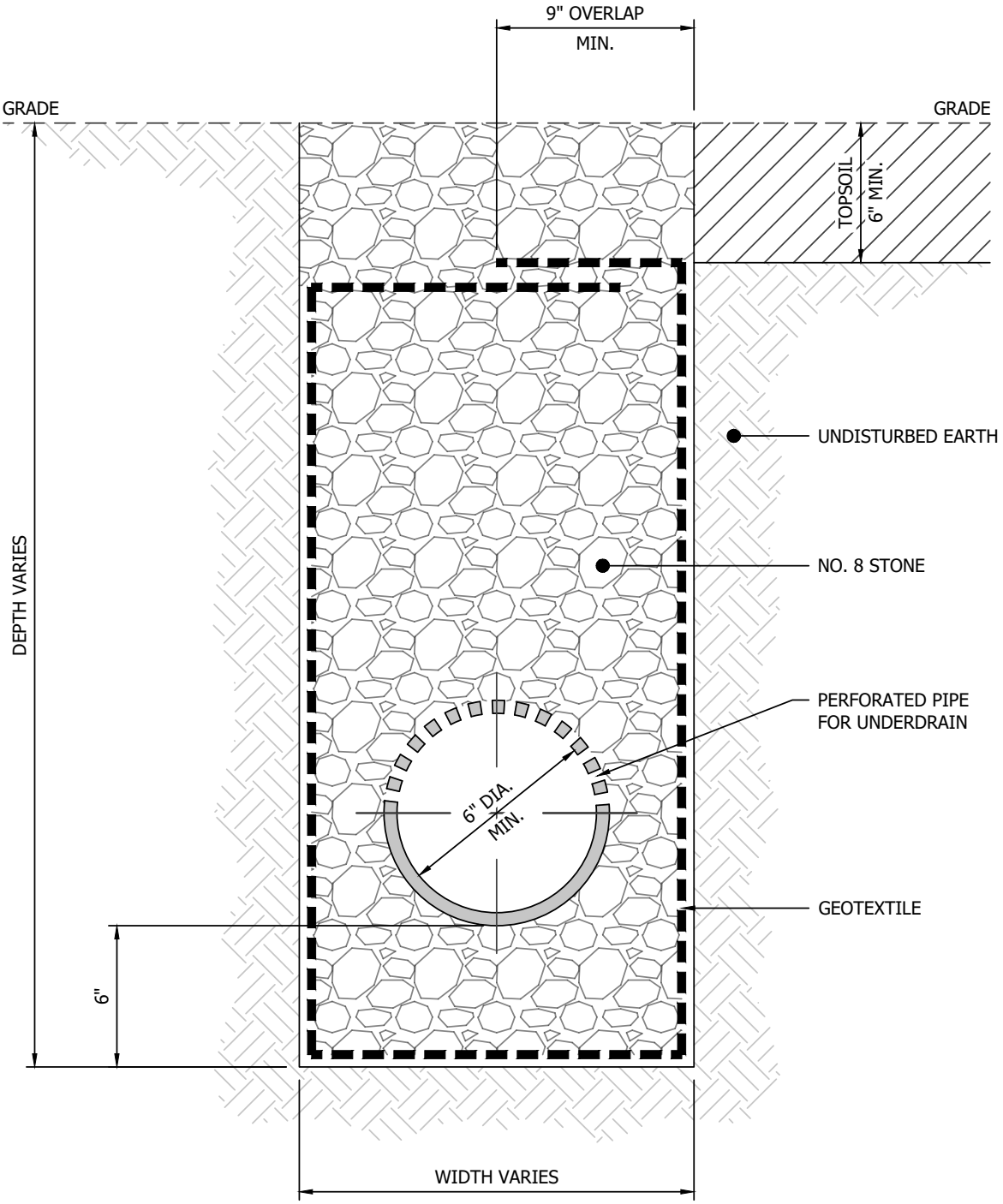
STANDARD: **DN-707**



Muncie SANITARY DISTRICT

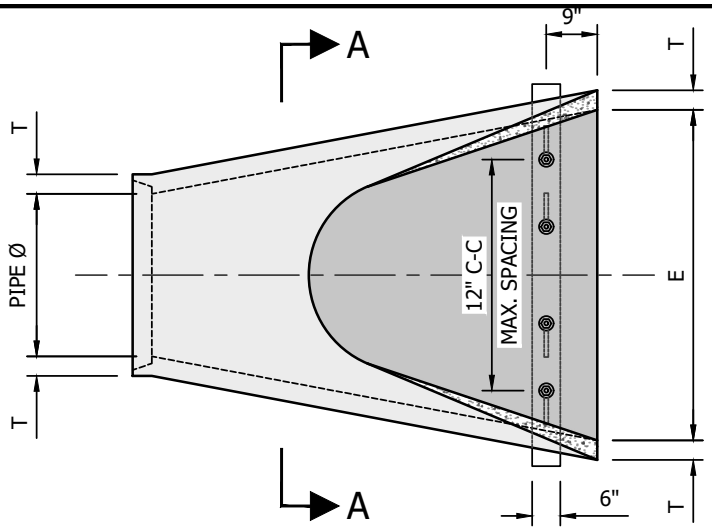
MUNCIE PUBLIC WORKS

PERFORATED PIPE BEDDING

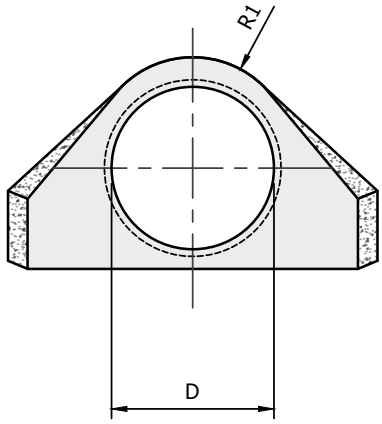
APPROVED: XX/XX/20XX

REVISED: XX/XX/20XX

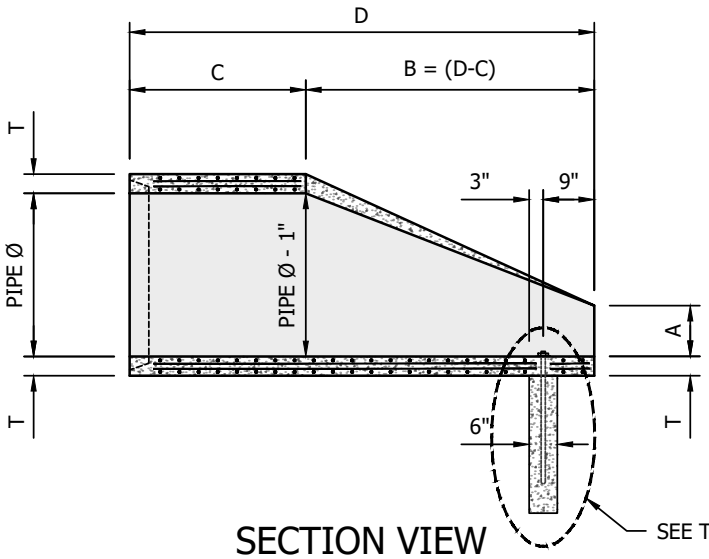
STANDARD: **DN-708**



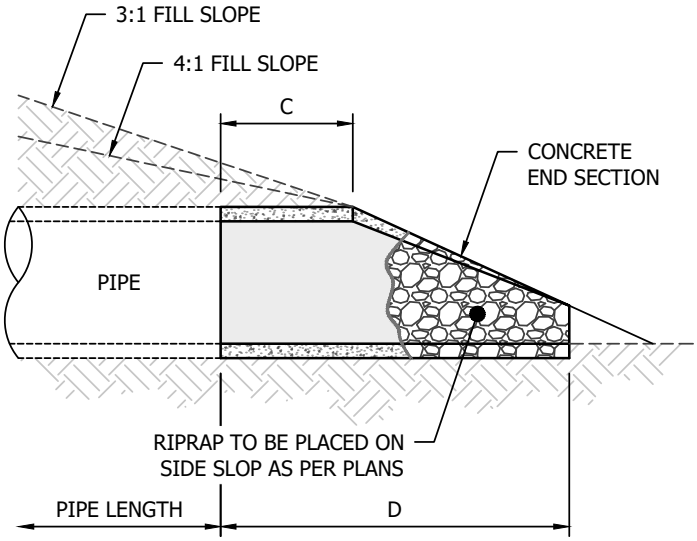
PLAN VIEW



SECTION A-A

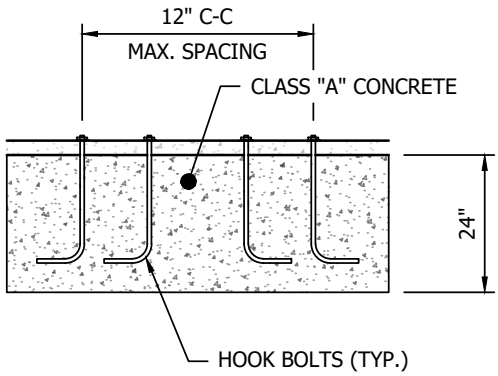


SECTION VIEW



SLOPE DETAIL

DIMENSION TABLE					
DIA.	T (MIN.)	A (±1")	C (±1")	D (±1")	E (±1")
12"	2"	5"	51"	74"	24"
15"	2¼"	7"	48"	75"	30"
18"	2½"	11"	49"	74"	36"
21"	2¾"	11"	42"	75"	42"
24"	3"	12"	32"	75"	48"
27"	3¼"	13"	29"	75"	54"
30"	3½"	14"	34"	75"	60"
33"	3¾"	15"	42"	99"	66"
36"	4"	17"	46"	99"	72"



TOE ANCHOR DETAIL

Muncie SANITARY DISTRICT

MUNCIE PUBLIC WORKS

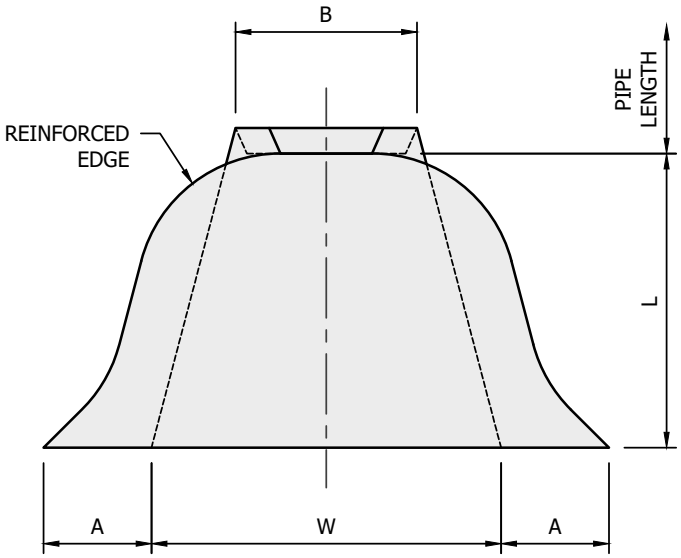
END SECTION PRECAST CONCRETE

APPROVED: XX/XX/20XX

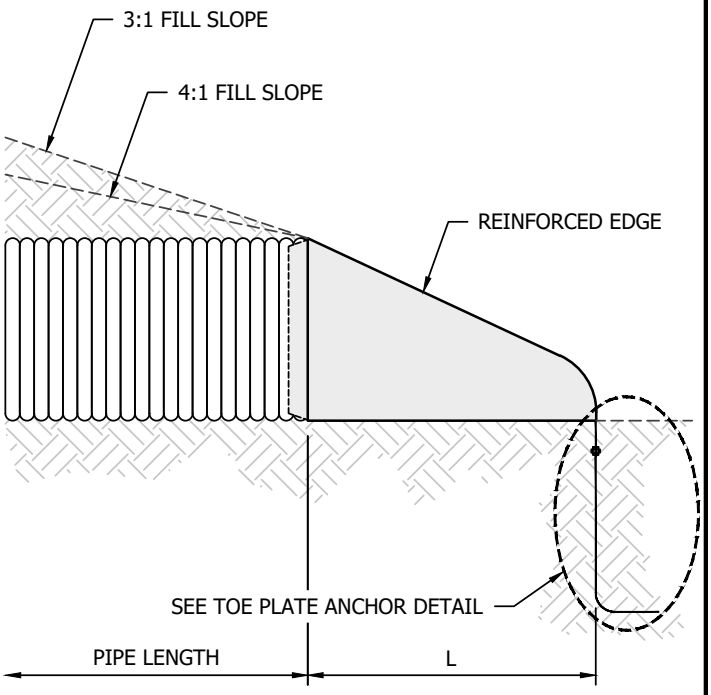
REVISED: XX/XX/20XX

STANDARD: **DN-709**

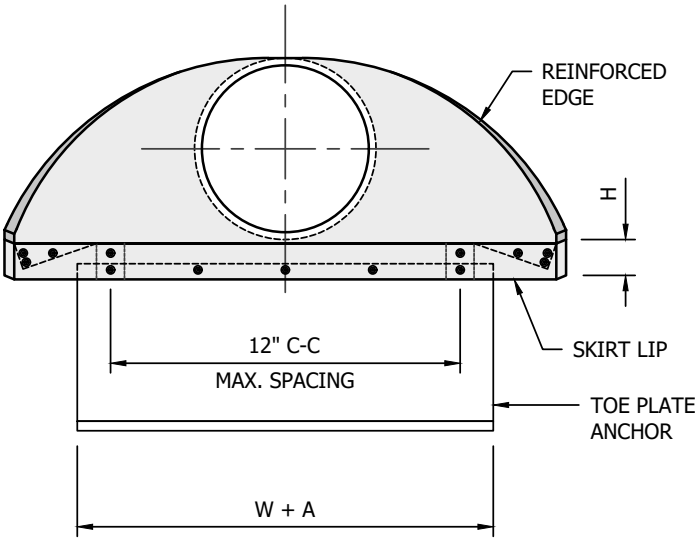
PLOT DATE: 10/16/2023 9:35AM EDIT DATE: 10/5/2023 EDITED BY: PTRAWINSKI DRAWING FILE: P:\2022\01013D. Drawings\Utility Infrastructure\MSD_DN_709_END SECTION CONCRETE.dwg



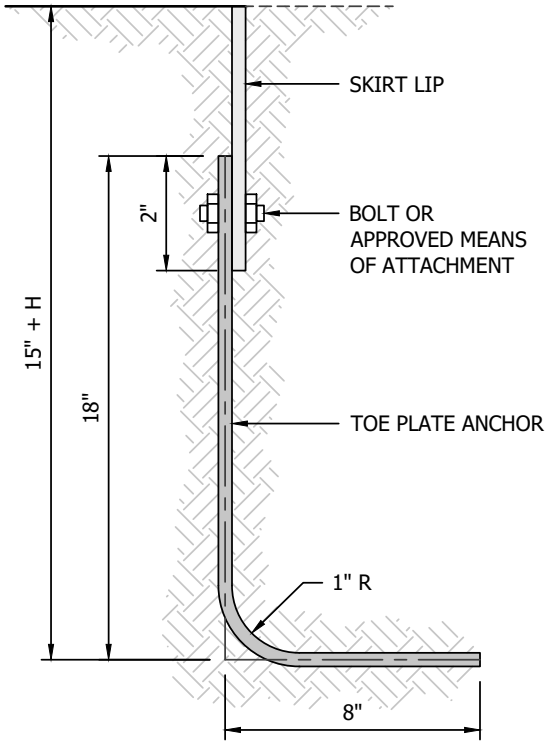
PLAN VIEW



SIDE VIEW



SECTION VIEW



TOE PLATE ANCHOR

DIMENSION TABLE

DIA.	END SECTION THICKNESS (IN.)	A (±1")	B (MAX.)	H (±1")	L (±1½")	W (±2")
12"	.064	6"	6"	6"	21"	24"
15"	.064	7"	8"	6"	26"	30"
18"	.064	8"	10"	6"	31"	36"
21"	.064	9"	12"	6"	36"	42"
24"	.064	10"	13"	6"	41"	48"
30"	.079	12"	16"	8"	51"	60"
36"	.079	14"	19"	9"	60"	72"

Muncie SANITARY DISTRICT

MUNCIE PUBLIC WORKS

END SECTION METAL

APPROVED: XX/XX/20XX

REVISED: XX/XX/20XX

STANDARD: **DN-710**

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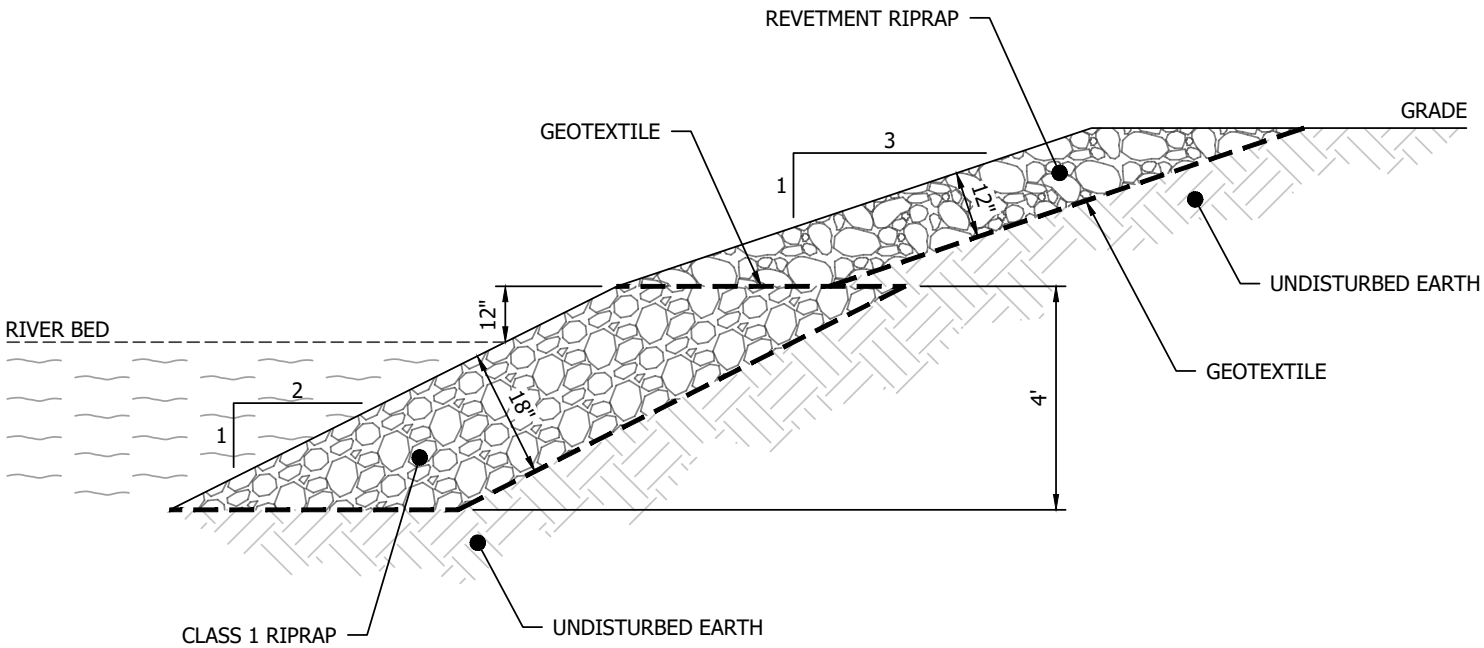


Muncie SANITARY DISTRICT

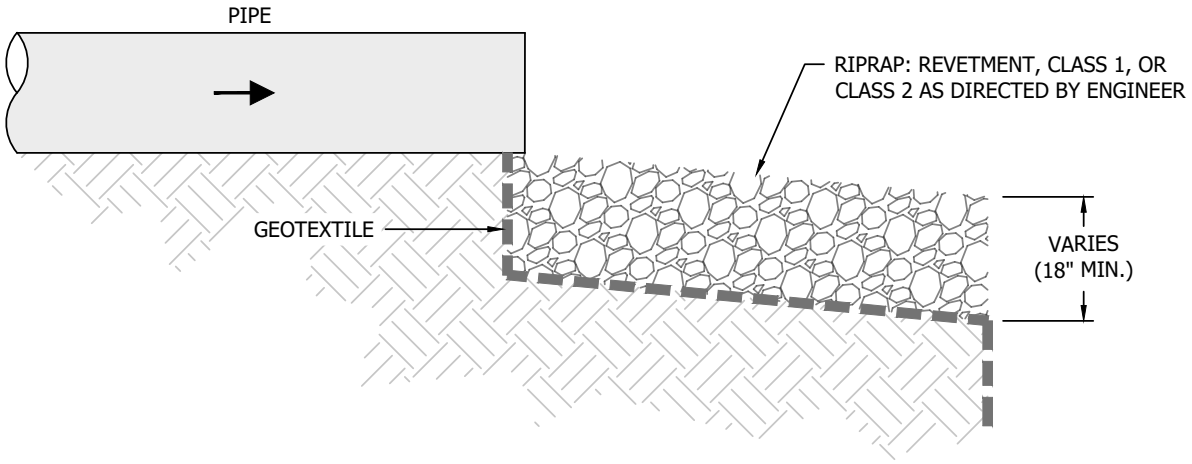
MUNCIE PUBLIC WORKS

RIPRAP DITCH OR RIVER BED

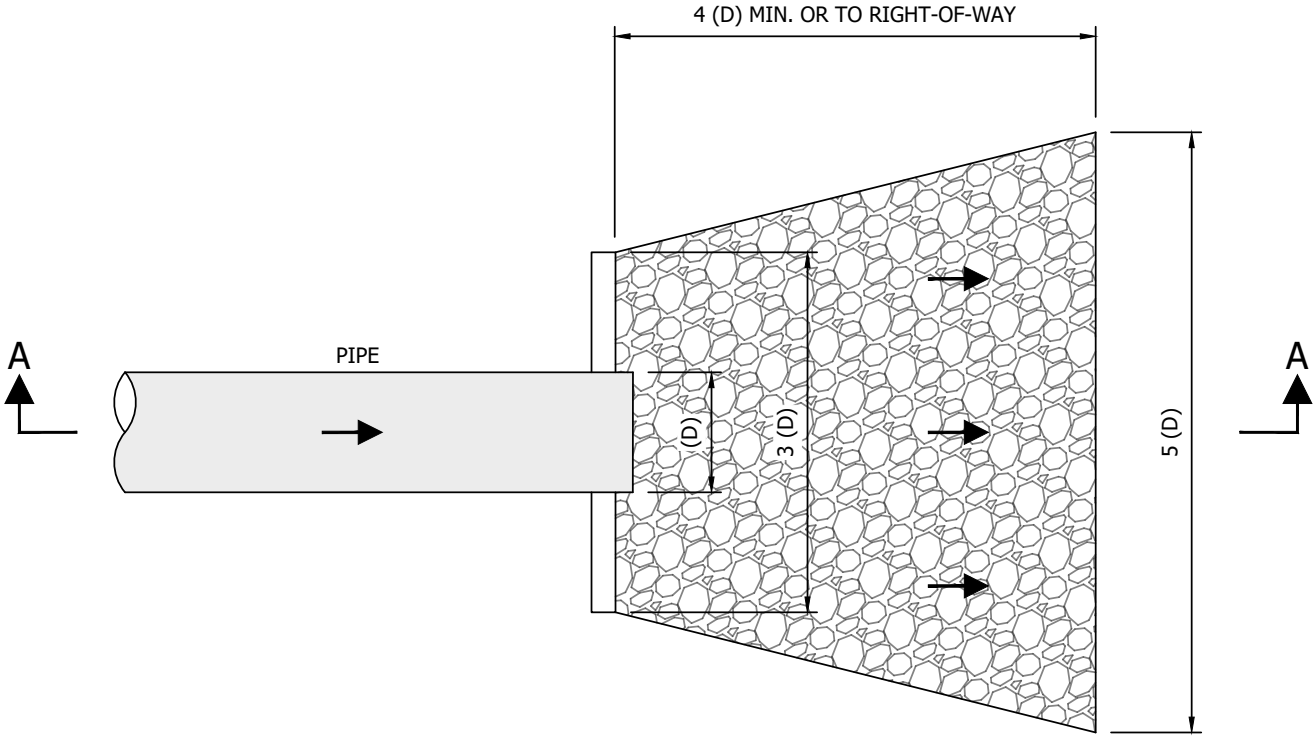
APPROVED: XX/XX/20XX

REVISED: XX/XX/20XX

STANDARD: **DN-711**



SECTION A-A



PLAN VIEW

(D) = OUTSIDE DIAMETER OF STRUCTURE

Muncie SANITARY DISTRICT

MUNCIE PUBLIC WORKS

RIPRAP APRON

APPROVED: XX/XX/20XX

REVISED: XX/XX/20XX

STANDARD: **DN-712**

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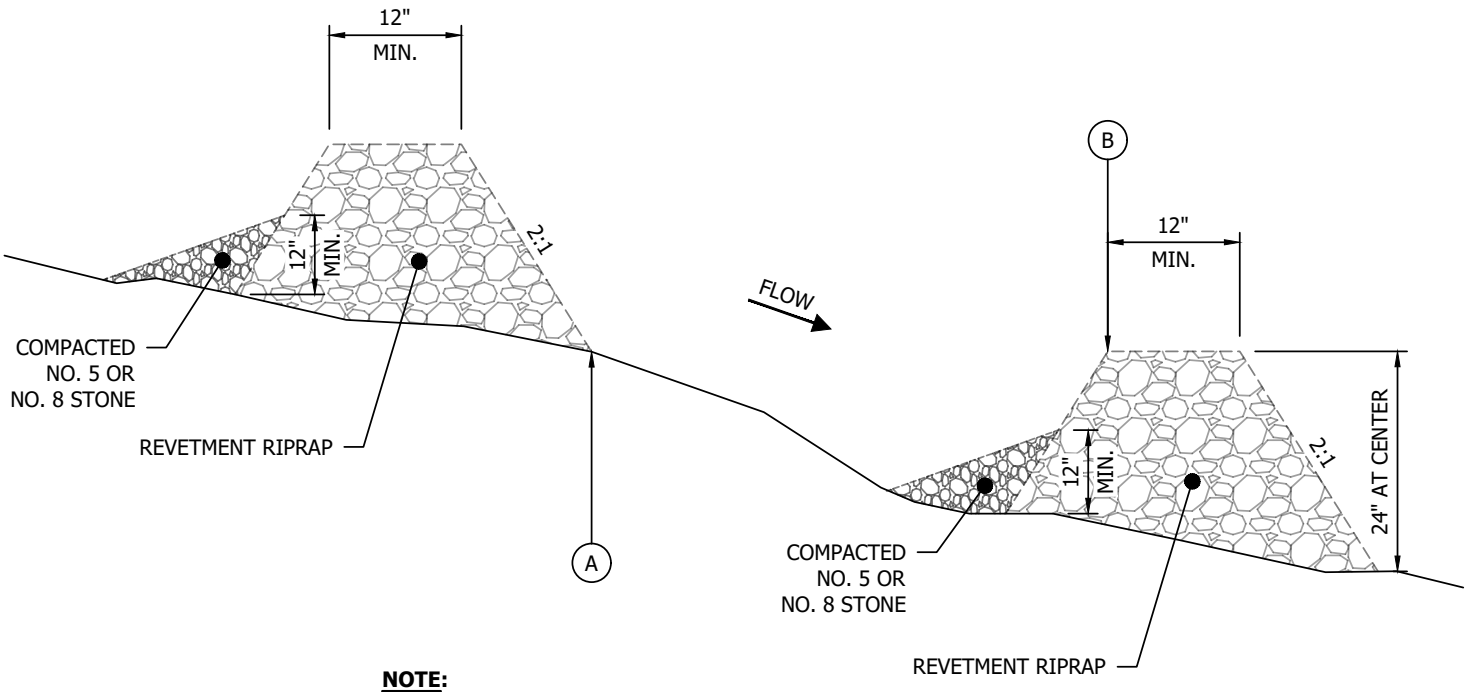
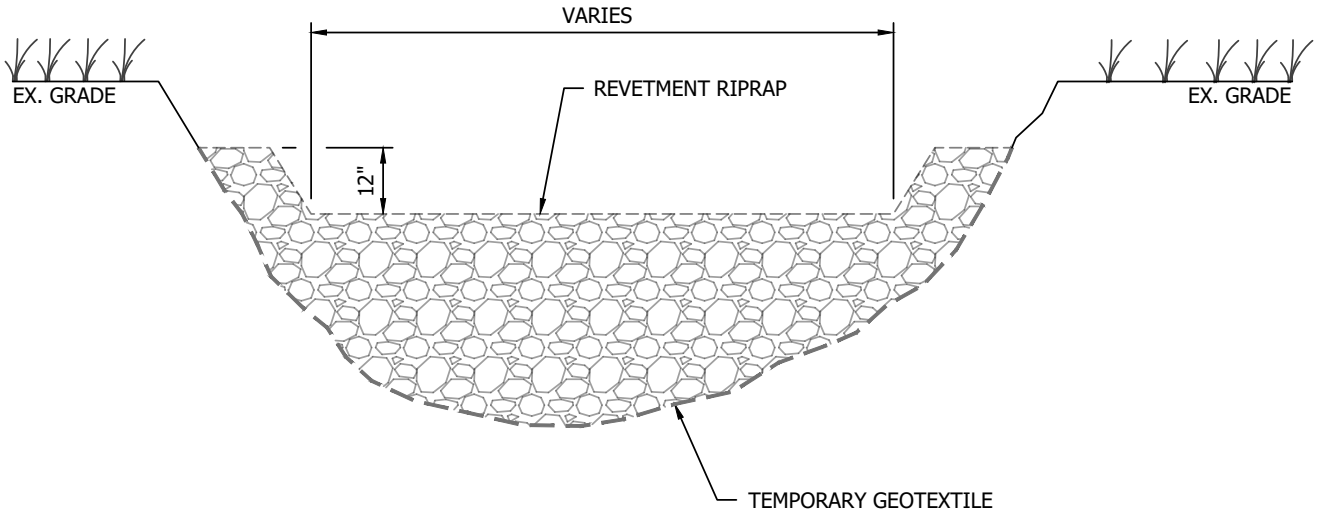


NOTE:

SPACE CHECK DAMS IN THE CHANNEL SO THE UPSTREAM DAM TOE ELEVATION (A) AND THE DOWNSTREAM DAM TOP ELEVATION (B) ARE THE SAME.



MAINTENANCE REQUIREMENTS:

1. INSPECT CHECK DAMS AND CHANNEL AFTER EACH STORM EVENT AND REPAIR ANY DAMAGE.
2. REMOVE SEDIMENT ACCUMULATED BEHIND EACH DAM AS NEEDED TO MAINTAIN CHANNEL CAPACITY AND TO ALLOW DRAINAGE THROUGH THE DAM.
3. ADD ROCK TO THE DAMS TO MAINTAIN DESIGN HEIGHT AND CROSS SECTION.
4. REMOVE ROCK AND STABILIZE CHANNEL WHEN DAM IS NO LONGER NEEDED.

Muncie SANITARY DISTRICT

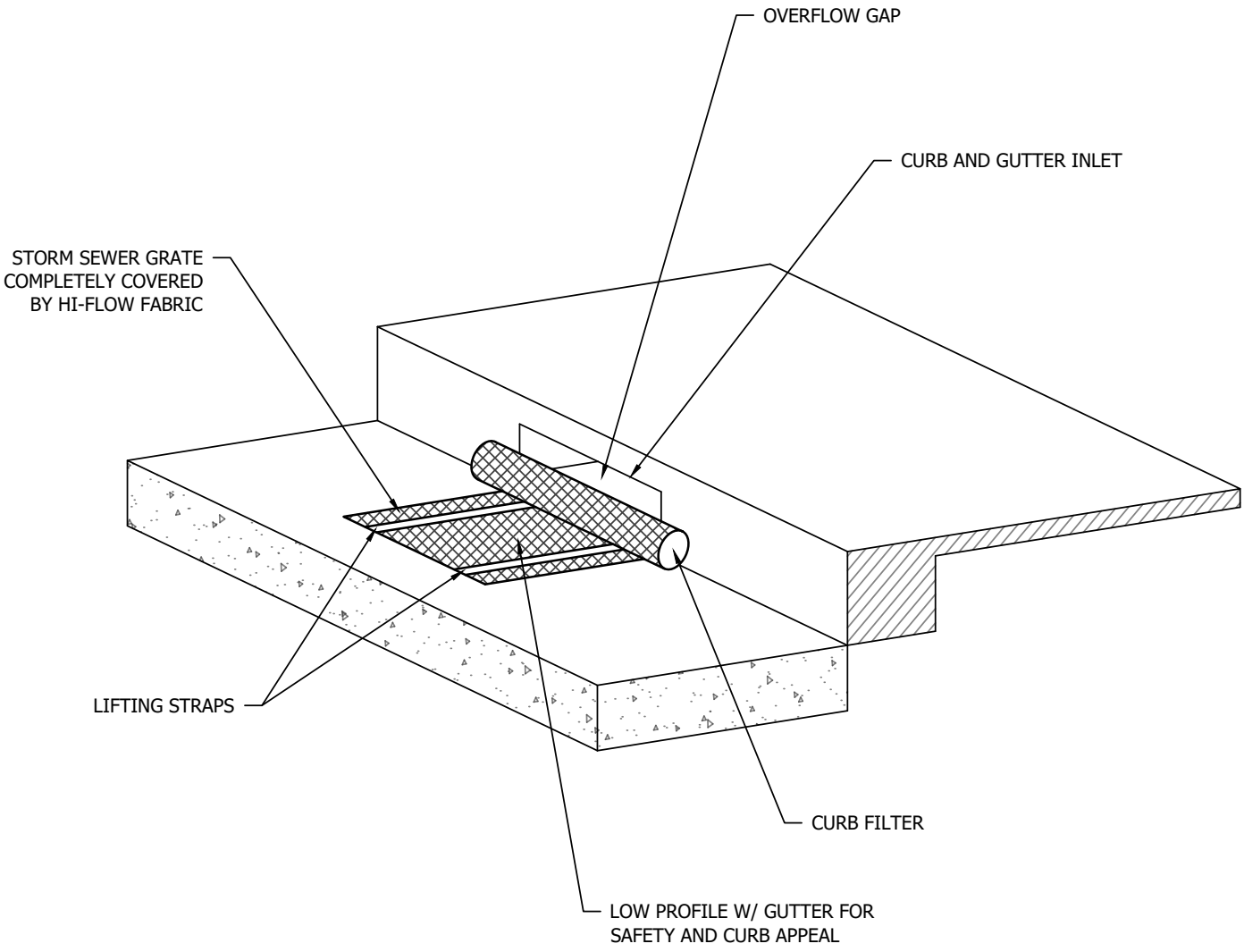
MUNCIE PUBLIC WORKS

ROCK CHECK DAM

APPROVED: XX/XX/20XX

REVISED: XX/XX/20XX

STANDARD: **DN-713**



MAINTENANCE REQUIREMENTS:

1. INSPECT CURB BAGS WEEKLY AND AFTER EACH STORM EVENT FOR DAMAGE OR CLOGGING.
2. REMOVE SEDIMENT AFTER EACH STORM EVENT.
3. CLEANING BY FLUSHING WITH WATER IS PROHIBITED.

Muncie SANITARY DISTRICT

MUNCIE PUBLIC WORKS

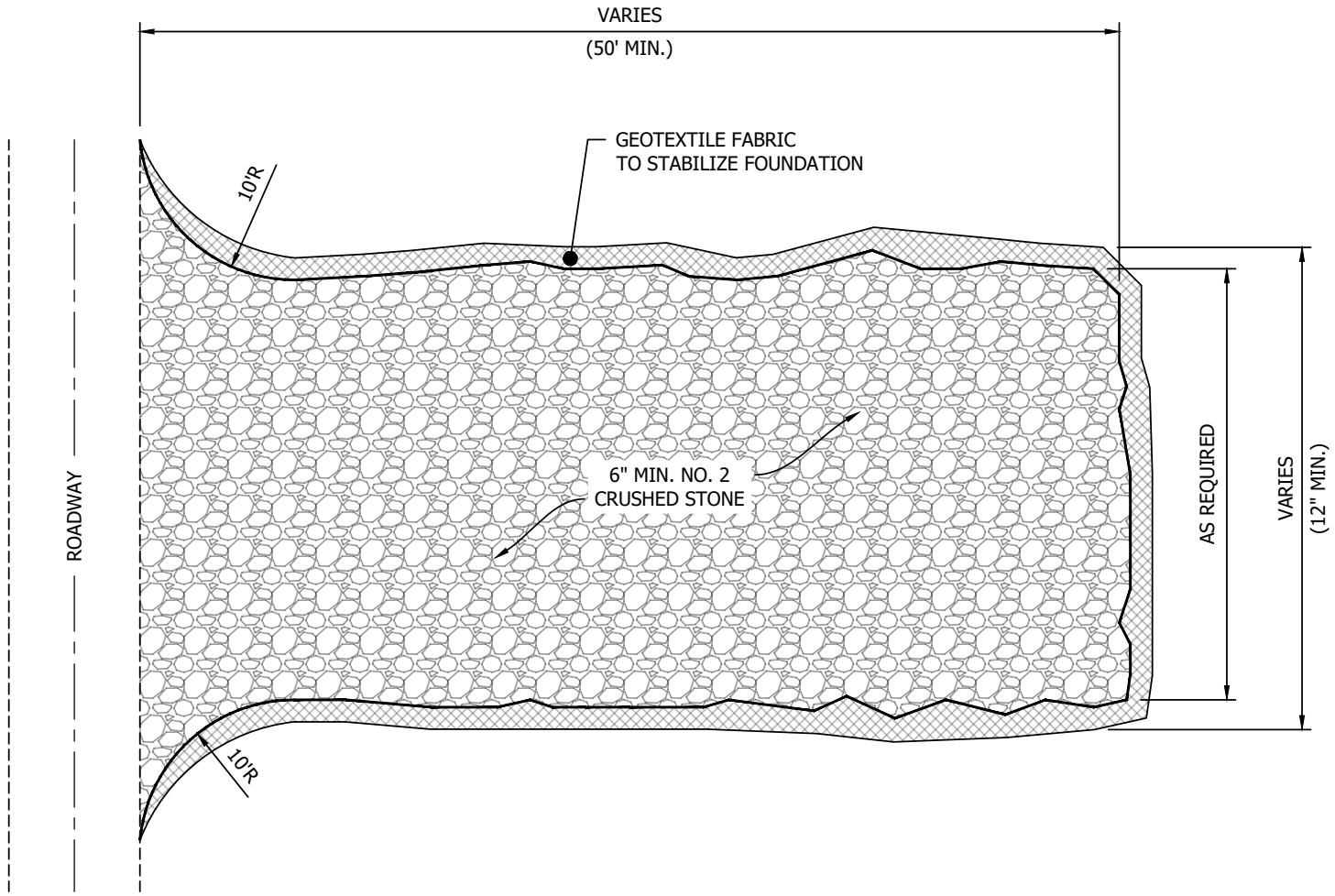
SILT FENCE INLET FILTER

APPROVED: *XX/XX/20XX*

REVISED: *XX/XX/20XX*

STANDARD: **DN-714**

PLOT DATE: 10/16/2023 9:35AM EDIT DATE: 10/16/2023 EDITED BY: PTRAWINSKI DRAWING FILE: P:\2022\01013D. Drawings\Utility Infrastructure\MSD_DN_714_INLET FILTER.dwg



TEMPORARY CONSTRUCTION INGRESS/EGRESS PAD INSTALLATION:

1. REMOVE ALL VEGETATION AND OTHER OBJECTIONABLE MATERIAL FROM THE FOUNDATION AREA.
2. GRADE THE FOUNDATION AND CROWN FOR POSITIVE DRAINAGE.
3. INSTALL A CULVERT PIPE UNDER THE PAD IF NEEDED TO MAINTAIN PROPER PUBLIC ROAD DRAINAGE.
4. IF WET CONDITIONS ARE ANTICIPATED, PLACE GEOTEXTILE FABRIC ON THE GRADED FOUNDATION TO IMPROVE STABILITY.
5. PLACE AGGREGATE NO. 2 STONE TO THE DIMENSIONS AND GRADE SHOWN IN THE CONSTRUCTION PLANS, LEAVING THE SURFACE SMOOTH AND SLOPED FOR DRAINAGE.
6. TOP-DRESS THE DRIVE WITH WASHED AGGREGATE NO. 53 STONE.
7. WHERE POSSIBLE, DIVERT ALL STORM WATER RUNOFF AND DRAINAGE FROM THE TEMPORARY CONSTRUCTION INGRESS/EGRESS PAD TO A SEDIMENT TRAP OR BASIN.

MAINTENANCE REQUIEMENTS:

1. INSPECT DAILY.
2. RESHAPE PAD AS NEEDED FOR DRAINAGE AND RUNOFF CONTROL
3. TOP-DRESS WITH CLEAN AGGREGATE AS NEEDED.
4. IMMEDIATELY REMOVE MUD AND SEDIMENT TRACKED OR WASHED INTO PUBLIC ROADS.
5. FLUSHING SHOULD ONLY BE USED IF THE WATER FROM THE CONSTRUCTION DRIVE CAN BE CONVEYED INTO A SEDIMENT TRAP OR BASIN.

Muncie SANITARY DISTRICT

MUNCIE PUBLIC WORKS

TEMPORARY CONSTRUCTION ENTRANCE

APPROVED: XX/XX/20XX

REVISED: XX/XX/20XX

STANDARD: DN-715

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EDIT DATE: 10/16/2023
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* APPROXIMATELY 300 STAPLES PER ROLL (8' OR 4' WIDTH) REQUIRED - DRAWINGS NOT TO SCALE 8' WIDE BLANKET SHOWN

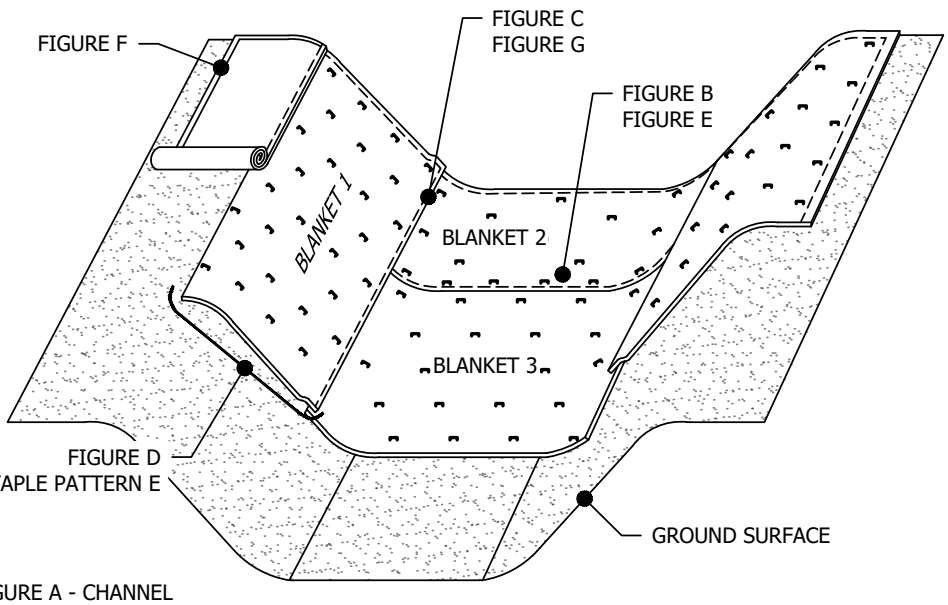


FIGURE A - CHANNEL

* APPROXIMATELY 200 STAPLES PER ROLL (8' OR 4' WIDTH) REQUIRED - DRAWINGS NOT TO SCALE 8' WIDE BLANKET SHOWN

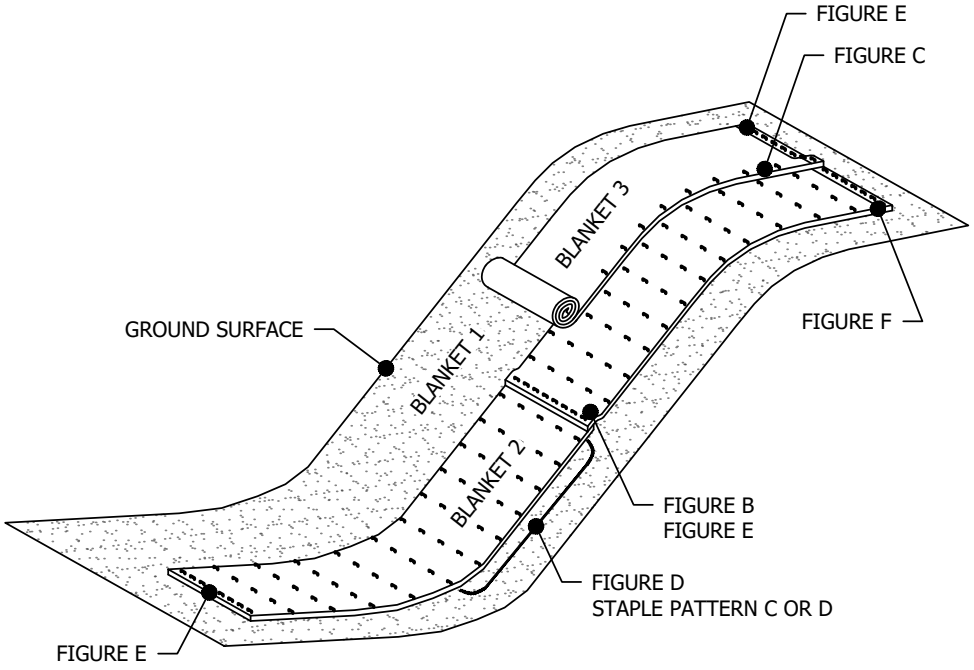


FIGURE A - SLOPE

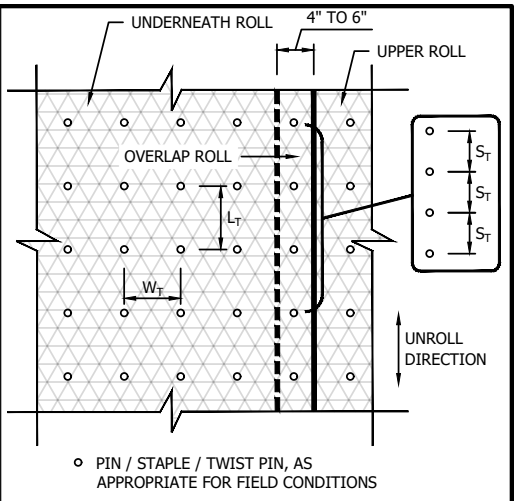


FIGURE D - PLAN VIEW

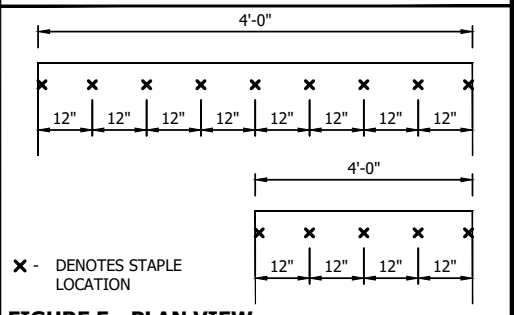


FIGURE E - PLAN VIEW

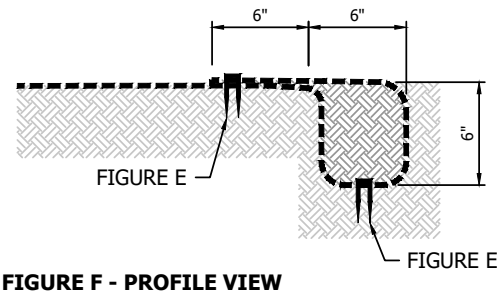


FIGURE F - PROFILE VIEW

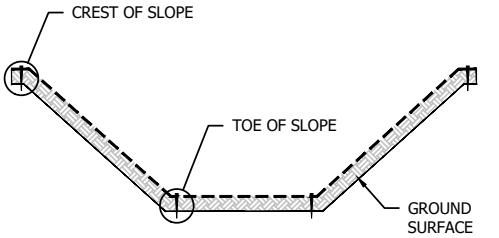


FIGURE G - CRITICAL POINT - CHANNEL

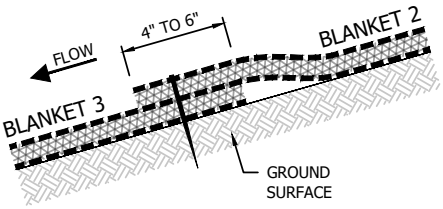


FIGURE B - PROFILE VIEW

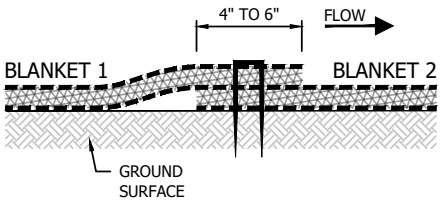


FIGURE C - CROSS SECTION VIEW

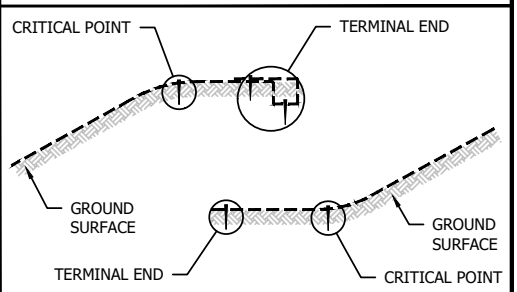


FIGURE G - CRITICAL POINT - SLOPE

Muncie SANITARY DISTRICT

MUNCIE PUBLIC WORKS

EROSION CONTROL BLANKET AND TURF REINFORCEMENT MAT

APPROVED: XX/XX/20XX

REVISED: XX/XX/20XX

STANDARD: **DN-716**

DRAWING FILE: P:\2022\01013D. Drawings\Utility Infrastructure\MSD_DN_716_BLANKET AND TURF REINFORCEMENT.dwg
EDITED BY: PTRAWINSKI
EDIT DATE: 10/16/2023
PLOT DATE: 10/16/2023 9:35 AM

CHANNEL & SLOPE INSTALLATION:

STEP 1 - SITE PREPARATION
PREPARE SITE TO DESIGN PROFILE AND GRADE. REMOVE DEBRIS, ROCKS, CLOGS, ETC.. GROUND SURFACE SHOULD BE SMOOTH PRIOR TO INSTALLATION TO ENSURE BLANKET OR MAT REMAINS IN CONTACT WITH SLOPE.

