City of East Grand Rapids Construction Standards for Right-of-Way and Easements

General Information

- A ROW permit is required for all utility owners with facilities located within City of East Grand Rapids right-of-way. Annual permits cover facility maintenance and emergency work only.
- Certificate of Insurance: Utilities and contractors must be insured and list the City of East Grand Rapids as certificate holder and are required to have a minimum $1 million limit per occurrence for bodily injury and property damage.
- Subcontractors and work crews must have a copy of the annual permit or permit and these specifications/requirements in their possession while doing work in the right-of-way.
- Traffic must be maintained in accordance with the “Michigan Manual of Uniform Traffic Controls.”

City of East Grand Rapids Local Street Design Standards

(a) *Lots.* All platted subdivisions or site condominiums shall comply with the applicable provisions of the City zoning ordinance

(see Chapter 50 Zoning)

(b) Streets.

(1) Generally.

a. Public streets shall be classified according to the street use classification of the current major thoroughfare plan of the City of East Grand Rapids Public Act 51 Street Classification.

b. All streets within a subdivision or site condominium shall be developed according to the regulations set forth in this section and shall be dedicated public streets.

c. Provisions shall be made for the continuation of principal existing streets in adjoining or adjacent subdivisions. All approvals shall be subject to zoning ordinance.

d. Every subdivision or site condominium shall have access to a dedicated street right-of-way.

e. Streets shall intersect one another at right angles or as nearly at right angles as conditions permit. Intersections with offsets of less than 125 feet should be avoided, where possible.

f. Local streets shall have a minimum right-of-way width of 66 feet (See Local Street Cross Section-66' Right-of-Way). Local Streets terminating with a cul-de-sac and having 20 or fewer lots/units shall have a minimum right-of-way width of 50 feet (See Local Street Cross Section-50' Right-of-Way).

g. Grade Limits are as follows:

Grade Limit	Local Street Grade (Concrete/HMA)
Minimum	0.5%
Maximum	6.0%

The Director of Public Works may approve grades in excess of the maximum, where deemed necessary.

h. Wherever a dedicated or platted substandard street right-of-way exists adjacent to the tract to be subdivided, additional width shall be platted to bring the street right-of-way to the noted standards. The proprietor shall be required to dedicate, at his expense, not more than 50 feet to meet the standard required.

i. Streets must be named in a manner to avoid confusion in identification. Streets that are not continuous, or which have 90-degree turns, shall have different names. All street segments shall be designated by the City in accordance with City policy and practices.

j. Subdivisions or site condominiums which abut or contain an existing or proposed minor arterial or major arterial as defined in Public Act 51 Street Classification, shall not permit direct access to such streets for individual lots. Through lots shall be discouraged, but where provided, access to through lots shall comply with the standards provided in the zoning ordinance.

k. Specifications for public streets, including, but not limited to, road curvature, etc., shall be in accordance with the design specifications of the Kent County Road Commission or the City as amended from time to time, unless provided otherwise in this section.

l. Private utilities shall be below ground in a 10-foot utility easement located behind the street right- of-way.

m. Mailboxes shall be located on front porch or in a designed mail kiosk. Mailboxes in the front yard or outlawn are not permitted.

n. Street lighting shall spaced be no greater than 700 feet in accordance with City of East Grand Rapids policy. Light poles shall be decorative or approved equivalent and be LED.

o. Sidewalks shall be ADA compliant with East Jordan metal plates. All sidewalks shall be constructed at time of street construction.

(2) Cul-de-sac.

a. The maximum length of a cul-de-sac street shall be 800 feet measured from centerline of intersecting existing street to terminus of the cul-de-sac.

b. A public hydrant shall be at end of cul-de-sac.

c. At or near the entrance to the circular terminal area, an unobstructed (no driveway, mailbox, or other obstruction) space of at least 30 feet along the curb line of the street shall be provided for the purposes of snow storage. At least one such space shall be provided on each side of any circular terminal area.

d. Circular terminal areas for residential permanent cul-de-sac streets (without center islands) shall have a right-of-way diameter of 120 feet, and a turning diameter of 80 feet (See Residential Cul-de- sac Detail).

e. Hammerhead design will not be allowed; however, alternate designs, such as landscape center islands for cul-de-sac streets, may be considered by the Deputy City Manager, upon recommendation of the Fire Marshal, zoning administrator, traffic safety specialist, and City Engineer to ensure that a sufficient turnaround area is provided.

(3) *Design standards*. For residential streets the following minimum standards apply:

	Pavement Width (feet)	Right-of-Way Width (feet)	Required Sidewalks	On-Street Parking
Local Street	31’ B-B	66’	2 sides	2 sides
Local Street w/Cul-de-sac (≤20 units)	28’ B-B	50’	2 sides	1 side

a. Pavement width includes two feet of concrete curb and gutter on each side of the

street.