STEP 2 - SEEDING
SEEDING OF SITE SHOULD BE CONDUCTED TO DESIGN REQUIREMENTS OR TO FOLLOW LOCAL OR STATE SEEDING REQUIREMENTS AS NECESSARY.

STEP 3 - STAPLE SELECTION
AT A MINIMUM, 6" LONG BY 1" CROWN, 11 GAUGE STAPLES ARE TO BE USED TO SECURE THE BLANKET OR MAT TO THE GROUND SURFACE. INSTALLATION IN ROCKY, SANDY OR OTHER LOOSE SOIL MAY REQUIRE LONGER STAPLES. BIO-DEGRADABLE FASTENERS SHALL NOT BE USED WITH TRM MATERIALS.

STEP 4 - EXCAVATE ANCHOR TRENCH AND SECURE BLANKET OR MAT
EXCAVATE A TRENCH ALONG THE TOP OF THE CHANNEL SIDE SLOPES AND THE UPSTREAM TERMINAL END OF THE CHANNEL TO SECURE THE EDGES OF THE BLANKET OR MAT. THE TRENCH SHOULD RUN ALONG THE LENGTH AND WIDTH OF THE INSTALLATION, BE 6" WIDE AND 6" DEEP. STAPLE BLANKET OR MAT ALONG BOTTOM OF TRENCH, FILL WITH COMPACTED SOIL, OVERLAP BLANKET OR MAT TOWARDS TOE OF SLOPE AND SECURE WITH ROW OF STAPLES (SHOWN IN FIGURES A, E AND F).

STEP 5 - SECURE BODY OF BLANKET OR MAT
ROLL BLANKET OR MAT DOWN SLOPE FROM ANCHOR TRENCH. STAPLE BODY OF BLANKET OR MAT FOLLOWING THE PATTERN SHOWN IN FIGURE D. LEAVE END OF BLANKET OR MAT UNSTAPLED TO ALLOW FOR OVERLAP SHOWN IN FIGURE B. PLACE DOWNSTREAM BLANKET OR MAT UNDERNEATH UPSTREAM BLANKET OR MAT TO FORM SHINGLE PATTERN. STAPLE SEAM AS SHOWN IN FIGURE E. SECURE DOWNSTREAM BLANKET OR MAT WITH STAPLING PATTERN SHOWN IN FIGURE D. STAPLING PATTERN SHOWN IN FIGURE D REFLECTS MINIMUM STAPLES TO BE USED. MORE STAPLES MAY BE REQUIRED TO ENSURE BLANKET OR MAT IS SUFFICIENTLY SECURED TO RESIST MOWERS AND FOOT TRAFFIC AND TO ENSURE BLANKET OR MAT IS IN CONTACT WITH SOIL SURFACE OVER THE ENTIRE AREA OF BLANKET OR MAT. FURTHER, CRITICAL POINTS REQUIRE ADDITIONAL STAPLES. CRITICAL POINTS ARE IDENTIFIED IN FIGURE G.

STEP 6 - CONTINUE ALONG SLOPE - COMPLETE INSTALLATION
OVERLAP ADJACENT BLANKETS OR MATS AS SHOWN IN FIGURE C AND REPEAT STEP 5. SECURE TOE OF SLOPE USING STAPLING PATTERN SHOWN IN FIGURE E. SECURE EDGES OF INSTALLATION BY STAPLING AT 1.0' INTERVALS ALONG THE TERMINAL EDGE.

MAINTENANCE REQUIREMENTS:

1. DURING VEGETATIVE ESTABLISHMENT INSPECT AFTER STORM EVENTS FOR ANY EROSION BELOW THE BLANKET OR MAT.
2. IF ANY AREA SHOWS EROSION PULL BACK THAT PORTION OF THE BLANKET OR MAT COVERING IT, ADD SOIL, RE-SEED THE AREA, AND RE-LAY AND STAPLE THE BLANKET OR MAT.
3. AFTER VEGETATIVE ESTABLISHMENT, CHECK THE TREATED AREA WEEKLY.

EROSION CONTROL BLANKET AND TURF REINFORCEMENT MAT INSTALLATION

STAPLE PATTERN CHART

DIMENSION	C	D	E
W_T	30"	22"	20"
L_T	30"	22"	20"
S_T	18"	18"	18"
NOMINAL FREQUENCY	1.7 / SY	3.0 / SY	3.8 / SY
APPLICATION	ECB (DEGRADABLE	TRM (PERMANENT)	ECB/TRM (CHANNEL LAYOUT)
REQUIRED FASTENER	MIN. 20# PULLOUT	MIN. 20# PULLOUT	MIN. 20# PULLOUT

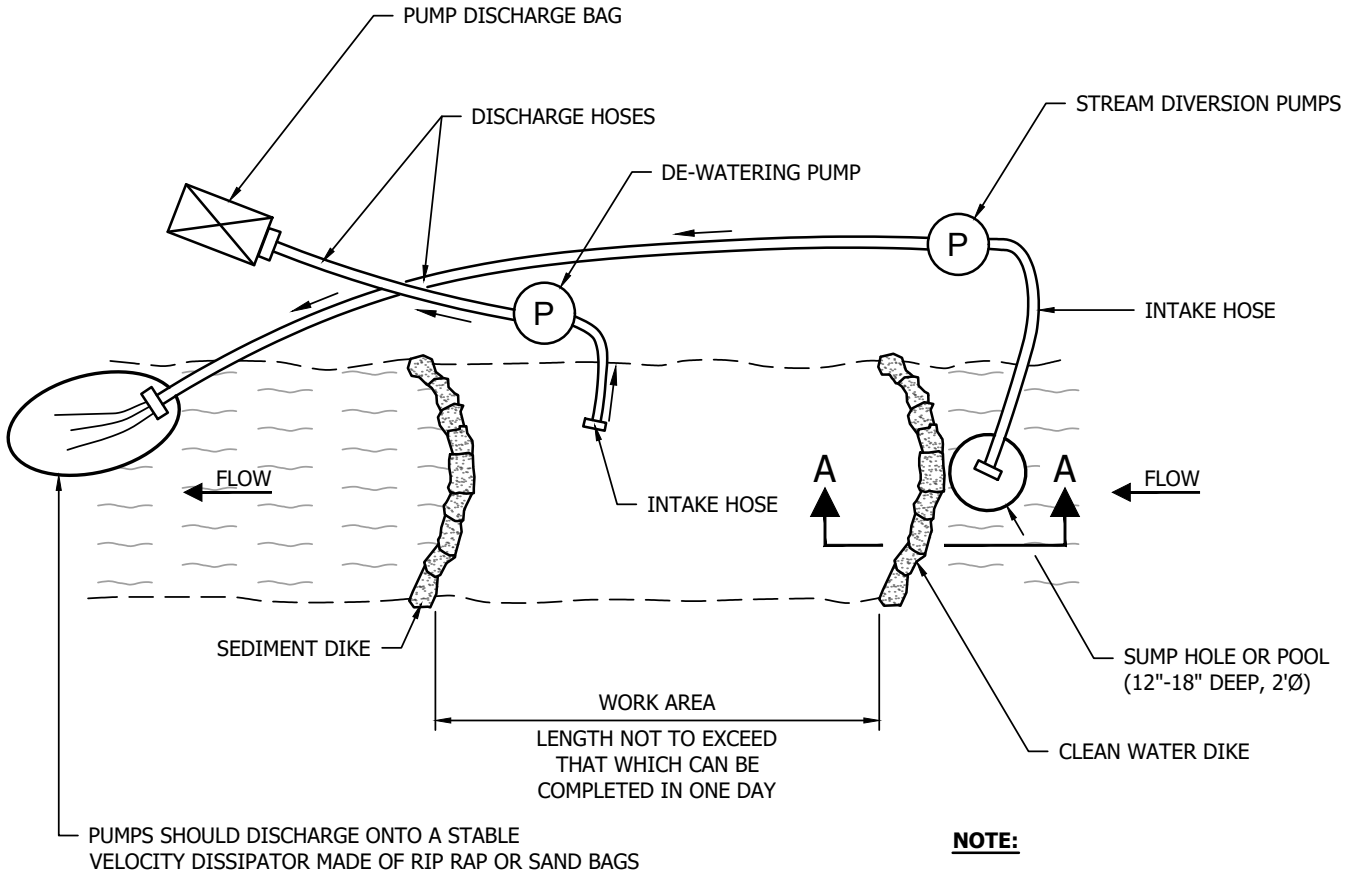
Muncie SANITARY DISTRICT

MUNCIE PUBLIC WORKS

EROSION CONTROL BLANKET AND TURF REINFORCEMENT MAT

APPROVED: XX/XX/20XX
REVISED: XX/XX/20XX
STANDARD: **DN-716**

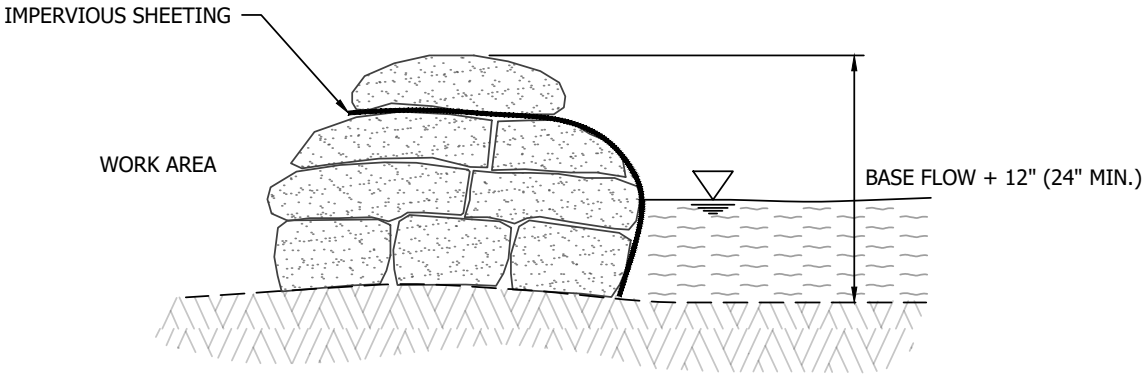
PLOT DATE: 10/16/2023 9:35 AM EDIT DATE: 10/16/2023 EDITED BY: PTRAWINSKI DRAWING FILE: P:\2022\01013D. Drawings\Utility Infrastructure\MSD_DN_716_BLANKET AND TURF REINFORCEMENT.dwg



NOTE:

CONTRACTOR MAY USE LARGE 3'x3'x3' SANDBAGS FOR PUMP AROUND PRACTICE.

PLAN VIEW



SECTION A-A

MAINTENANCE REQUIREMENTS:

1. INSPECT DAILY DURING PUMP AROUND OPERATIONS.
2. ADJUST OUTLET STABILIZATION IF BANK EROSION IS NOTICED.
3. ADJUST PUMP CAPACITY AS NEEDED TO HANDLE THE STREAM WATER VOLUME.
4. FIX LEAKS OR OTHERWISE STABILIZE CLEAN WATER AND SEDIMENT DIKES IF WATER IS BACK-FLOWING INTO WORK AREA.

Muncie SANITARY DISTRICT

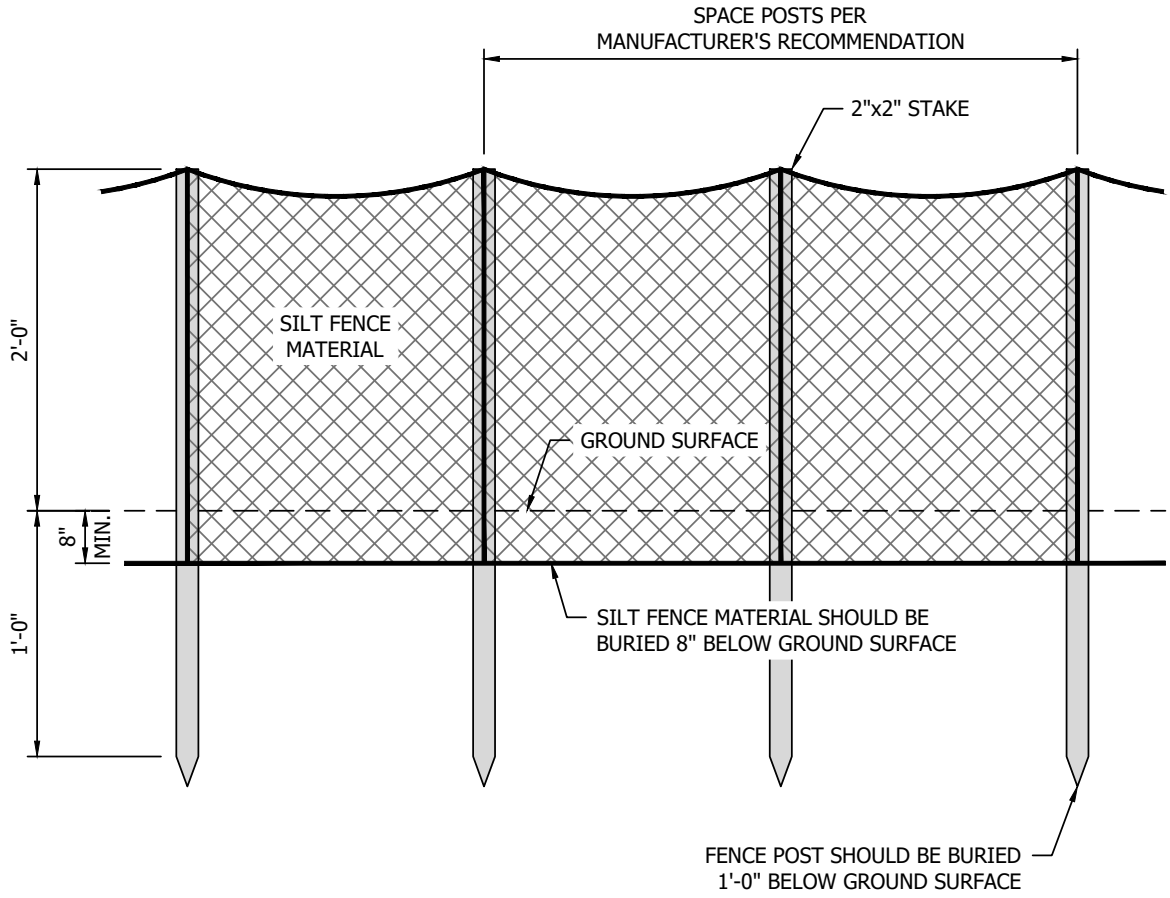
MUNCIE PUBLIC WORKS

PUMP AROUND PRACTICE

APPROVED: XX/XX/20XX

REVISED: XX/XX/20XX

STANDARD: DN-717

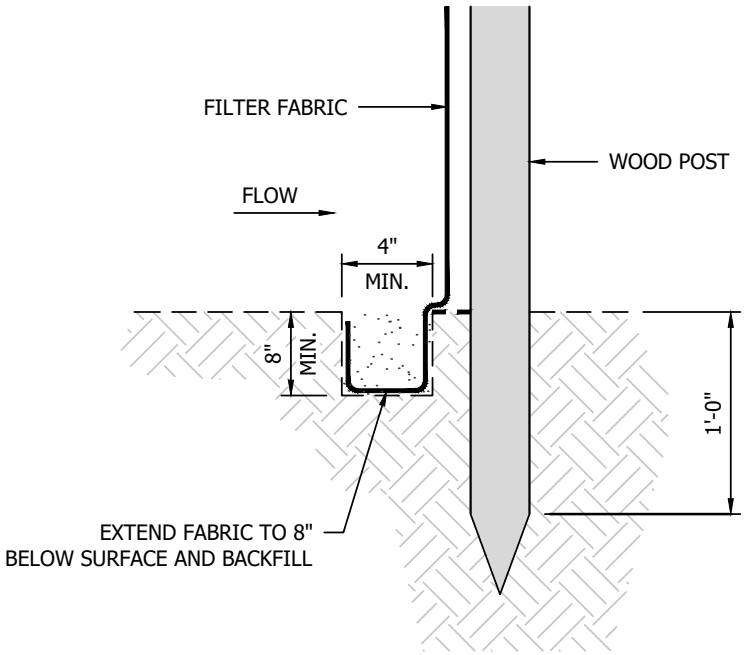


NOTES:

1. SILT FENCE SHALL BE A MACHINE PRODUCED, NON-WOVEN GEOTEXTILE OF 100% POLYPROPYLENE.
2. ALL STAKES SHALL BE 2"x2" HARDWOOD, 36" TALL WITH 24" TALL LATH STAPLED TO STAKES OVER FABRIC AS REINFORCEMENT.
3. ALL SILT FENCE SHALL BE PREFABRICATED BY THE SUPPLIER. NO FIELD ASSEMBLY WILL BE ACCEPTED.

MAINTENANCE REQUIREMENTS:

1. INSPECT SILT FENCE WEEKLY AND AFTER EACH STORM EVENT.
2. REPAIR OR REPLACE SILT FENCE IF TORN, STARTING TO DECOMPOSE, DAMAGED BY CONSTRUCTION EQUIPMENT, OR IS INEFFECTIVE.
3. REMOVE SEDIMENT ONCE IT REACHES ½ OF THE HEIGHT OF THE FENCE.



WOODEN POST ANCHOR SECTION

Muncie SANITARY DISTRICT

MUNCIE PUBLIC WORKS

SILT FENCE DETAIL

APPROVED: XX/XX/20XX

REVISED: XX/XX/20XX

STANDARD: **DN-718**

PLOT DATE: 10/16/2023 9:36 AM
EDIT DATE: 10/16/2023
EDITED BY: PTRAWINSKI
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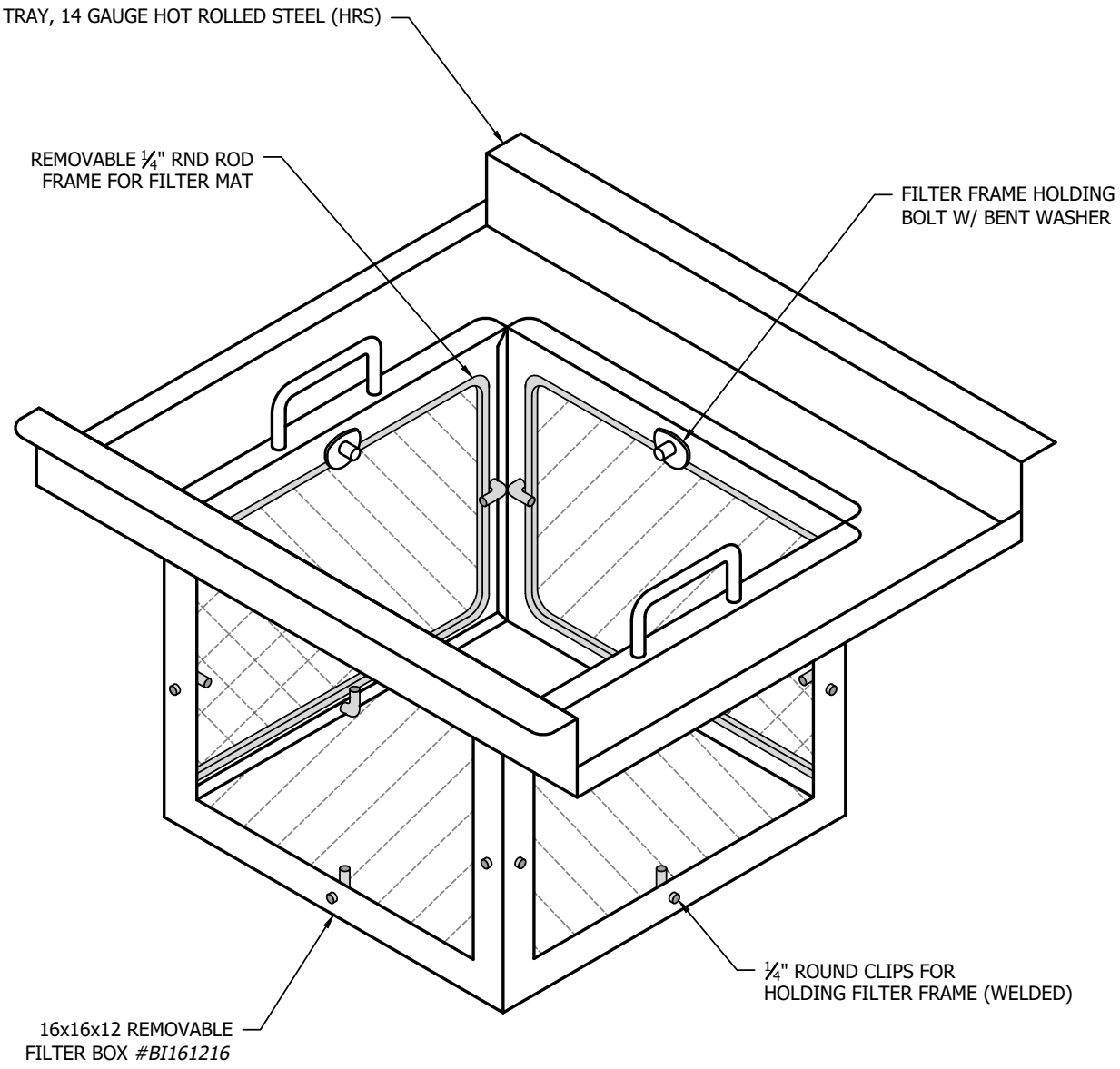


RECOMMENDED INLET PROTECTION DEVICE, SIMILAR INLET PROTECTION DEVICES MAY BE USED UPON APPROVAL FROM ENGINEER

MAINTENANCE REQUIREMENTS:

1. INSPECT INLET PROTECTION DEVICES WEEKLY AND AFTER EACH STORM EVENT FOR DAMAGE OR CLOGGING.
2. REMOVE SEDIMENT AFTER EACH STORM EVENT.
3. CLEANING BY FLUSHING WITH WATER IS PROHIBITED.

Muncie SANITARY DISTRICT

MUNCIE PUBLIC WORKS

INLET PROTECTION DEVICE

APPROVED: *XX/XX/20XX*

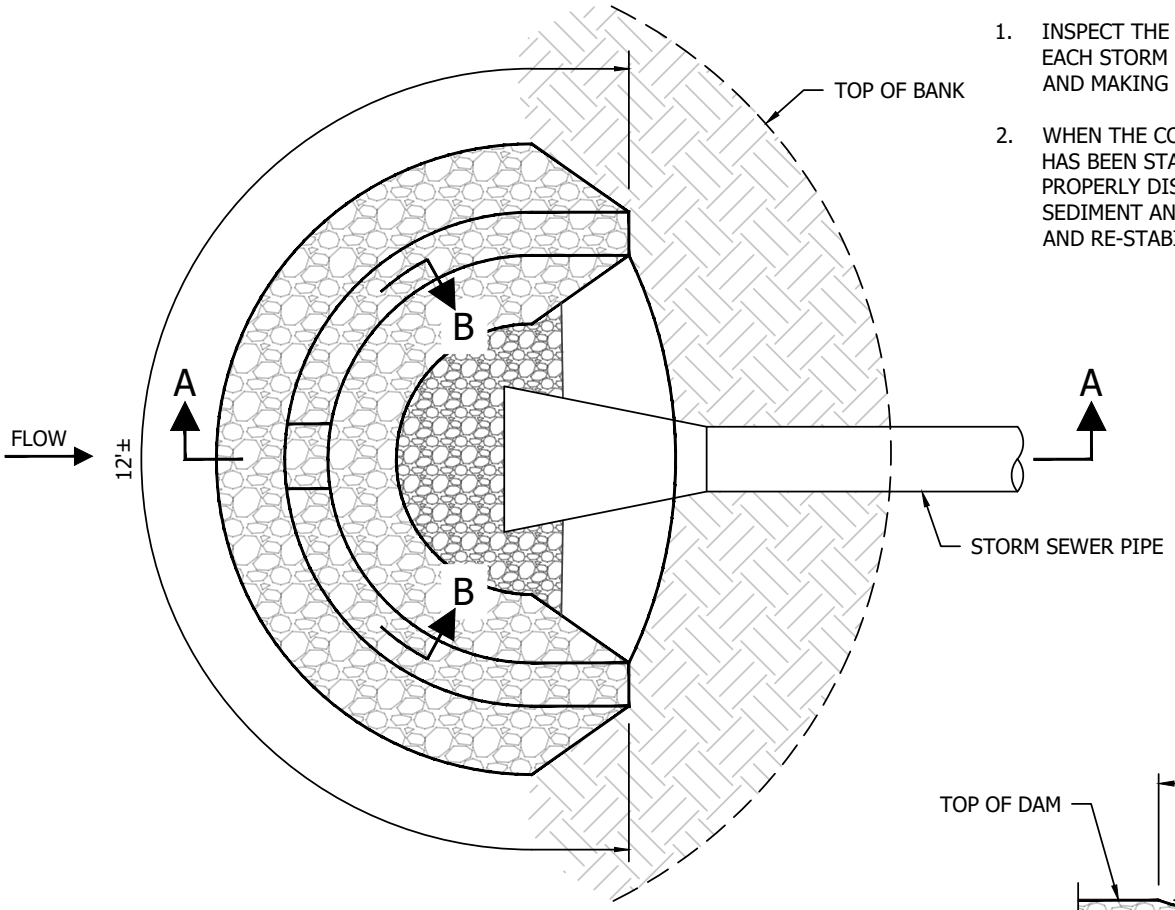
REVISED: *XX/XX/20XX*

STANDARD: **DN-719**

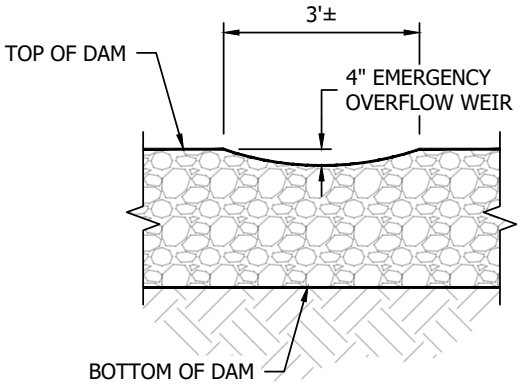
PLOT DATE: 10/16/2023 9:36 AM EDIT DATE: 10/16/2023 EDITED BY: PTRAWINSKI DRAWING FILE: P:\2022\01013D. Drawings\Utility Infrastructure\MSD_DN_719_INLET PROTECTION DEVICE.dwg

MAINTENANCE REQUIREMENTS:

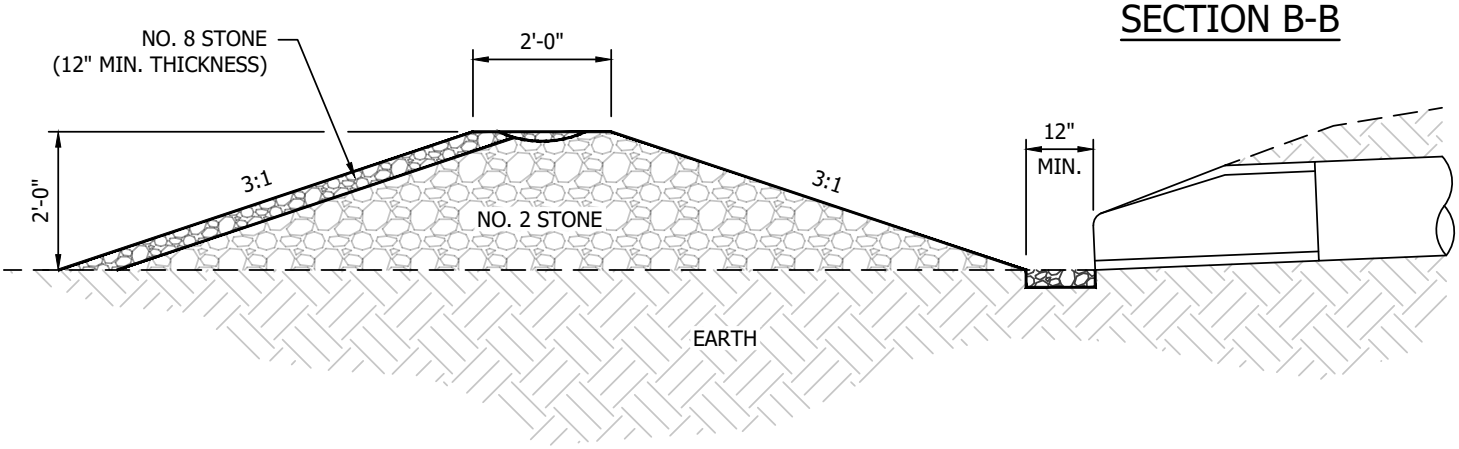
1. INSPECT THE STRUCTURE WEEKLY AND AFTER EACH STORM EVENT, REMOVING SEDIMENT, AND MAKING NEEDED REPAIRS IMMEDIATELY.
2. WHEN THE CONTRIBUTING DRAINAGE AREA HAS BEEN STABILIZED, REMOVE AND PROPERLY DISPOSE OF ANY UNSTABLE SEDIMENT AND CONSTRUCTION MATERIAL, AND RE-STABILIZE.



PLAN



SECTION B-B



SECTION A-A

Muncie SANITARY DISTRICT

MUNCIE PUBLIC WORKS

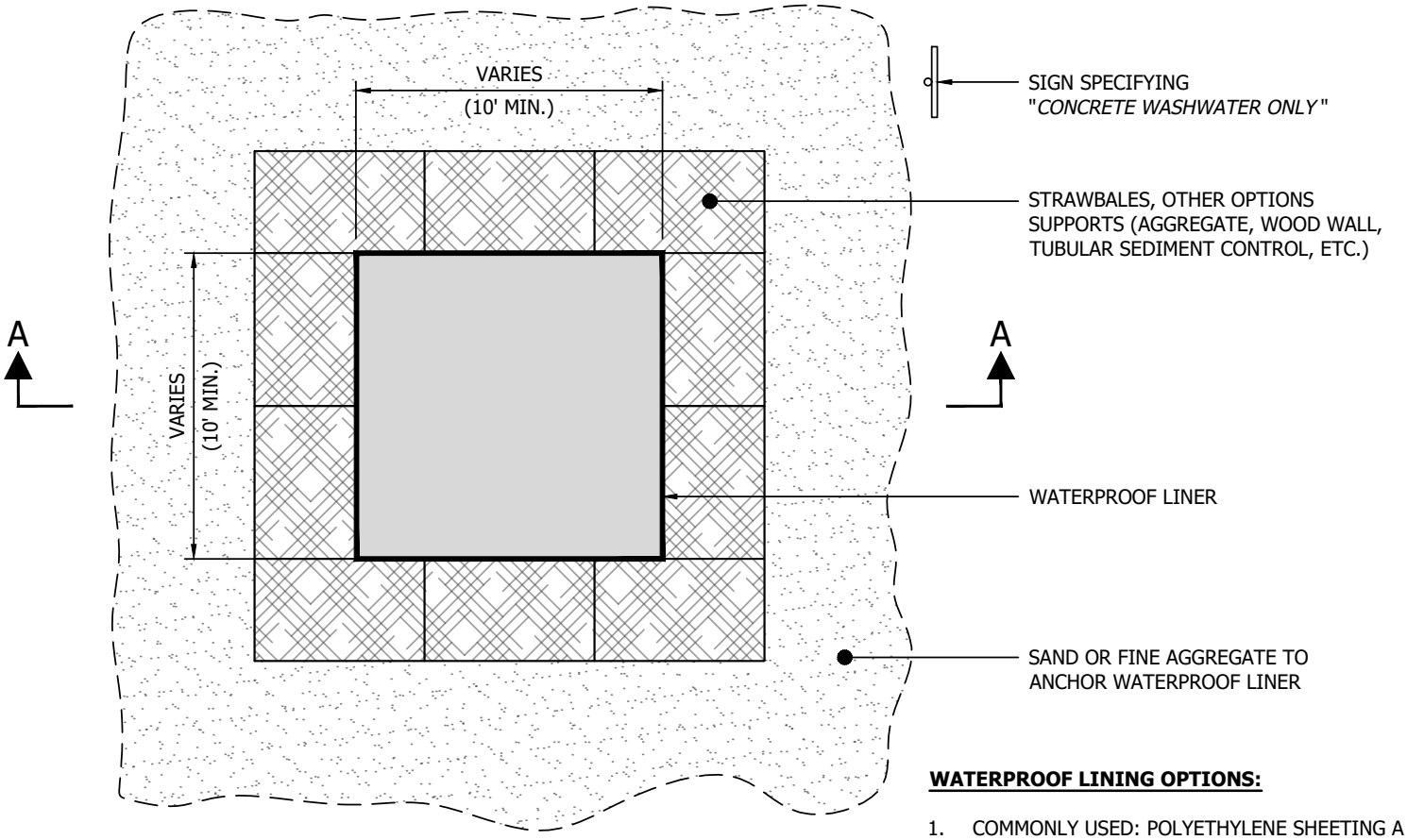
ROCK DONUT

APPROVED: XX/XX/20XX

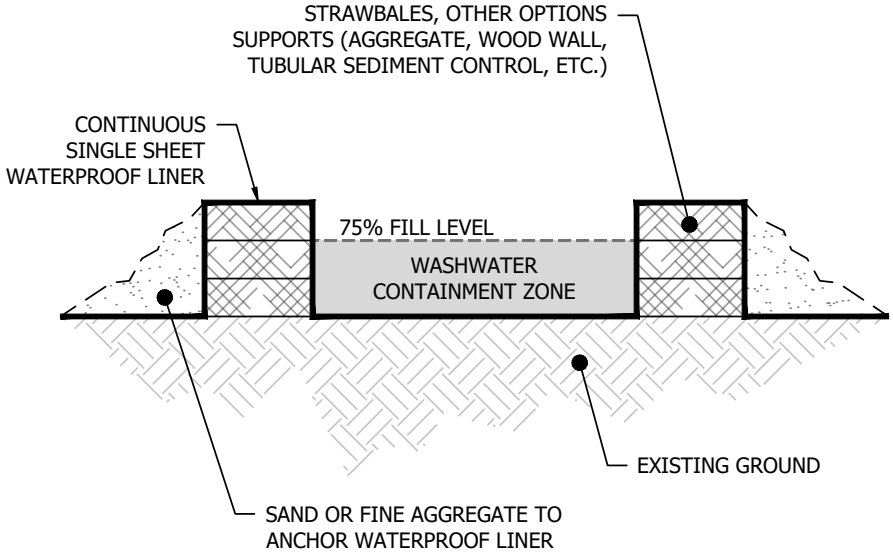
REVISED: XX/XX/20XX

STANDARD: **DN-720**

PLOT DATE: 10/16/2023 9:36 AM
EDIT DATE: 10/16/2023
EDITED BY: PTRAWINSKI
DRAWING FILE: P:\2022\01013D. Drawings\Utility Infrastructure\MSD_DN_720_ROCK DONUT.dwg



PLAN VIEW



SECTION A-A

WATERPROOF LINING OPTIONS:

1. COMMONLY USED: POLYETHYLENE SHEETING A MINIMUM THICKNESS OF 10 MIL (0.254 mm OR 0.01 INCH).
2. MUST BE DURABLE, RESISTANT TO WASHWATER CHEMISTRY (HIGH pH), WEATHERING OR DETERIORATION FOR THE ANTICIPATED LENGTH OF USE TIME.
3. MUST BE FREE OF DEFECTS, HOLES, RIPS, OR TEARS.
4. CONTAINMENT LINING MUST BE A SINGLE CONTINUOUS SHEET SUFFICIENT TO ADEQUATELY LINE THE ENTIRE CONTAINMENT.

MAINTENANCE REQUIREMENTS:

1. INSPECT DAILY AS WASHOUT CONTAINMENTS ARE BEING USED AND AFTER EACH STORM EVENT.
2. INSPECT FOR LEAKS OR SPILLS. DISCONTINUE USE IF UNITS ARE OVERFLOWING OR LEAKING.
3. INSPECT THE WATERPROOF LINING FOR FAILURE, INCLUDING TEARS PUNCTURES, OR SLIDE DOWN FROM CONTAINMENT STRUCTURE WALLS.
4. WHEN CONTAINMENTS REACH 75% OF CAPACITY, DISCONTINUE USE WITH SIGNAGE IDENTIFYING "*CLOSED*" AND INSTALL OR BRING IN ADDITIONAL CONTAINMENTS AS NEEDED.

Muncie SANITARY DISTRICT

MUNCIE PUBLIC WORKS

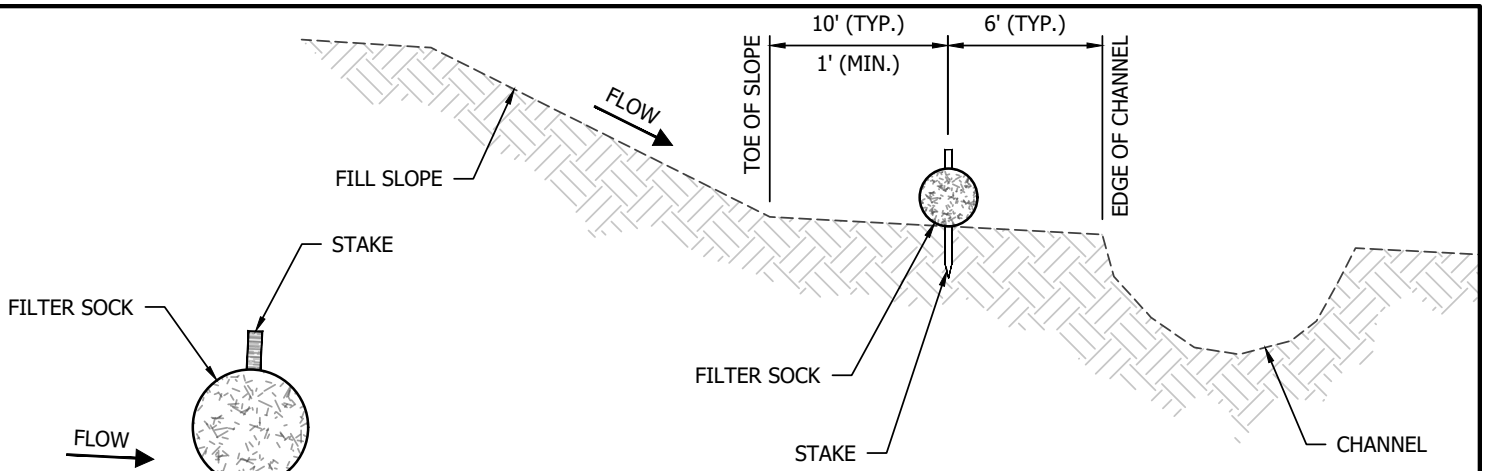
CONCRETE WASHOUT

APPROVED: *XX/XX/20XX*

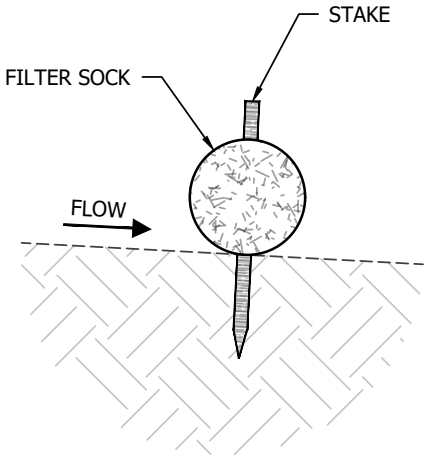
REVISED: *XX/XX/20XX*

STANDARD: **DN-721**

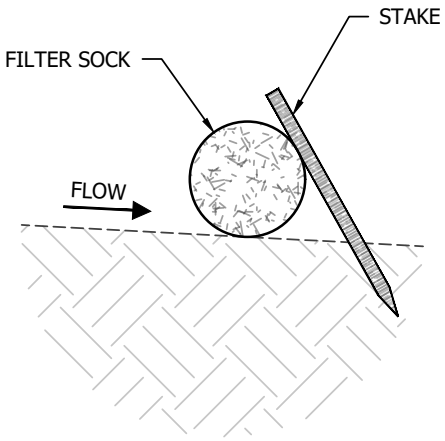
PLOT DATE: 10/16/2023 9:36 AM
EDIT DATE: 10/16/2023
EDITED BY: PTRAWINSKI
DRAWING FILE: P:\2022\01013D. Drawings\Utility Infrastructure\MSD_DN_721_CONCRETE WASHOUT.dwg



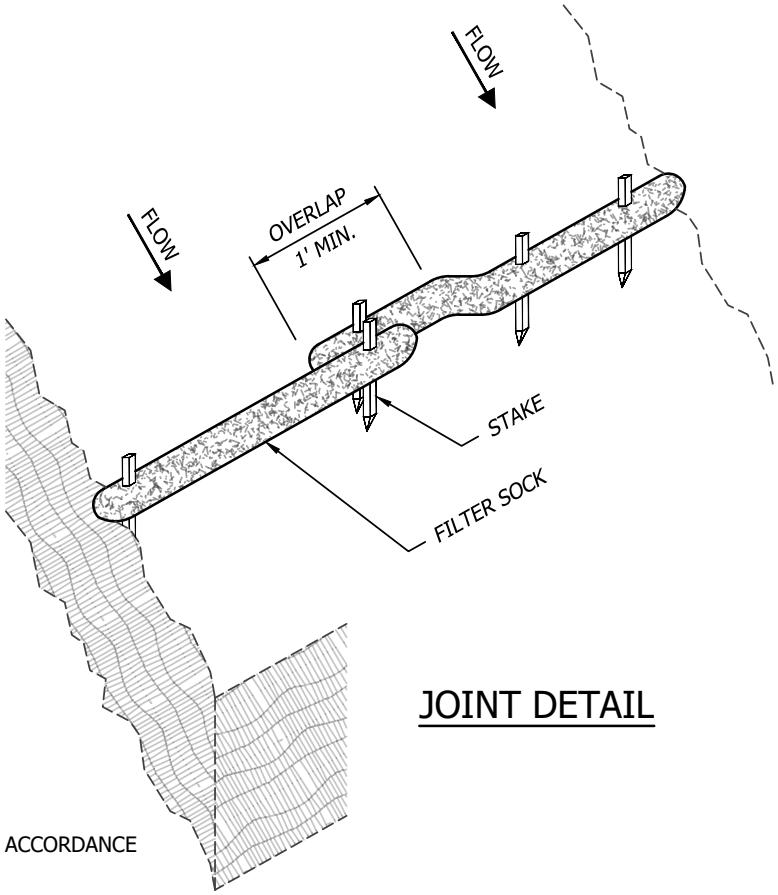
PLACEMENT WITH CHANNEL RELATIVE TO FLOW



STAKE THROUGH METHOD



SLANTED STAKE METHOD



JOINT DETAIL

NOTES:

1. FILTER SOCK SHALL BE INSTALLED AS SHOWN OR IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS.
2. FILTER SOCK SHALL BE AS REQUIRED BY DESIGN BASED ON WATERSHED AREA.
3. FILTER SOCK SHALL BE PLACED PERPENDICULAR TO THE FLOW OF WATER.
4. FILTER SOCKS SHALL BE SECURED IN LOCATIONS BELOW THE 100-YEAR STORM (Q_{100}) WATER SURFACE ELEVATION, FLOOD PRONE AREAS, OR WHEN FILL SLOPE IS GREATER THAN 12%. FILTER SOCK END SHALL BE SECURED USING THE STAKE THROUGH METHOD. INTERMEDIATE POINTS MAY BE SECURED USING EITHER THE STAKE THROUGH OR SLANTED STAKE METHOD.
5. STAKE ANGLE AND LENGTH SHALL BE SUFFICIENT TO WEDGE FILTER SOCK TO THE GROUND TO PREVENT MOVEMENT AND UNDERCUTTING.

MAINTENANCE REQUIREMENTS:

1. INSPECT FILTER SOCKS WEEKLY AND AFTER EACH STORM EVENT.
2. REMOVE ACCUMULATED SEDIMENT ONCE IT REACHES ¼ OF THE HEIGHT OF THE FILTER BERM.
3. SECURE OR REPLACE DAMAGED FILTER SOCKS. IF DAMAGE IS SEVERE OR REOCCURRING, REPLACE WITH A STRONGER MEASURE, SUCH AS ROCK.

Muncie SANITARY DISTRICT

MUNCIE PUBLIC WORKS

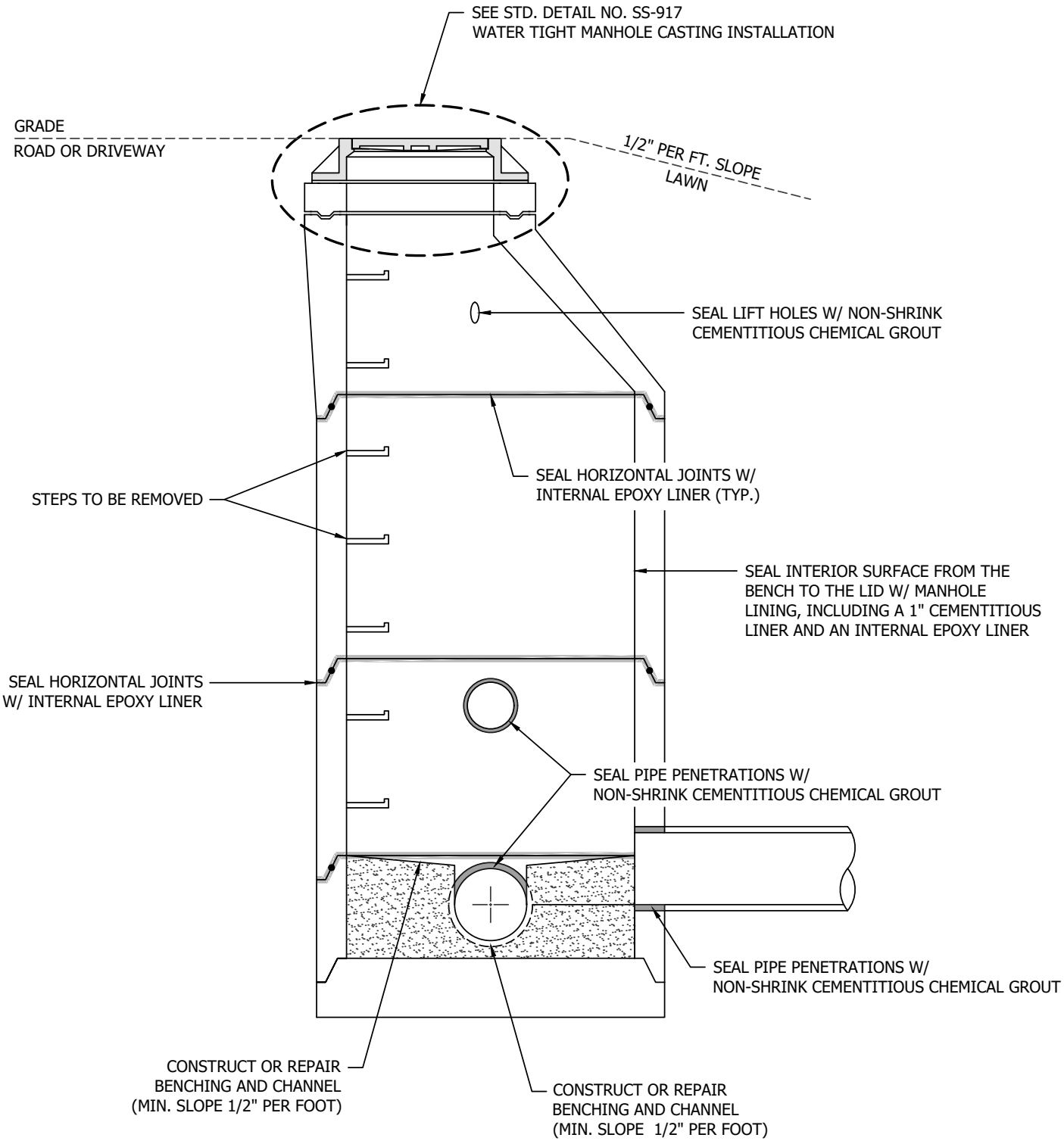
PERIMETER FILTER SOCK

APPROVED: XX/XX/20XX

REVISED: XX/XX/20XX

STANDARD: **DN-722**

PLOT DATE: 10/16/2023 9:36 AM
EDIT DATE: 10/16/2023
EDITED BY: PTRAWINSKI
DRAWING FILE: P:\2022\01013D. Drawings\Utility Infrastructure\MSD_DN_722_PERIMETER FILTER SOCK.dwg



ROADWAY AND DRIVEWAY:

MATCH EXISTING GRADE AND RESTORE SURFACE PER APPLICABLE MSD SPECIFICATION.

LAWN AND EASEMENT:

AREA WITHIN 2-FEET OF CENTER OF CASTING SHALL BE LEVEL WITH CASTING. AREA BEYOND 4-FOOT PERIMETER SHALL BE SLOPED DOWNWARD AT 1/2" PER FOOT SLOPE TO MEET EXISTING GROUND LEVEL.

Muncie SANITARY DISTRICT

MUNCIE PUBLIC WORKS

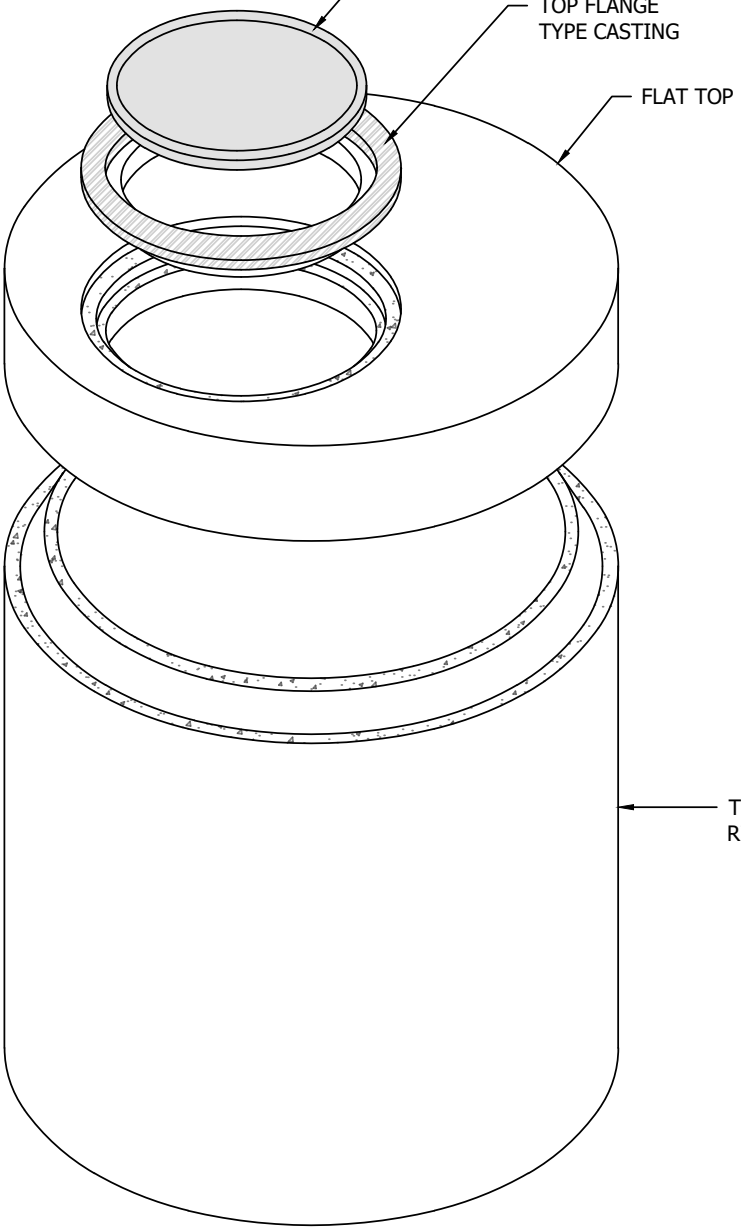
SANITARY MANHOLE REHABILITATION

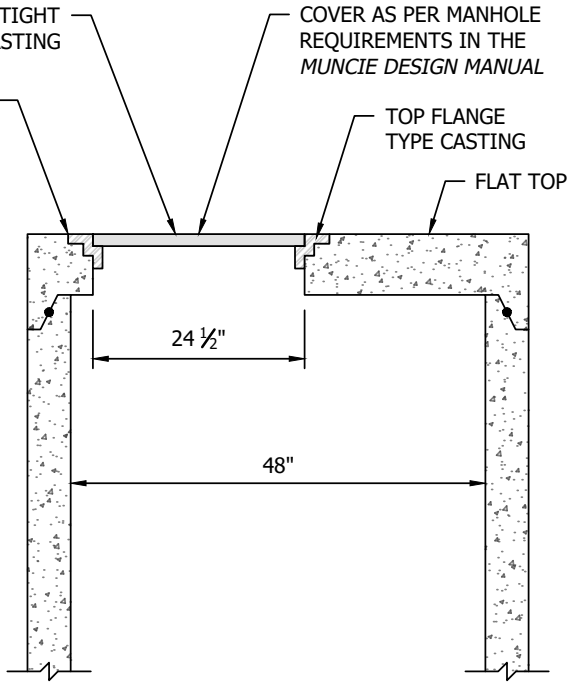
APPROVED: XX/XX/20XX

REVISED: XX/XX/20XX

STANDARD: **SS-901**

PLOT DATE: 10/30/2023 2:03 PM
EDIT DATE: 10/30/2023
EDITED BY: PTRAWINSKI
DRAWING FILE: P:\2022\01013D. Drawings\Utility Infrastructure\MSD_SS_901_MH REHAB.dwg





NOTES:

1. FOR DETAILED SPECIFICATIONS OF STANDARD MANHOLE, SEE STANDARD DETAIL SS-905.
2. CASTING SET IN 1/2" BITUMINOUS SEAL.
3. FLAT TOP APPLICABLE FOR SANITARY AND STORM MANHOLES.

Muncie SANITARY DISTRICT

MUNCIE PUBLIC WORKS

SANITARY MANHOLE FLAT TOP

APPROVED: XX/XX/20XX

REVISED: XX/XX/20XX

STANDARD: **SS-902**

PLOT DATE: 10/30/2023 2:03 PM
EDIT DATE: 10/30/2023
EDITED BY: PTRAWINSKI
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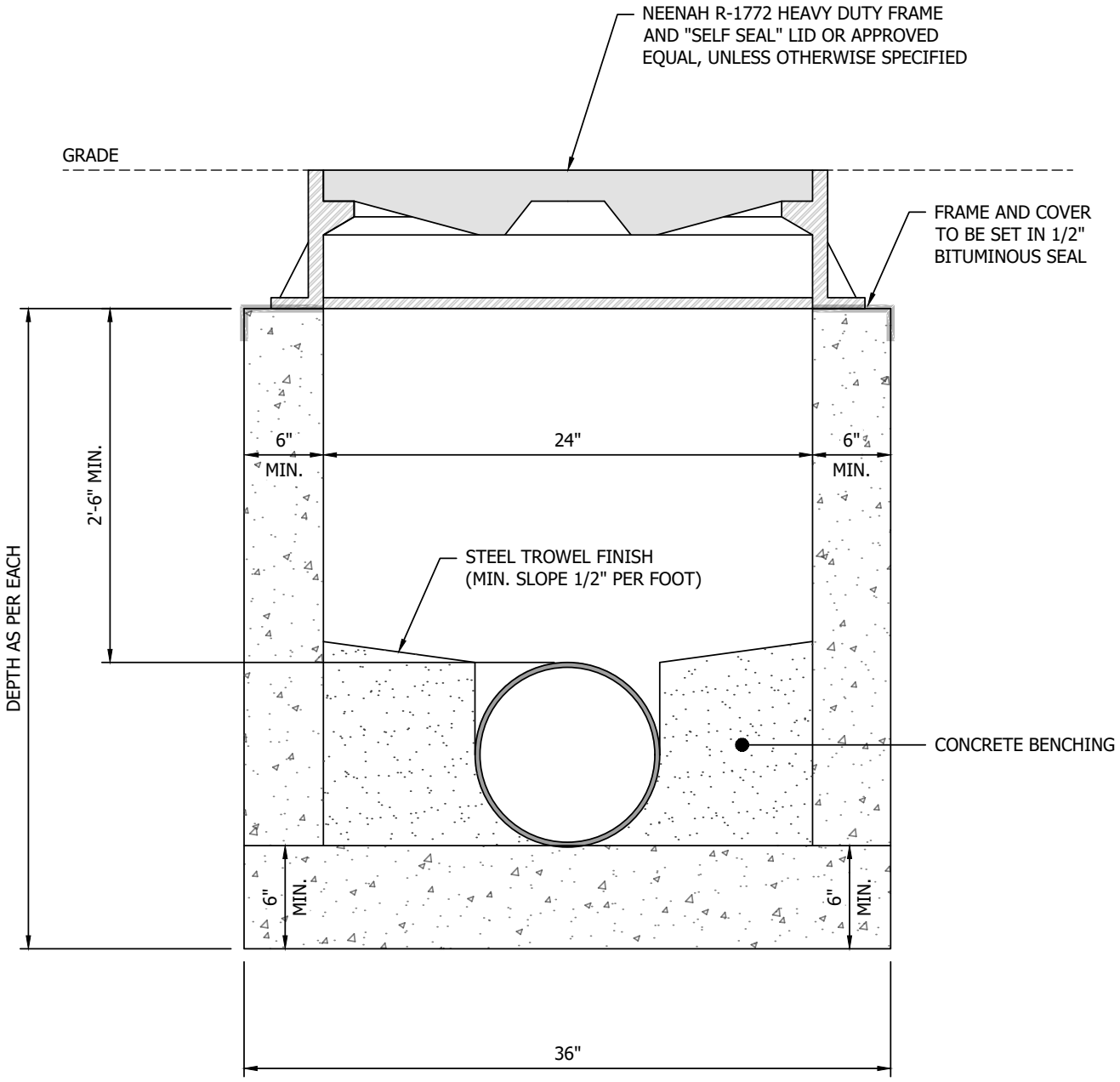

ENGINEER APPROVAL REQUIRED FOR USE

NOTES:

1. 1/2" MORTAR TO BE USED BETWEEN ALL JOINTS, IF BRICK OR BLOCK IS USED, WITH 1/2" MORTAR SEAL, EXTERIOR AND INTERIOR.
2. INLET TO BE CONSTRUCTED OF SOLID CONCRETE BLOCK, BRICK, OR PRECAST; ROUND OR SQUARE.
3. 24-INCH REINFORCED CONCRETE PIPE SECTIONS MAY BE USED ONLY IF ENCHASED IN A MINIMUM OF 4-INCH READY MIX CONCRETE, AND TO A MAXIMUM DEPTH OF 5-FEET OR AS DIRECTED BY THE *MUNCIE SANITARY DISTRICT* .
4. CONCRETE STRENGTH: 4,000 psi.
5. REINFORCEMENT: ASTM C-913, BASE AND SIDES, 6" O.C. BOTH WAYS.

Muncie SANITARY DISTRICT

MUNCIE PUBLIC WORKS

SANITARY MANHOLE SMALL DIAMETER

APPROVED: *XX/XX/20XX*

REVISED: *XX/XX/20XX*

STANDARD: **SS-903**

PLOT DATE: 10/30/2023 2:03 PM
EDIT DATE: 10/27/2023
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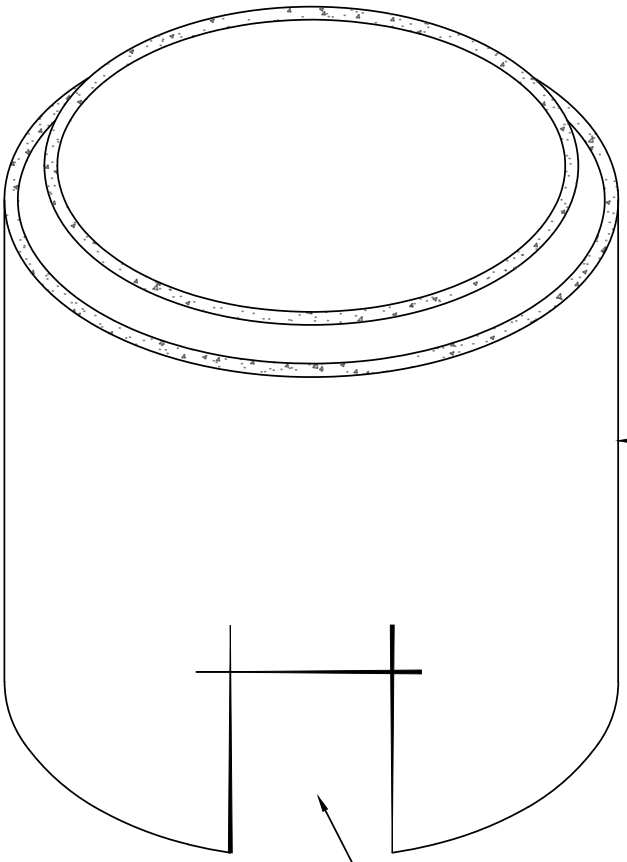
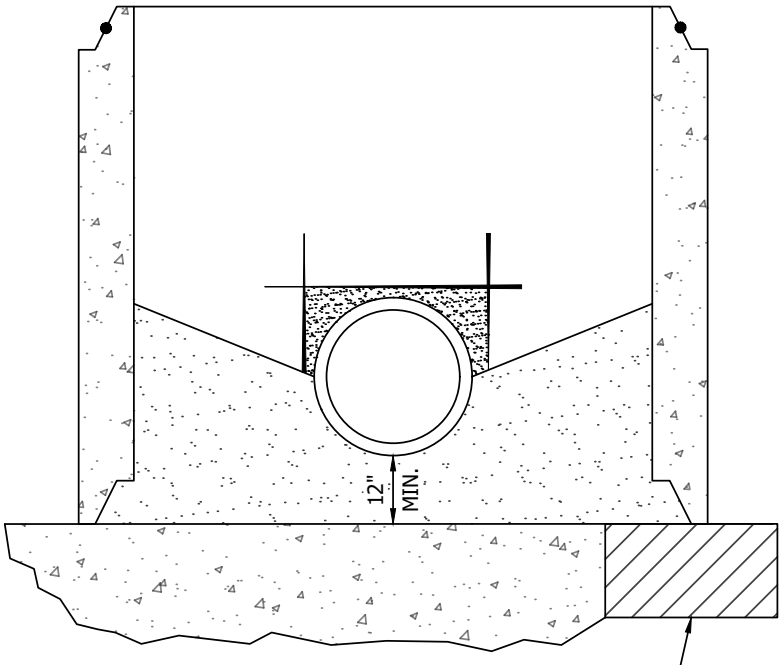


ASTM C-478 48" MANHOLE SECTION

SAW-CUT AND REMOVE SECTION
ADEQUATE TO FIT OVER EXISTING SEWER



8"x8"x16" SOLID BLOCK

NOTES:

1. EXCAVATE A MINIMUM OF 12" BELOW PIPE AND PREPARE A STABLE SUB-FOUNDATION OF WETTED AND COMPACTED NO. 53 CRUSHED STONE; PLACE FOUR 8"x8"x16" SOLID BLOCKS EVENLY SPACED BELOW NEW MANHOLE SECTION AND ADJUST TO LEVEL.

2. PLACE MANHOLE SECTION ON SUPPORT BLOCKS WITH OPENINGS OVER THE EXISTING SEWER, CHECK FOR LEVEL AND ADJUST AS NEEDED, POUR 4,000 psi CONCRETE BASE AND BENCHING.

3. SEAL AROUND CUT-OUT WITH HIGH-STRENGTH PATCHING CEMENT, FORCING CEMENT THROUGH TO THE OUTSIDE TO COMPLETELY FILL VOID AROUND PIPE. SAW CUT AND REMOVE TOP HALF OF PIPE THROUGH MANHOLE.

4. ALL OTHER DETAILS SHALL CONFORM TO TYPE 102 STANDARD MANHOLE.

Muncie SANITARY DISTRICT

MUNCIE PUBLIC WORKS

SANITARY MANHOLE CUT-OUT OVER EXISTING SEWERS

APPROVED: XX/XX/20XX

REVISED: XX/XX/20XX

STANDARD: **SS-904**

PLOT DATE: 10/30/2023 2:03 PM EDIT DATE: 10/27/2023 EDITED BY: PTRAWINSKI DRAWING FILE: P:\2022\01013D. Drawings\Utility Infrastructure\MSD_SS_904_MH CUT OUT.dwg

NOTES:

1. ALL SOFT OR YIELDING SOILS ARE TO BE REMOVED AND A SOLID FOUNDATION OF GRANULAR MATERIAL COMPACTED TO 95% DRY DENSITY SHALL BE PROVIDED BY THE CONTRACTOR PRIOR TO MANHOLE PLACEMENT.

2. ALL CONCRETE MANHOLE SECTIONS AND REINFORCING STEEL SHALL CONFORM TO ASTM C-478. THE TAPERED CONE SECTION TO BE A MIN OF 30-INCH IN HEIGHT AND THE BOTTOM SECTION SHALL BE 30-INCH IN HEIGHT. ALL CONCRETE SHALL BE A MINIMUM OF 4,000 psi.

3. PRECAST BOTTOMS TO BE CONSTRUCTED WITH THE BASE AND FIRST RISER SECTION AS ONE COMPLETE PRECAST UNIT. MONOLITHIC MANHOLE BASES SHALL BE 6-INCH MINIMUM THICKNESS FOR 48-INCH DIAMETER STANDARD MANHOLES AND 12-INCH THICKNESS FOR ALL OTHER MANHOLES.

4. ALL FACTORY FORMED CONCRETE FOR BASE AND BENCH WALLS SHALL BE MONOLITHICALLY PLACED. BENCH HEIGHT TO BE AT OR ABOVE TOP OF PIPE, TOP TO BE TROWELED, SLOPED TOWARDS CHANNEL.

5. CONCRETE MANHOLE SECTIONS SHALL BE STEAM OR HEAT-AND-MIST CURED AND SHALL NOT BE INSTALLED UNTIL AT LEAST 5 DAYS AFTER BEING CAST.

6. JOINTS BETWEEN PRECAST CONCRETE MANHOLE SECTIONS SHALL CONFORM TO ASTM C-443. ALL JOINTS SHALL HAVE AN EXTERIOR JOINT WRAP. THE JOINT WRAP SHALL BE A MINIMUM OF 6-INCHES IN WIDTH.

7. EACH CONNECTION FOR SEWER PIPES TO BE FURNISHED WITH AN APPROPRIATE COUPLING FOR THE TYPE OF PIPE SPECIFIED.

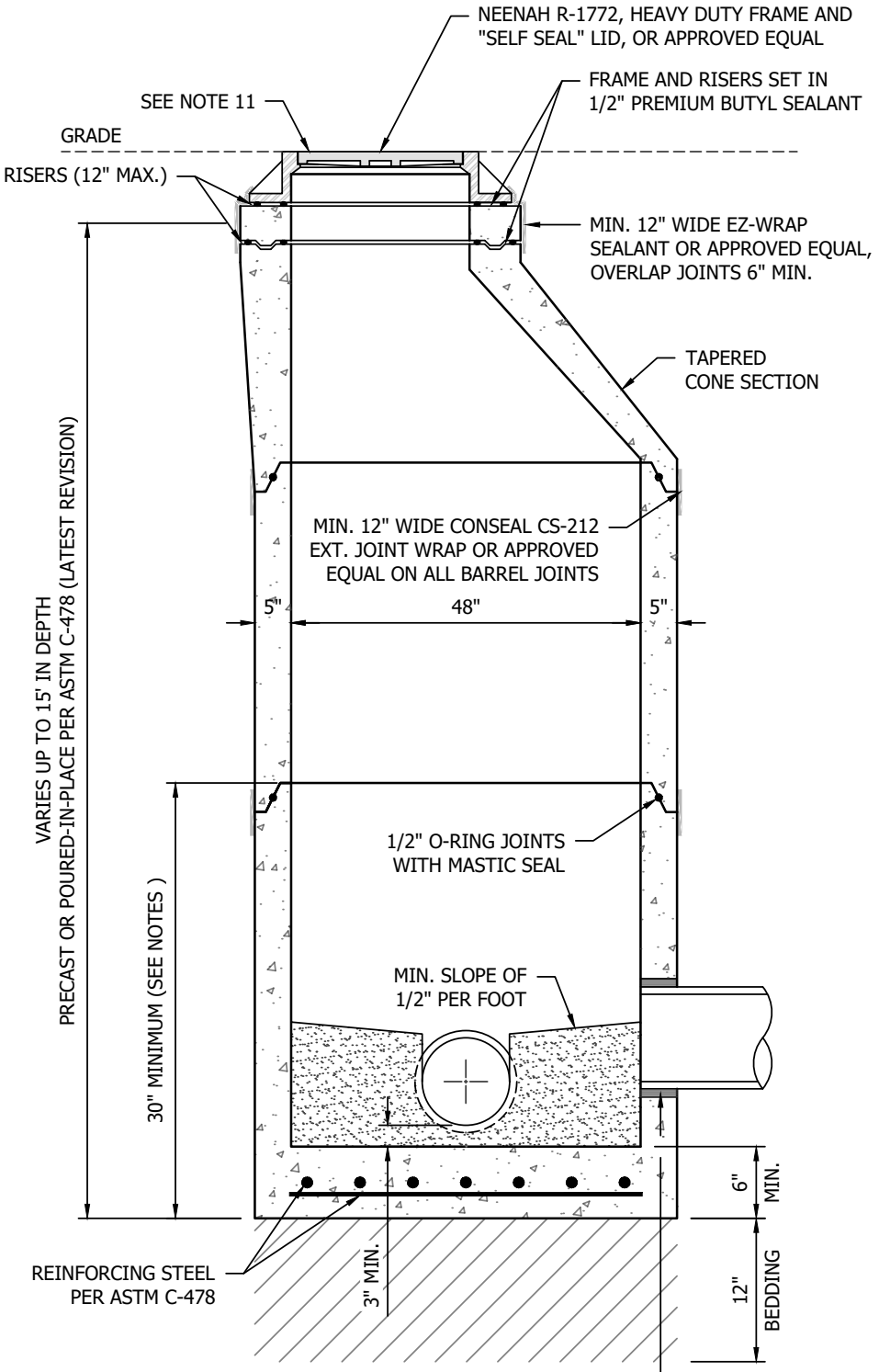
8. NO "SEE THROUGH" LIFT HOLES SHALL BE PERMITTED ON MANHOLES. LIFT HOLES SHALL BE FILLED WITH NON-SHRINK MORTAR OR EPOXY GROUT AND COVERED, INSIDE AND OUT, WITH A TROWELABLE BUTYL RUBBER BASE MATERIAL TO INSURE A WATERTIGHT SEAL.

9. SANITARY MANHOLES REQUIRE VACUUM TESTING PER ASTM C-1244.

10. PRECAST REINFORCED CONCRETE REDUCER SECTION REQUIRED FOR MANHOLES GREATER THAN 48-INCH DIAMETER, SEE STANDARD DETAIL SS-907.

11. <u>PAVEMENT AREAS:</u>
THE USE OF NOT-TO-EXCEED TWO COURSES OF PRECAST CONCRETE RISER RINGS WILL BE PERMITTED.

<u>UNPAVED AREAS OR UNIMPROVED STREETS:</u>
INSTALL TWO TO FOUR COURSES OF PRECAST CONCRETE RISER RINGS TO ALLOW FOR FUTURE ADJUSTMENT.



JOINT WRAPS MAY BE OMITTED AND SOLID "SELF SEAL" LID IS NOT REQUIRED FOR STORM MANHOLE APPLICATIONS

Muncie SANITARY DISTRICT

MUNCIE PUBLIC WORKS

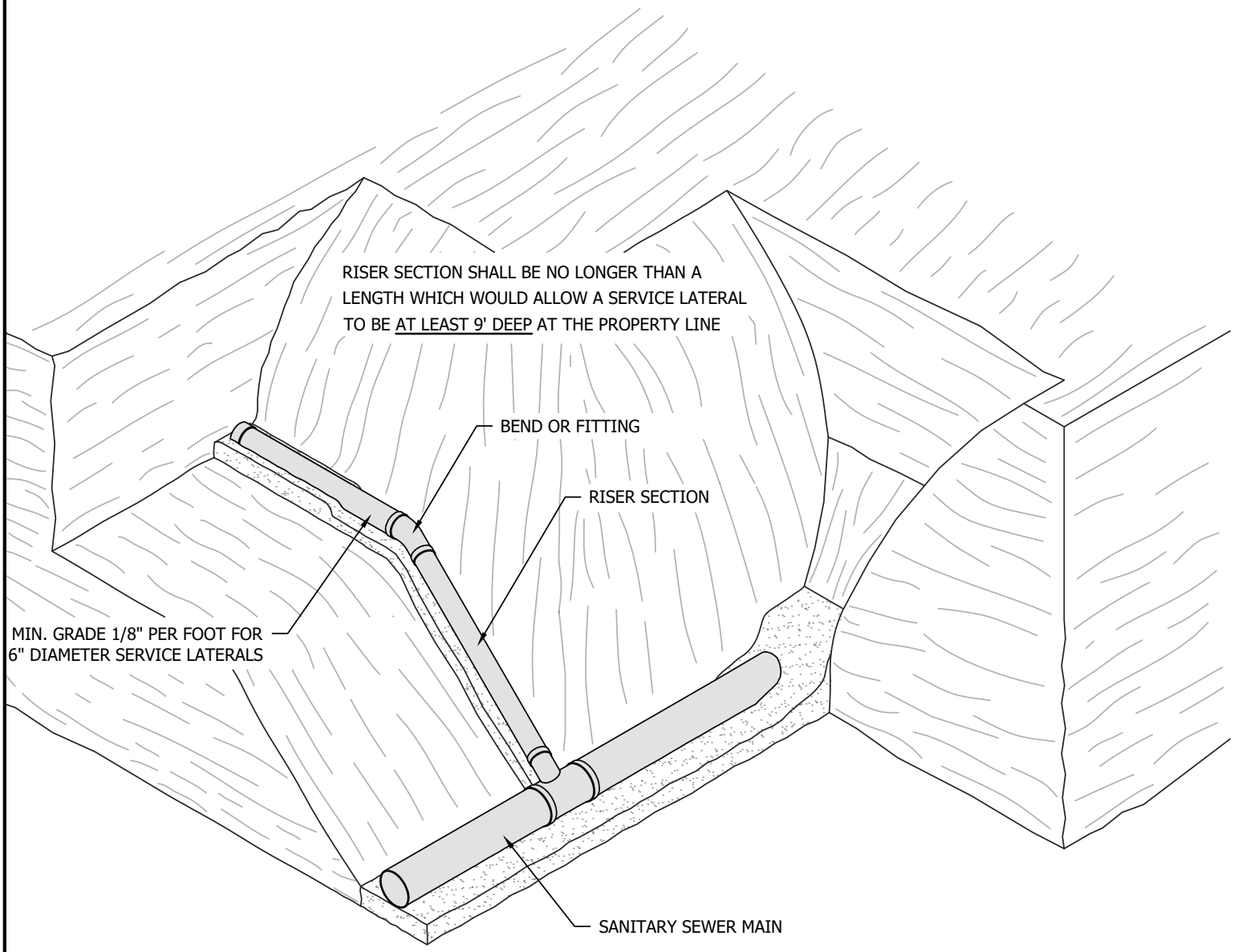
SANITARY MANHOLE

APPROVED: XX/XX/20XX

REVISED: XX/XX/20XX

STANDARD: **SS-905**

PLOT DATE: 10/30/2023 2:03 PM
EDIT DATE: 10/30/2023
EDITED BY: PTRAWINSKI
DRAWING FILE: P:\2022\01013D. Drawings\Utility Infrastructure\MSD_SS_905_MH.dwg



NOTES:

1. CONTRACTOR SHALL CAP AND SEAL THE END OF EACH SERVICE LATERAL WITH THE APPROPRIATE FITTING FOR THE TYPE OF PIPE USED.
2. ALL PIPE, EXCEPT RISER PIPE, SHALL BE LAID TO A UNIFORM GRADE OF AT LEAST 1/8" PER FOOT FOR 6-INCH DIAMETER PIPE.
3. MATERIAL FOR SERVICE LATERAL SHALL BE POLYVINYL CHLORIDE (PVC) SDR 35 AS PER *MUNCIE SANITARY DISTRICT SPECIFICATIONS AND DESIGN MANUAL*, UNLESS OTHERWISE DIRECTED.
4. BELL HOLES SHALL BE PROVIDED AND THE TRENCH PREPARED SO THAT THE LOWER HALF OF PIPE IS PROPERLY SUPPORTED THROUGHOUT ITS LENGTH.
5. DEPTH AT PROPERTY LINE TO BE APPROXIMATELY 9-FEET BELOW ESTABLISHED GRADE, EXCEPT WHERE A MINIMUM GRADE OF 1/8" PER FOOT FROM SANITARY SEWER MAIN FIXES A LESSER DEPTH.
6. PROPER BENDS OR FITTINGS SHALL BE USED FOR ALL ABRUPT CHANGES IN LINE OR GRADE.

Muncie SANITARY DISTRICT

MUNCIE PUBLIC WORKS

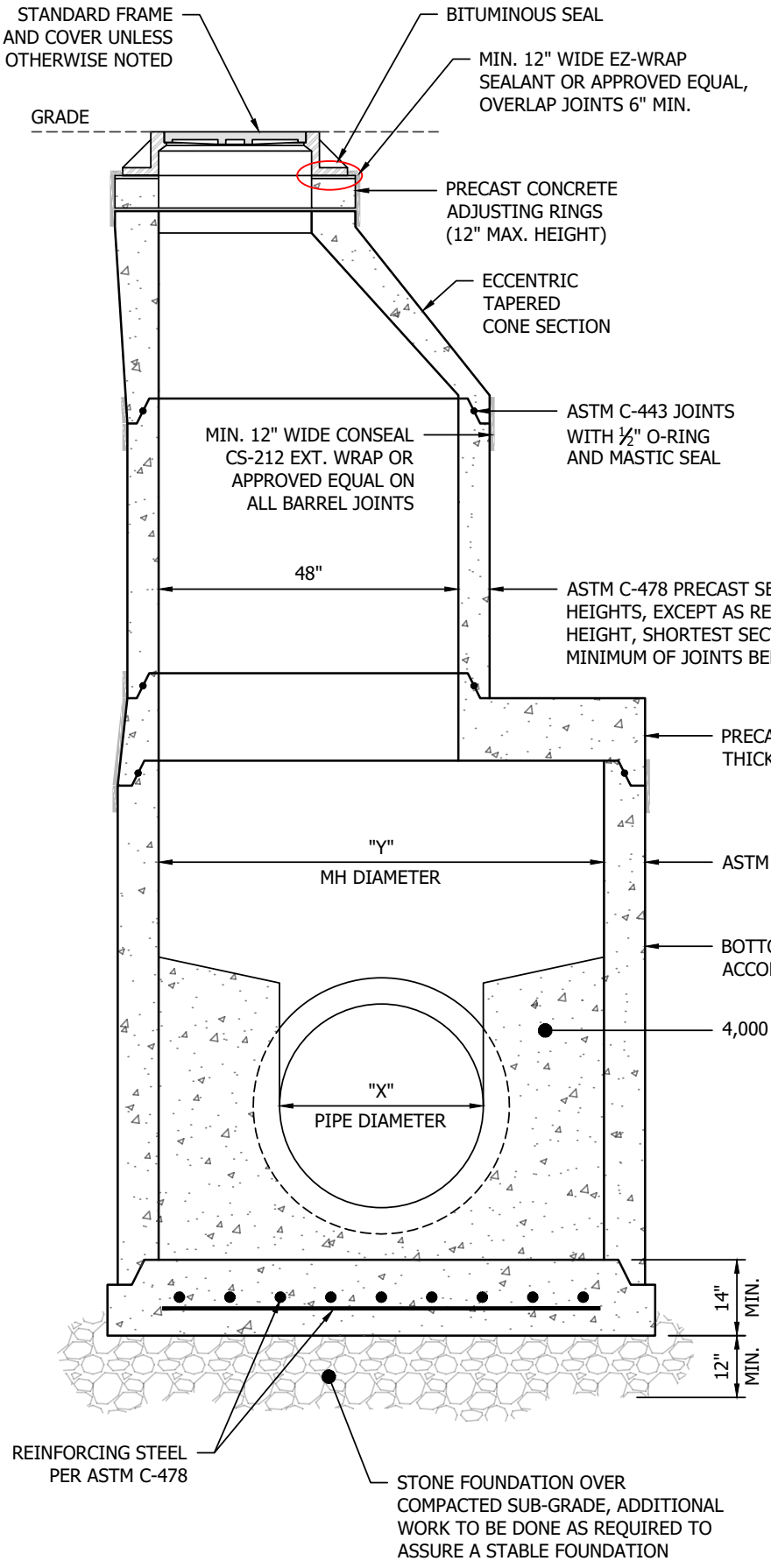
SANITARY SEWER RESIDENTIAL SERVICE

APPROVED: *XX/XX/20XX*

REVISED: *XX/XX/20XX*

STANDARD: **SS-906**

PLOT DATE: 10/30/2023 2:03 PM EDIT DATE: 10/27/2023 EDITED BY: PTRAWINSKI DRAWING FILE: P:\2022\01013D. Drawings\Utility Infrastructure\MSD_SS_906_SERVICE RESIDENTIAL.dwg



MANHOLE AND PIPE SIZE TABLE		
"Y" (MH DIAMETER)	"X" (TURNS UP TO 45°)	"X" (TURNS 45° TO 90°)
48"	8" TO 24"	8" TO 21"
60"	27" TO 36"	24" TO 33"
72"	42" TO 48"	36"
84"	48"	42"
96"	54" TO 66"	48"
102"	72"	54" TO 66"
108"	78" TO 84"	72"

THIS TABLE REPRESENTS TYPICAL SIZES AND IS INTENDED TO BE USED AS A GENERAL PRE-SELECTION GUIDE. CONTRACTOR SHALL NOT EXCEED THE RANGE FOR WHICH MANUFACTURER CERTIFIES PRODUCT.

SLAB BASE (SHOWN) OR MONO BASE AND RISER WITH PREFORMED INVERT CHANNEL OPTIONAL

NOTES:

1. ALL JOINTS SHALL HAVE AN EXTERIOR JOINT WRAP. THE JOINT WRAP SHALL BE A MINIMUM OF 12-INCHES IN WIDTH.

Muncie SANITARY DISTRICT

MUNCIE PUBLIC WORKS

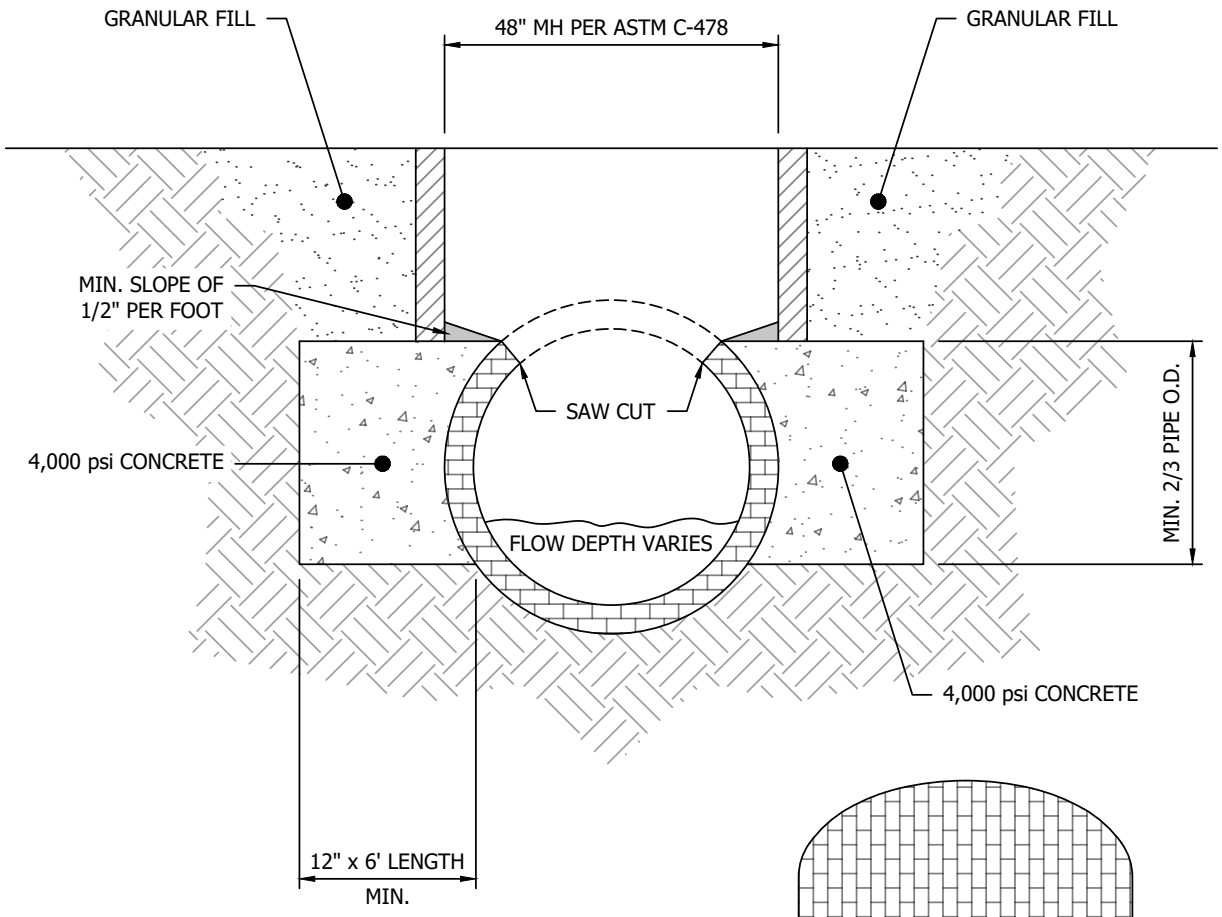
SANITARY MANHOLE LARGE DIAMETER WITH REDUCER CAP

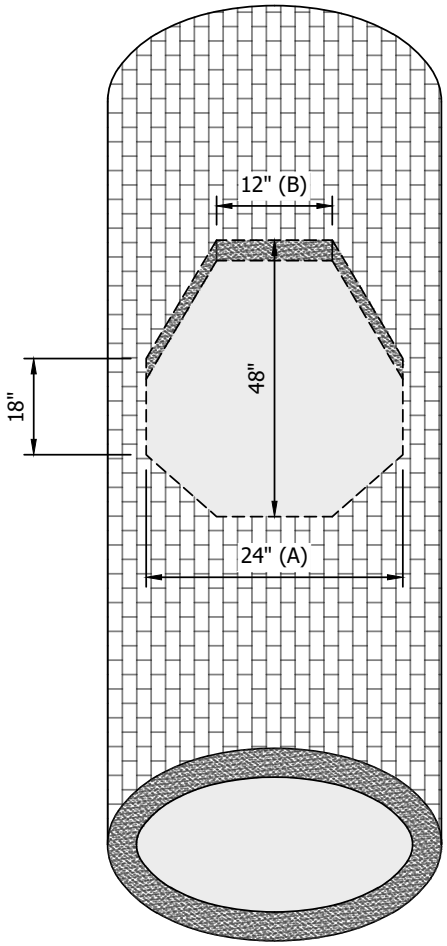
APPROVED: XX/XX/20XX

REVISED: XX/XX/20XX

STANDARD: **SS-907**

PLOT DATE: 10/30/2023 2:03 PM
EDIT DATE: 10/27/2023
EDITED BY: PTRAWINSKI
DRAWING FILE: P:\2022\01013D. Drawings\Utility Infrastructure\MSD_SS_907_MH LARGE DIAMETER W REDUCER CAP.dwg





NOTES:

1. SAW CUT EXISTING BRICK SEWER WITH CAUTION TO PREVENT EXCESS REMOVAL OF MATERIAL FOR ACCESS ENTRY.
2. REMOVE ALL DEBRIS FROM EXISTING SEWER DEPOSITED AS A RESULT OF NEW MANHOLE INSTALLATION.
3. CONCRETE BASE SHALL BE CURED A MINIMUM OF 24-HOURS PRIOR TO MANHOLE PLACEMENT.
4. CONCRETE SHALL BE REINFORCED WITH #5 (5/8") BLACK REBAR, 12-INCH O.C., BOTH WAYS.
5. EXISTING B-WALL RCP:
   A. SAW CUT EXISTING PIPE TO MAKE AN OCTAGONAL OPENING APPROXIMATELY 48-INCH x 48-INCH
   B. USE DIMENSION CHART PROVIDED TO ALLOW FOR CURVATURE OF B-WALL RCP.