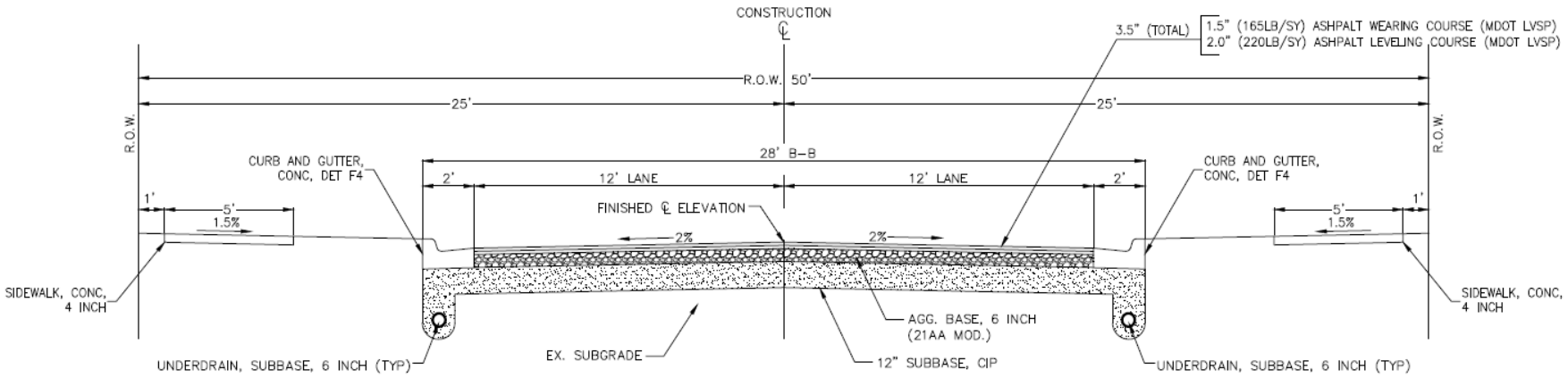
b. Wherever practical, hydrants should be placed on the north and/or west sides of streets.

(4) Lands

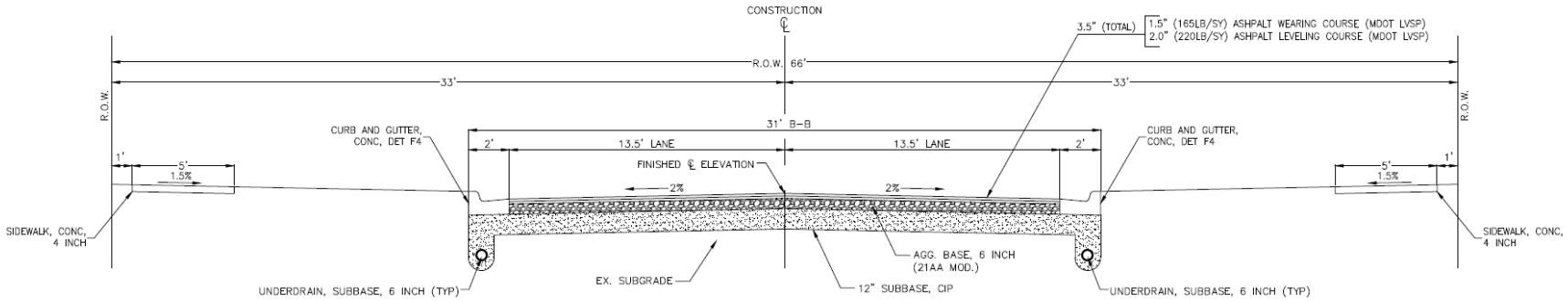
a. Each Residential unit shall have one 2-inch caliper tree per the City right-of-way tree planting program as amended. Approval per the program shall be by the Director of Public Works or their designee.

(Comp. Ords. City of East Grand Rapids Local Street Design Standards)

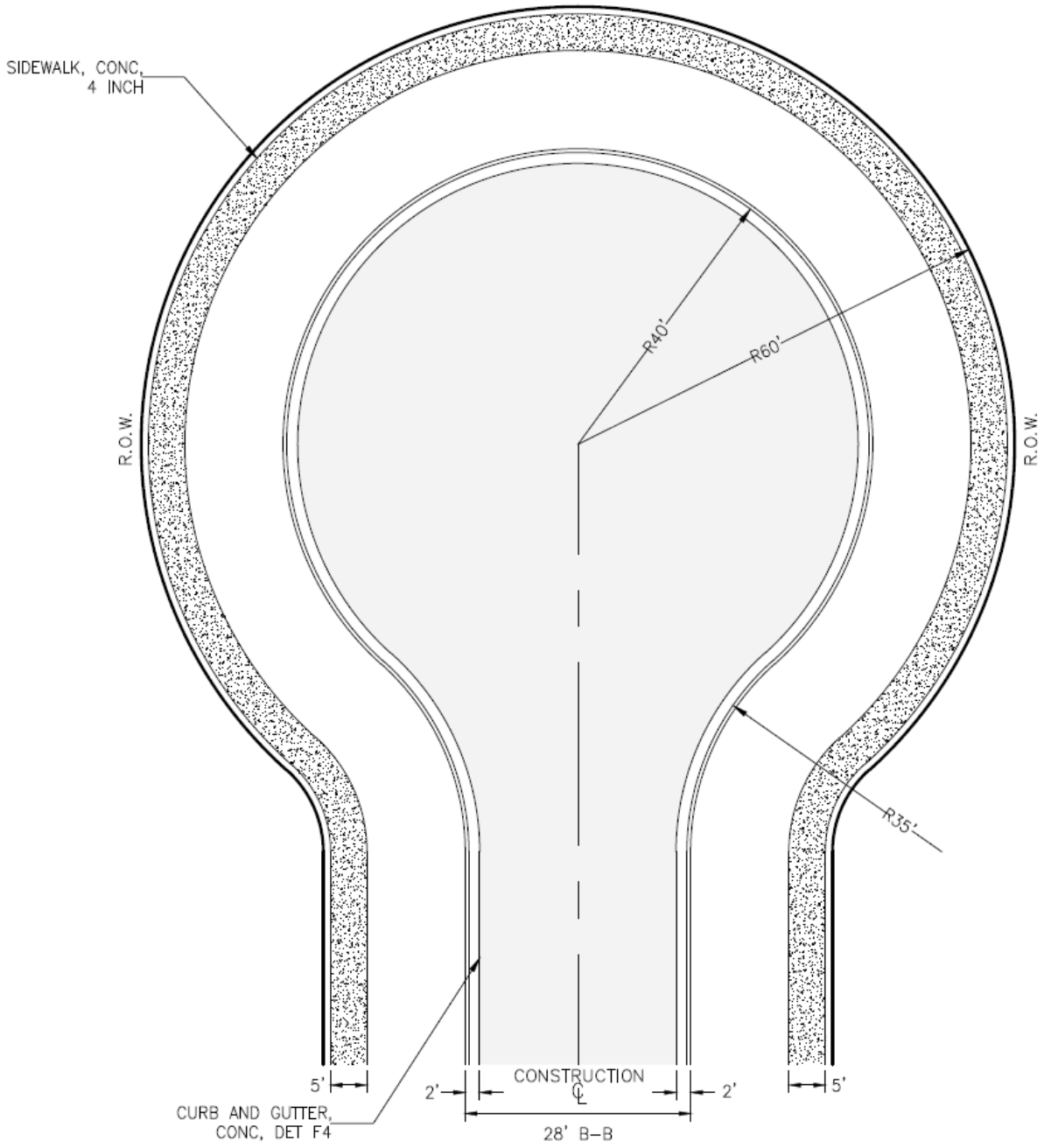
Local Street Cross Section 50' Right-of-Way



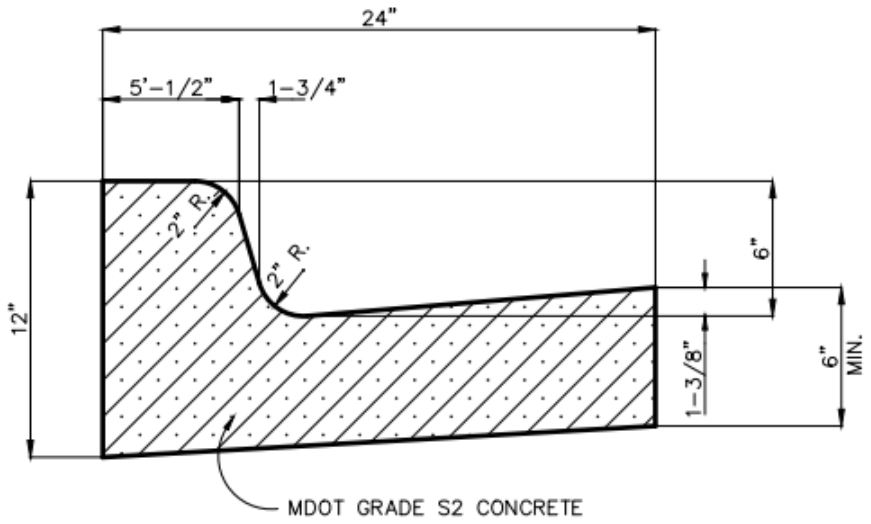
Local Street Cross Section 66' Right-of-Way