DIMENSIONAL CHART		
SIZE	A	B
42"	67"	18 13/16"
48"	56 1/2"	18 11/16"
54"	54"	18 5/8"
60"	52 1/2"	18 9/16"

Muncie SANITARY DISTRICT

MUNCIE PUBLIC WORKS

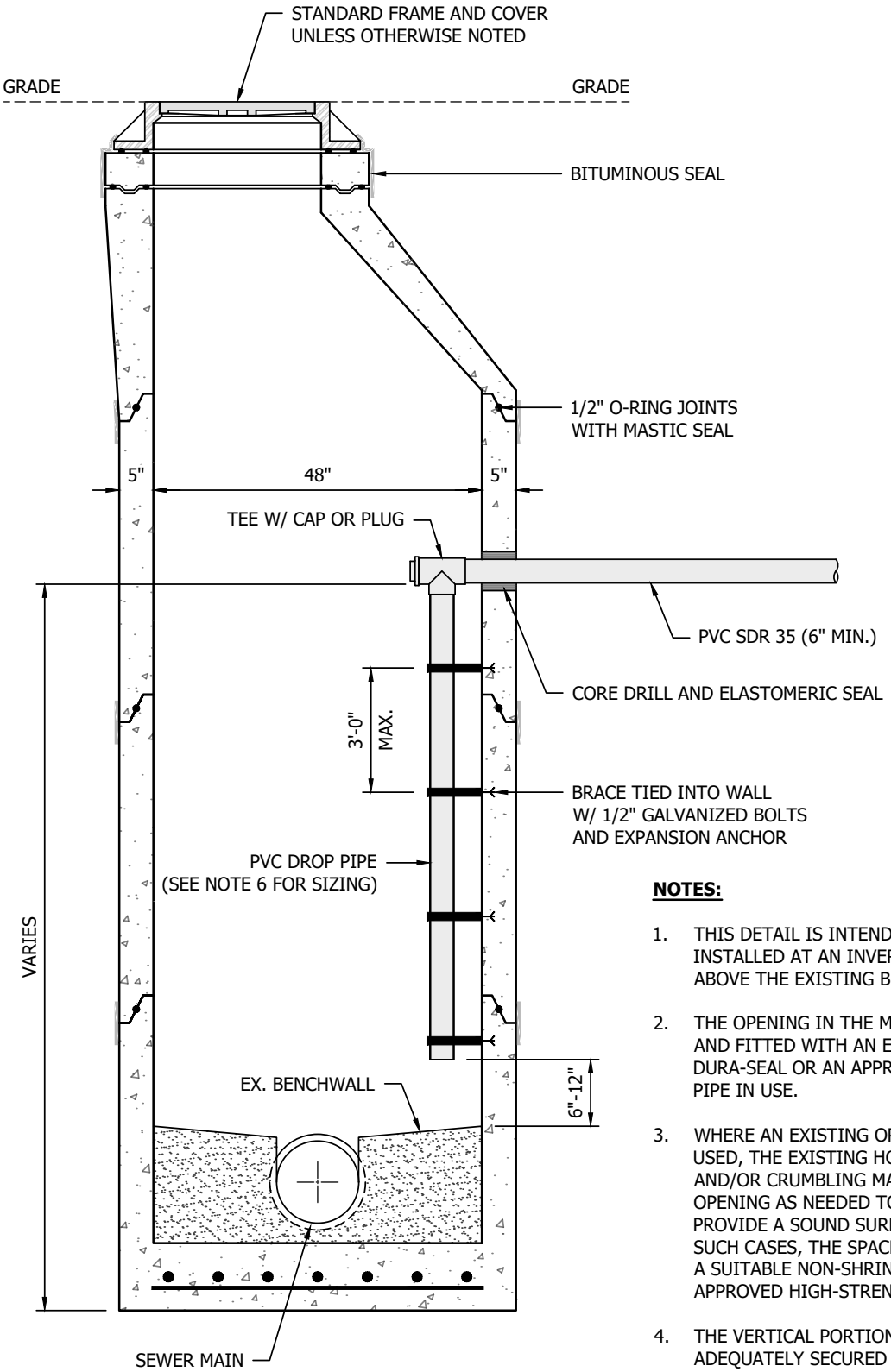
SANITARY MANHOLE OVER LARGE BRICK SEWER

APPROVED: XX/XX/20XX

REVISED: XX/XX/20XX

STANDARD: **SS-908**

PLOT DATE: 10/30/2023 2:03 PM EDIT DATE: 10/27/2023 EDITED BY: PTRAWINSKI DRAWING FILE: P:\2022\01013D. Drawings\Utility Infrastructure\MSD_SS_908_MH OVER LARGE BRICK SEWER.dwg



NOTES:

1. THIS DETAIL IS INTENDED FOR USE WHERE A NEW PIPE MUST BE INSTALLED AT AN INVERT HEIGHT GREATER THAN 24-INCHES ABOVE THE EXISTING BENCH WALL.

2. THE OPENING IN THE MANHOLE WALL SHALL BE CORE-DRILLED AND FITTED WITH AN ELASTOMERIC SEAL SUCH AS KOR-N-SEAL, DURA-SEAL OR AN APPROVED EQUAL, PROPERLY SIZED FOR THE PIPE IN USE.

3. WHERE AN EXISTING OPENING IN THE MANHOLE WALL IS TO BE USED, THE EXISTING HOLE SHALL BE CLEANED FREE OF LOOSE AND/OR CRUMBLING MATERIAL AND ROUGHED OUT TO A LARGER OPENING AS NEEDED TO ACCOMMODATE THE NEW PIPE AND PROVIDE A SOUND SURFACE FOR SEALING AND GROUTING. IN SUCH CASES, THE SPACE AROUND THE PIPE IS TO BE FILLED WITH A SUITABLE NON-SHRINK GROUT, WATER PLUG OR OTHER APPROVED HIGH-STRENGTH PATCHING CEMENT.

4. THE VERTICAL PORTION OF THE INTERIOR DROP SHALL BE ADEQUATELY SECURED TO THE MANHOLE WALL AND THE TEE FITTING TO ASSURE THAT IT WILL NOT COME LOOSE OR FALL FROM ITS POSITION.

5. THE BOTTOM OF THE DROP PIPE SHALL BE SPACED 6-INCHES TO 12-INCHES ABOVE THE TOP OF THE EXISTING BENCHWALL.

6. DROP PIPE SHALL BE A MINIMUM OF 6-INCH DIAMETER WITH TYPICAL SIZING EQUAL TO INCOMING SEWER MINUS 2-INCHES.

Muncie SANITARY DISTRICT

MUNCIE PUBLIC WORKS

SANITARY MANHOLE INTERIOR DROP

APPROVED: XX/XX/20XX

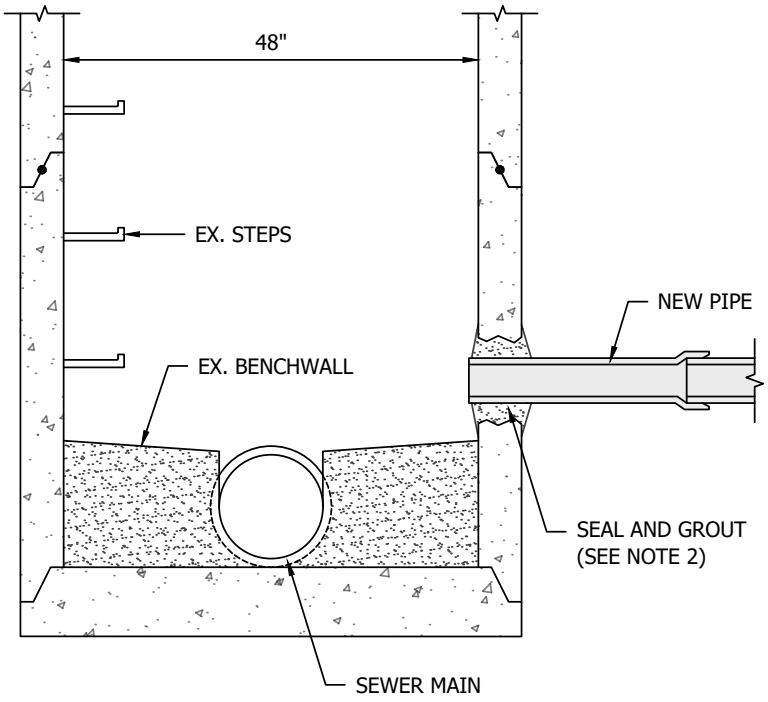
REVISED: XX/XX/20XX

STANDARD: **SS-909**

PLOT DATE: 10/30/2023 2:03 PM
EDIT DATE: 10/27/2023
EDITED BY: PTRAWINSKI
DRAWING FILE: P:\2022\01013D. Drawings\Utility Infrastructure\MSD_SS_909_MH DROP INTERIOR.dwg

NOTES:

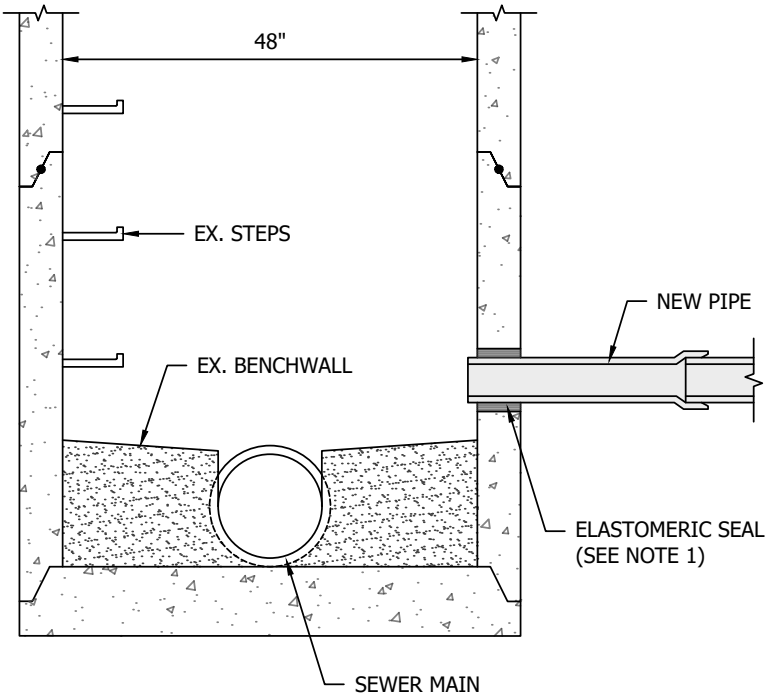
1. EXISTING OPENING IN MANHOLE WALL TO BE CLEANED FREE OF LOOSE OR CRUMBLING MATERIALS AND ROUGHED OUT TO A LARGER OPENING AS NEEDED TO ACCOMMODATE THE NEW PIPE AND PROVIDE A STABLE, ACCEPTABLE SURFACE FOR SEALING AND GROUT.
2. THE SPACE AROUND THE PIPE IS TO BE FILLED WITH A SUITABLE NON-SHRINK GROUT, WATER PLUG OR OTHER APPROVED HIGH STRENGTH PATCHING CEMENT.
3. LATERAL CONNECTION IS TO BE POSITIONED SO AS TO NOT INTERFERE WITH EXISTING STEPS OR OTHER EXISTING SEWERS.
4. INVERT OF NEW LATERAL TO BE NO MORE THAN 24-INCHES ABOVE THE TOP OF THE EXISTING BENCHWALL. IN MANHOLES WITHOUT BENCHING, NEW INVERT IS TO BE NO MORE THAN 24-INCHES ABOVE THE CENTERLINE OF THE SEWER MAIN.
5. IN CASES WHERE THE EXISTING OPENING DOES NOT MEET THE ABOVE REQUIREMENTS, A NEW OPENING SHALL BE CORE-DRILLED AS DESECRIBED BELOW.



FOR CONNECTIONS USING AN EXISTING OPENING

NOTES:

1. OPENING IN MANHOLE WALL TO BE CORE-DRILLED AND FITTED WITH AN ELASTOMERIC PIPE SEAL SUCH AS KOR-N-SEAL OR APPROVED EQUAL, SIZED TO FIT THE PIPE BEING USED.
2. LATERAL CONNECTION IS TO BE POSITIONED SO AS NOT TO INTERFERE WITH EXISTING STEPS OR OTHER EXISTING SEWERS.
3. INVERT OF NEW LATERAL TO BE NO MORE THAN 24-INCHES ABOVE THE TOP OF THE EXISTING BENCHWALL. IN MANHOLES WITHOUT BENCHING, NEW INVERT IS TO BE NO MORE THAN 24-INCHES ABOVE THE CENTERLINE OF THE SEWER MAIN.



FOR NEW OPENINGS IN MANHOLE WALL

ENGINEER APPROVAL REQUIRED FOR USE

Muncie SANITARY DISTRICT

MUNCIE PUBLIC WORKS

CONNECTION TO EXISTING MANHOLE

APPROVED: XX/XX/20XX

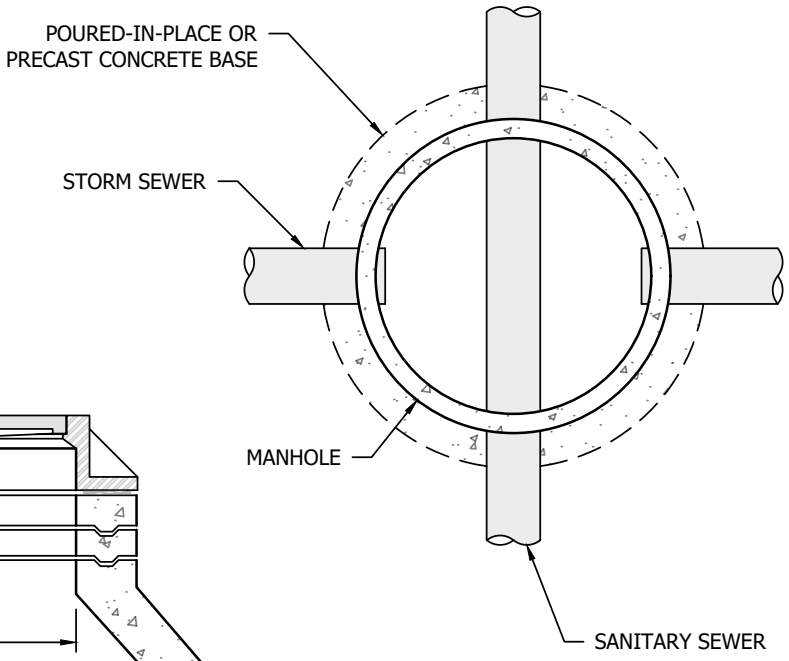
REVISED: XX/XX/20XX

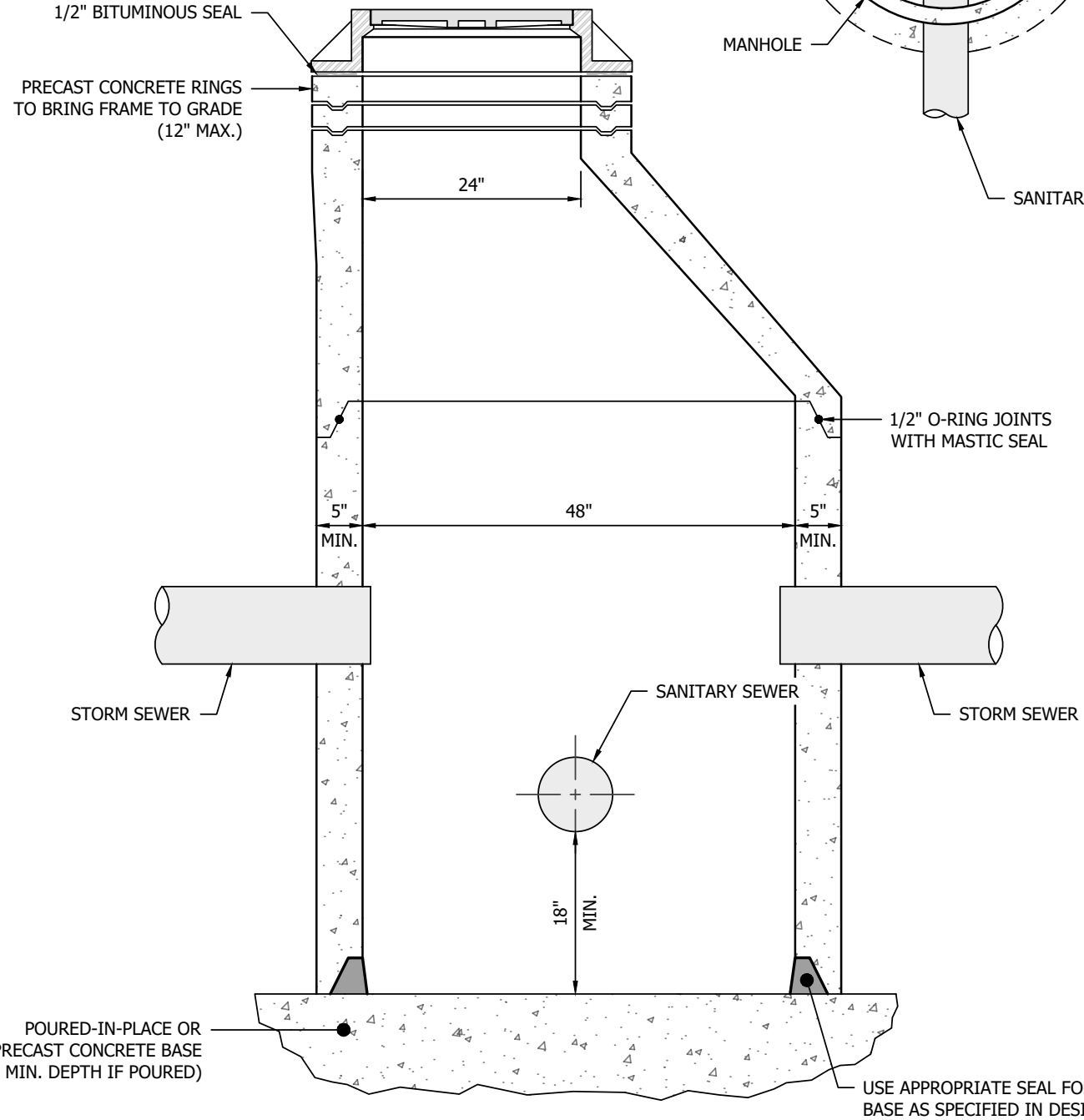
STANDARD: **SS-910**

PLOT DATE: 10/30/2023 2:03 PM EDIT DATE: 10/27/2023 EDITED BY: PTRAWINSKI DRAWING FILE: P:\2022\01013D. Drawings\Utility Infrastructure\MSD_SS_910_CONNECTION TO EXISTING.dwg

NOTES:

1. ALL CONSTRUCTION TO BE DONE AS PER THE STANDARDS SET FORTH IN THE *CITY OF MUNCIE DESIGN MANUAL*.
2. FOR USE WHERE STORM AND SANITARY LINES CROSS, BUT DO NOT MIX.
3. REPLACE SANITARY LINE WITH DUCTILE IRON PIPE THROUGH MANHOLE CAST-IN-PLACE DURING MANHOLE CONSTRUCTION. SANITARY LINE SHALL BE REPLACED WITH ONE FULL STICK OF DUCTILE IRON PIPE WITH THE MIDPOINT OF THE PIPE BEING AT THE CENTER OF THE MANHOLE STRUCTURE.
4. WATER PRESSURE GRADE PVC MAY BE USED AS AN ALTERNATE TO DUCTILE IRON PIPE WITH ENGINEER APPROVAL.





Muncie SANITARY DISTRICT

MUNCIE PUBLIC WORKS

CONFLICT MANHOLE

APPROVED: XX/XX/20XX

REVISED: XX/XX/20XX

STANDARD: **SS-911**

PLOT DATE: 10/30/2023 2:03 PM
EDIT DATE: 10/27/2023
EDITED BY: PTRAWINSKI
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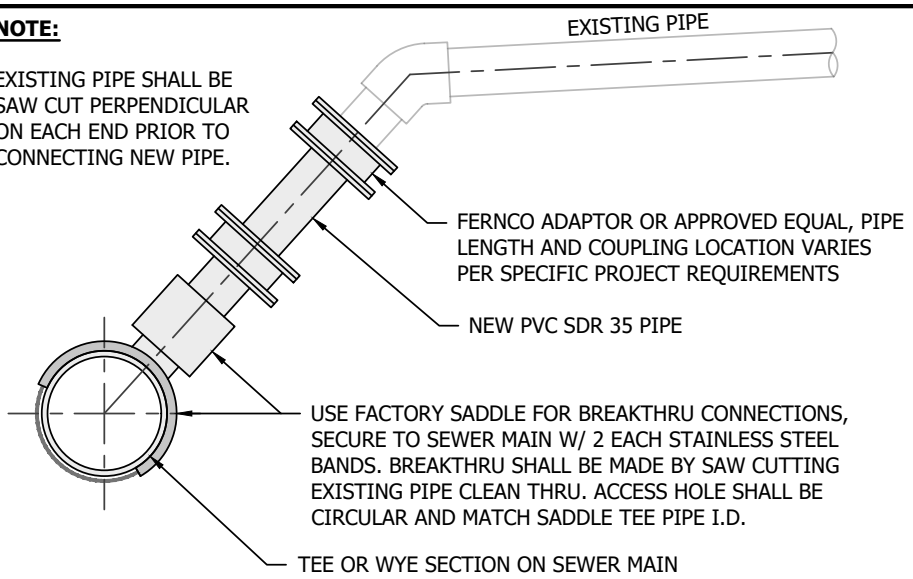
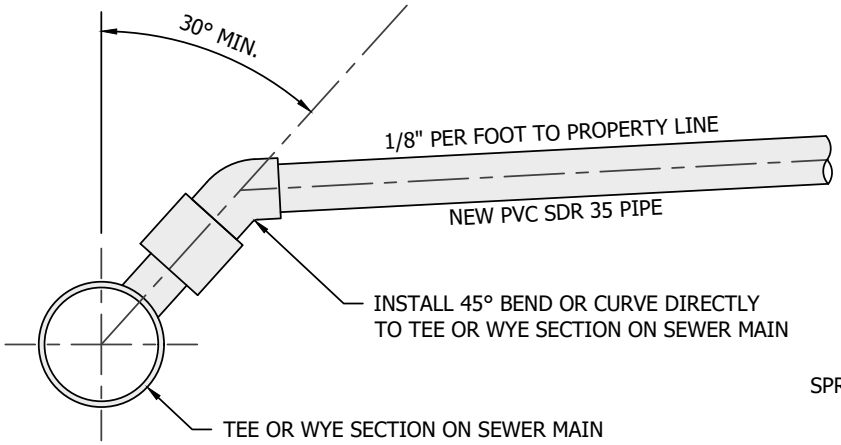
NOTE:

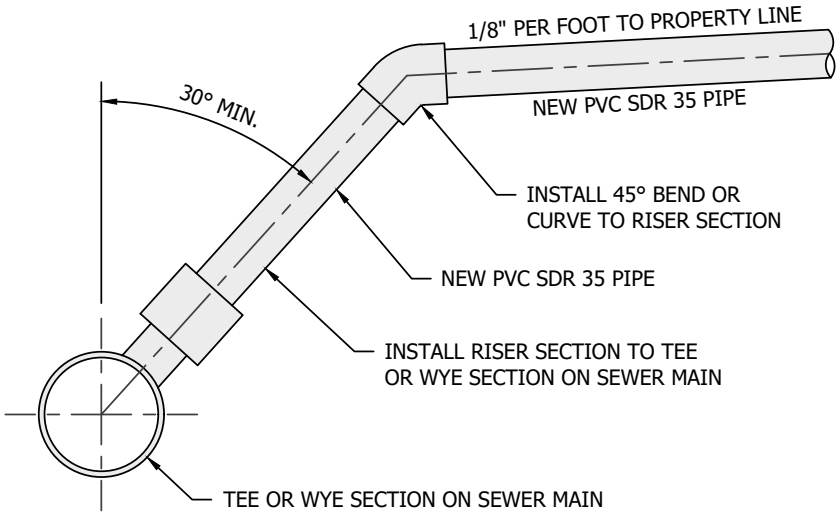
EXISTING PIPE SHALL BE SAW CUT PERPENDICULAR ON EACH END PRIOR TO CONNECTING NEW PIPE.



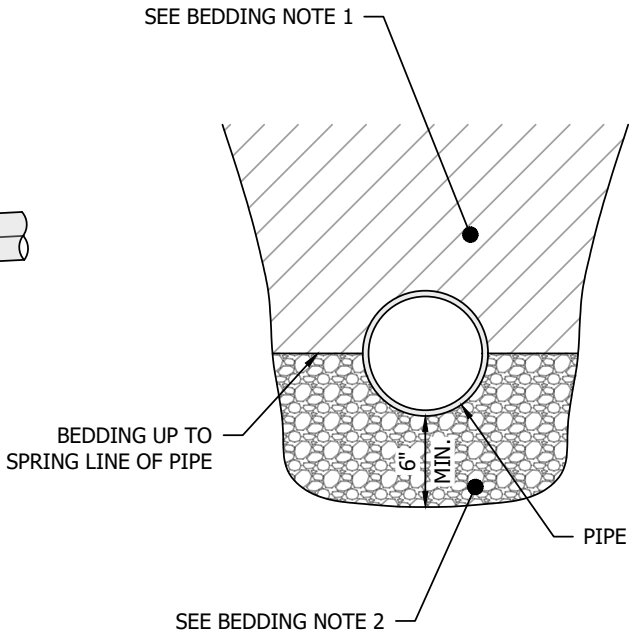
EXISTING SERVICE LATERAL REPAIR



SHALLOW SEWERS - NEW INSTALLATION



DEEP SEWERS - NEW INSTALLATION



BEDDING NOTES:

1. APPROVED BACKFILL AS PER INSTALLATION SPECIFICATIONS FOR PAVED OR NON-PAVED SURFACES
2. BEDDING MATERIAL SHALL BE CRUSHED STONE; MIN. NO. 11, MAX. NO. 5, AND SHALL BE HANDED TAMPED MECHANICALLY TO A COMPACTION OF 95% DRY DENSITY

SERVICE LATERAL BEDDING

Muncie SANITARY DISTRICT

MUNCIE PUBLIC WORKS

SANITARY SERVICE LATERAL INSTALLATION

APPROVED: XX/XX/20XX

REVISED: XX/XX/20XX

STANDARD: **SS-912**

PLOT DATE: 10/30/2023 2:03 PM
EDIT DATE: 10/27/2023
EDITED BY: PTRAWINSKI
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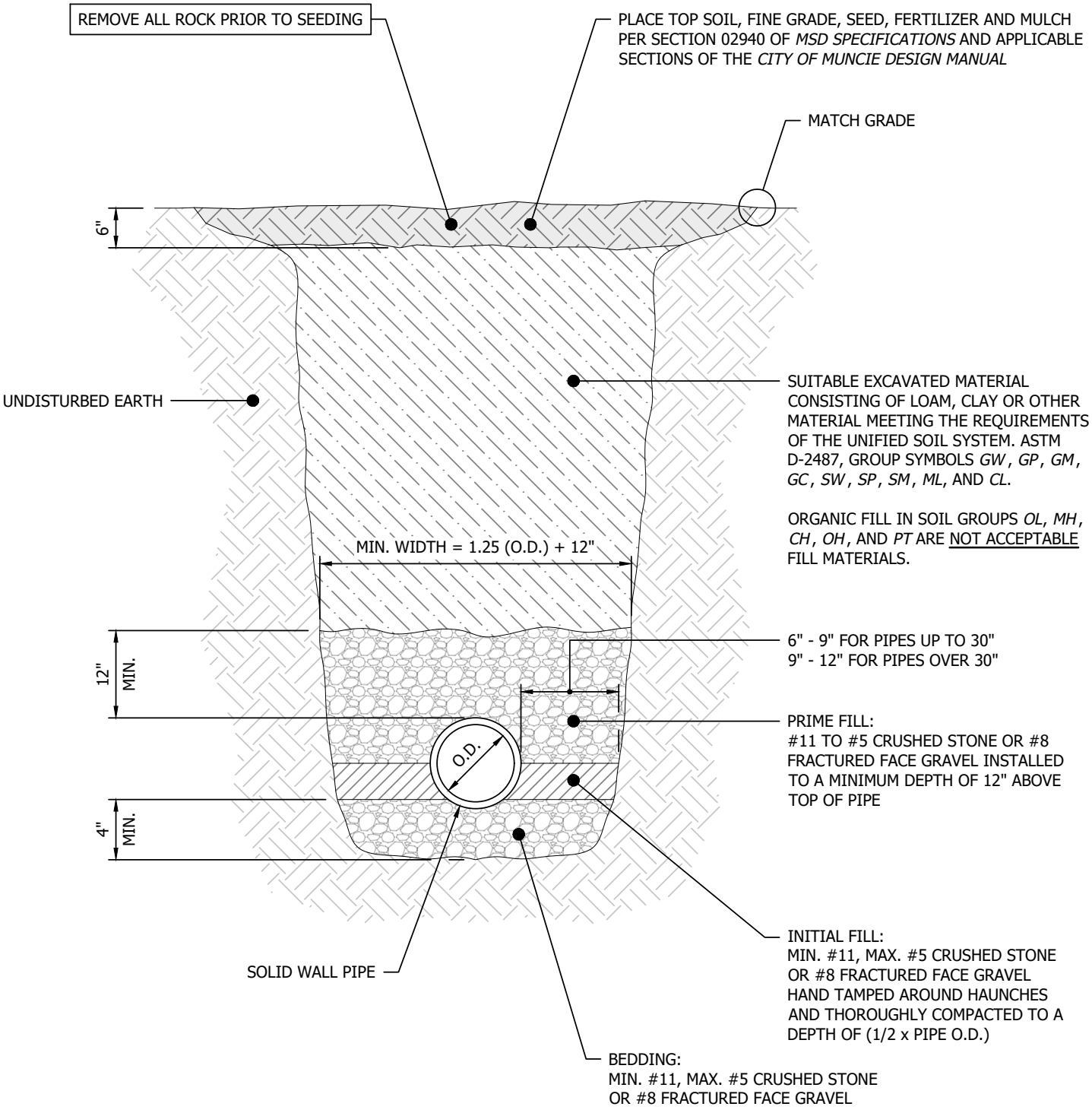


Muncie SANITARY DISTRICT

MUNCIE PUBLIC WORKS

CLASS "B" BEDDING NON-PAVED AREAS

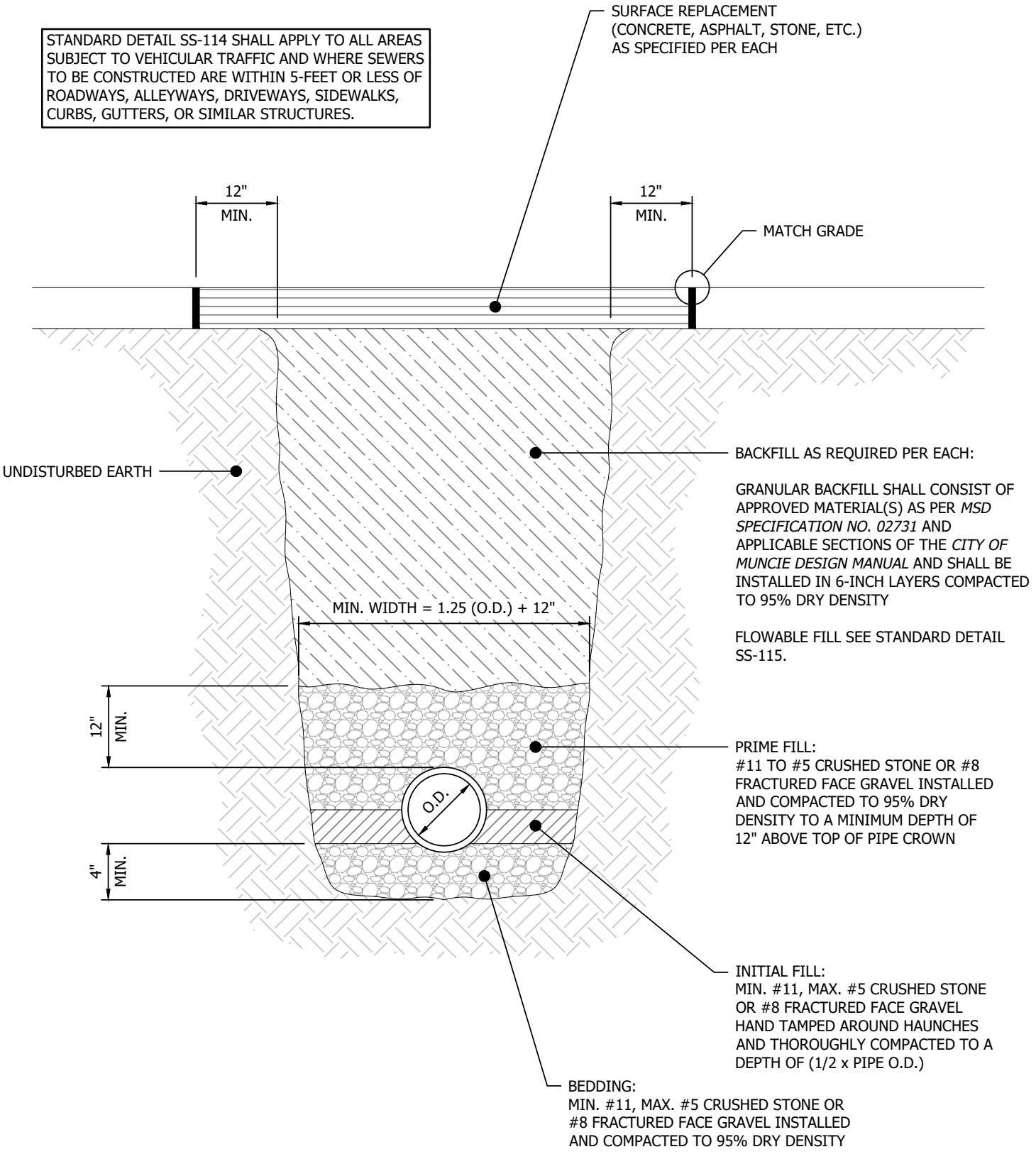
APPROVED: XX/XX/20XX

REVISED: XX/XX/20XX

STANDARD: **SS-913**

PLOT DATE: 10/30/2023 2:03 PM EDIT DATE: 10/27/2023 EDITED BY: PTRAWINSKI DRAWING FILE: P:\2022\01013D. Drawings\Utility Infrastructure\MSD_SS_913_BEDDING NON-PAVED.dwg

STANDARD DETAIL SS-114 SHALL APPLY TO ALL AREAS SUBJECT TO VEHICULAR TRAFFIC AND WHERE SEWERS TO BE CONSTRUCTED ARE WITHIN 5-FEET OR LESS OF ROADWAYS, ALLEYWAYS, DRIVEWAYS, SIDEWALKS, CURBS, GUTTERS, OR SIMILAR STRUCTURES.



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EDIT DATE: 10/27/2023
PLOT DATE: 10/30/2023 2:03 PM

Muncie SANITARY DISTRICT

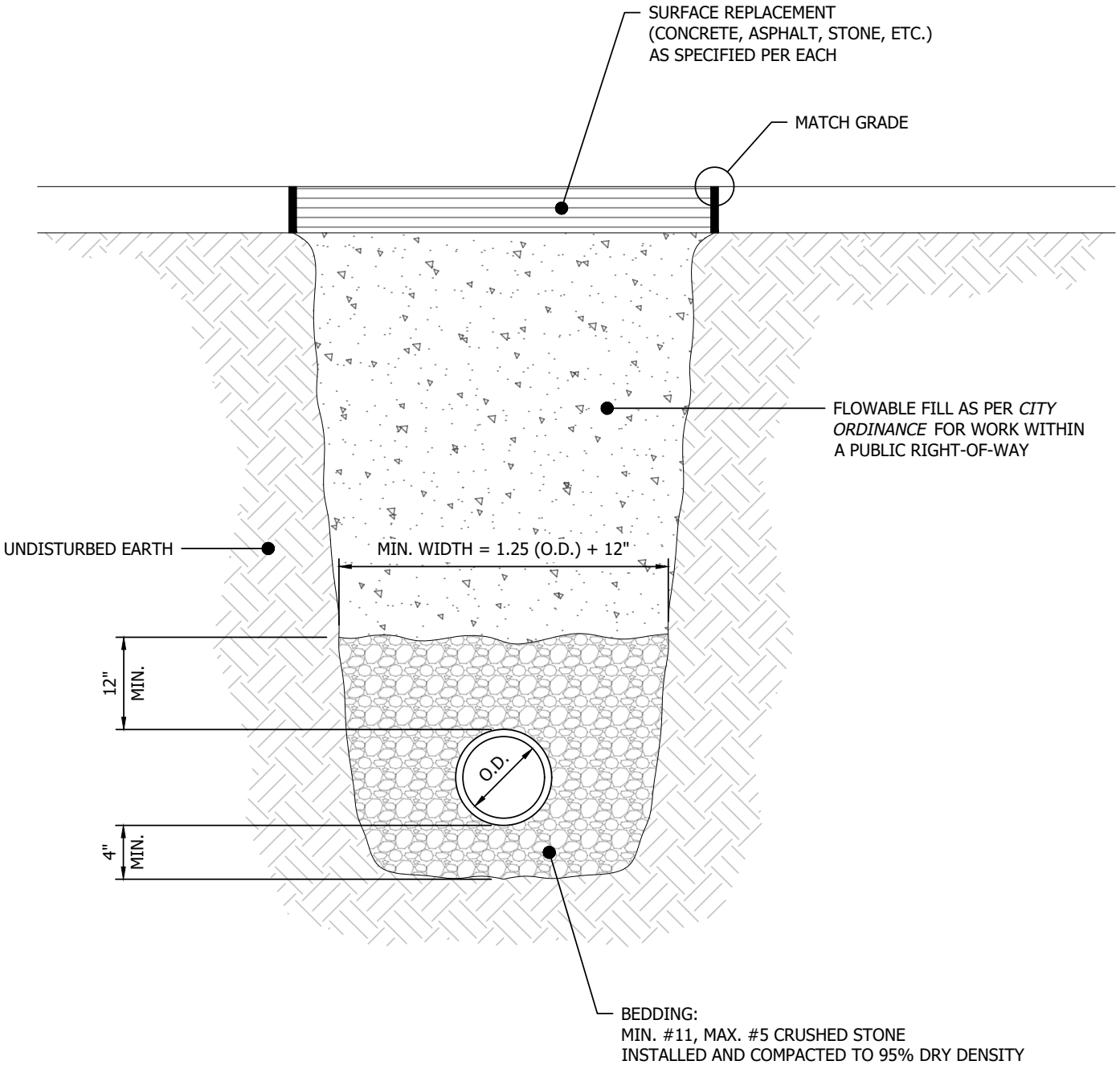
MUNCIE PUBLIC WORKS

CLASS "B" BEDDING PAVED AREAS

APPROVED: XX/XX/20XX

REVISED: XX/XX/20XX

STANDARD: **SS-914**



ENGINEER APPROVAL REQUIRED FOR USE

NOTES:

1. FLOWABLE FILL FOR USE WITHIN MUNCIE CITY LIMITS SHALL CONFORM TO THE LATEST APPLICABLE RIGHT-OF-WAY USE ORDINANCE. SPECIFICATIONS ARE GOVERNED BY THE OFFICE OF THE CITY ENGINEER, CITY OF MUNCIE, AND ARE AVAILABLE FROM THAT OFFICE. SPECIFICATIONS FOR FLOWABLE FILL INTENDED USE IN DELAWARE COUNTY ARE GOVERNED BY THE OFFICE OF THE COUNTY ENGINEER, AND MAY OR MAY NOT BE THE SAME. THE CONTRACTOR SHALL BE RESPONSIBLE FOR COMPLYING WITH THE APPROPRIATE SPECIFICATION.

2. FLOWABLE FILL MAY BE GENERALLY DESCRIBED AS LOW-STRENGTH, HIGH-SLUMP CONCRETE SLURRY, AND SHOULD BE REGULARLY AVAILABLE FROM ALL LOCAL READY-MIX CONCRETE SUPPLIERS. THE COMPRESSIVE STRENGTH SHALL BE FROM 50 TO 150 psi AND THE FLOW TEST SPREAD DIAMETER SHALL BE A MINIMUM OF 8-INCHES AS DETERMINED BY THE TEST PROCEDURE OUTLINED IN THE APPLICABLE SPECIFICATION.