Residential Cul-De-Sac 60' Right-of-Way

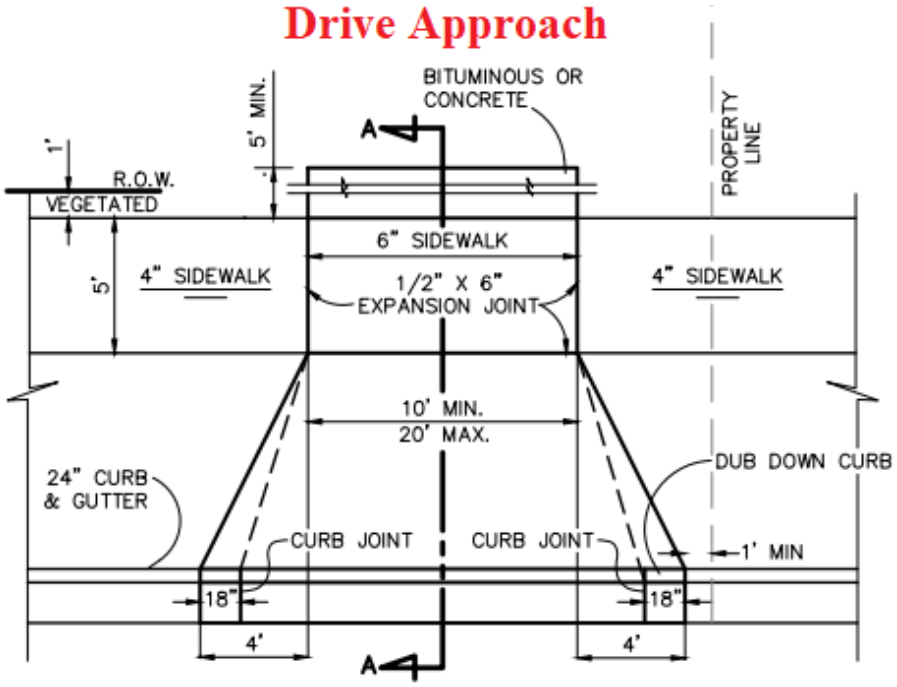


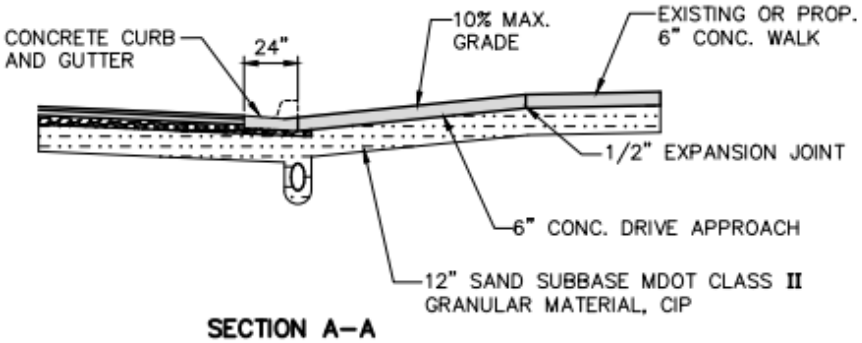
Curb and Gutter



NOTES:
1. CONTRACTION JOINTS TO BE PLACED EVERY 10 FT.
2. EXPANSION JOINTS TO BE PLACED EVERY 300 FT AND AT THE SPRING POINTS OF RADII

Drive Approach

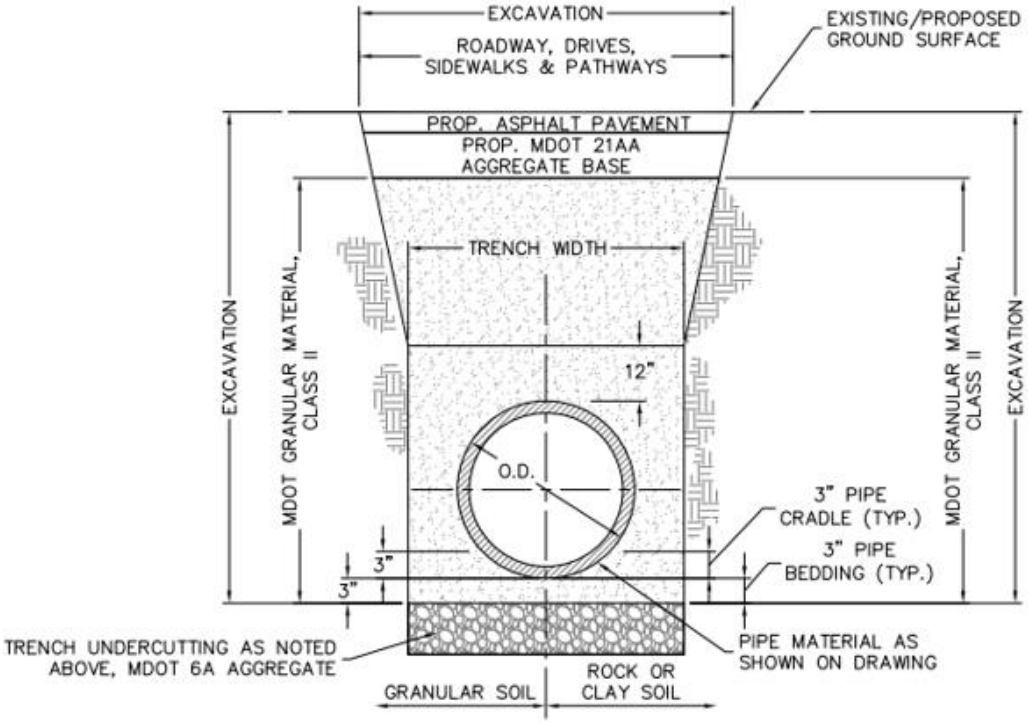




SECTION A–A

NOTES:
1. SAWING AND REMOVAL OF CURB HEAD IS NOT PERMITTED

Utility Trench Excavation/Backfill Detail



UTILITY TRENCH EXCAVATION & BACKFILL

UNDER ROADWAYS

Horizontal Directional Drilling

Minimum Allowable Depths

The minimum allowable installation depth of cover of a HDD installed pipe under the road and shoulder surface is correlated to the pipe diameter. Table 2 summarizes the minimum allowable depths for road crossings:

Table 2 - Minimum Allowable Depth

Pipe Diameters (inches)	Depth of Cover (feet)
6 or less	4
7 - 12	8
13- 24	10
24 and greater	12

In locations where the road surface is super elevated, the minimum depth of the bore shall be measured from the lowest side of the pavement surface. In addition, a minimum 3-foot depth shall be maintained in all other features including ditch bottoms.

Drilling Site

(a) Location – All directional drilling operations shall take place between the back of curb and face of sidewalk within the right-of-way. Any deviation from this location requires prior approval from the City of East Grand Rapids.

(b) Resident coordination – All affected residents shall be notified by written notice when drilling operations will be taking place (24 hours prior notice required). Any drilling that is necessary outside of the right-of-way requires permission from the resident and submittal to the City of East Grand Rapids 24 hours prior to drilling operations.

(c) Protection – Fencing barriers shall be installed adjacent to equipment and supplies with suitable fencing and plastic drums to prohibit pedestrian access to the work site. Equipment shall not be used as fencing to protect access pits.

Any deviations require advance approval by the City.

EGR Open Road Cuts

If an open-road cut is necessary on a City of East Grand Rapids roadway/street, requirements are the following:

- Open cuts require EGR approval **prior** to starting work.
- Contractor must notify EGr of all emergency open cuts by phone, 616-940-4817. After hours contact Kent County Disptach at 616-632-6100 Press 1, to have them connect to On-Call Public Works staff.
- Open trenches within the influence of the road shall be backfilled with Class II sand and 21AA or 22A aggregate (8" gravel depth in Major Streets, 6" gravel depth on local streets) bith meeting minimum density testing requirements of **98%.**
- Hot mix asphalt shall be placed at a depth equal to the existing road, but not less than a total of 3.5" of HMA (2" MDOT LVSP or 3C base course, followed by 1.5" 5E1 top course for Major Streets or MDOT LVSP wearing course for Local Streets. If these mixes are not available, an alternate mix type must be approved by the City. HMA mixes must be placed in two or more lifts (depending on road thickness) meeting density testing requirements of 92-98% ising the TMD method.
- In winter months, a temporary hot mix asphalt shall be used (No Cold Patch) and replaced with permanent HMA the following spring.

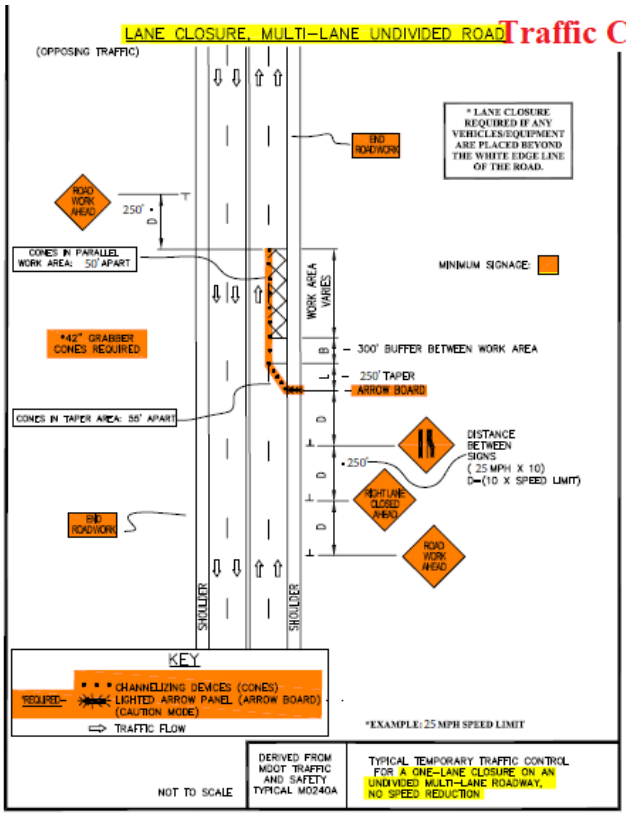
Aerial Wire Crossings

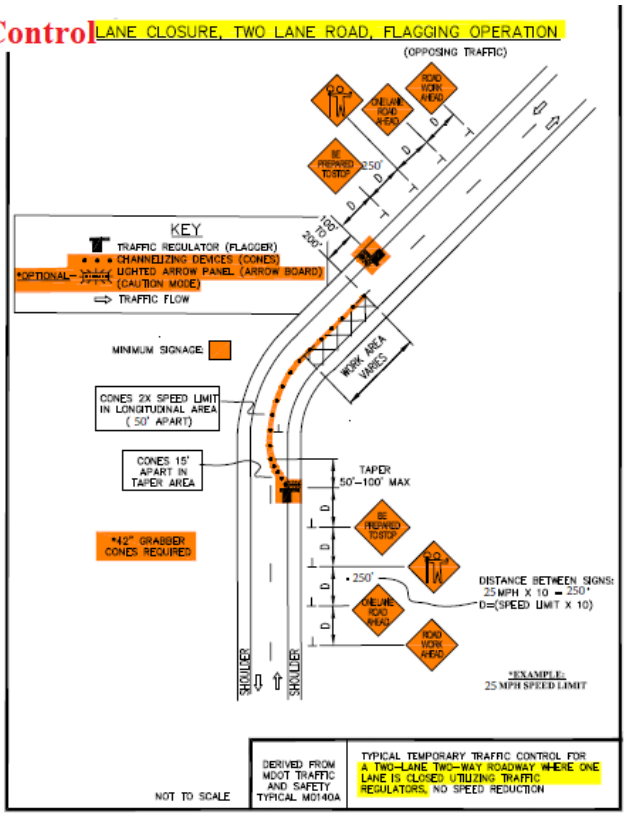
Vertical clearance of wires, conductors, and cables over EGR Major and Local Streets shall not be less than required by Rule 231 of the National Electric Safety Code, except that the under clearance for an unloaded sag with no wind at 60 degrees F shall not be less than **18 feet.**