Muncie SANITARY DISTRICT

MUNCIE PUBLIC WORKS

FLOWABLE FILL PAVED AREAS

APPROVED: *XX/XX/20XX*

REVISED: *XX/XX/20XX*

STANDARD: **SS-915**

PLOT DATE: 10/30/2023 2:03 PM
EDIT DATE: 10/27/2023
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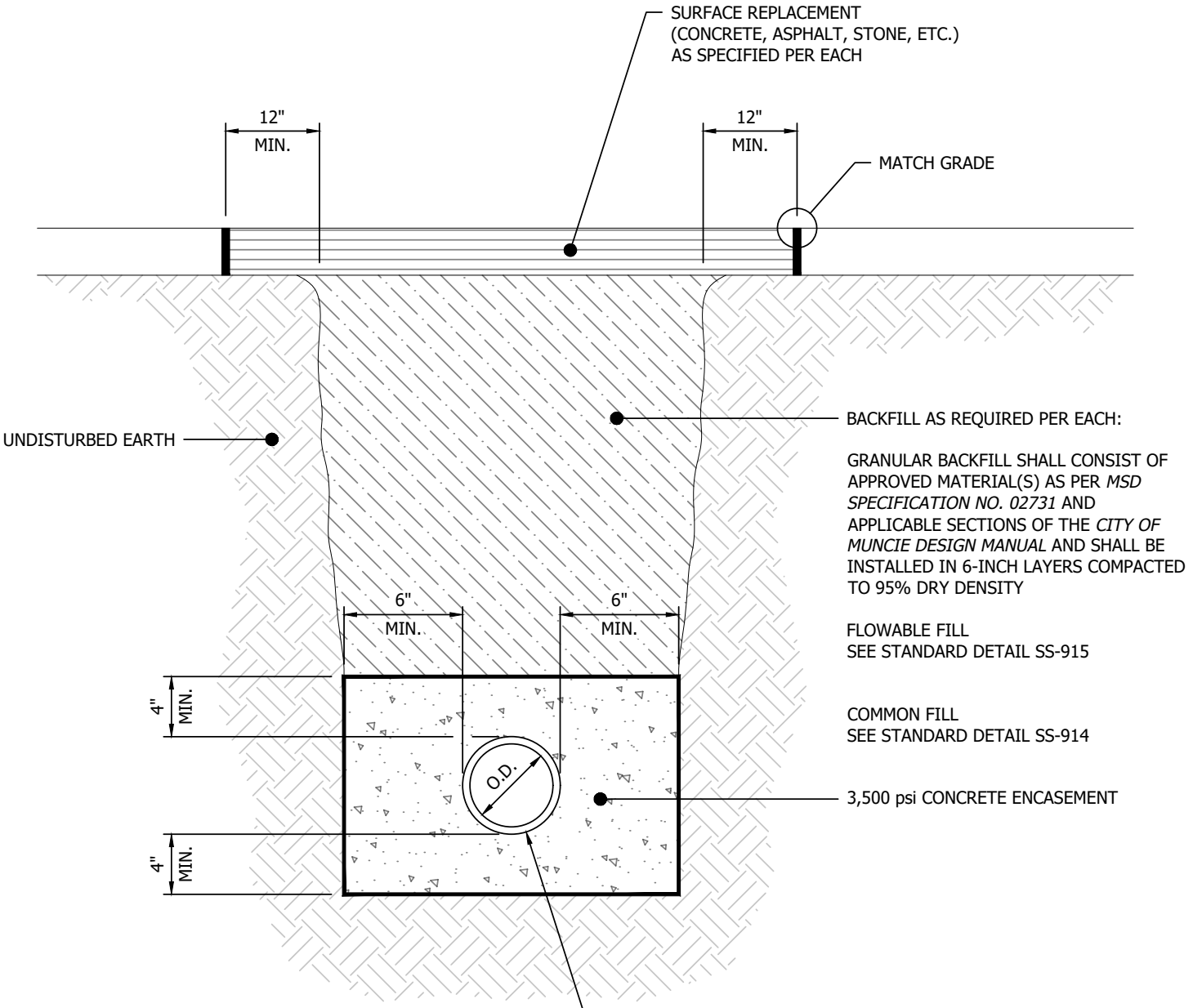

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Muncie SANITARY DISTRICT

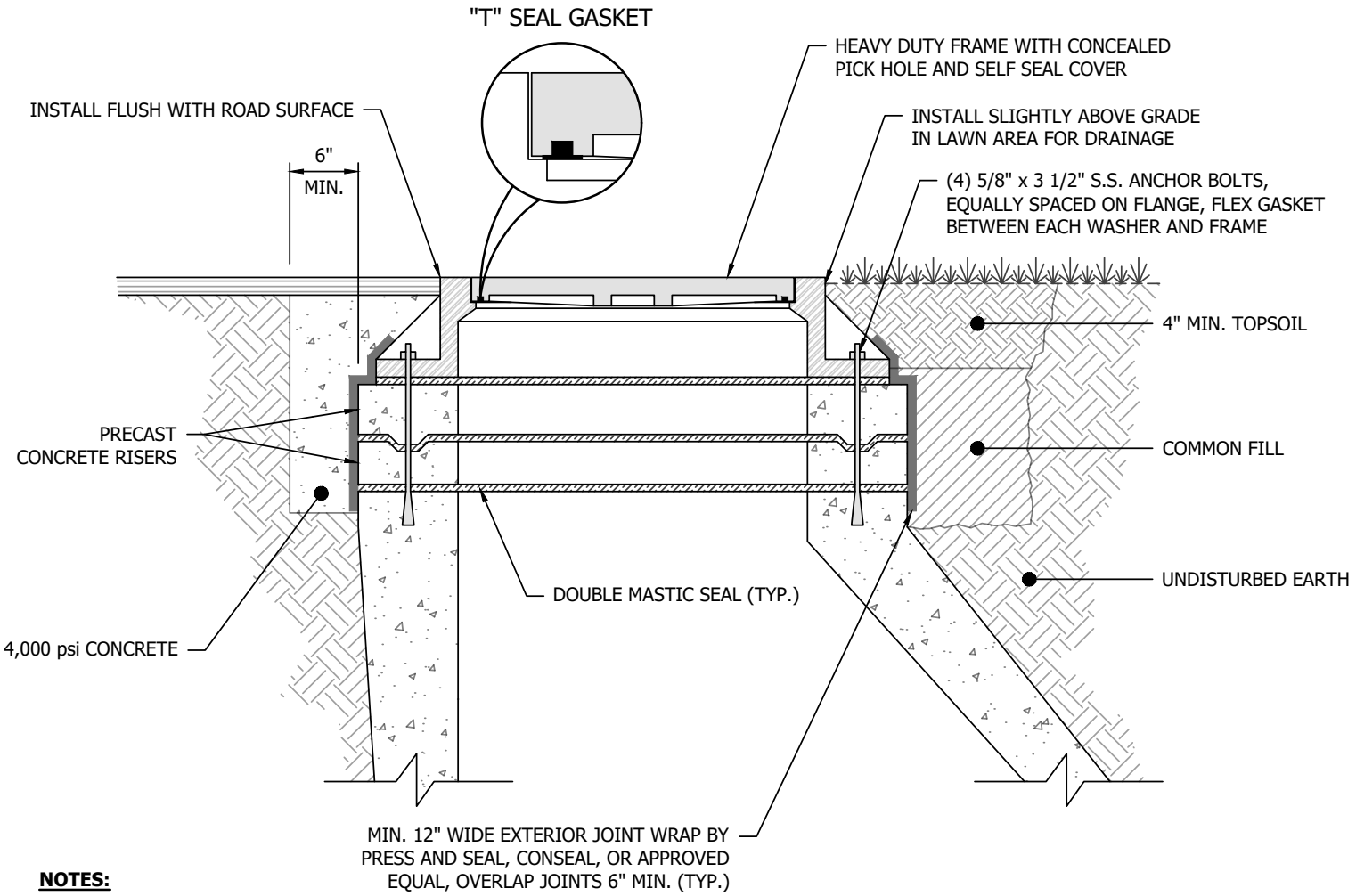
MUNCIE PUBLIC WORKS

CONCRETE ENCASEMENT

APPROVED: XX/XX/20XX

REVISED: XX/XX/20XX

STANDARD: **SS-916**



NOTES:

1. MANHOLE TO BE ADJUSTED BY REMOVING BRICK, BLOCK OR PRECAST CONCRETE RISER SECTIONS AS NEEDED AND INSTALLING NEW PRECAST CONCRETE RISER SECTIONS. EACH RISER SECTION TO BE SET IN 1/2" BITUMINOUS SEAL.
2. CAST TO BE SET IN 1/2" BITUMINOUS SEAL AND TO BE INSTALLED FLUSH WITH THE ROAD SURFACE. INSTALL SLIGHTLY ABOVE GRADE IN LAWN AREAS FOR DRAINAGE.
3. IN STONE OR GRAVEL ALLEYS, PARKING LOTS OR OTHER AREAS SUBJECT TO VEHICULAR TRAFFIC CASTING AND ALL NEW MASONRY TO BE ANCHORED IN PLACE WITH CONCRETE EXTENDING TO THE BOTTOM OF ANY NEW MASONRY AND EXTENDING A MINIMUM OF 6-INCHES BEYOND THE OUTER EDGE OF NEW MASONRY ON ALL SIDES.
4. IN LAWN OR EARTHEN AREAS THE INITIAL FILL MAY BE COMMON FILL (DIRTY, CLAY, SAND) OR EXCAVATION MATERIAL FREE OF BOULDERS. COVER WITH A MINIMUM OF 4-INCHES OF TOPSOIL.
5. AFTER FILL HAS ADEQUATELY SETTLED, GRADE, SEED AND MULCH AS NEEDED.
6. IN GRAVEL OR STONE AREAS, REPLACE THE SURFACE WITH A MATERIAL SIMILAR TO THE SURROUNDED SURFACE (MATCH EXISTING), UNLESS OTHERWISE SPECIFIED.
7. CENTER CASTING OVER MANHOLE TOP BEFORE ANCHORING IN PLACE.
8. CONTRACTOR SHALL TAKE NECESSARY PRECAUTIONS TO PREVENT CONSTRUCTION DEBRIS FROM FALLING INTO MANHOLE.
9. ASPHALT SURFACE REPAIR SHALL CONSIST OF:

   1.5-INCH HAC 11/12 SURFACE OVER
   MINIMUM 6-INCHES 4,000 psi 7 BAG/YD. CONCRETE;
   CONCRETE SURFACE, MINIMUM 6-INCHES 4,000 psi 7 BAG/YD.;
   STONE SURFACE, MINIMUM 6-INCHES TYPE "0" AGGREGATE.

   SAW CUT ALL EDGES OF EXISTING SURFACE PRIOR TO RESTORATION. TACK COAT ALL SURFACES PRIOR TO SURFACE ASPHALT APPLICATION.

Muncie SANITARY DISTRICT

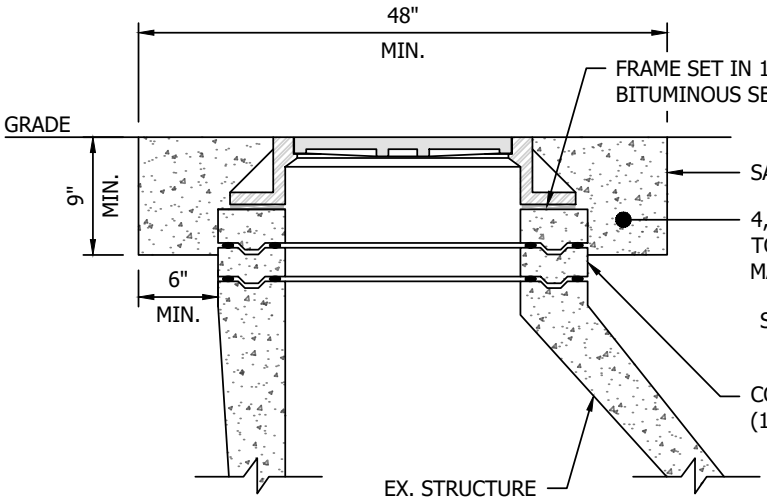
MUNCIE PUBLIC WORKS

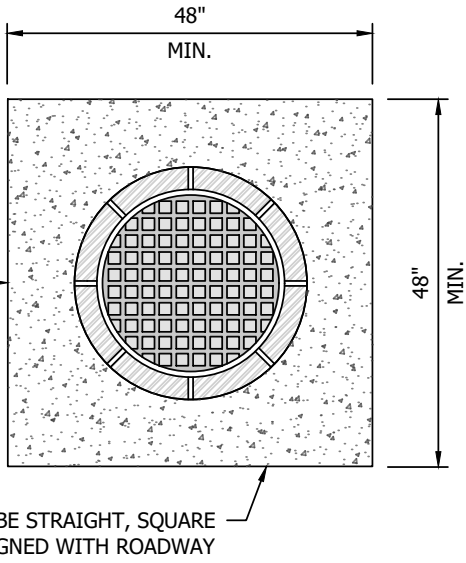
WATER-TIGHT MANHOLE CASTING

APPROVED: XX/XX/20XX

REVISED: XX/XX/20XX

STANDARD: **SS-917**



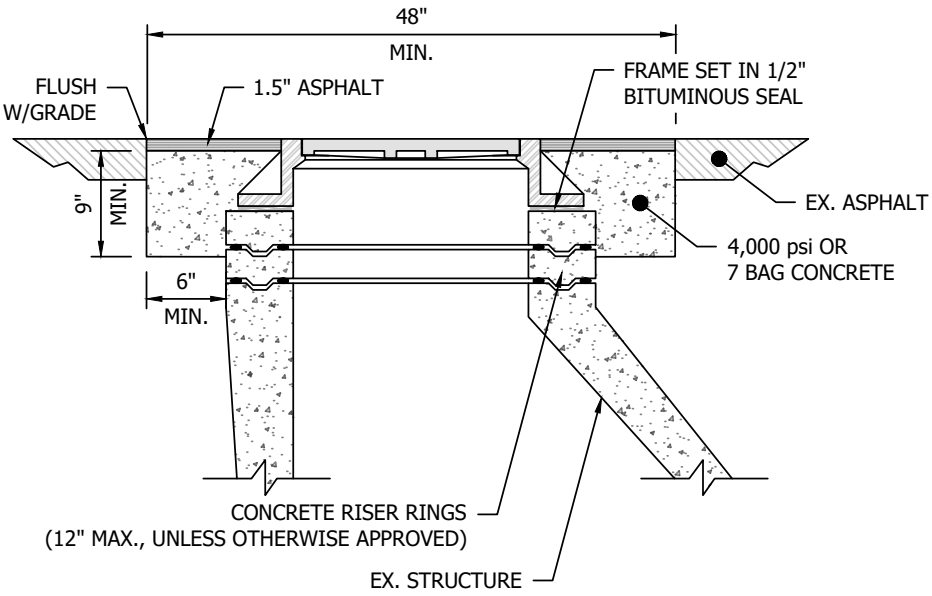


CONCRETE INSTALLATION NOTES:

1. MANHOLE TO BE ADJUSTED BY REMOVING BRICK, BLOCK OR PRECAST CONCRETE RISER SECTIONS AS NEEDED AND INSTALLING NEW PRECAST CONCRETE RISER SECTIONS OR POURED IN PLACE CONCRETE. CASTING AND EACH RISER TO BE SET ON 1/2" GASKET OR BITUMINOUS SEAL AS PER STANDARD DETAIL SS-905.
2. CASTING AND MASONRY WORK TO BE ANCHORED IN PLACE WITH 4,000 psi CONCRETE EXTENDING TO THE BOTTOM OF ANY NEW MASONRY AND EXTENDING 6-INCHES BEYOND OUTER EDGE OF MASONRY ON ALL SIDES.
3. WITHIN MUNCIE CITY LIMITS ALL CONCRETE SHALL BE 7 BAG MIX INSTEAD OF 4,000 psi.
4. RUBBER "INFRA-RISERS" MAY BE USED ONLY WHEN APPROVED IN ADVANCED AND ONLY IN THE QUANTITY APPROVED. 1/2" BITUMINOUS SEAL TO BE APPLIED BETWEEN ALL LAYERS AS PER STANDARD DETAIL SS-905.

CONTRACTOR SHALL TAKE NECESSARY PRECAUTIONS TO PREVENT LOOSE MATERIAL FROM ENTERING INTO STRUCTURE

IN CONCRETE



IN ASPHALT

ASPHALT INSTALLATION NOTES:

1. MANHOLE OR CATCH BASIN TO BE ADJUSTED BY REMOVING BRICK, BLOCK OR PRECAST CONCRETE RISER SECTIONS AS NEEDED AND INSTALLING NEW PRECAST CONCRETE RISER SECTIONS OR POURED IN PLACE CONCRETE. EACH RISER TO BE SET IN 1/2" BITUMINOUS SEAL.
2. CASTING TO BE SET IN 1/2" BITUMINOUS SEAL AND TO BE INSTALLED FLUSH WITH THE SURFACE OF PAVEMENT.
3. CASTING AND ALL NEW MASONRY TO BE ANCHORED IN PLACE WITH CONCRETE EXTENDING TO THE BOTTOM OF ANY MASONRY AND EXTENDING A MINIMUM OF 6-INCHES BEYOND THE OUTER EDGE OF NEW MASONRY ON ALL SIDES.
4. CONCRETE TO BE LEFT 1.5-INCHES BELOW FINISHED SURFACE TO ALLOW FOR ASPHALT PAVEMENT.
5. SAW CUT ALL EDGES OF EXISTING PAVEMENT PRIOR TO PLACEMENT OF HAC SURFACE.
6. TACK COAT SURFACE OF CONCRETE AND ALL VERTICAL EDGES OF REPAIR AREA PRIOR TO PLACEMENT OF HAC.
7. INSTALL 165 LB/YD. (1.5-INCH) OF #11 OR #12 COMPACTED HOT ASPHALTIC CONCRETE.
8. WITHIN *MUNCIE CITY* LIMITS ALL CONCRETE SHALL BE 7 BAG MIX INSTEAD OF 4,000 psi.

Muncie SANITARY DISTRICT

MUNCIE PUBLIC WORKS

CASTING ADJUSTMENT

APPROVED: XX/XX/20XX

REVISED: XX/XX/20XX

STANDARD: **SS-918**

PLOT DATE: 10/30/2023 2:03 PM
EDIT DATE: 10/30/2023
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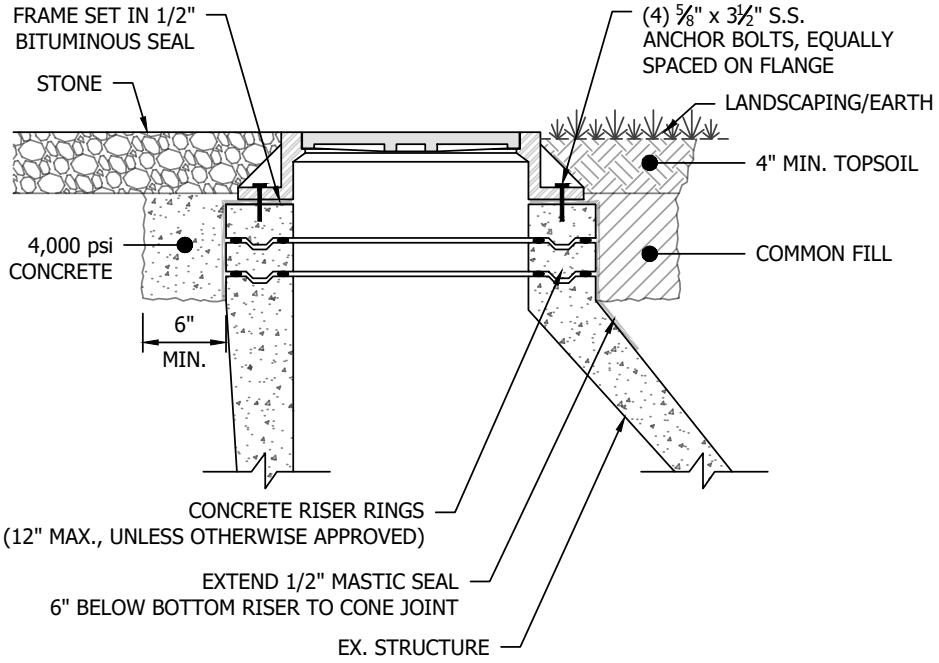

CONTRACTOR SHALL TAKE NECESSARY PRECAUTIONS TO PREVENT LOOSE MATERIAL FROM ENTERING INTO STRUCTURE

STONE OR EARTH INSTALLATION NOTES:

1. MANHOLE OR CATCH BASIN TO BE ADJUSTED BY REMOVING BRICK, BLOCK OR PRECAST CONCRETE RISER SECTIONS AS NEEDED AND INSTALLING NEW PRECAST CONCRETE RISER SECTIONS OR POURED IN PLACE CONCRETE. EACH RISER TO BE SET IN 1/2" BITUMINOUS SEAL.
2. CASTING TO BE SET IN 1/2" BITUMINOUS SEAL AND TO BE INSTALLED FLUSH WITH THE SURFACE OF STONE OR LAWN AREA.
3. IN STONE OR GRAVEL ALLEYS, PARKING LOTS, OR OTHER AREAS SUBJECT TO VEHICULAR TRAFFIC CASTING AND ALL NEW MASONRY TO BE ANCHORED IN PLACE WITH CONCRETE EXTENDING TO THE BOTTOM OF ANY NEW MASONRY AND EXTENDING A MINIMUM OF 6-INCHES BEYOND THE OUTER EDGE OF NEW MASONRY ON ALL SIDES.
4. IN LAWN OR EARTHEN AREAS THE INITIAL FILL MAY BE COMMON FILL (DIRT, CLAY, SAND) OR EXCAVATION MATERIAL FREE OF BOULDERS. COVER WITH A MINIMUM OF 4-INCHES TOPSOIL.
5. AFTER FILL HAS ADEQUATELY SETTLED, LANDSCAPE AS PER *CITY OF MUNCIE DESIGN MANUAL*.
6. IN GRAVEL OR STONE AREAS REPLACE THE SURFACE WITH A MATERIAL SIMILAR TO THE SURROUNDING SURFACE UNLESS OTHERWISE SPECIFIED.
7. CENTER CASTING OVER MANHOLE TOP.

IN STONE OR EARTH

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Muncie SANITARY DISTRICT

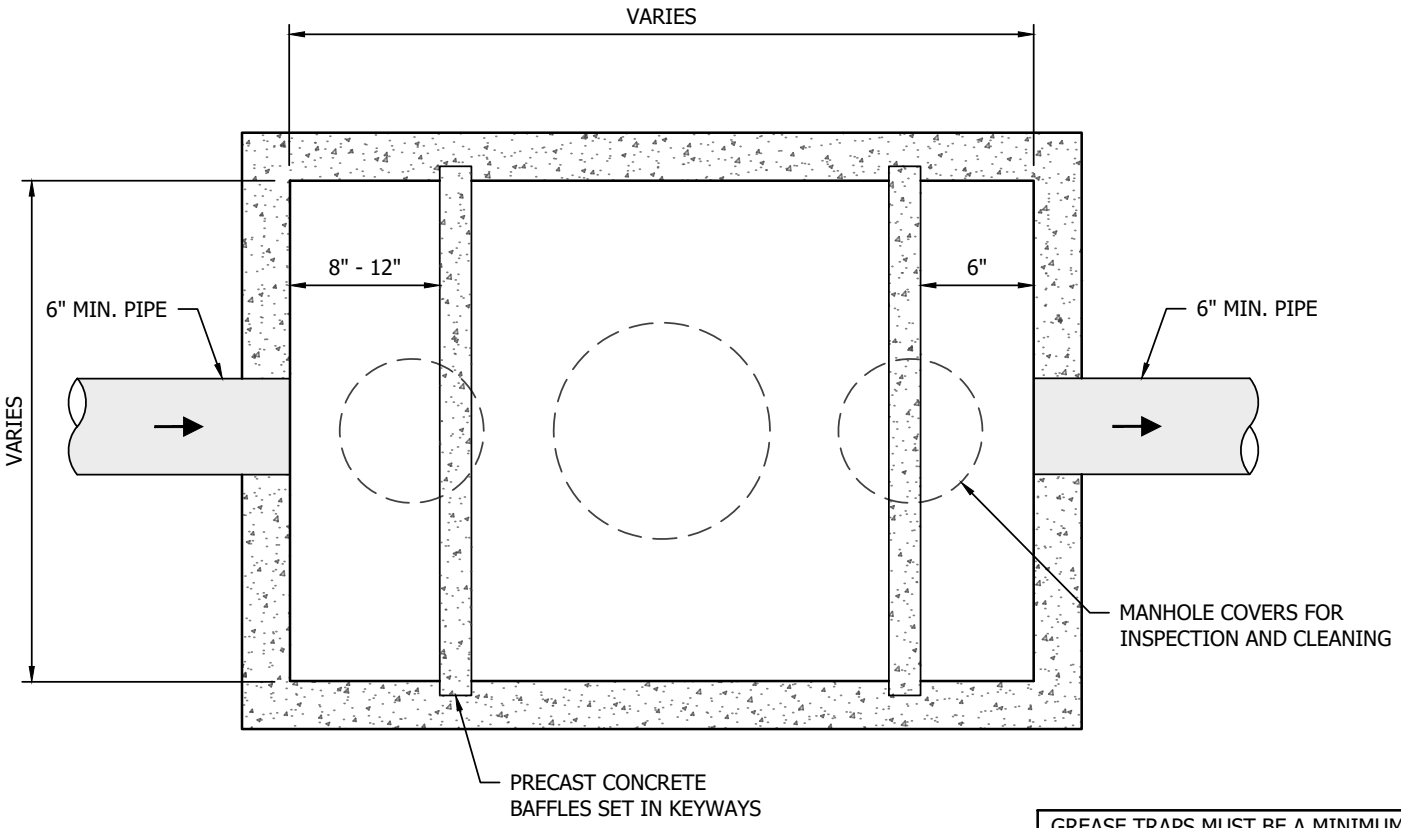
MUNCIE PUBLIC WORKS

CASTING ADJUSTMENT

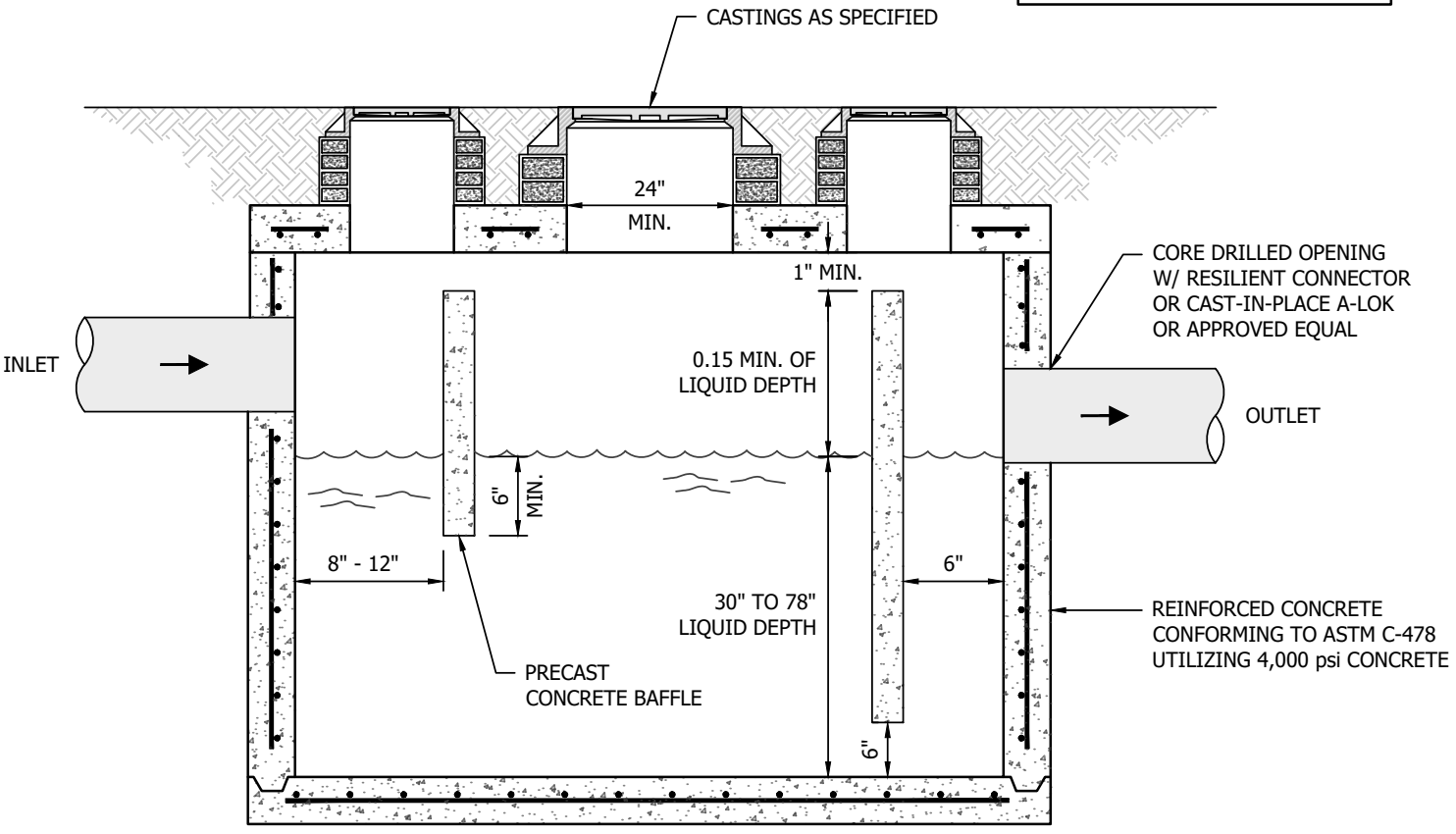
APPROVED: *XX/XX/20XX*

REVISED: *XX/XX/20XX*

STANDARD: **SS-918**



GREASE TRAPS MUST BE A MINIMUM OF 1,000 GALLONS AND SIZED ACCORDING TO *410 IAC 6-10.1-66*



Muncie SANITARY DISTRICT

MUNCIE PUBLIC WORKS

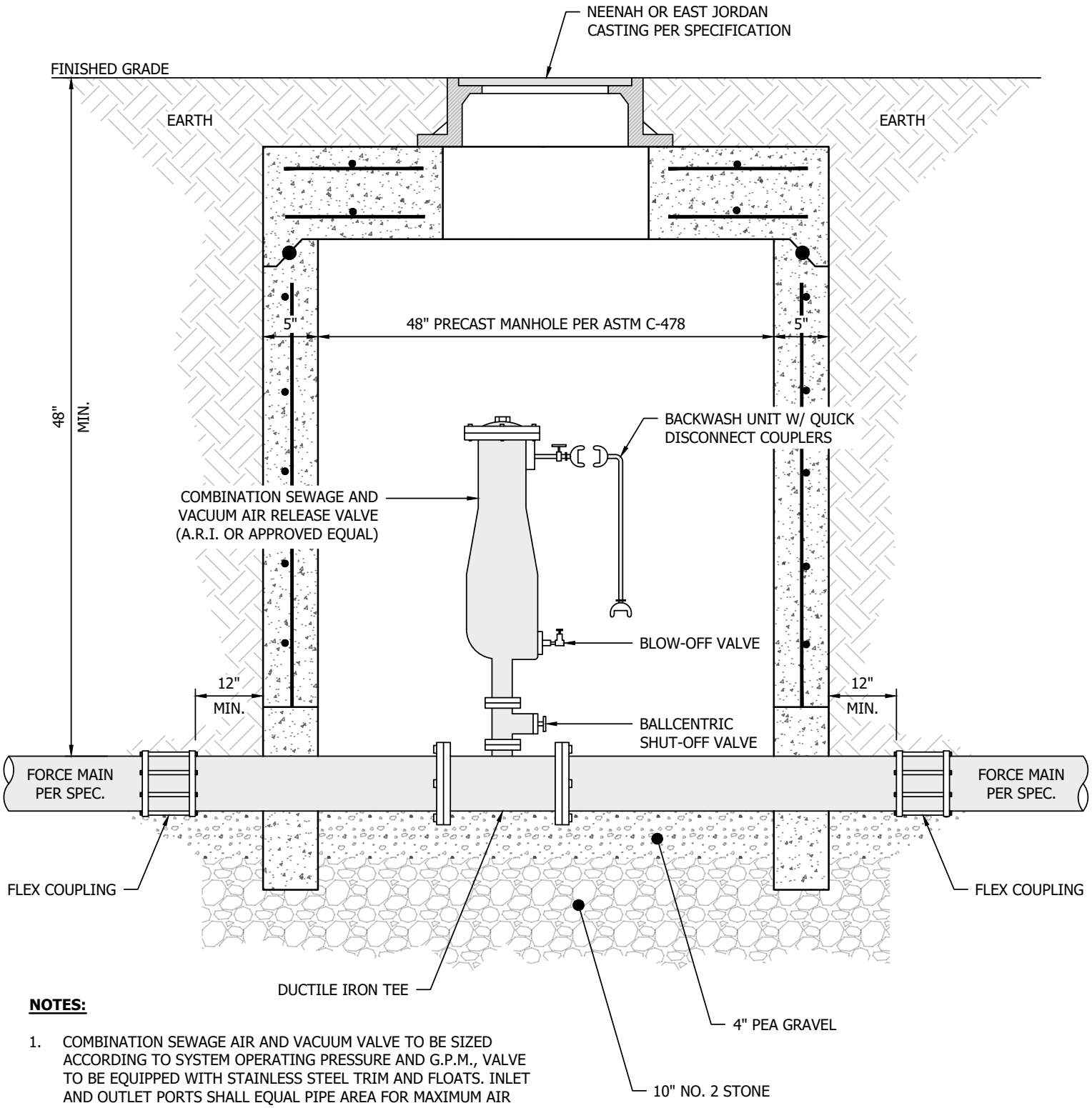
GREASE INTERCEPTOR

APPROVED: *XX/XX/20XX*

REVISED: *XX/XX/20XX*

STANDARD: **SS-919**

PLOT DATE: 10/30/2023 2:03 PM
EDIT DATE: 10/27/2023
EDITED BY: PTRAWINSKI
DRAWING FILE: P:\2022\01013D. Drawings\Utility Infrastructure\MSD_SS_919_GREASE INTERCEPTOR.dwg



NOTES:

1. COMBINATION SEWAGE AIR AND VACUUM VALVE TO BE SIZED ACCORDING TO SYSTEM OPERATING PRESSURE AND G.P.M., VALVE TO BE EQUIPPED WITH STAINLESS STEEL TRIM AND FLOATS. INLET AND OUTLET PORTS SHALL EQUAL PIPE AREA FOR MAXIMUM AIR FLOW EFFICIENCY AND PROTECTION OF FORCE MAIN.

2. PLUG AND SHUT-OFF VALVES TO BE BUNA-N OR NITRILE RUBBER COATED ECCENTRIC PLUG OR CAM CENTRIC PLUG, DESIGNED FOR RAW SEWAGE WITH FULL FOUND, STRAIGHT THROUGH PORT WHEN OPEN, VALV-MATIC, DRUM-OWEN, DEZURIK, OR APPROVED EQUAL.

Muncie SANITARY DISTRICT

MUNCIE PUBLIC WORKS

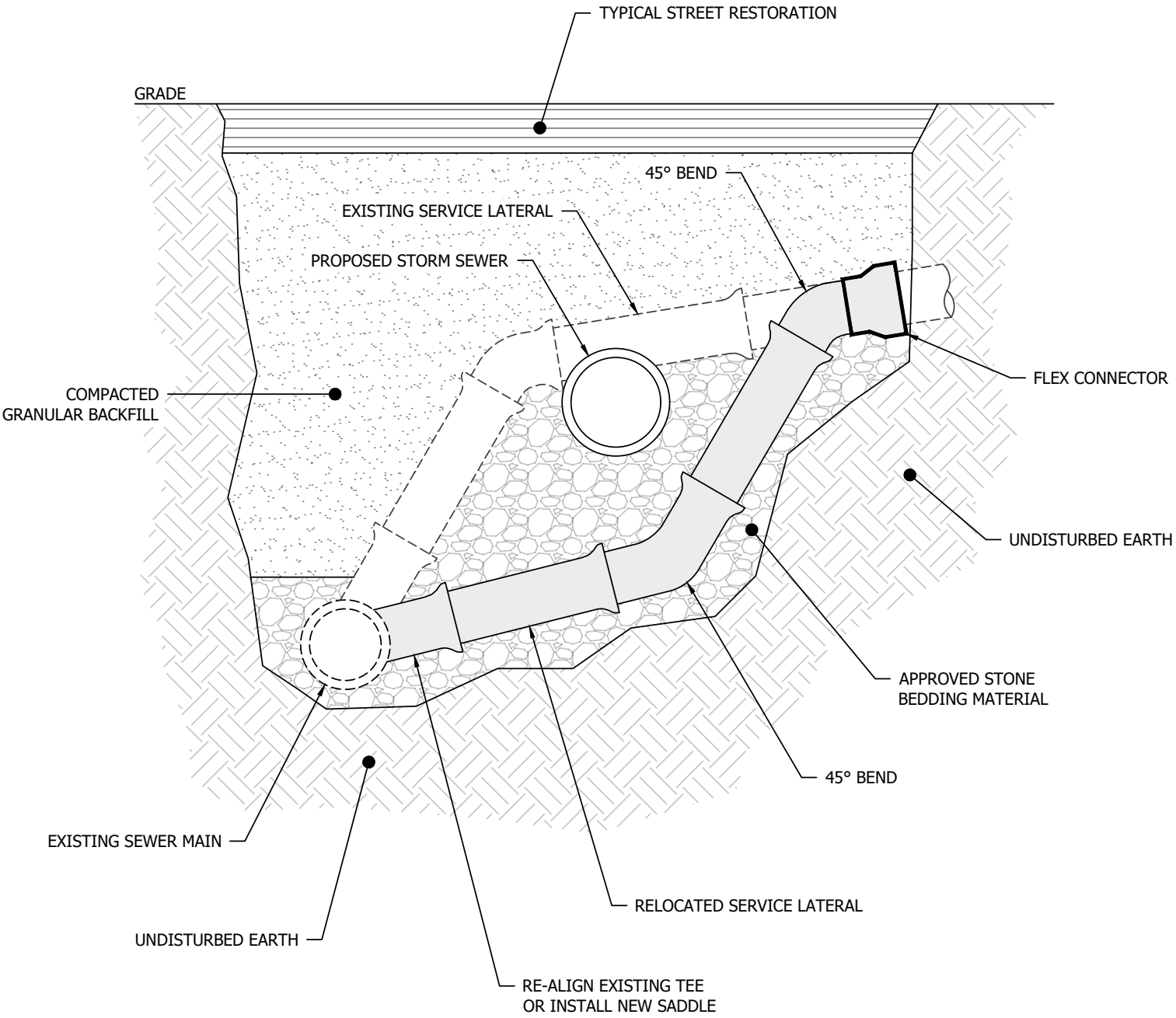
COMBINATION AIR RELEASE VALVE

APPROVED: XX/XX/20XX

REVISED: XX/XX/20XX

STANDARD: **SS-920**

DRAWING FILE: P:\2022\01013D. Drawings\Utility Infrastructure\MSD_SS_920_COMBINATION ARV.dwg
EDITED BY: PTRAWINSKI
EDIT DATE: 10/27/2023
PLOT DATE: 10/30/2023 2:04 PM



NOTES:

1. PLUG AND SEAL ENDS OF OLD SERVICE LATERAL.
2. USE APPROVED PIPE AND CONNECTORS FOR NEW SERVICE LATERAL INSTALLATION. NEW SERVICE LATERALS MUST BE PVC SDR 35 OR APPROVED EQUAL.
3. ALLOW A MINIMUM OF 6-INCHES OF FILL BETWEEN NEW SERVICE LATERAL AND STORM SEWER.
4. VERTICAL LOCATION OF EXISTING SERVICE LATERAL IS REPRESENTATIVE IN NATURE, ACTUAL LOCATIONS VARY.

Muncie SANITARY DISTRICT

MUNCIE PUBLIC WORKS

SANITARY SERVICE LATERAL RELOCATION

APPROVED: *XX/XX/20XX*

REVISED: *XX/XX/20XX*

STANDARD: **SS-921**

PLOT DATE: 10/30/2023 2:04 PM
EDIT DATE: 10/27/2023
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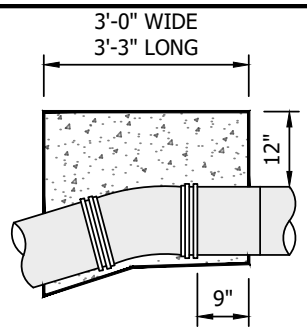
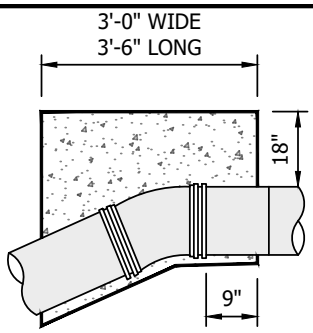
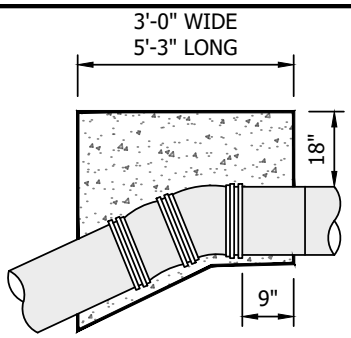
DRAWING FILE: P:\2022\01013D. Drawings\Utility Infrastructure\MSD_SS_921_SERVICE RELOCATION.dwg



11.25° BEND

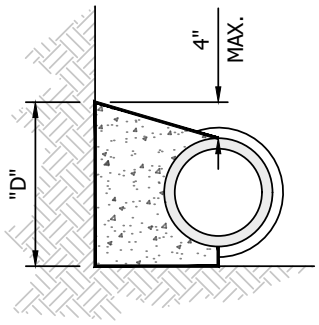


22.5° BEND

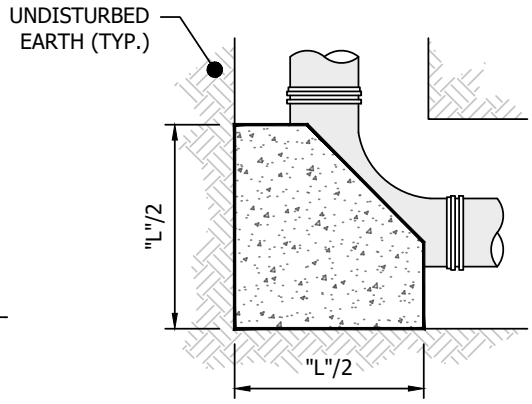


11.25° AND 22.5° BEND

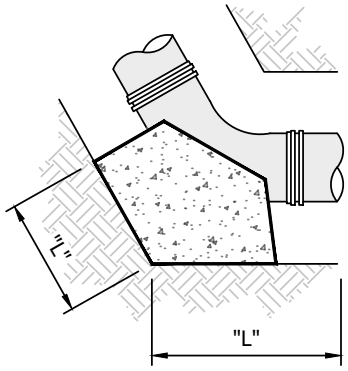
CONCRETE BLOCKING FOR VERTICAL BENDS



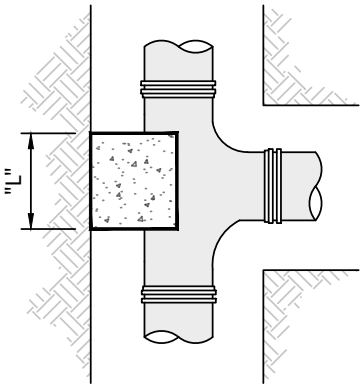
TYPICAL SECTION



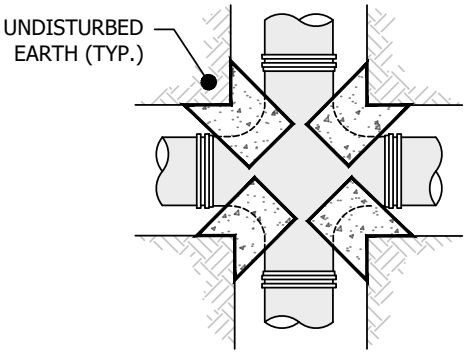
90° BENDS



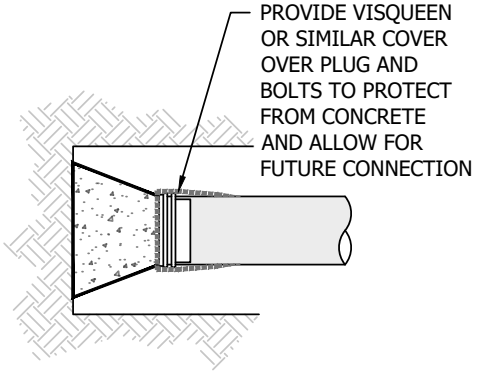
BENDS LESS THAN 90°



TEES



CROSSES



PLUGS

CONCRETE BLOCKING FOR HORIZONTAL BENDS

NOTE:

NOTE THRUST BLOCKING SHALL BE MIN. 3,000 psi, 28-DAY COMPRESSIVE STRENGTH. BOLTS, FITTINGS, AND JOINTS SHALL BE KEPT CLEAR OF CONCRETE. CONCRETE SHALL BE POURED AGAINST UNDISTURBED EARTH. THE CROSS SECTION OF THRUST BLOCKING SHALL BE PERPENDICULAR. TIED OR RESTRAINED JOINTS MAY BE USED IN LIEU OF OR IN COMBINATION WITH THRUST BLOCKING UPON WRITTEN APPROVAL BY THE ENGINEER OR OWNER.

BENDS

SIZE OF PIPE	DEGREE OF BEND							
	11.25°		22.50°		45°		90°	
	L	D	L	D	L	D	L	D
3", 4" , 6"	8"	6"	10"	6"	20"	6"	36"	6"
8"	9"	8"	14"	8"	24"	9"	50"	8"
12"	14"	12"	22"	12"	30"	16"	60"	15"
16"	18"	16"	24"	18"	33"	36"	70"	22"

TEES

RUN	BRANCH							
	3", 4", 6"		8"		12"		16"	
	L	D	L	D	L	D	L	D
3", 4", 6"	16"	7"						
8"	14"	8"	18"	12"				
12"	9"	12"	18"	12"	24"	18"		
16"	8"	16"	14"	16"	28"	16"	30"	26"

Muncie SANITARY DISTRICT

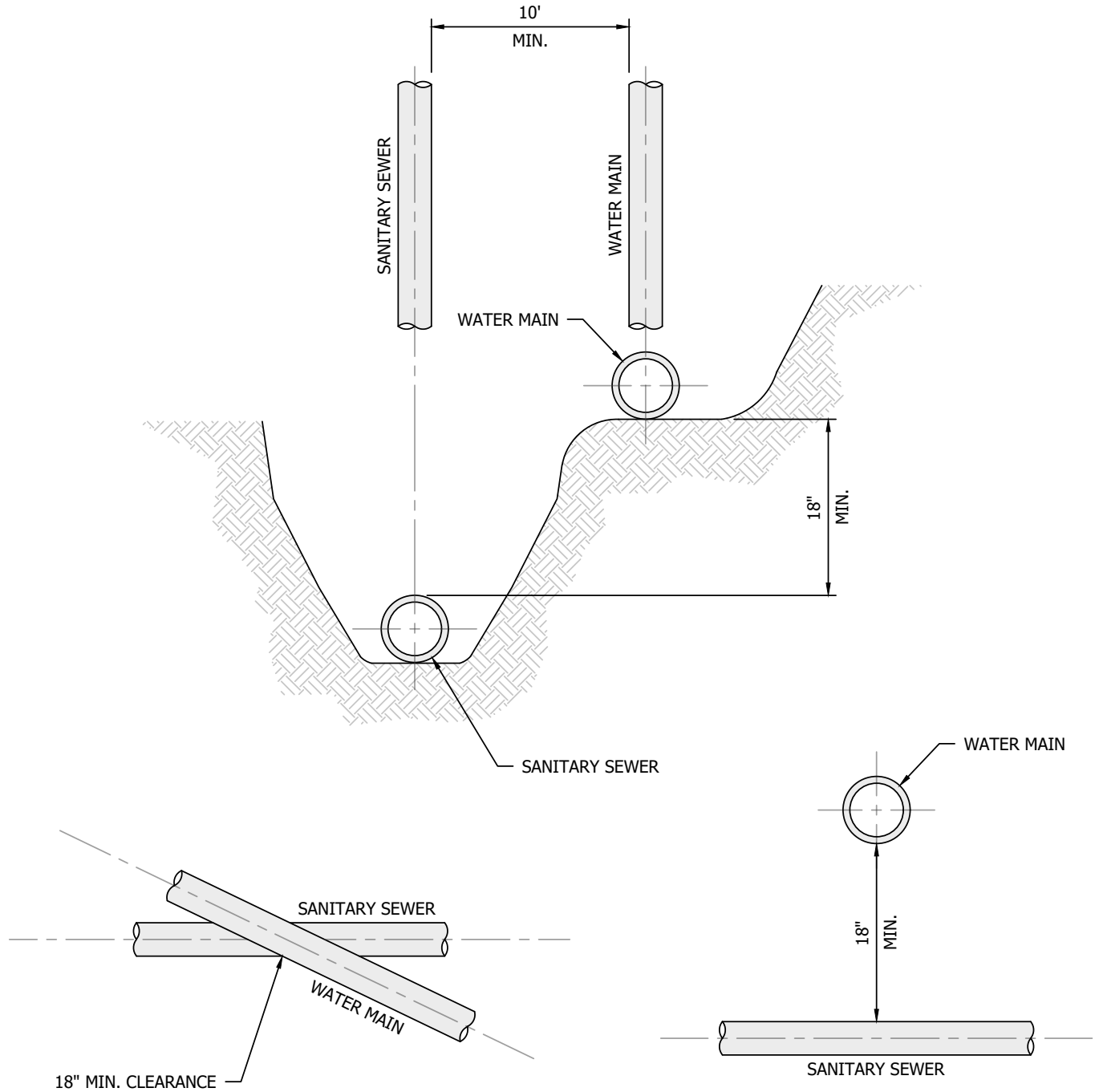
MUNCIE PUBLIC WORKS

SANITARY FORCE MAIN THRUST BLOCKING

APPROVED: XX/XX/20XX

REVISED: XX/XX/20XX

STANDARD: **SS-922**



NOTES:

1. WHEN MINIMUM WATER AND SANITARY SEWER CLEARANCE DIMENSIONS CANNOT BE ACHIEVED, WATER AND SEWER PIPE SHALL BE CONSTRUCTED OF SLIP-ON OR MECHANICAL JOINT PIPE COMPLYING WITH *AWWA DESIGN STANDARDS* AND BE PRESSURE RATED AND TESTED TO 150 psi TO ASSURE WATERTIGHTNESS PRIOR TO BACKFILLING.