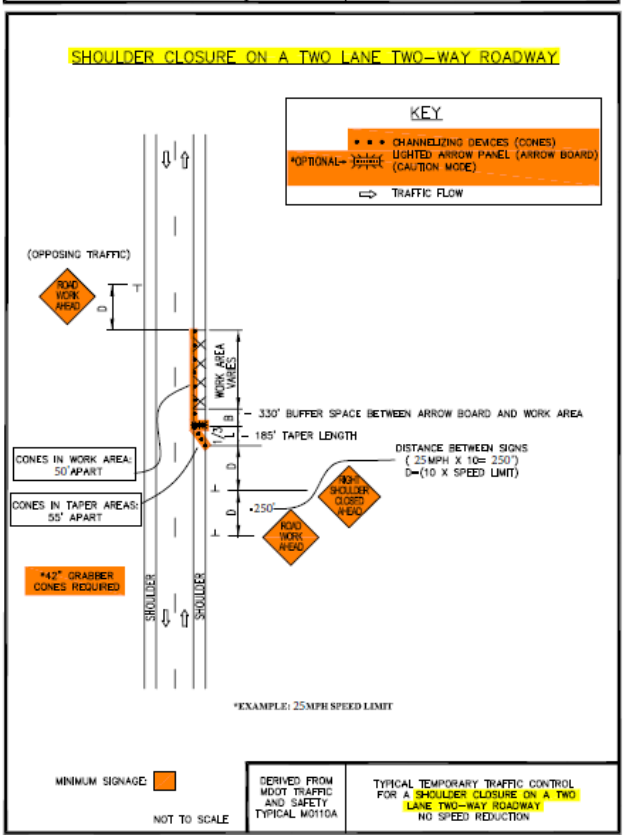
Worksite Restorations

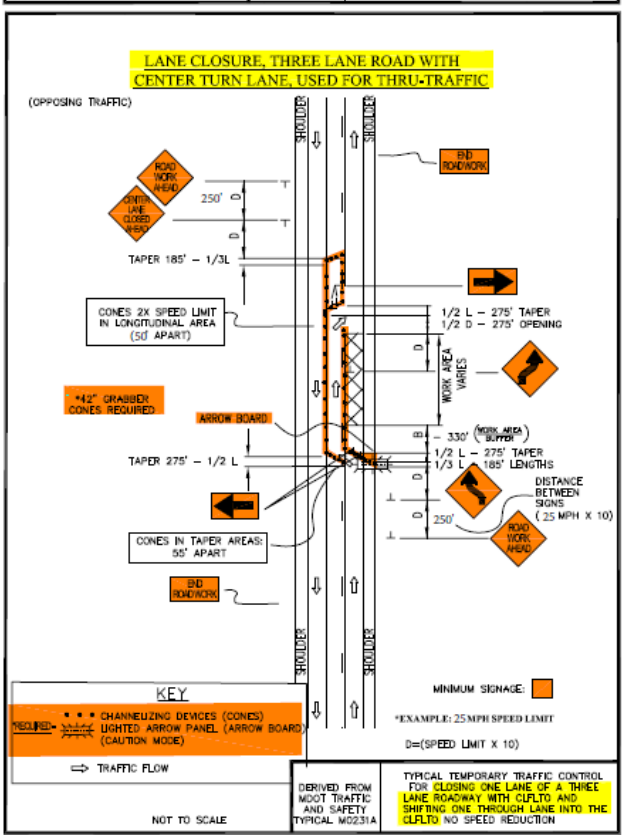
- The disturbed grass-surface area shall be immediately (within 24 hours of completion) top soiled, seeded, fertilized, mulched, and anchored according the current MDOT Standard Specifications for Construction, Sections 816 and 917.
- All underground sprinkling to include piping, fittings, and sprinkler heads shall be replaced in kind to match existing conditions.
- The contractor should take care so as not to damage existing conditions within the right-of-way and adjacent lawns and driveways. Any damage to existing sidewalks, curb and gutter, ramps, driveways, landscaping, etc. will be required to be replaced in kind/as noted.
- Upon completion of the work, the contractor shall remove and properly dispose of all excess materials and equipment from the work site.