2. THE CONTRACTOR SHALL OBTAIN APPROVAL FROM THE *MUNCIE SANITARY DISTRICT* PRIOR TO INSTALLING ANY PIPE WHICH EXCEEDS THESE MINIMUM (10-FEET) AND VERTICAL (18-INCHES) CLEARANCES.

Muncie SANITARY DISTRICT

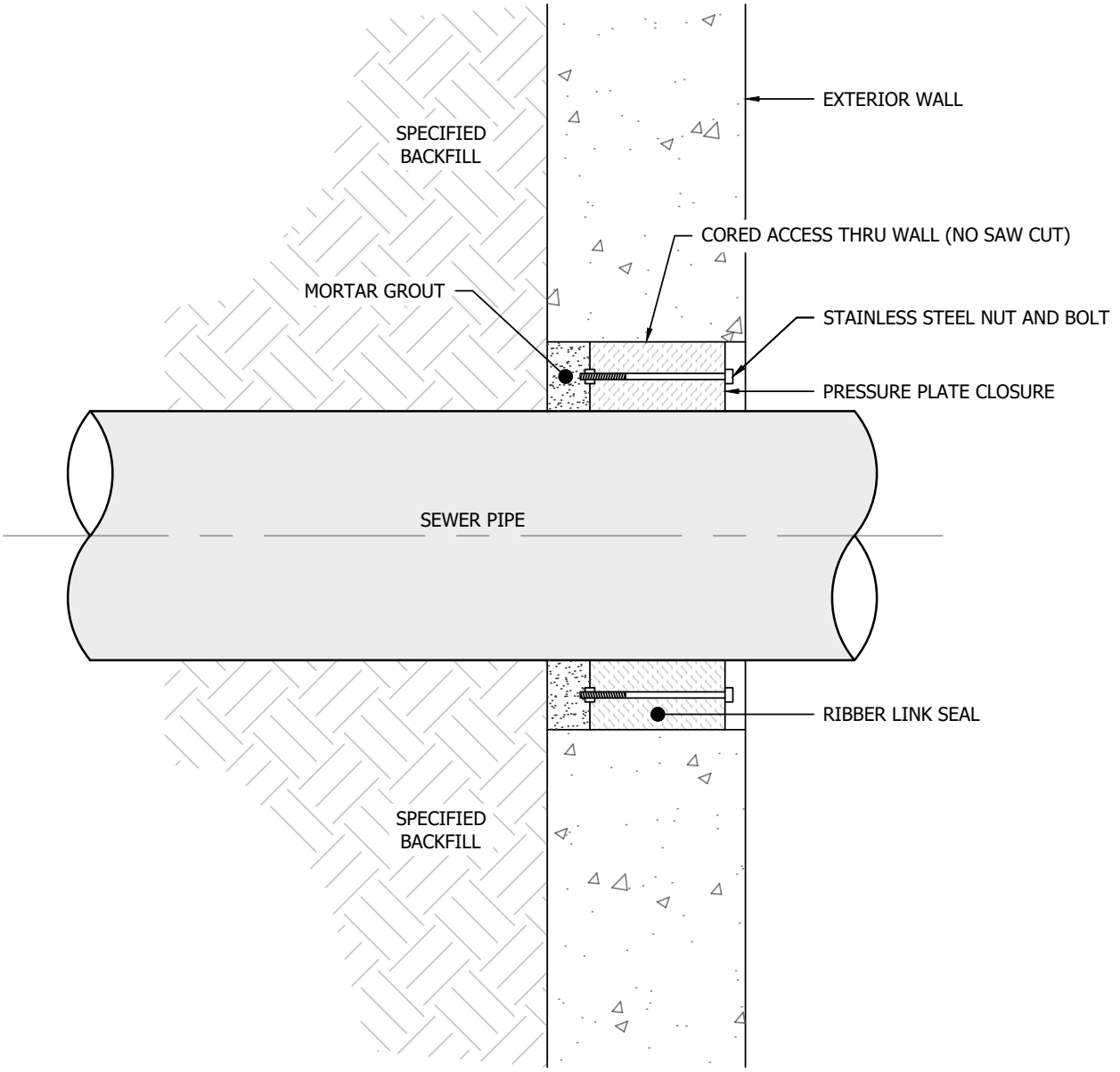
MUNCIE PUBLIC WORKS

SANITARY SEWER AND WATER MAIN SEPARATION

APPROVED: XX/XX/20XX

REVISED: XX/XX/20XX

STANDARD: **SS-923**



NOTE:

1. TO BE USED FOR WET WELL, VALVE VAULT, OR OTHER SPECIFIED EXTERIOR WALL ACCESS.

Muncie SANITARY DISTRICT

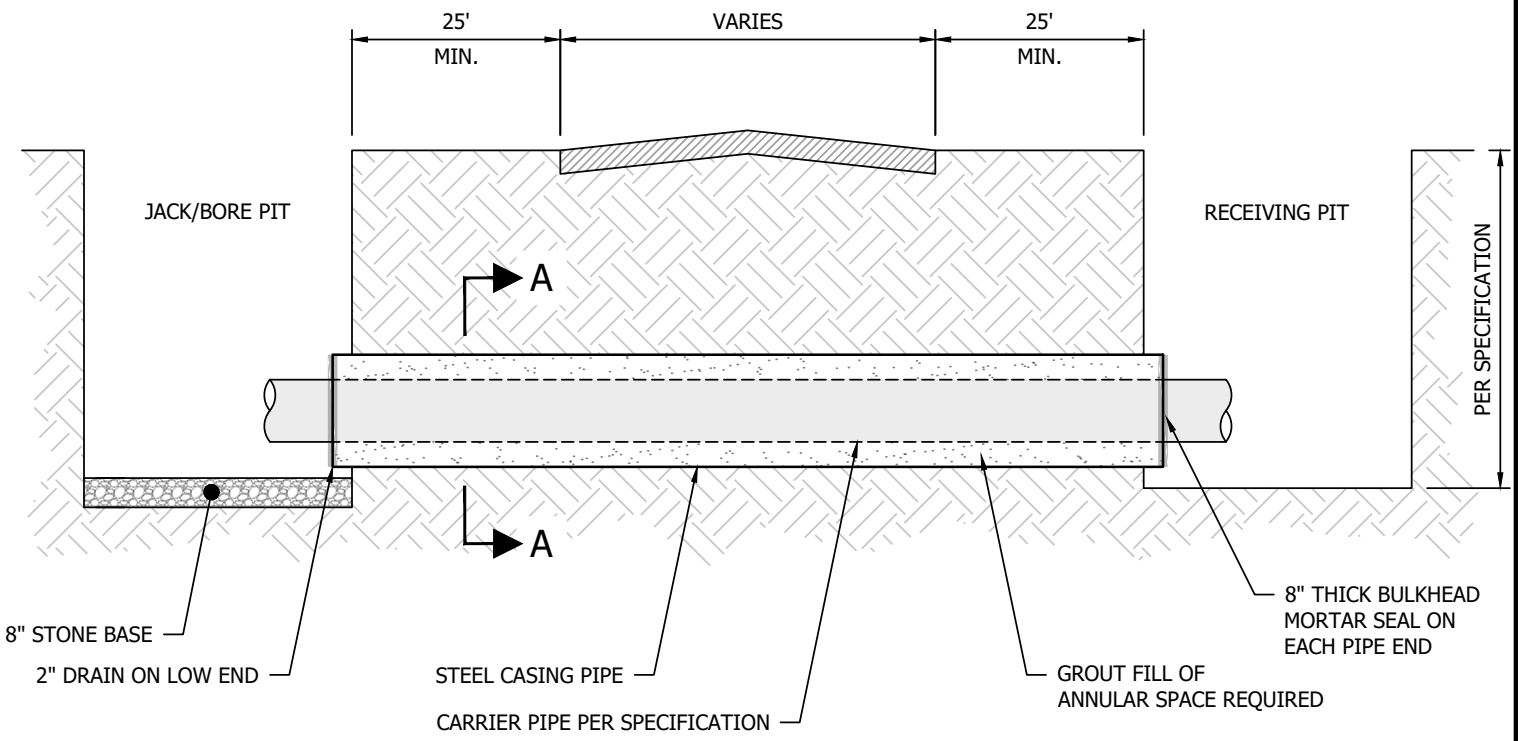
MUNCIE PUBLIC WORKS

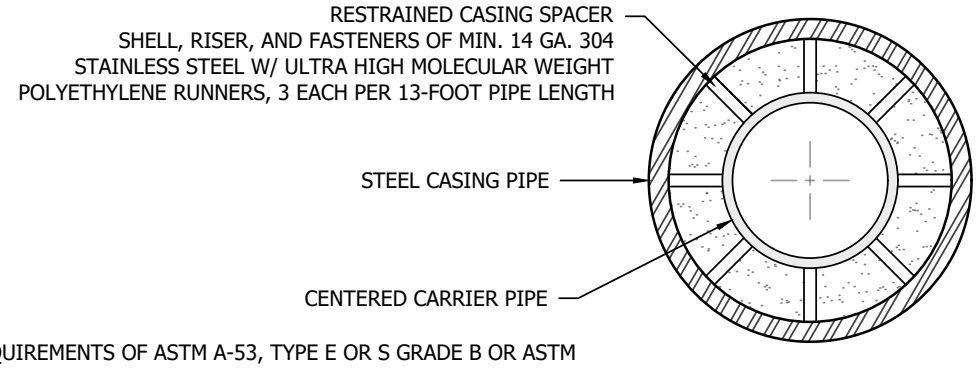
PIPE SEAL THRU EXTERIOR WALL

APPROVED: XX/XX/20XX

REVISED: XX/XX/20XX

STANDARD: **SS-924**





SECTION A-A

NOTES:

1. STEEL PIPE SHALL MEET THE REQUIREMENTS OF ASTM A-53, TYPE E OR S GRADE B OR ASTM A-139 GRADE B.

   12-INCH OR LESS STEEL CASING PIPE SHALL HAVE 0.25-INCH MINIMUM WALL THICKNESS. 48-INCH STEEL CASING PIPE SHALL HAVE A 0.625-INCH MINIMUM WALL THICKNESS.

2. STEEL CASING PIPE WALL THICKNESS SHALL MEET THE REQUIREMENTS OF INDOT AND JURISDICTIONAL RAILROADS WHEN APPLICABLE.

3. WELD ALL ENCASEMENT PIPE JOINTS. ALL JOINT WELDS SHALL BE FULL PENETRATION.

4. CASING PIPE DIAMETER EQUALS CARRIER PIPES LARGEST O.D. + 4-INCHES (O.D. + 4") MINIMUM.

5. CARRIER PIPE SHALL BE INSTALLED PER SPECIFIED GRADE. SPECIFIED INVERT ELEVATIONS SHALL NOT EXCEED ± ONE-TENTH (0.10) FEET.

6. BORE AND RECEIVING PITS SHALL BE SHORED AND BRACED PER *OSHA REQUIREMENTS*.

7. FOR RAILROAD CROSSINGS, ALL CASING PIPES SHALL EXTEND FROM RIGHT-OF-WAY LINE TO RIGHT-OF-WAY LINE PROTECTING THE ENTIRE R/W CROSSING, OR ACCORDING TO JURISDICTION OF RAILROAD REQUIREMENTS.

Muncie SANITARY DISTRICT

MUNCIE PUBLIC WORKS

CASING PIPE FOR BORE

APPROVED: XX/XX/20XX

REVISED: XX/XX/20XX

STANDARD: **SS-925**

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EDIT DATE: 10/27/2023
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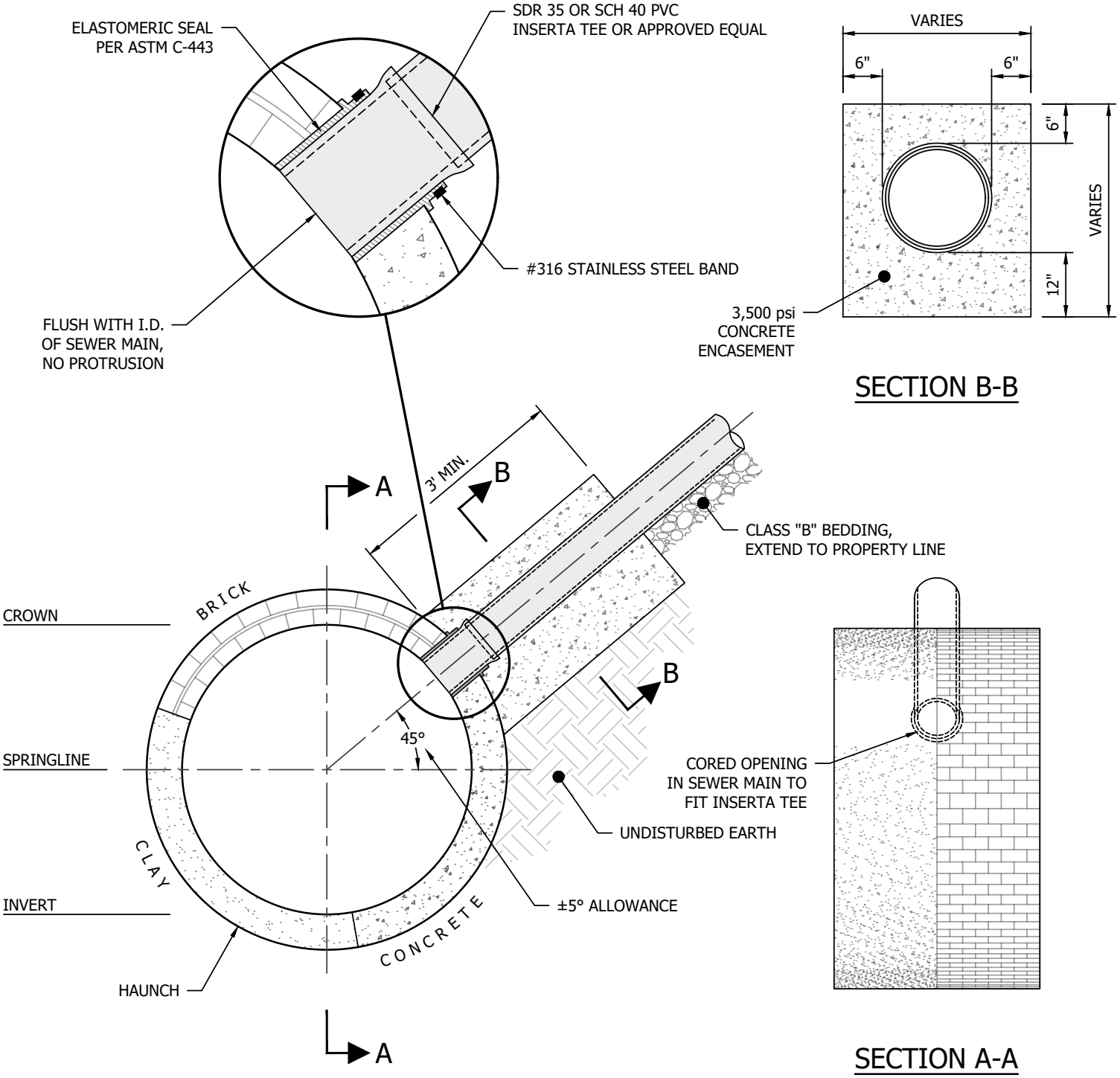

ENGINEER APPROVAL REQUIRED FOR USE

NOTE:

1. THIS DETAIL SHALL APPLY TO ALL SOLID WALL, DIRECT TAP, PIPE CONNECTIONS TO SEWER MAIN, INCLUDING, BUT NOT LIMITED TO: CONCRETE, BRICK, CLAY, DUCTILE IRON, AND PVC.

Muncie SANITARY DISTRICT

MUNCIE PUBLIC WORKS

SANITARY SERVICE DIRECT CONNECTION TO SOLID WALL SEWER

APPROVED: XX/XX/20XX

REVISED: XX/XX/20XX

STANDARD: SS-926

PLOT DATE: 10/30/2023 2:04 PM
EDIT DATE: 10/27/2023
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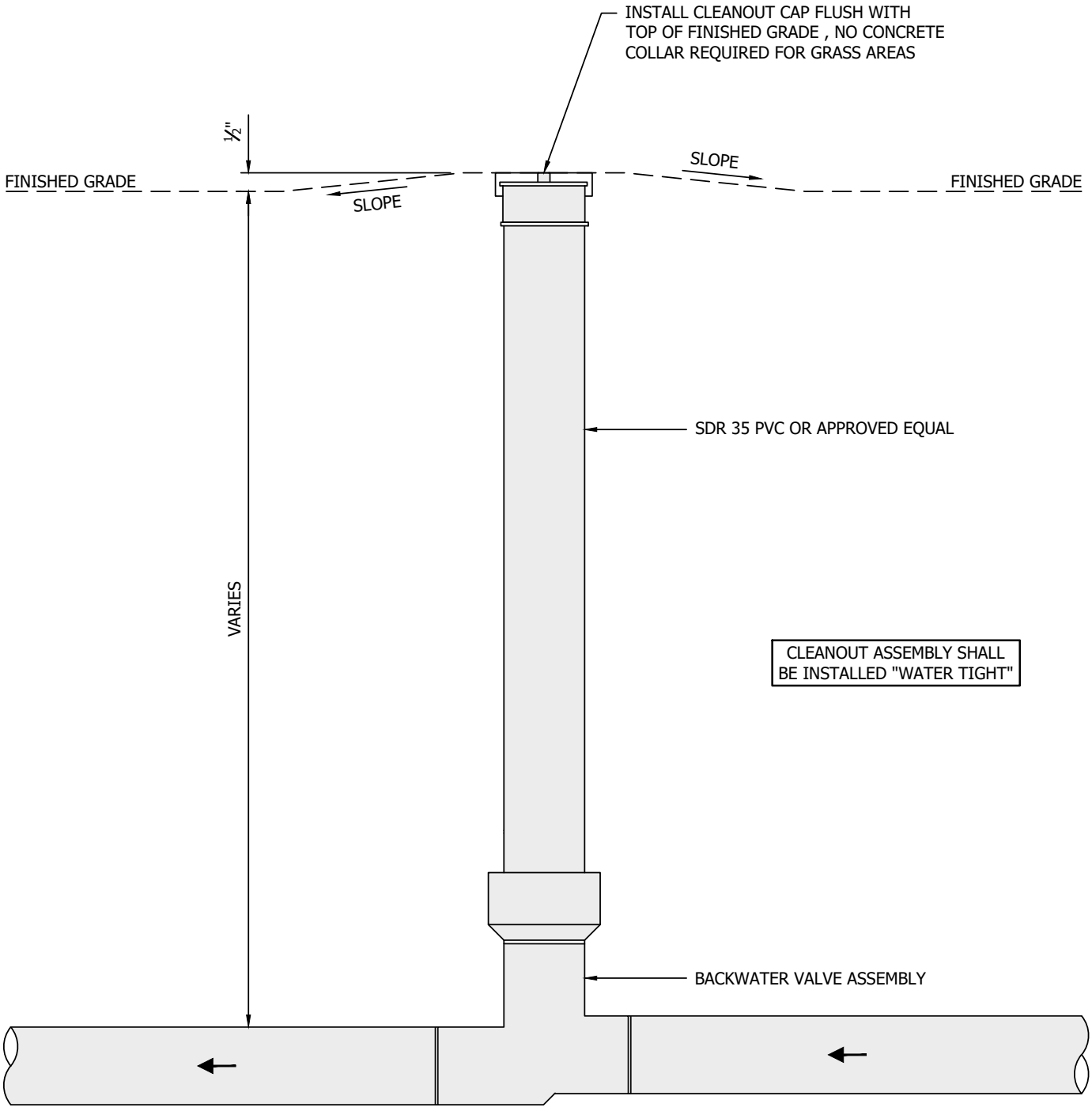


Muncie SANITARY DISTRICT

MUNCIE PUBLIC WORKS

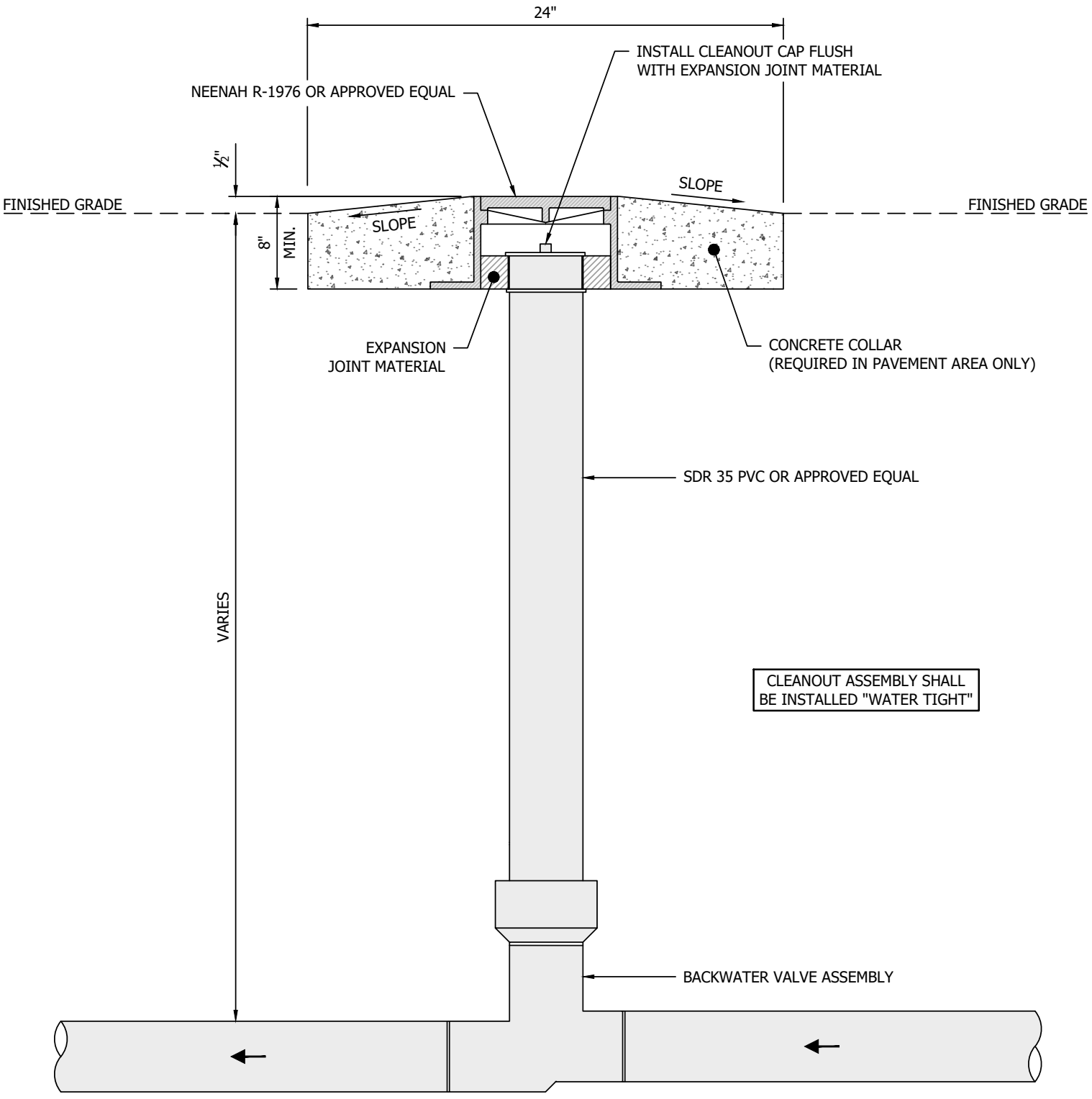
CLEANOUT BACKWATER VALVE YARD SURFACE

APPROVED: XX/XX/20XX

REVISED: XX/XX/20XX

STANDARD: **SS-927**

PLOT DATE: 10/30/2023 2:04 PM EDIT DATE: 10/27/2023 EDITED BY: PTRAWINSKI DRAWING FILE: P:\2022\01013D Drawings\Utility Infrastructure\MSD_SS_927_CLEANOUT BWV YARD SURFACE.dwg



Muncie SANITARY DISTRICT

MUNCIE PUBLIC WORKS

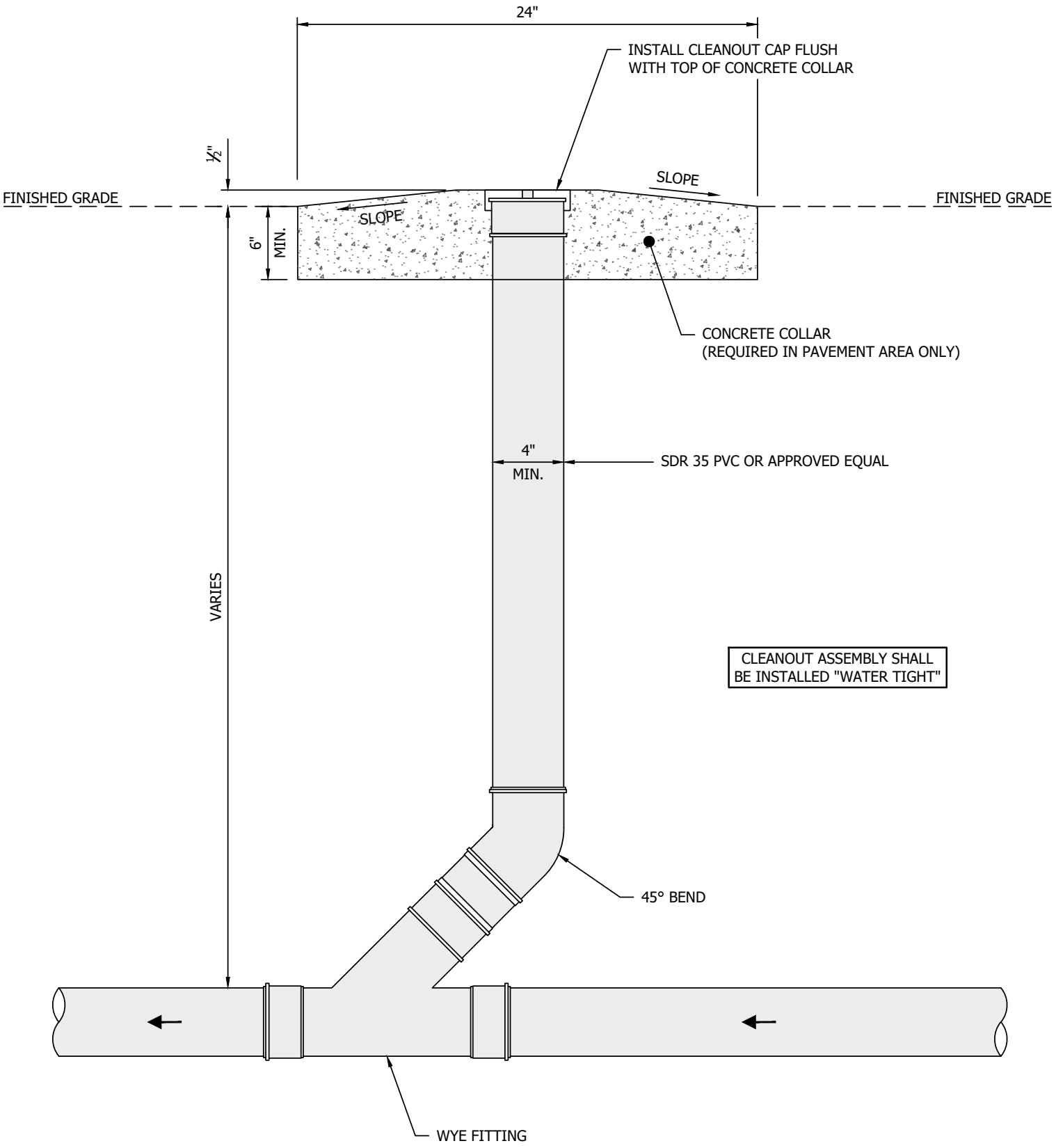
CLEANOUT BACKWATER VALVE HARD SURFACE

APPROVED: XX/XX/20XX

REVISED: XX/XX/20XX

STANDARD: **SS-928**

PLOT DATE: 10/30/2023 2:04 PM EDIT DATE: 10/27/2023 EDITED BY: PTRAWINSKI DRAWING FILE: P:\2022\01013D. Drawings\Utility Infrastructure\MSD_SS_928_CLEANOUT BWV HARD SURFACE.dwg



Muncie SANITARY DISTRICT

MUNCIE PUBLIC WORKS

CLEANOUT

APPROVED: XX/XX/20XX

REVISED: XX/XX/20XX

STANDARD: **SS-929**

PLOT DATE: 10/30/2023 2:04 PM
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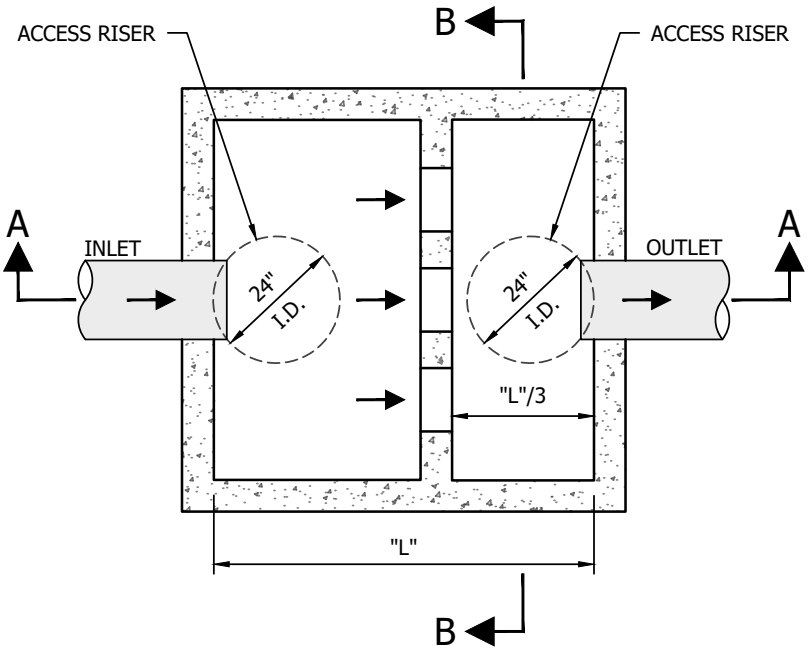
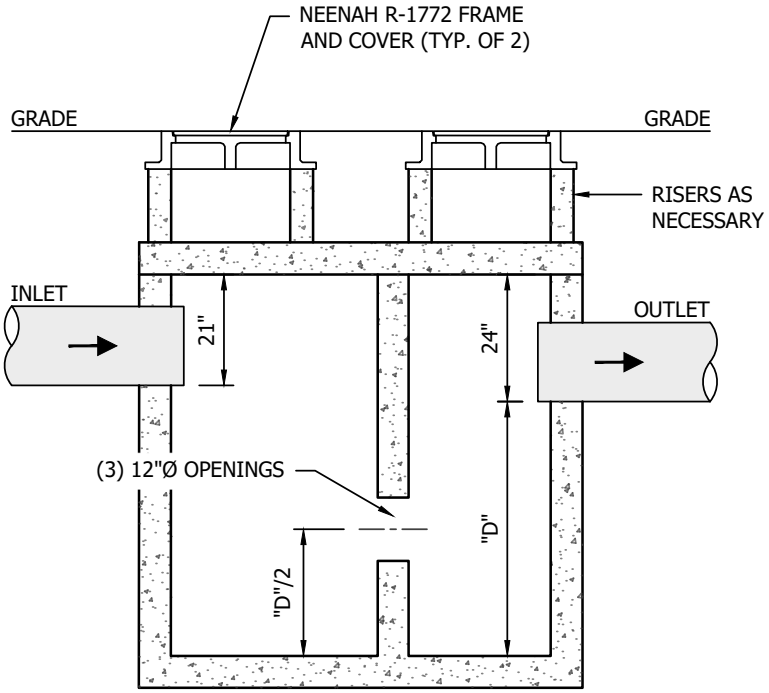


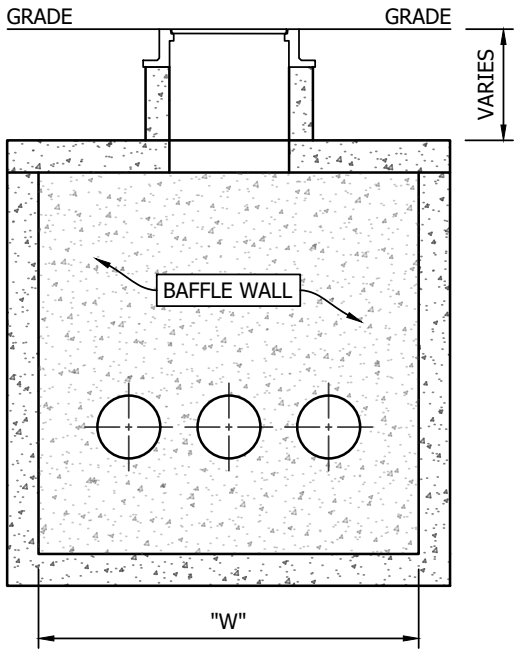
PLAN

TYPICAL DIMENSIONS			
CAPACITY (GALLONS)	D (FT.)	W (FT.)	L (FT.)
1,000	4	6	6
1,500	4	5	6

7,500	TO	30,000 SQ. FT. DRAINAGE AREA USE 1,000 GAL.
30,000	TO	40,000 SQ. FT. DRAINAGE AREA USE 1,500 GAL.



SECTION A-A



SECTION B-B

Muncie SANITARY DISTRICT

MUNCIE PUBLIC WORKS

OIL AND PARTICLE SEPARATOR

APPROVED: XX/XX/20XX

REVISED: XX/XX/20XX

STANDARD: **SS-930**

PLOT DATE: 10/30/2023 2:04 PM
EDIT DATE: 10/27/2023
EDITED BY: PTRAWINSKI
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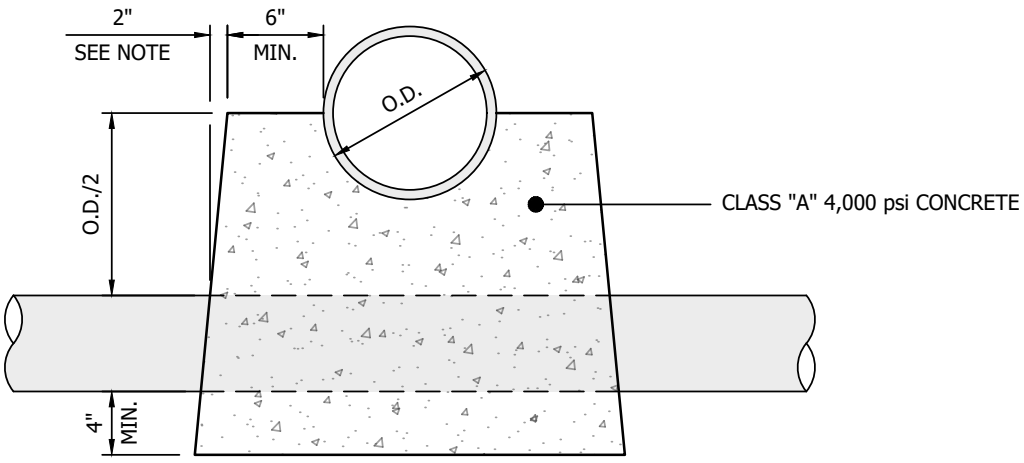

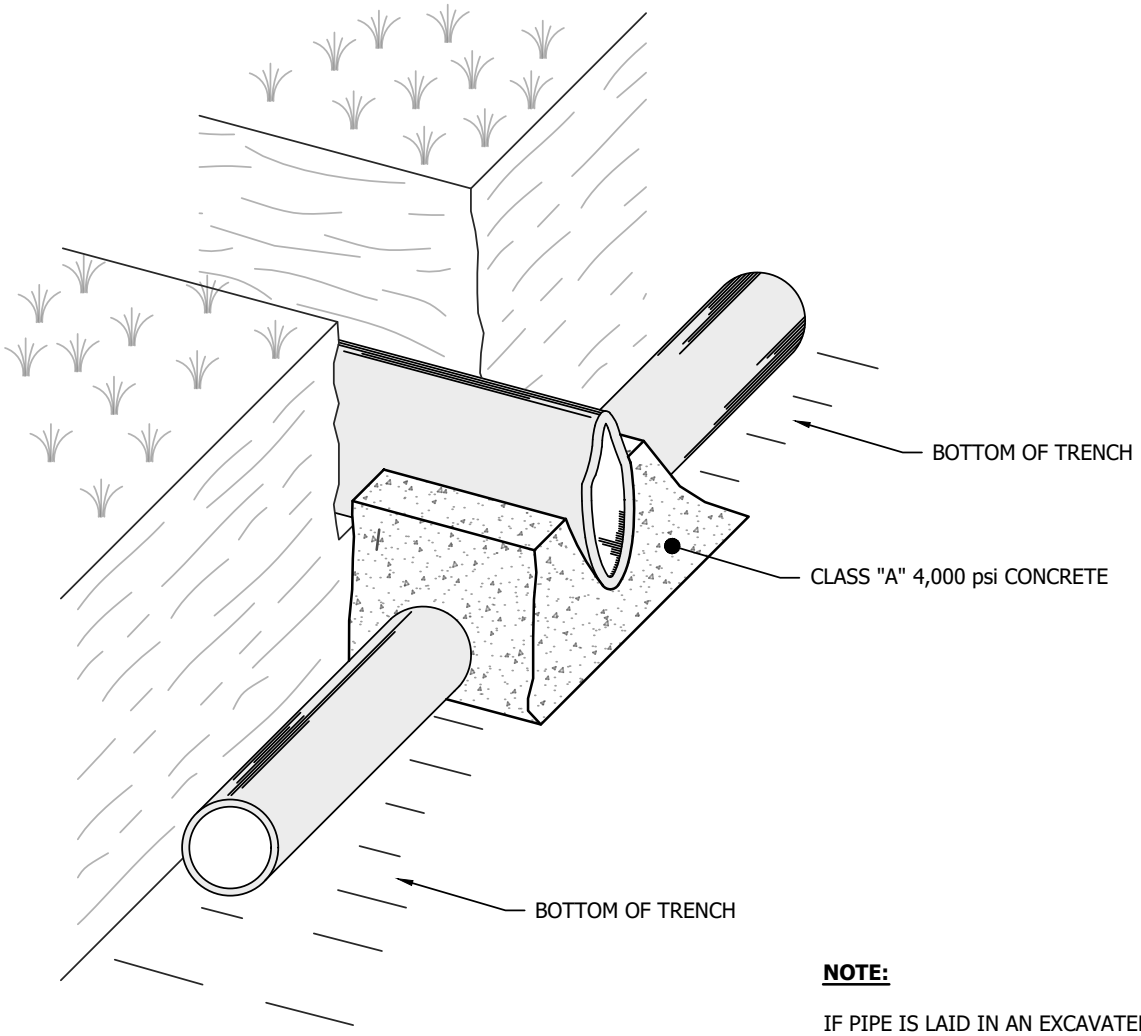

NOTE:

IF PIPE IS LAID IN AN EXCAVATED TRENCH, THE SIDEWALLS OF THE TRENCH MAY BECOME THE FORM OF THE CRADLE.