Traffic Control

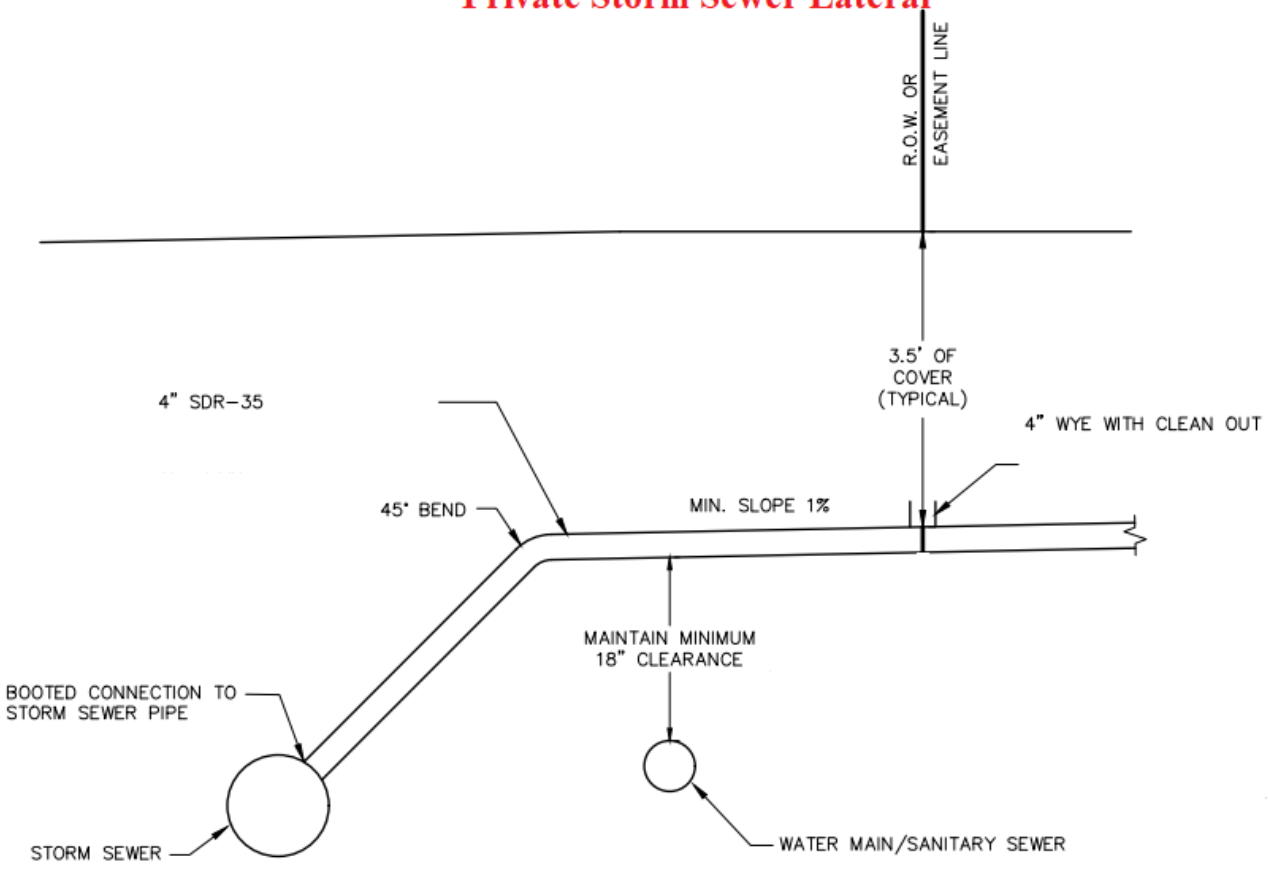






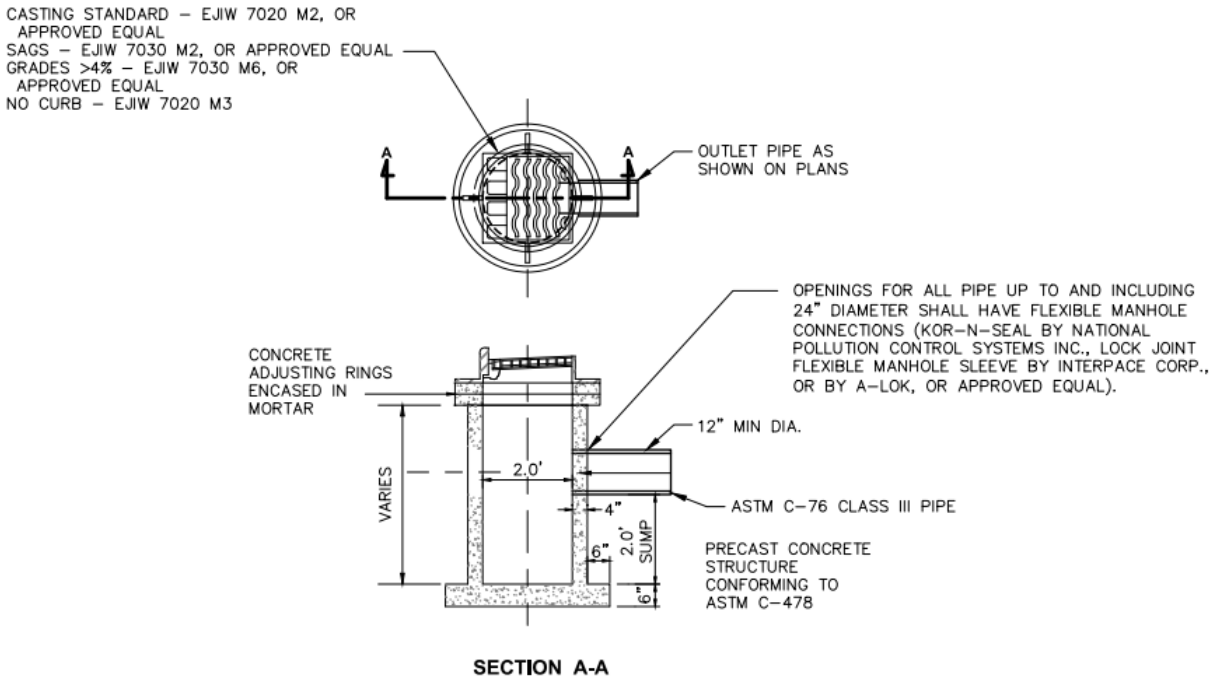


Private Storm Sewer Lateral



NOTES:
1. AIR GAP MUST BE PROVIDED BETWEEN SUMP PUMP AND STORM LATERAL. DIRECT CONNECTION OF FOOTING DRAINS TO STORM SEWER IS NOT PERMITTED.