Muncie SANITARY DISTRICT

MUNCIE PUBLIC WORKS

CONCRETE CRADLE

APPROVED: XX/XX/20XX

REVISED: XX/XX/20XX

STANDARD: **SS-931**

PLOT DATE: 10/30/2023 2:04 PM
EDIT DATE: 10/27/2023
EDITED BY: PTRAWINSKI
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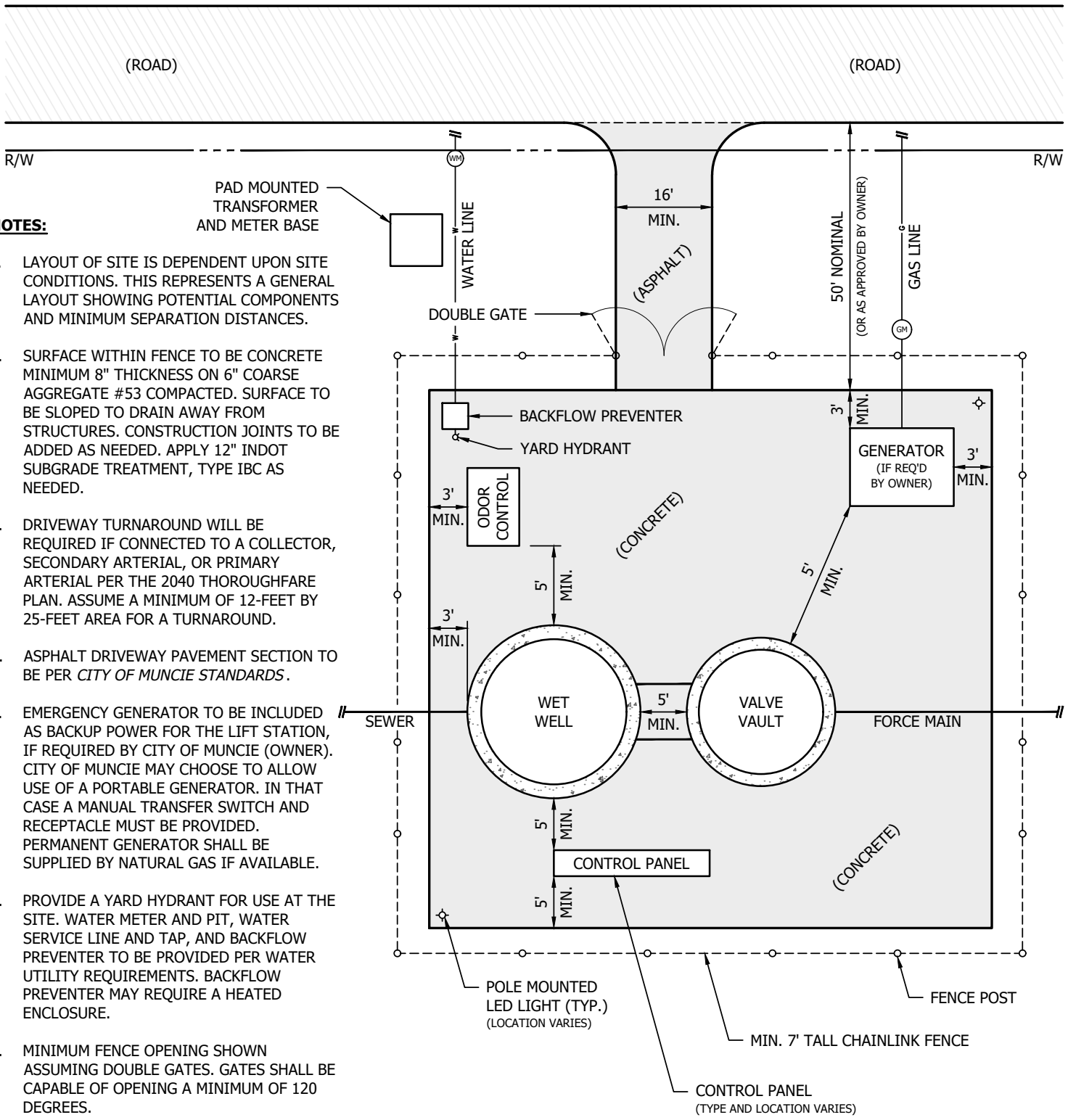

NOTES:

1. LAYOUT OF SITE IS DEPENDENT UPON SITE CONDITIONS. THIS REPRESENTS A GENERAL LAYOUT SHOWING POTENTIAL COMPONENTS AND MINIMUM SEPARATION DISTANCES.
2. SURFACE WITHIN FENCE TO BE CONCRETE MINIMUM 8" THICKNESS ON 6" COARSE AGGREGATE #53 COMPACTED. SURFACE TO BE SLOPED TO DRAIN AWAY FROM STRUCTURES. CONSTRUCTION JOINTS TO BE ADDED AS NEEDED. APPLY 12" INDOT SUBGRADE TREATMENT, TYPE IBC AS NEEDED.
3. DRIVEWAY TURNAROUND WILL BE REQUIRED IF CONNECTED TO A COLLECTOR, SECONDARY ARTERIAL, OR PRIMARY ARTERIAL PER THE 2040 THOROUGHFARE PLAN. ASSUME A MINIMUM OF 12-FEET BY 25-FEET AREA FOR A TURNAROUND.
4. ASPHALT DRIVEWAY PAVEMENT SECTION TO BE PER *CITY OF MUNCIE STANDARDS*.
5. EMERGENCY GENERATOR TO BE INCLUDED AS BACKUP POWER FOR THE LIFT STATION, IF REQUIRED BY CITY OF MUNCIE (OWNER). CITY OF MUNCIE MAY CHOOSE TO ALLOW USE OF A PORTABLE GENERATOR. IN THAT CASE A MANUAL TRANSFER SWITCH AND RECEPTACLE MUST BE PROVIDED. PERMANENT GENERATOR SHALL BE SUPPLIED BY NATURAL GAS IF AVAILABLE.
6. PROVIDE A YARD HYDRANT FOR USE AT THE SITE. WATER METER AND PIT, WATER SERVICE LINE AND TAP, AND BACKFLOW PREVENTER TO BE PROVIDED PER WATER UTILITY REQUIREMENTS. BACKFLOW PREVENTER MAY REQUIRE A HEATED ENCLOSURE.
7. MINIMUM FENCE OPENING SHOWN ASSUMING DOUBLE GATES. GATES SHALL BE CAPABLE OF OPENING A MINIMUM OF 120 DEGREES.
8. ONE (1) POLE MOUNTED LED LIGHT REQUIRED. LOCATION MAY VARY.
9. ANY PLANTINGS ON THE EXTERIOR ARE TO BE A MINIMUM OF 5-FEET FROM THE FENCE.
10. CONTROL PANEL SHALL MEET THE REQUIREMENTS SPECIFIED IN *SECTION 1015 OF THE CITY OF MUNCIE DESIGN MANUAL.*

PLOT DATE: 10/30/2023 2:04 PM
EDIT DATE: 10/27/2023
EDITED BY: PTRAWINSKI
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Muncie SANITARY DISTRICT

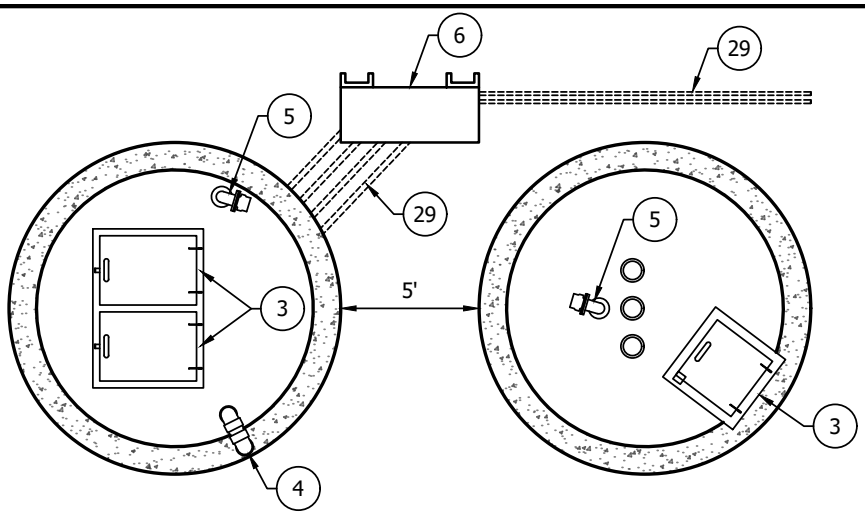
MUNCIE PUBLIC WORKS

PUMP STATION SITE LAYOUT

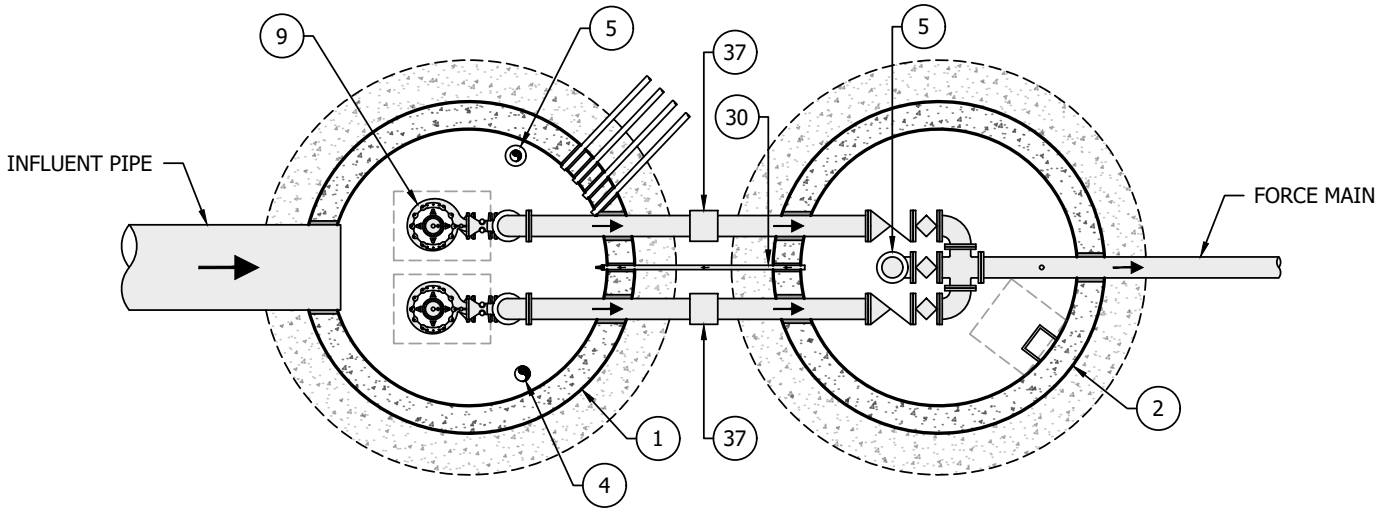
APPROVED: XX/XX/20XX

REVISED: XX/XX/20XX

STANDARD: **SS-932**



PLAN VIEW ABOVE SLAB



PLAN VIEW BELOW SLAB

(X) **PUMP STATION KEY**

1. WET WELL MIN 60" DIAMETER
2. VALVE VAULT, MIN 60" DIAMETER
3. ALUMINUM ACCESS HATCH W/ FALL PROTECTION
4. 6" PVC VENT W/ SCREEN AND PASSIVE ODOR CONTROL DEVICE
5. D.I. BYPASS PIPE W/ D.I. 90° BEND & CAM AND GROOVE CONNECTION
6. NEMA 4X STAINLESS STEEL CONTROL PANEL. PANEL SHALL BE MIN. 5' FROM ANY OPENING OR OBSTRUCTION
7. LEVEL DEVICE
8. REDUNDANT FLOAT BACK-UP
9. SUBMERSIBLE PUMP
10. CONCRETE FILLETS
11. FORCE MAIN, DUCTILE IRON, RESTRAINED JOINTS
12. CHECK VALVE, SWING TYPE, LEVER WEIGHT OPERATED
13. RESILIENT WEDGE ISOLATION VALVE
14. SEAL OPENING W/ LINK SEAL (TYP. ALL PIPE PENETRATIONS)
15. LOWEST PIPE INVERT (HIGH ALARM ON)
16. PIPE SUPPORT, PER DETAIL (TYP. 3 PER PIPE SECTION)
17. PIPE SUPPORT, SEE DETAIL
18. S.S. STEM W/ OPERATOR NUT 1/2" BELOW CONCRETE SLAB AND S.S COVERS AND FASTENERS.
19. TOP OF STRUCTURE, MIN. 6", MAX. 12" ABOVE FINISH GRADE
20. S.S. GUIDE RAIL
21. MONOLITHIC BASE
22. ANTI-FLOTATION EXTENSIONS (AS REQUIRED)
23. BACKFLOW PREVENTER / DUCKBILL
24. VENTED JUNCTION BOX
25. SEPARATE CONDUITS FOR EACH PUMP
26. CABLE HANGER
27. S.S. LIFTING CABLE SIZED TO THE WEIGHT OF THE PUMP
28. FORCE MAIN TRANSITION FITTING FROM DUCTILE IRON TO ALTERNATE MATERIAL
29. CONDUIT PUMP TO JUNCTION BOX - PVC COATED RGS
30. PVC DRAIN PIPE, MAINTAIN 1/4" PER FOOT INTO WET WELL
31. SLOPE FLOOR TO DRAIN 1/4" PER FOOT
32. INTERMEDIATE GUIDE RAIL SUPPORT
33. FIBERGLASS REINFORCED POLYPROPYLENE MANHOLE STEPS AT 16" ON CENTER
34. SUMP PUMP
35. 6' HIGH CHAIN LINK FENCE WITH BARBED WIRE
36. EPOXY CONDUIT SEALS
37. FLEXIBLE COUPLING (TYP.)

Muncie SANITARY DISTRICT

MUNCIE PUBLIC WORKS

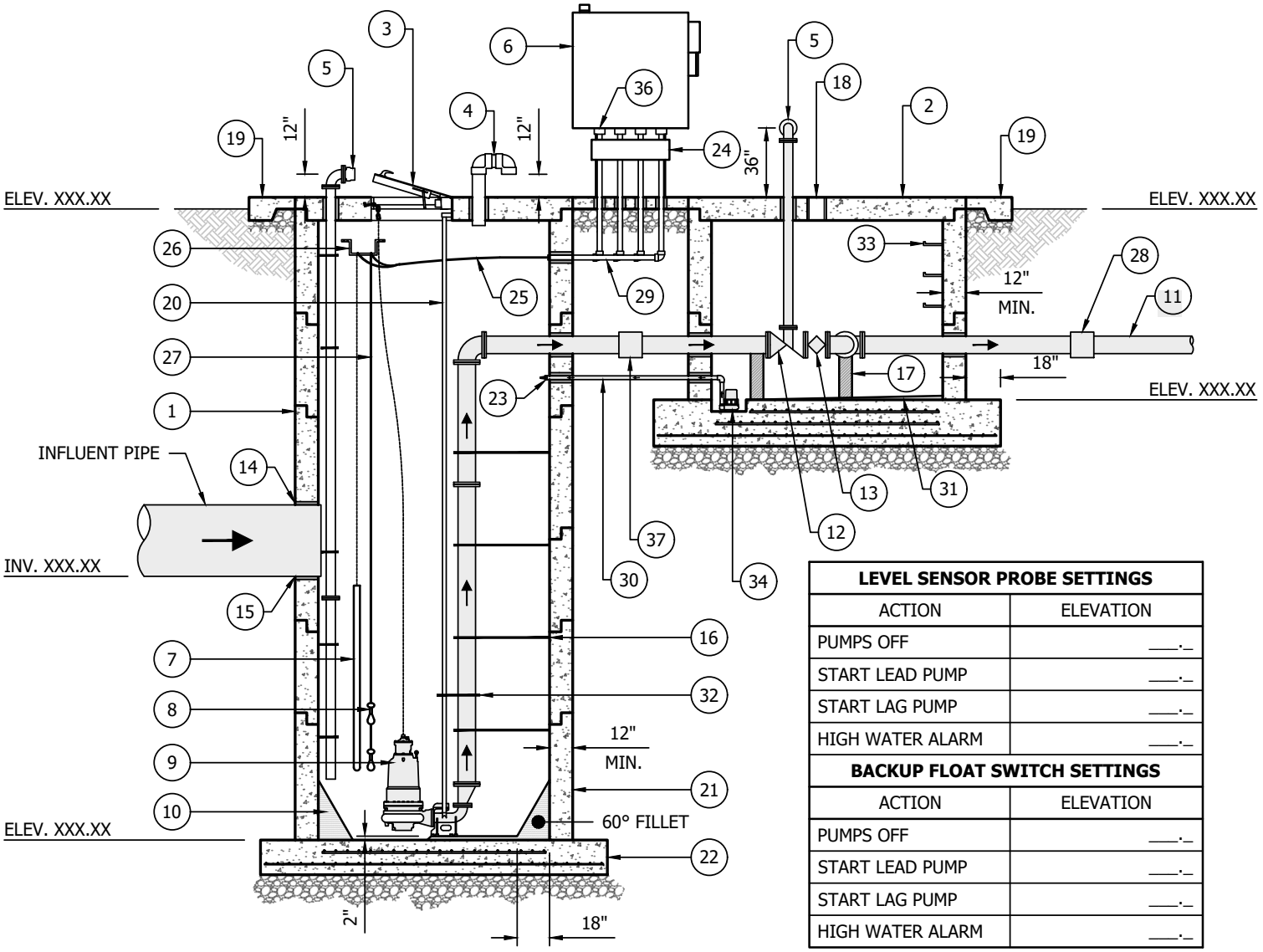
PUMP STATION DUPLEX

APPROVED: XX/XX/20XX

REVISED: XX/XX/20XX

STANDARD: **SS-933**

PLOT DATE: 10/30/2023 2:04 PM
EDIT DATE: 10/27/2023
EDITED BY: PTRAWINSKI
DRAWING FILE: P:\2022\01013D. Drawings\Utility Infrastructure\MSD_SS_933_PUMP STATION DUPLEX.dwg



SECTION VIEW

LEVEL SENSOR PROBE SETTINGS	
ACTION	ELEVATION
PUMPS OFF	___._
START LEAD PUMP	___._
START LAG PUMP	___._
HIGH WATER ALARM	___._
BACKUP FLOAT SWITCH SETTINGS	
ACTION	ELEVATION
PUMPS OFF	___._
START LEAD PUMP	___._
START LAG PUMP	___._
HIGH WATER ALARM	___._

FLOOD ELEVATIONS	
100 YEAR	___._

(X) PUMP STATION KEY

1. WET WELL MIN 60" DIAMETER
2. VALVE VAULT, MIN 60" DIAMETER
3. ALUMINUM ACCESS HATCH W/ FALL PROTECTION
4. 6" PVC VENT W/ SCREEN AND PASSIVE ODOR CONTROL DEVICE
5. D.I. BYPASS PIPE W/ D.I. 90° BEND & CAM AND GROOVE CONNECTION
6. NEMA 4X STAINLESS STEEL CONTROL PANEL. PANEL SHALL BE MIN. 5' FROM ANY OPENING OR OBSTRUCTION
7. LEVEL DEVICE
8. REDUNDANT FLOAT BACK-UP
9. SUBMERSIBLE PUMP
10. CONCRETE FILLETS
11. FORCE MAIN, DUCTILE IRON, RESTRAINED JOINTS
12. CHECK VALVE, SWING TYPE, LEVER WEIGHT OPERATED
13. RESILIENT WEDGE ISOLATION VALVE
14. SEAL OPENING W/ LINK SEAL (TYP. ALL PIPE PENETRATIONS)
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16. PIPE SUPPORT, PER DETAIL
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32. INTERMEDIATE GUIDE RAIL SUPPORT
33. FIBERGLASS REINFORCED POLYPROPYLENE MANHOLE STEPS AT 16" ON CENTER
34. SUMP PUMP
35. 6' HIGH CHAIN LINK FENCE WITH BARBED WIRE
36. EPOXY CONDUIT SEALS
37. FLEXIBLE COUPLING (TYP.)

Muncie SANITARY DISTRICT

MUNCIE PUBLIC WORKS

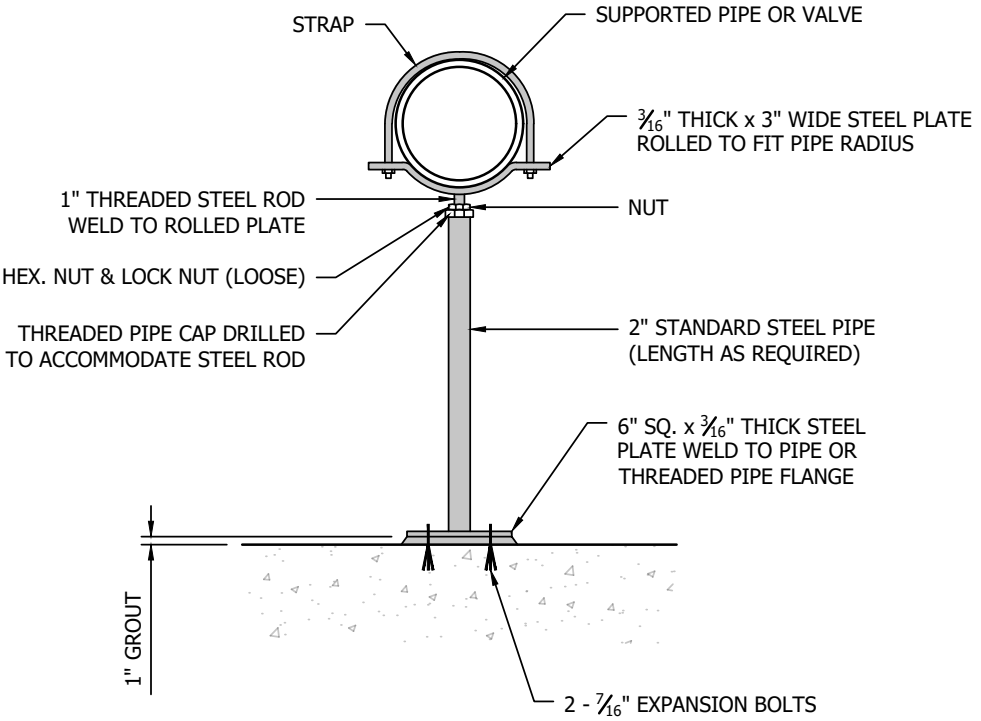
PUMP STATION DUPLEX

APPROVED: XX/XX/20XX

REVISED: XX/XX/20XX

STANDARD: **SS-933**

PLOT DATE: 10/30/2023 2:04 PM
EDIT DATE: 10/27/2023
EDITED BY: PTRAWINSKI
DRAWING FILE: P:\2022\01013D. Drawings\Utility Infrastructure\MSD_SS_933_PUMP STATION DUPLEX.dwg



NOTES:

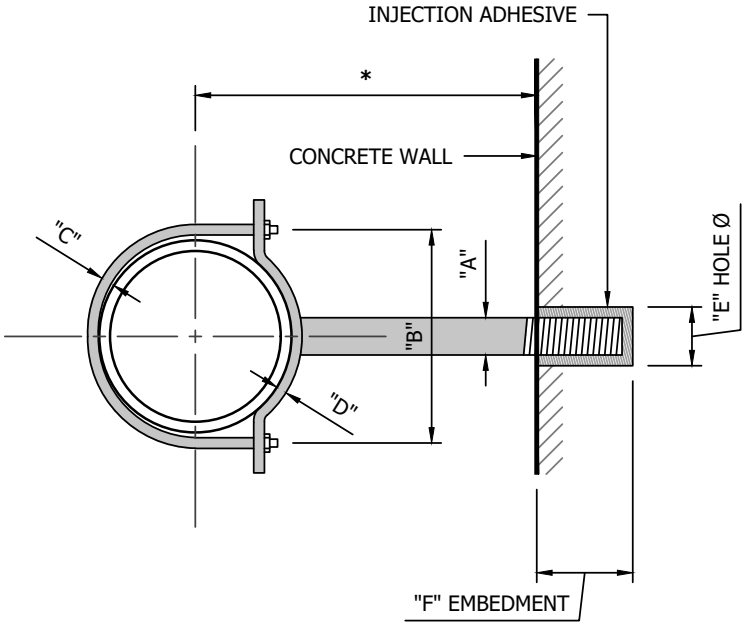
1. PIPE SUPPORTS SHALL BE SPACED NO MORE THAN 12-FEET ON CENTER.
2. PIPE TO BE SUPPORTED EACH SIDE OF VALVES, FLOW METERS, AND COUPLINGS.

ADJUSTABLE PIPE SUPPORT

NOTES:

1. CONTRACTOR SHALL DETERMINE DIMENSION * PER PUMP MANUFACTURER'S INSTALLATION INSTRUCTIONS.
2. PIPE SUPPORTS SHALL BE CARBON STEEL, COATED WITH 14 MIL COAL TAR EPOXY.
3. INJECTION ADHESIVE SHALL BE HIT HY 150 BY HILTI OR APPROVED EQUAL. INSTALL PER HILTI INSTALLATION INSTRUCTIONS FOR ROD INSTALLATION.
4. PIPE SUPPORT SHALL BE GRINNEL FIGURE 191 OR APPROVED EQUAL.

PIPE SUPPORT DIMENSIONS						
PIPE SIZE	A	B	C	D	E	F
4"	7/8"	5 1/4"	5/8"	1/4"x1 1/4"	1 1/16"	6"
8"	1"	9 3/8"	5/8"	3/8"x1 1/2"	1 1/16"	6"
12"	1 1/14"	13 1/2"	5/8"	5/8"x2"	1 1/16"	6"



PIPE SUPPORT

Muncie SANITARY DISTRICT

MUNCIE PUBLIC WORKS

PUMP STATION PIPE SUPPORTS

APPROVED: XX/XX/20XX

REVISED: XX/XX/20XX

STANDARD: **SS-934**

PLOT DATE: 10/30/2023 2:04 PM
EDIT DATE: 10/30/2023
EDITED BY: PTRAWINSKI
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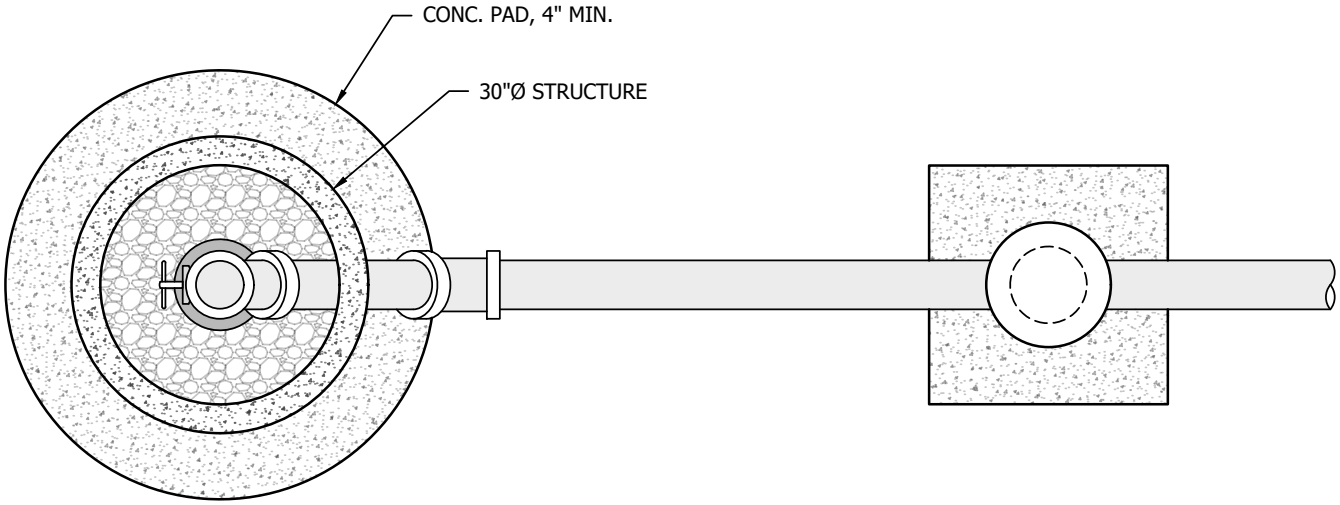
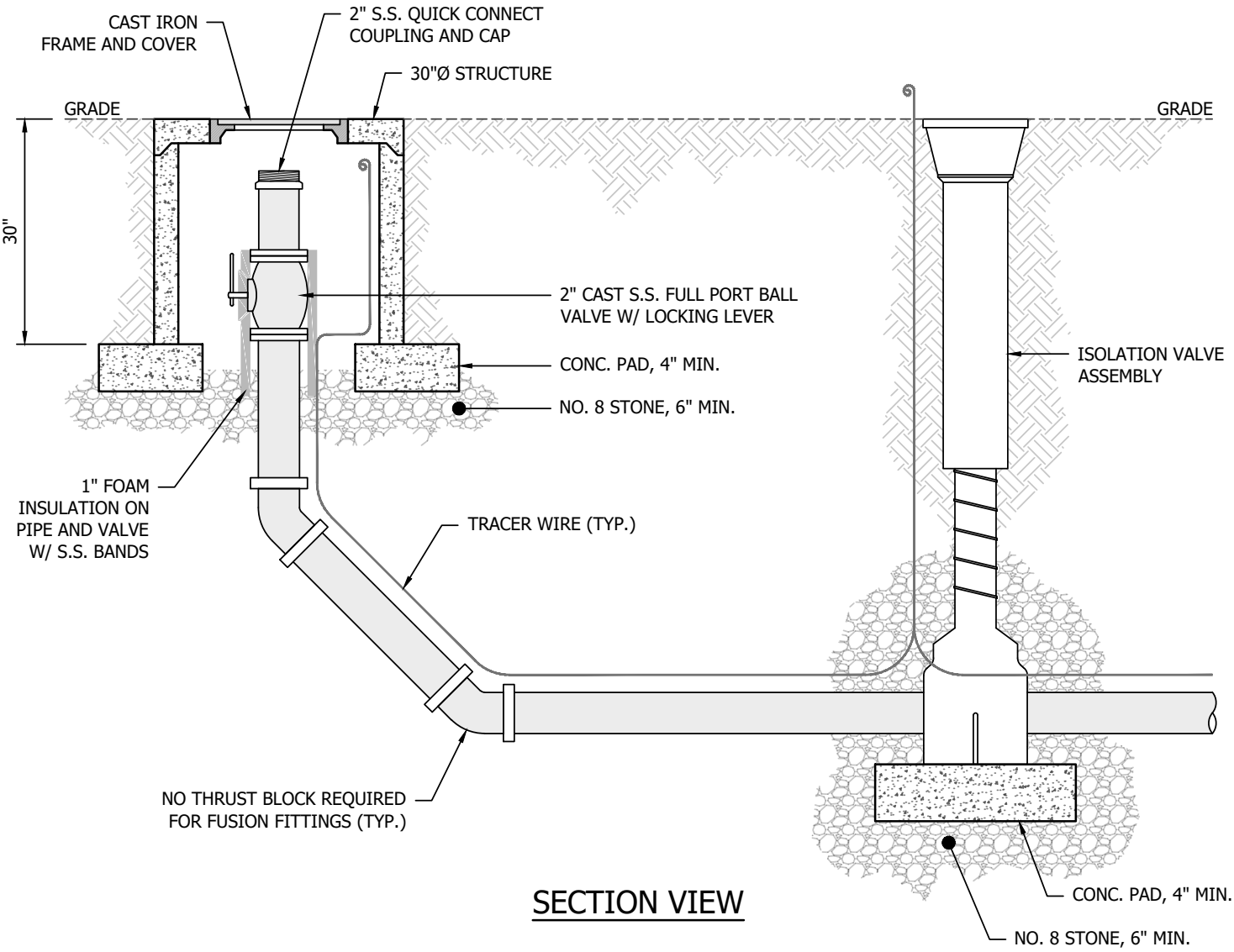


PLAN VIEW



SECTION VIEW

Muncie SANITARY DISTRICT

MUNCIE PUBLIC WORKS

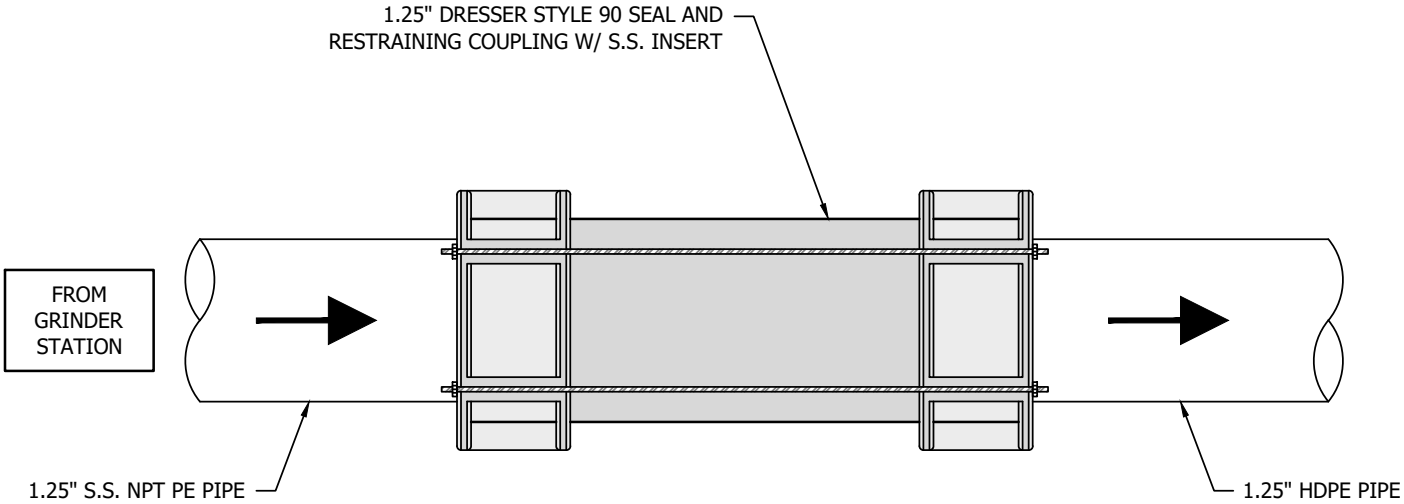
FLUSHING CONNECTION TYPE 1

APPROVED: XX/XX/20XX

REVISED: XX/XX/20XX

STANDARD: SS-935

PLOT DATE: 10/30/2023 2:04 PM
EDIT DATE: 10/30/2023
EDITED BY: PTRAWINSKI
DRAWING FILE: P:\2022\01013D. Drawings\Utility Infrastructure\MSD_SS_935_FLUSHING CONNECTION TYPE 1.dwg



Muncie SANITARY DISTRICT

MUNCIE PUBLIC WORKS

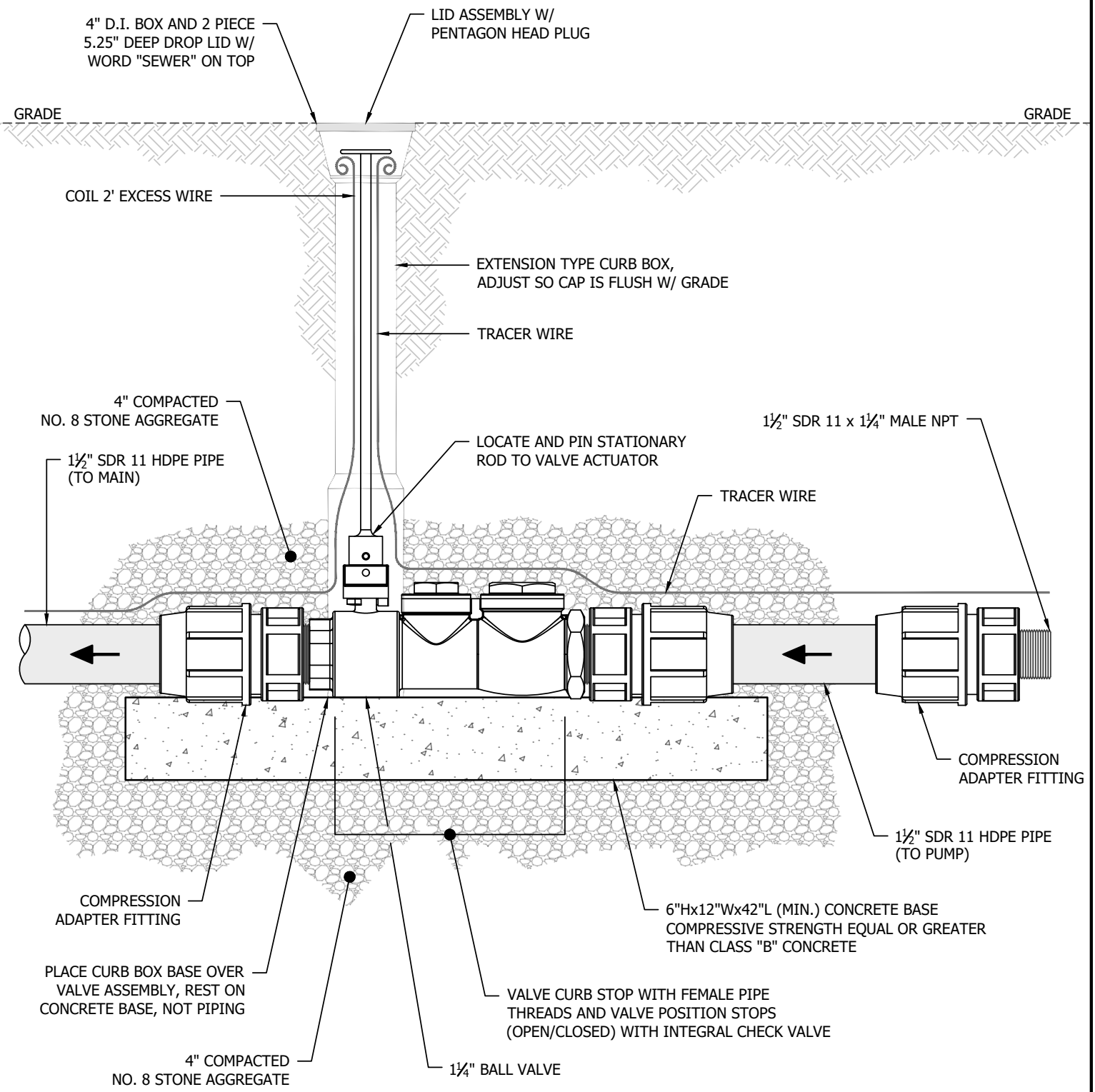
GRINDER PUMP CONNECTION

APPROVED: XX/XX/20XX

REVISED: XX/XX/20XX

STANDARD: **SS-936**

PLOT DATE: 10/30/2023 2:04 PM EDIT DATE: 10/27/2023 EDITED BY: PTRAWINSKI DRAWING FILE: P:\2022\01013D. Drawings\Utility Infrastructure\MSD_SS_936_GRINDER PUMP CONNECTION.dwg



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EDIT DATE: 10/27/2023
EDITED BY: PTRAWINSKI
DRAWING FILE: P:\2022\01013D. Drawings\Utility Infrastructure\MSD_SS_937_GRINDER PUMP CURB STOP ASSEMBLY.dwg

Muncie SANITARY DISTRICT

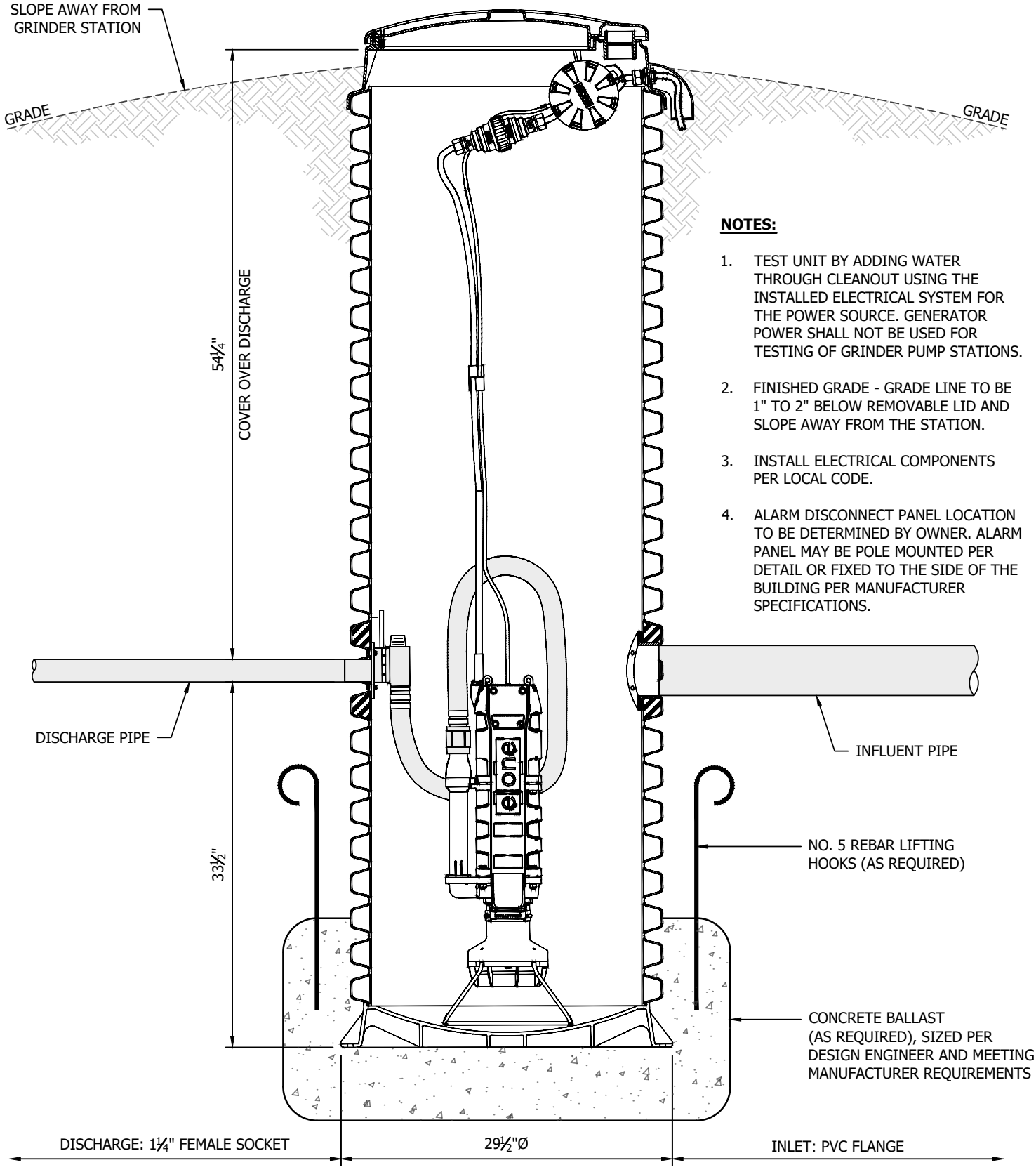
MUNCIE PUBLIC WORKS

GRINDER PUMP CURB STOP ASSEMBLY

APPROVED: XX/XX/20XX

REVISED: XX/XX/20XX

STANDARD: **SS-937**



NOTES:

1. TEST UNIT BY ADDING WATER THROUGH CLEANOUT USING THE INSTALLED ELECTRICAL SYSTEM FOR THE POWER SOURCE. GENERATOR POWER SHALL NOT BE USED FOR TESTING OF GRINDER PUMP STATIONS.
2. FINISHED GRADE - GRADE LINE TO BE 1" TO 2" BELOW REMOVABLE LID AND SLOPE AWAY FROM THE STATION.
3. INSTALL ELECTRICAL COMPONENTS PER LOCAL CODE.
4. ALARM DISCONNECT PANEL LOCATION TO BE DETERMINED BY OWNER. ALARM PANEL MAY BE POLE MOUNTED PER DETAIL OR FIXED TO THE SIDE OF THE BUILDING PER MANUFACTURER SPECIFICATIONS.

E-ONE W-SERIES WH1101-92 / WR101-92

Muncie SANITARY DISTRICT

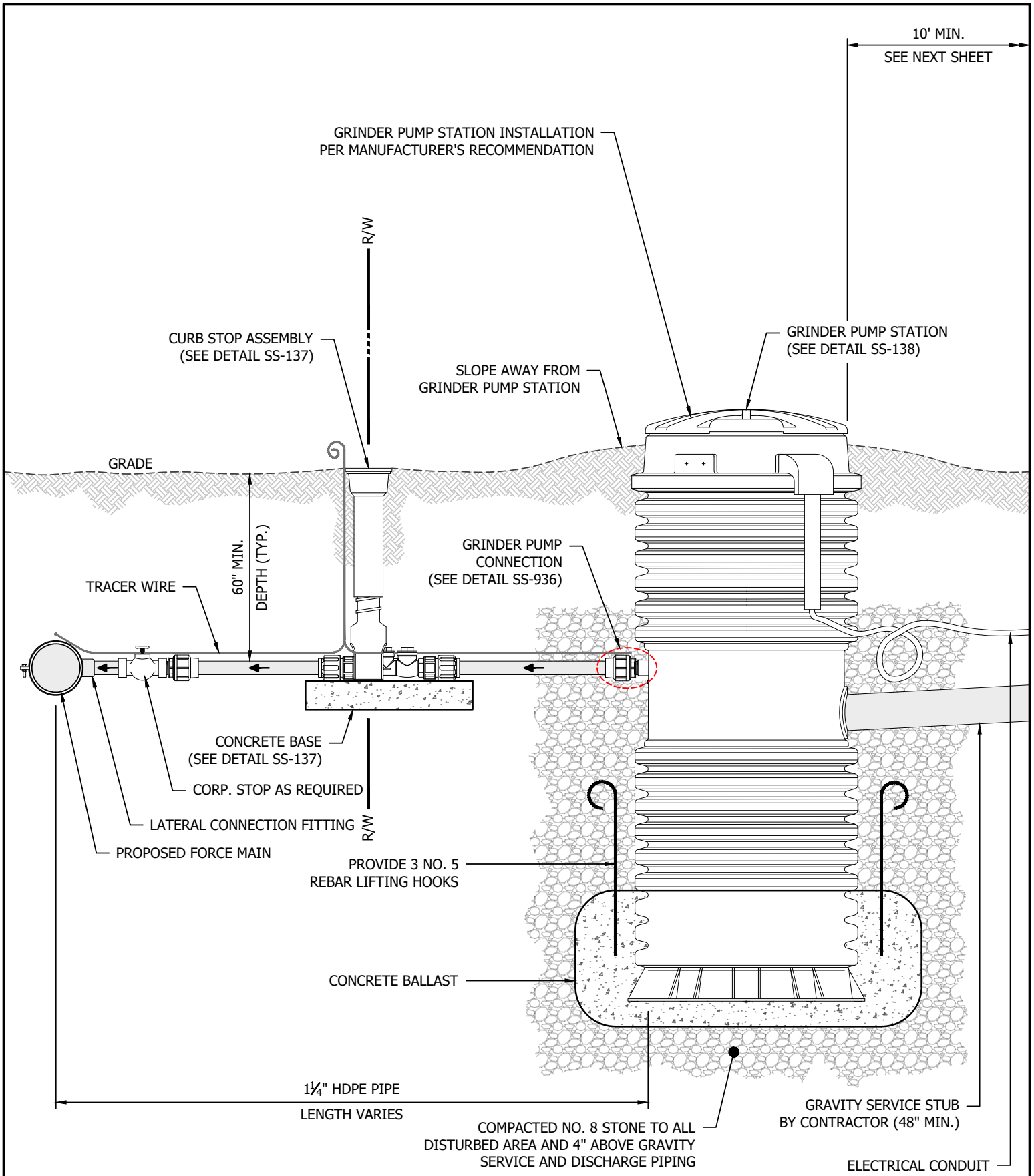
MUNCIE PUBLIC WORKS

GRINDER PUMP

APPROVED: XX/XX/20XX

REVISED: XX/XX/20XX

STANDARD: **SS-937**



Muncie SANITARY DISTRICT

MUNCIE PUBLIC WORKS

GRINDER PUMP INSTALLATION

APPROVED: XX/XX/20XX

REVISED: XX/XX/20XX

STANDARD: **SS-939**

PLOT DATE: 10/30/2023 2:05 PM
EDIT DATE: 10/30/2023
EDITED BY: PTRAWINSKI
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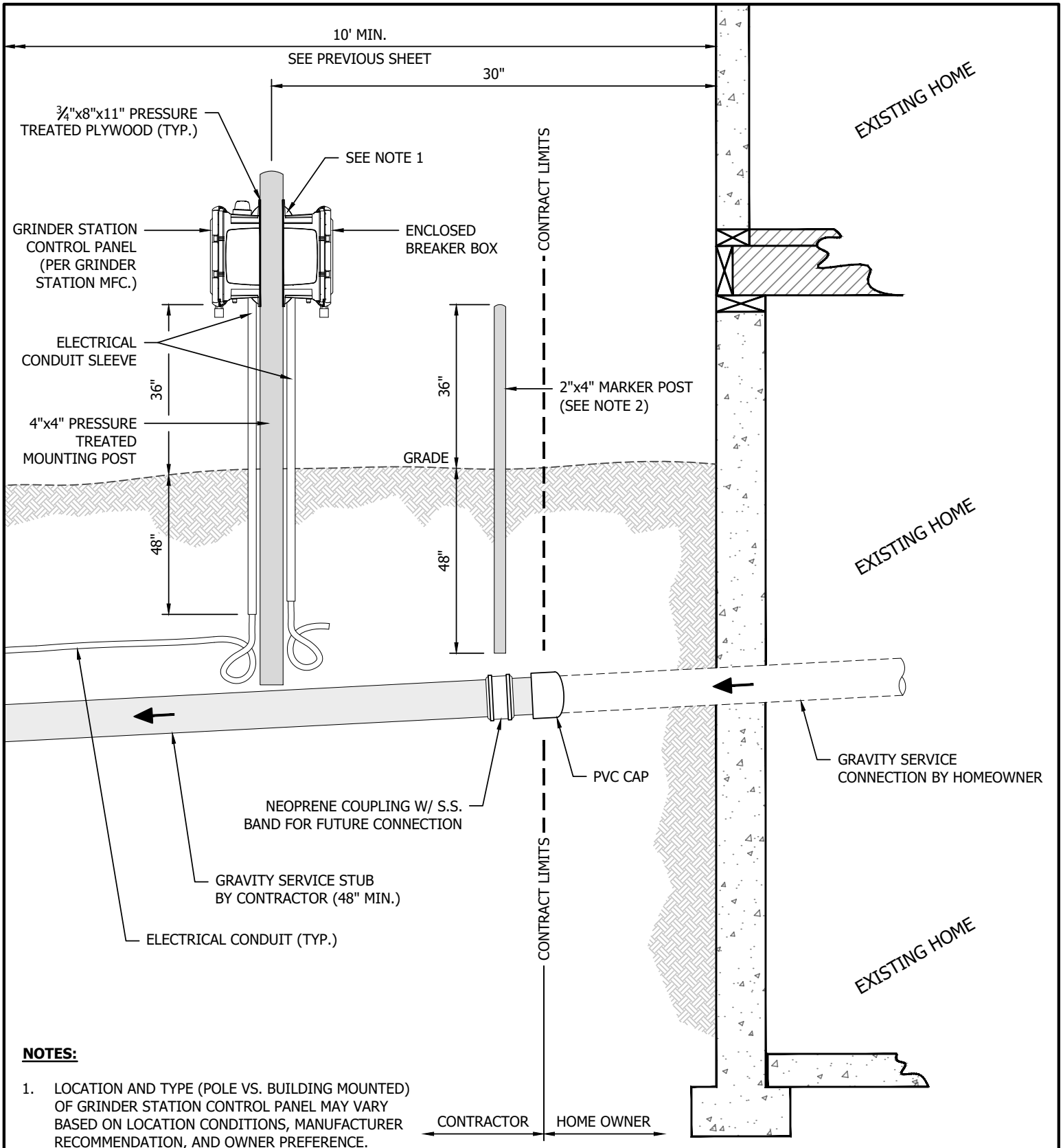

NOTES:

1. LOCATION AND TYPE (POLE VS. BUILDING MOUNTED) OF GRINDER STATION CONTROL PANEL MAY VARY BASED ON LOCATION CONDITIONS, MANUFACTURER RECOMMENDATION, AND OWNER PREFERENCE. CONTRACTOR TO COORDINATE FINAL LOCATION AND TYPE WITH OWNER PRIOR TO INSTALLATION.

2. MARKER POST TYPE PER *CITY OF MUNCIE* ENGINEER AND LOCATION TO BE COORDINATED WITH OWNER.

Muncie SANITARY DISTRICT

MUNCIE PUBLIC WORKS

GRINDER PUMP INSTALLATION

APPROVED: XX/XX/20XX

REVISED: XX/XX/20XX

STANDARD: **SS-939**

PLOT DATE: 10/30/2023 2:05 PM
EDIT DATE: 10/30/2023
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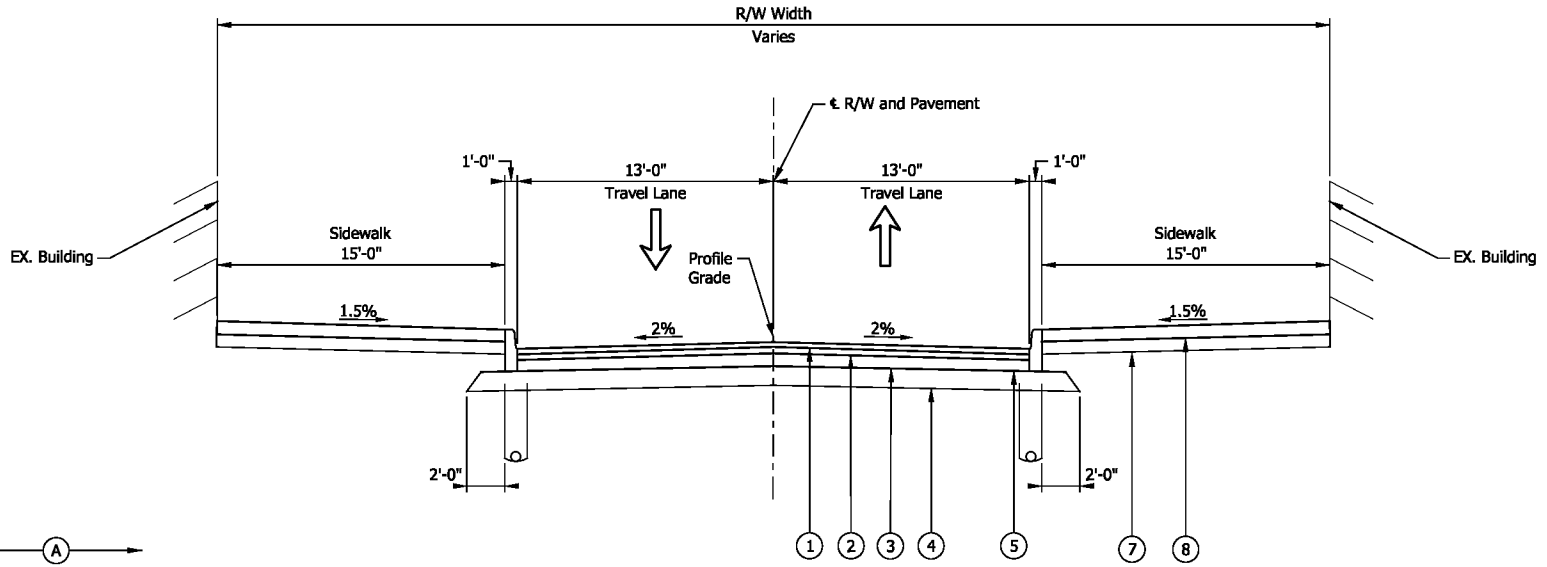
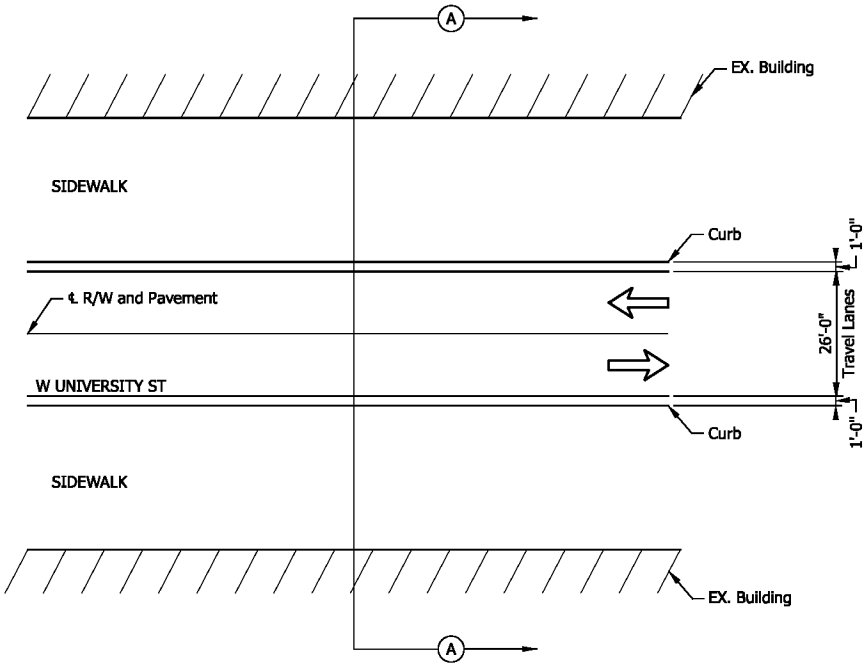


2-LANE MINOR COLLECTOR SECTION A-A



PLAN VIEW

PLOT DATE: 8/11/2023 10:51 AM
EDIT DATE: 8/5/2023
EDITED BY: JDAY
DRAWING FILE: C:\Users\jday\Desktop\MSD_TBLK (LANDSCAPE).dwg

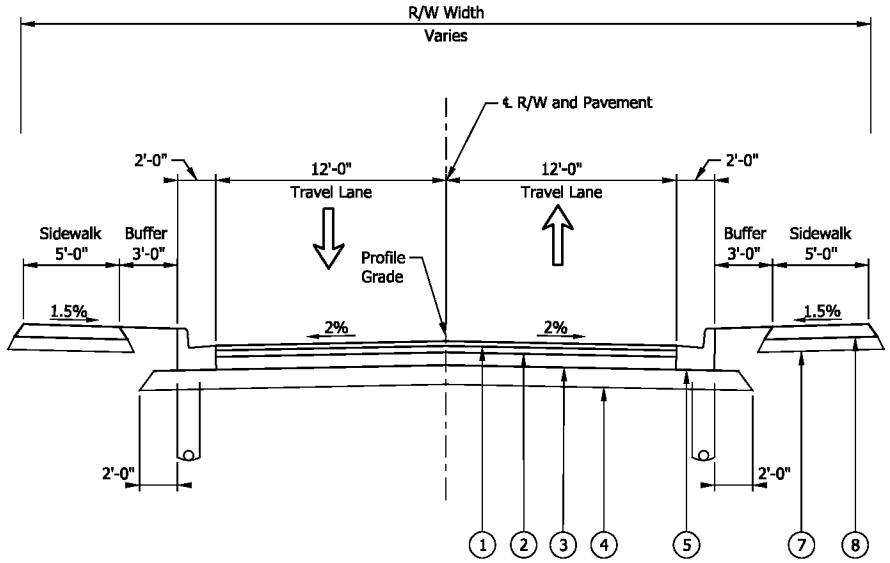
MUNCIE PUBLIC WORKS

UNIVERSITY VILLAGE - OVERLAY DISTRICT - AREA 1 - W UNIVERSITY AVE

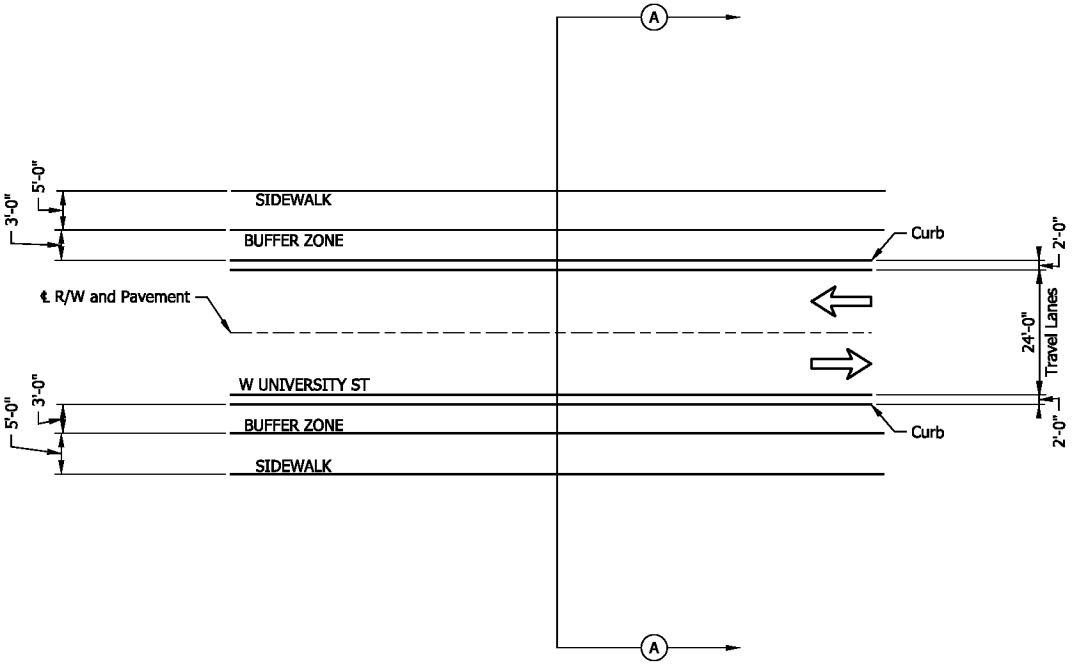
APPROVED: XX/XX/20XX

REVISED: XX/XX/20XX

STANDARD: **RW-1401**



2-LANE LOCAL ROAD A-A



PLAN VIEW

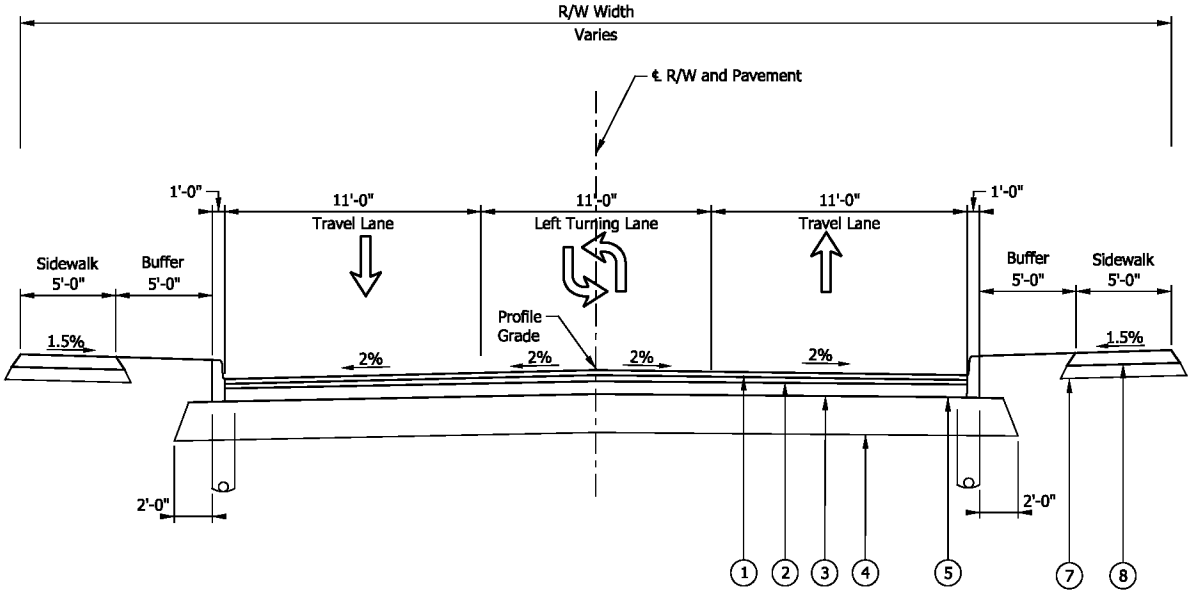
UNIVERSITY VILLAGE - OVERLAY DISTRICT - AREA 2, 3, 5

APPROVED: XX/XX/20XX

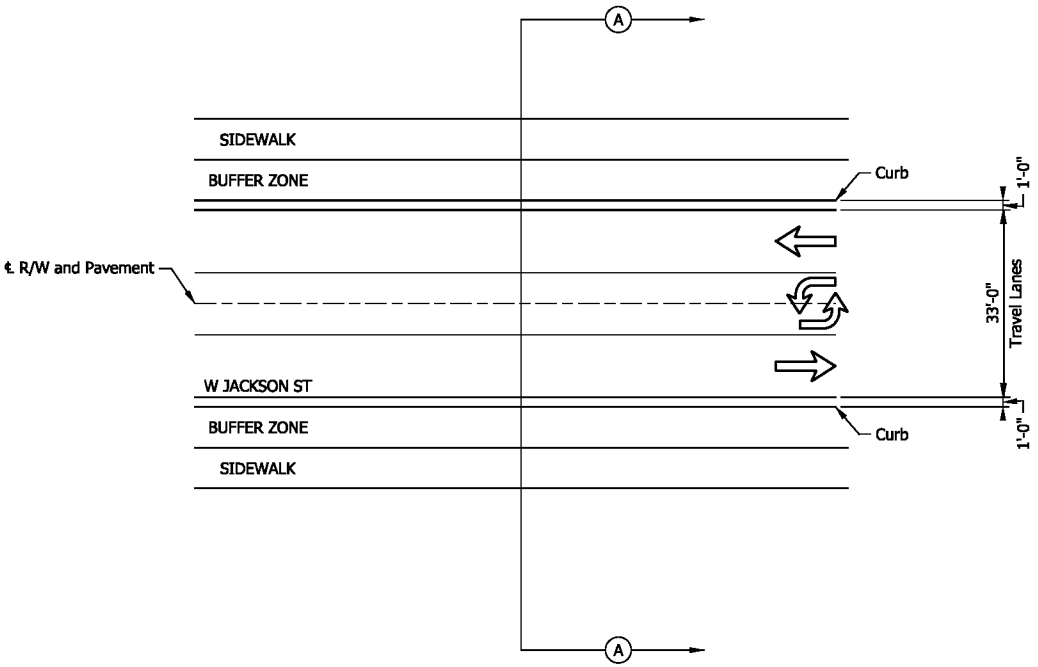
REVISED: XX/XX/20XX

STANDARD: **RW-1402**

PLOT DATE: 8/11/2023 10:51 AM EDIT DATE: 9/5/2023 EDITED BY: JDAY DRAWING FILE: C:\Users\jday\Desktop\MSD_TBLK (LANDSCAPE).dwg



3-LANE MAJOR COLLECTOR SECTION A-A



PLAN VIEW

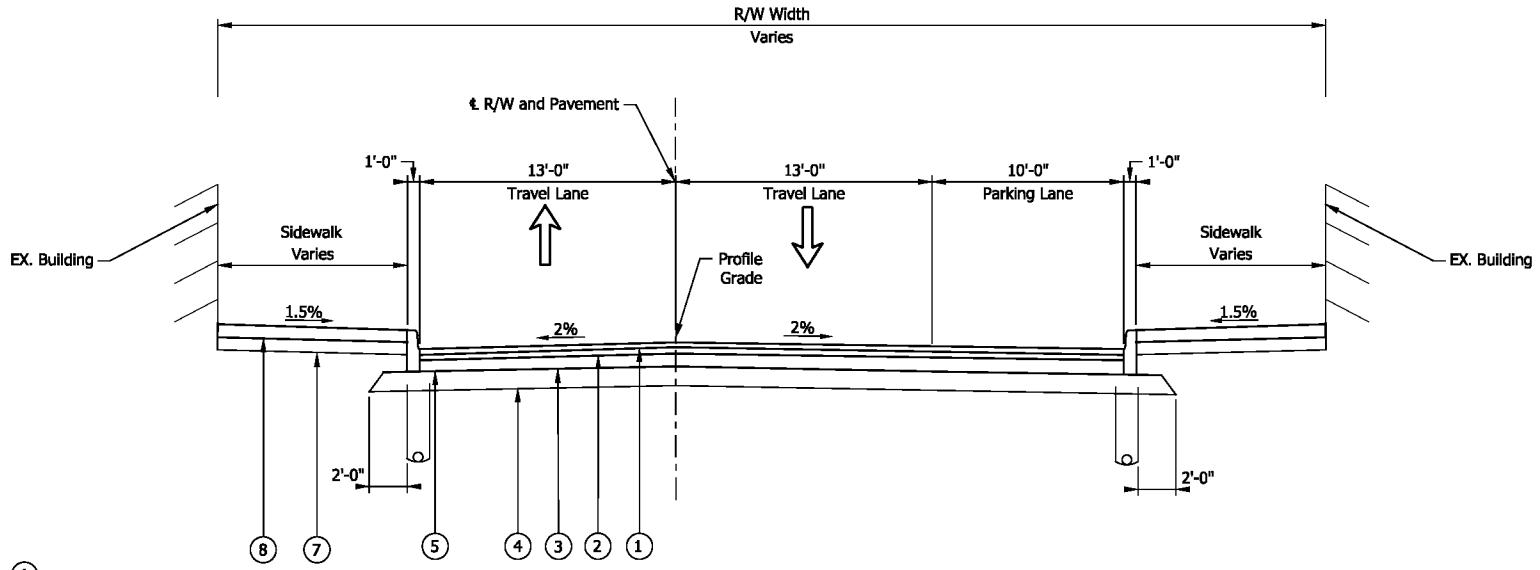
UNIVERSITY VILLAGE - OVERLAY DISTRICT - AREA 4 - W JACKSON ST

APPROVED: XX/XX/20XX

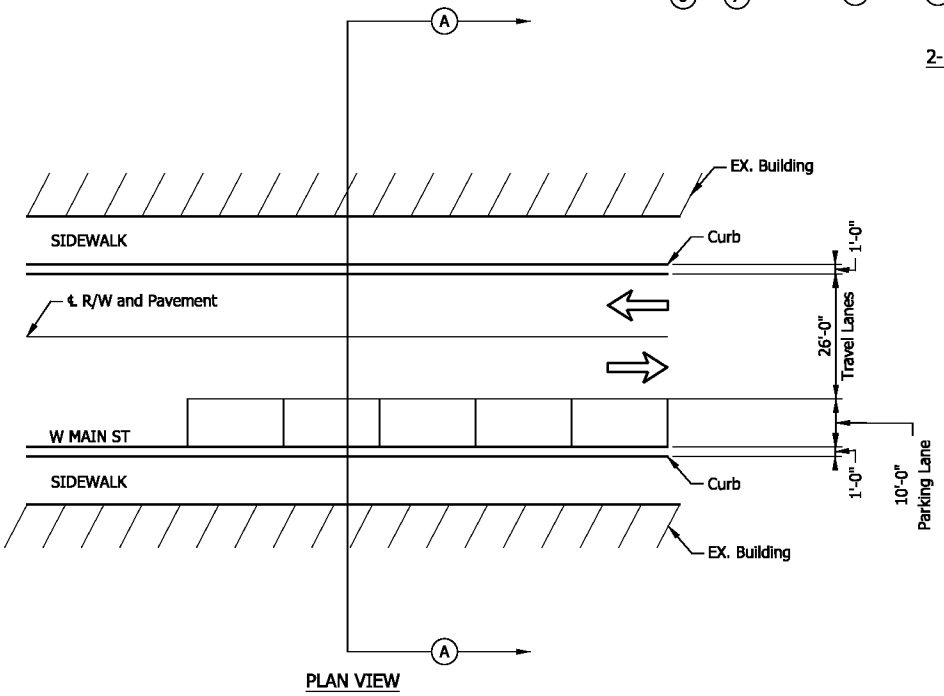
REVISED: XX/XX/20XX

STANDARD: **RW-1403**

PLOT DATE: 8/11/2023 10:51 AM EDIT DATE: 8/5/2023 EDITED BY: JDAY DRAWING FILE: C:\Users\jday\Desktop\MSD_TBLK (LANDSCAPE).dwg



2-LANE MINOR COLLECTOR SECTION A-A



PLAN VIEW

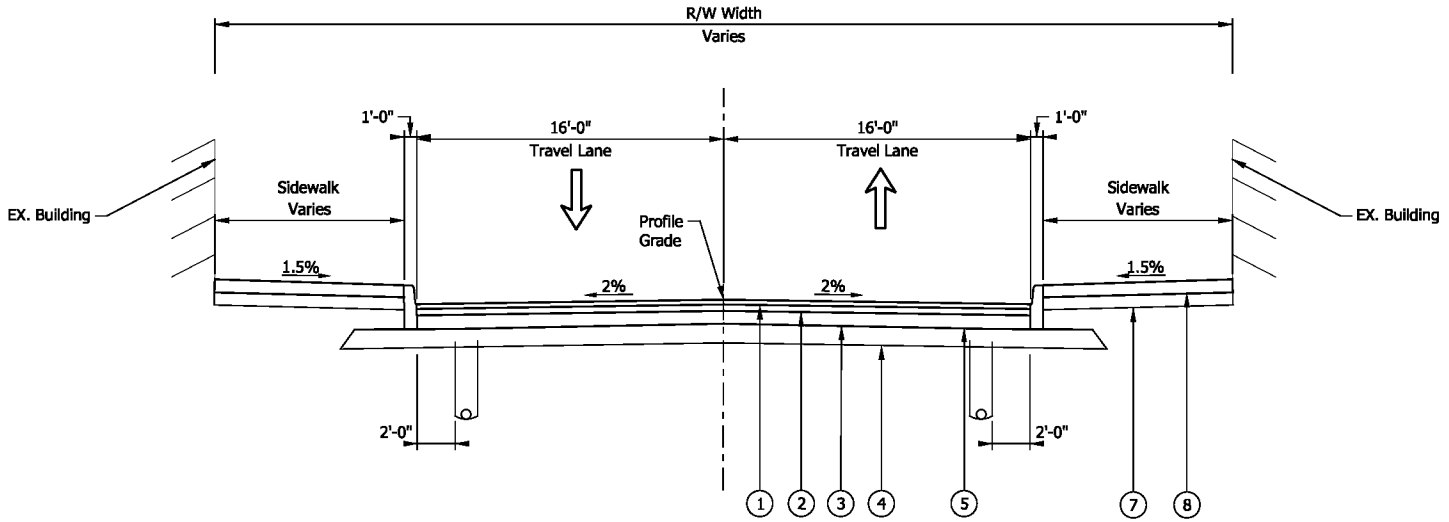
MUNCIE PUBLIC WORKS

WHITE RIVER CANAL - OVERLAY DISTRICT - W MAIN ST

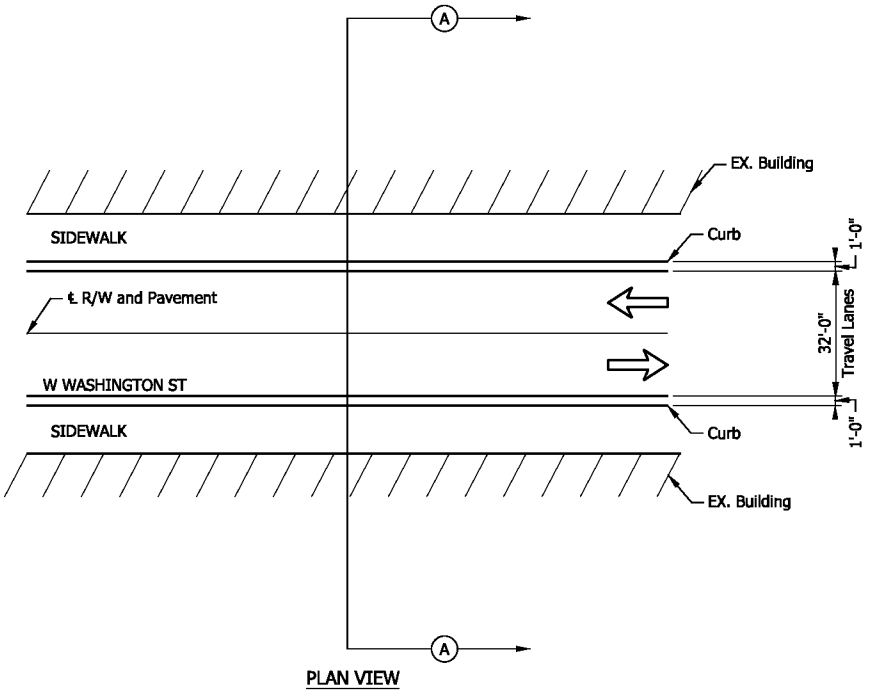
APPROVED: XX/XX/20XX

REVISED: XX/XX/20XX

STANDARD: **RW-1404**



2-LANE LOCAL ROAD A-A



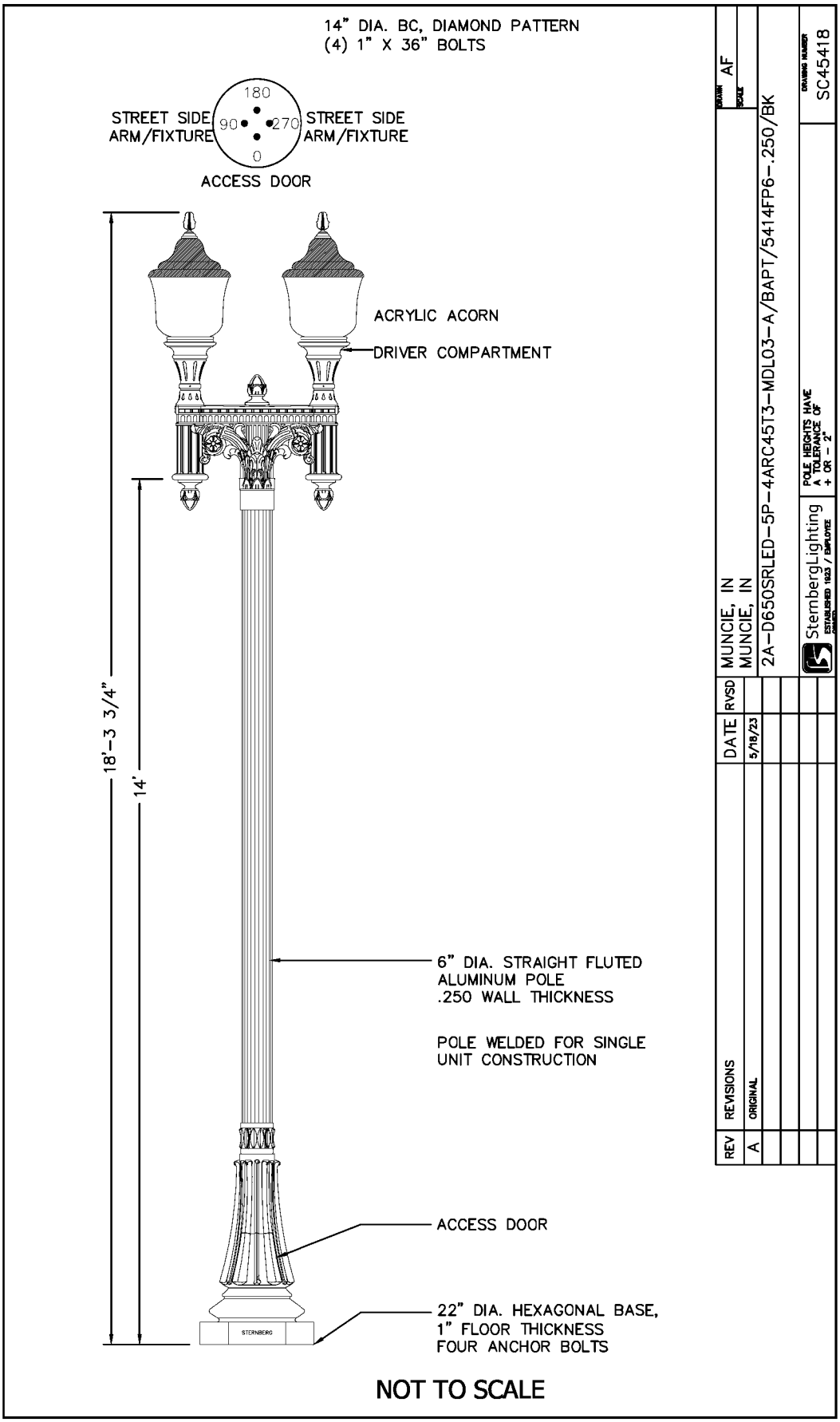
PLAN VIEW

WHITE RIVER CANAL - OVERLAY DISTRICT - WASHINGTON ST

APPROVED: XX/XX/20XX

REVISED: XX/XX/20XX

STANDARD: **RW-1405**



REV	REVISIONS	DATE	RVSD
A	ORIGINAL	5/18/23	

DRAWN AF
SCALE
MUNCIE, IN
MUNCIE, IN
2A-D650SRLED-5P-4ARC45T3-MDL03-A/BAPT/5414FP6-.250/BK
SternbergLighting
ESTABLISHED 1923 / EMPLOYEE OWNED
POLE HEIGHTS HAVE A TOLERANCE OF + OR - 2"
DRAWING NUMBER
SC45418

PLOT DATE: 8/11/2023 10:51 AM EDIT DATE: 8/30/2023 EDITED BY: JDAY DRAWING FILE: W:\sterne\MSD_TBLK (PORTRAIT)2013.dwg

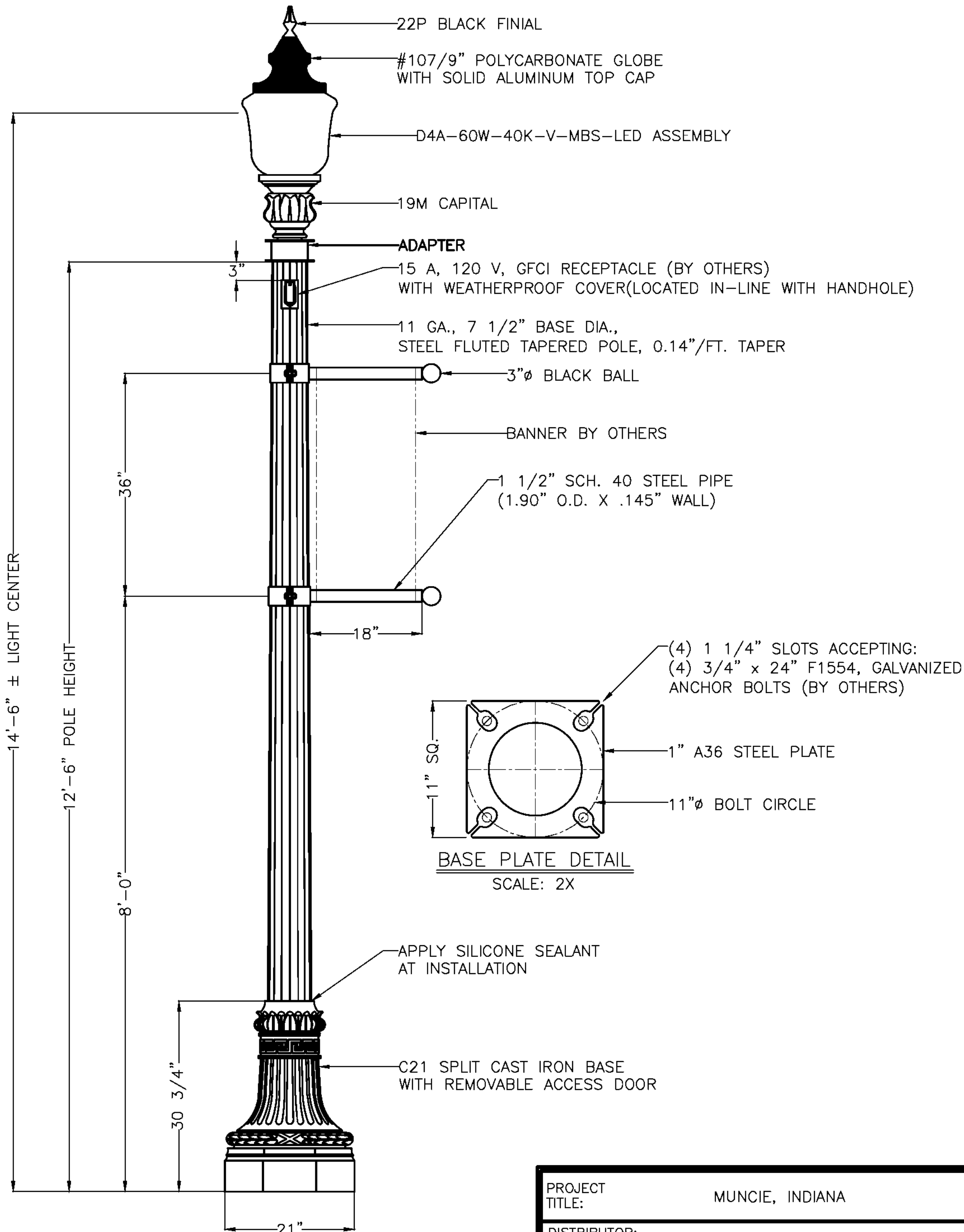
Muncie SANITARY DISTRICT

MUNCIE PUBLIC WORKS

14FT ORNAMENTAL POLE ASSEMBLY (STERNBERG)

APPROVED: XX/XX/20XX
REVISED: XX/XX/20XX
STANDARD: LT-1501

PAINT SPECIFICATION
ALL CAST IRON AND STEEL LIGHT POLE PARTS ARE TO BE FACTORY POWDER COATED "BLACK".



VI–C21–1–F/12'6"

NOT TO SCALE

PROJECT TITLE:	MUNCIE, INDIANA
DISTRIBUTOR:	
CONTRACTOR:	
REPRESENTATIVE:	STEVE BATES TRAFFIC

VISCO	SPECIFIED BY:	
	SCALE: 1"=1'	DATE: 9/18/2023
	JOB NO.:	CAD FILE: MUNCIE–STD

29579 AWBREY LANE EUGENE, OREGON 97402 PHONE (541) 688–7741 FAX (541) 461–0951

Muncie SANITARY DISTRICT

MUNCIE PUBLIC WORKS

12FT-6IN ORNAMENTAL POLE ASSEMBLY (VISCO)

APPROVED: XX/XX/20XX

REVISED: XX/XX/20XX

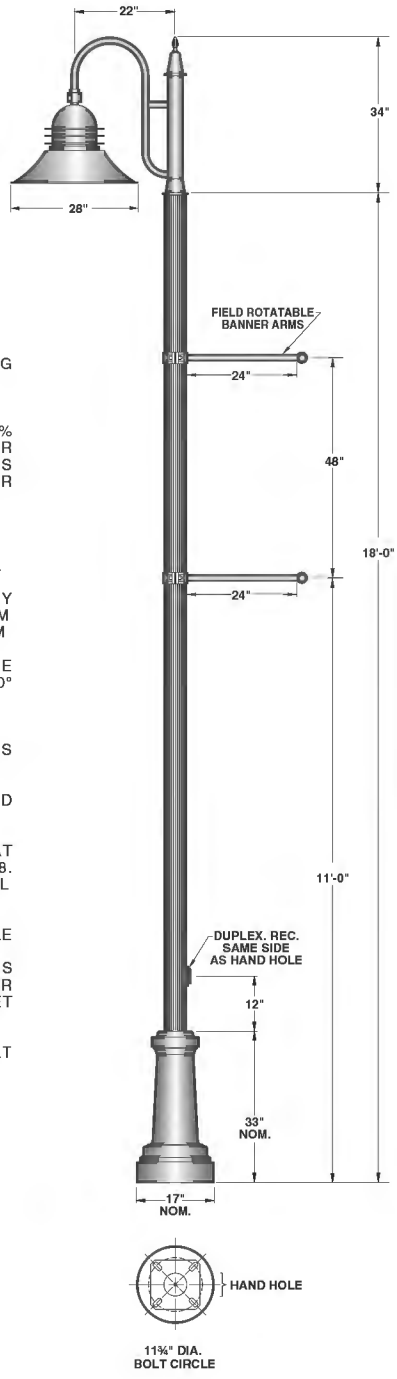
STANDARD: LT-1502

CUSTOMER APPROVAL:

X _____ DATE: _____

A signed approval will be required with the released order

PROPRIETARY SUBMITTAL, DO NOT MODIFY.



SPECIFICATIONS:

LUMINAIRE: **HOUSING** - HEAVY WALL ALUMINUM CONSTRUCTION. HOUSING PROVIDED WITH DECORATIVE CAST ALUMINUM RINGS.
REFLECTOR - HEAVY WALL ALUMINUM CONSTRUCTION.

VLED OPTICAL MODULE: SEALED LED OPTICAL MODULE. LOW COPPER A356 ALLOY (<.2% COPPER) CAST ALUMINUM HOUSING. INTEGRATED CLEAR TEMPERED 3/16" GLASS LENS SEALED WITH A CONTINUOUS SILICONE GASKET PROTECTS EMITTERS (LED'S) AND EMITTER REFLECTOR-PRISM OPTICS, AND SEALS THE MODULE FROM WATER INTRUSION AND ENVIRONMENTAL CONTAMINANTS. ENTIRE MODULE MEETS IP67 RATING

VLED EMITTERS AND OPTICS: **64** LUXEON **T** EMITTERS (LED'S) DRIVEN AT **525mA** FOR 106 TOTAL INPUT WATTS. HIGH OUTPUT, NEUTRAL WHITE NOMINAL 4000K CCT FOR THE ENTIRE MODULE. EACH EMITTER IS OPTICALLY CONTROLLED BY A REFLECTOR-PRISM INJECTION MOLDED FROM H12 ACRYLIC (3 TYPES PER MODULE; ONE FROM 0°-50°; ONE FROM 50°-65°; ONE FROM 65°-70°). THE REFLECTOR-PRISMS ARE ARRAYED TO PRODUCE IES **TYPE III** LIGHT DISTRIBUTION. THE ENTIRE OPTICAL MODULE IS FIELD ROTATABLE IN THE LUMINAIRE IN 90° INCREMENTS.

VLED DRIVER: CONSTANT CURRENT LED DRIVER OPERATES ON INPUT VOLTAGES FROM 120 - 277 V., 50/60Hz. FACTORY WIRED DRIVER IS INDEPENDENTLY SEALED AND UL LISTED FOR WET LOCATION.

ARM: DURABLE CORROSION RESISTANT, CAST AND EXTRUDED ALUMINUM CONSTRUCTION.

SHAFT: 5" DIA. EXTRUDED FROM 6063 ALLOY ALUMINUM TUBING, HEAT TREATED TO PRODUCE A T6 TEMPER. WALL THICKNESS .188. SHAFT HAS EVENLY SPACED HIGHLY DETAILED RAISED VERTICAL FLUTES..

DECORATIVE BASE: TWO PIECE WRAPAROUND, CORROSION RESISTANT, DURABLE CAST ALUMINUM CONSTRUCTION, MINIMUM .210 WALL THICKNESS. BASE CONSISTS OF A SMOOTH BOTTOM SECTION. BASE IS FURNISHED WITH HAND HOLE AND COVER. HAND HOLE COVER SUPPLIED WITH TAMPER RESISTANT HARDWARE. (4) 1/4"-20 SET SCREWS PROVIDED TO SECURE DECORATIVE BASE TO SHAFT.

ANCHORAGE: (4) 3/4"X24" FULLY GALVANIZED ANCHOR BOLTS. EACH BOLT SUPPLIED WITH TWO NUTS AND TWO WASHERS.

FINISH: POLYESTER POWDER COAT
(SPECIFY COLOR)

NOTE: AUDIO DRILLING WHERE REQUIRED.

NOT TO SCALE

MADE IN THE USA

SYM.	REVISION	BY	DATE

REV. 2

SUN VALLEY LIGHTING

PART NO.		
DR'N	CHK'D	MAT'L
DATE 05/21/14	SCALE	SHEET

TOLERANCE UNLESS NOTED

DESCRIPTION: CS-6742 REV. 2

660 WEST AVENUE O, PALMDALE, CA.93551 Ph. (661) 233-2000 - Fax (661) 233-2001

Muncie SANITARY DISTRICT

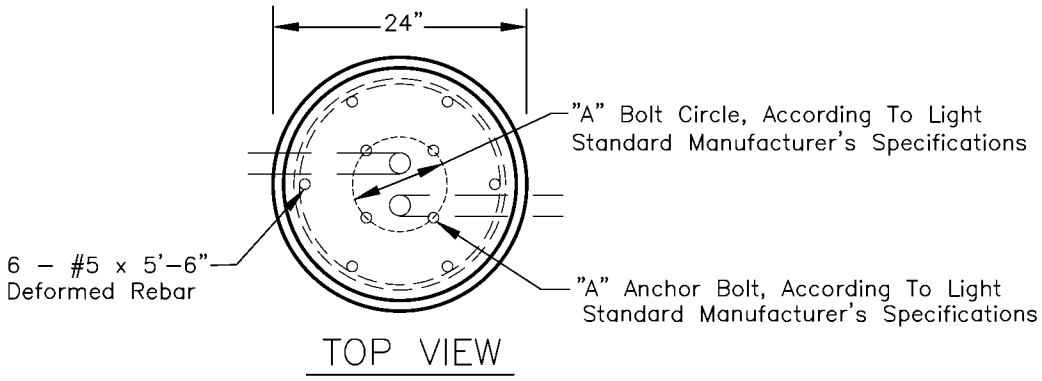
MUNCIE PUBLIC WORKS

18FT ORNAMENTAL POLE ASSEMBLY (SUN VALLEY)

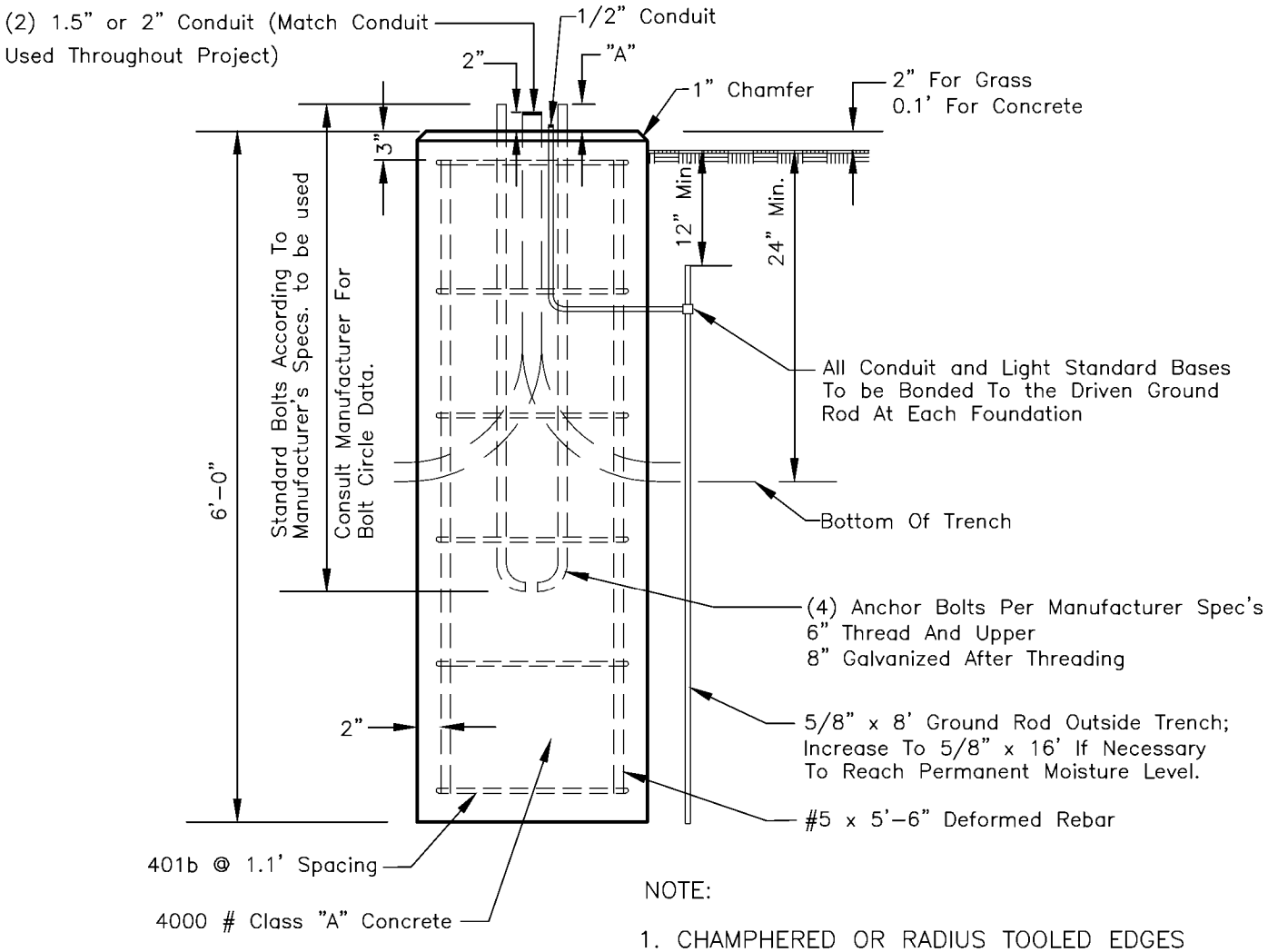
APPROVED: XX/XX/20XX

REVISED: XX/XX/20XX

STANDARD: LT-1503



TOP VIEW



NOTE:

1. CHAMPHERED OR RADIUS TOOLED EDGES
2. LIGHT BROOM FINISH ON ALL EXPOSED CONCRETE.

LIGHT STANDARD FOUNDATION

FOR POLE HEIGHTS <20'

NOT TO SCALE

Muncie SANITARY DISTRICT

MUNCIE PUBLIC WORKS

LIGHT POLE FOUNDATION (24IN DIA X 6FT)

APPROVED: XX/XX/20XX

REVISED: XX/XX/20XX

STANDARD: LT-1504