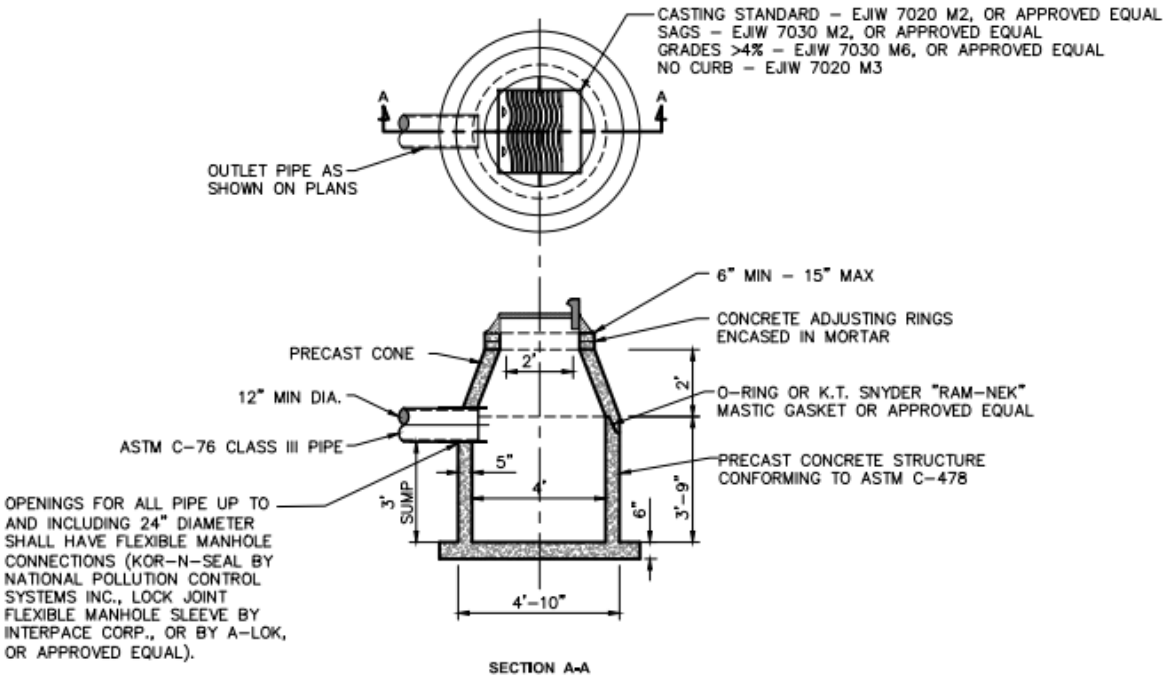
2' Diameter Catch Basin



SECTION A-A

NOTES:
1. INLET MUST INCLUDE DRAIN TO STREAM MESSAGING
2. 2' DIAMETER CATCH BASIN SHALL ONLY BE UTILIZED WHEN 4' DIAMETER CATCH BASIN DOES NOT FIT. SPECIAL APPROVAL REQUIRED BY CITY

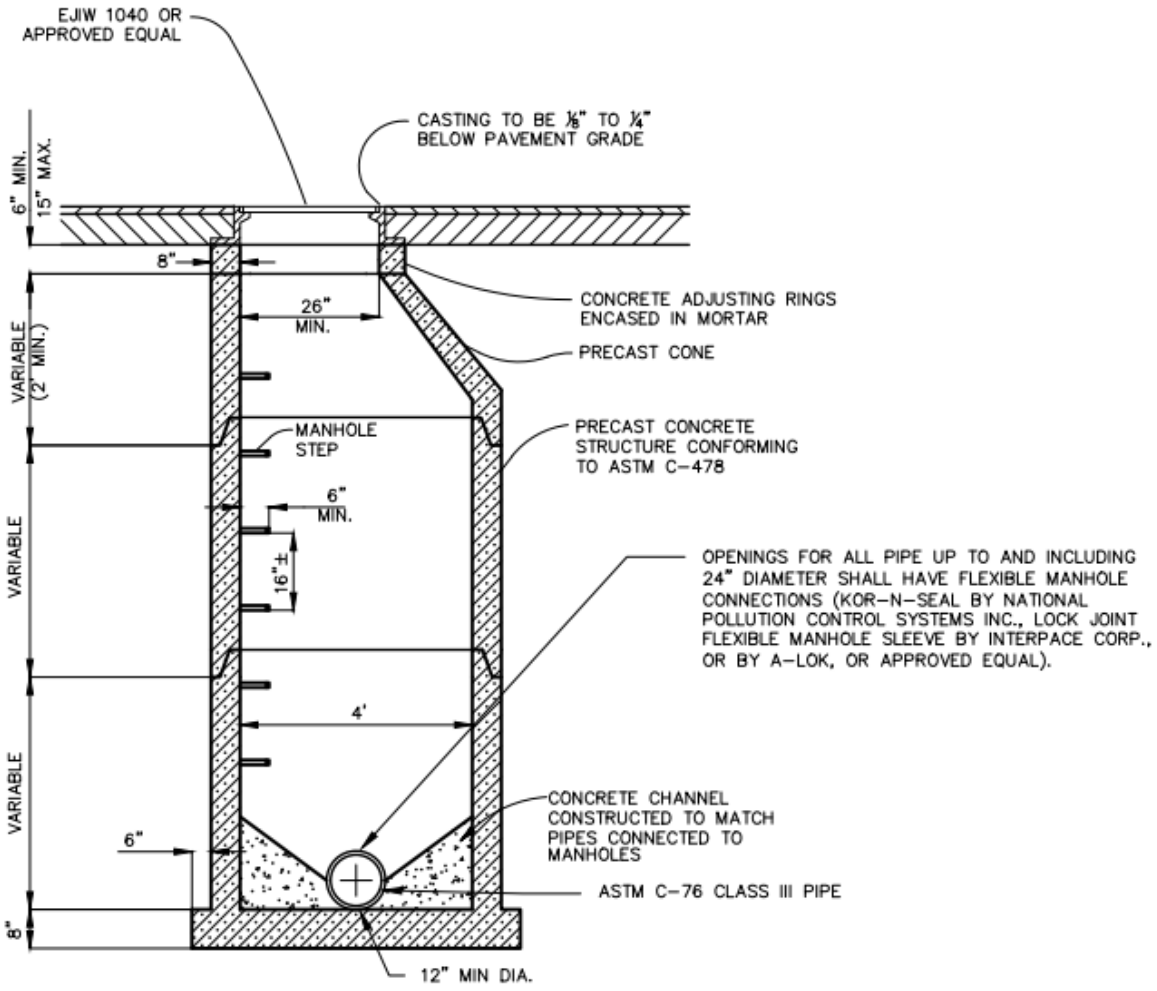
4' Diameter Catch Basin



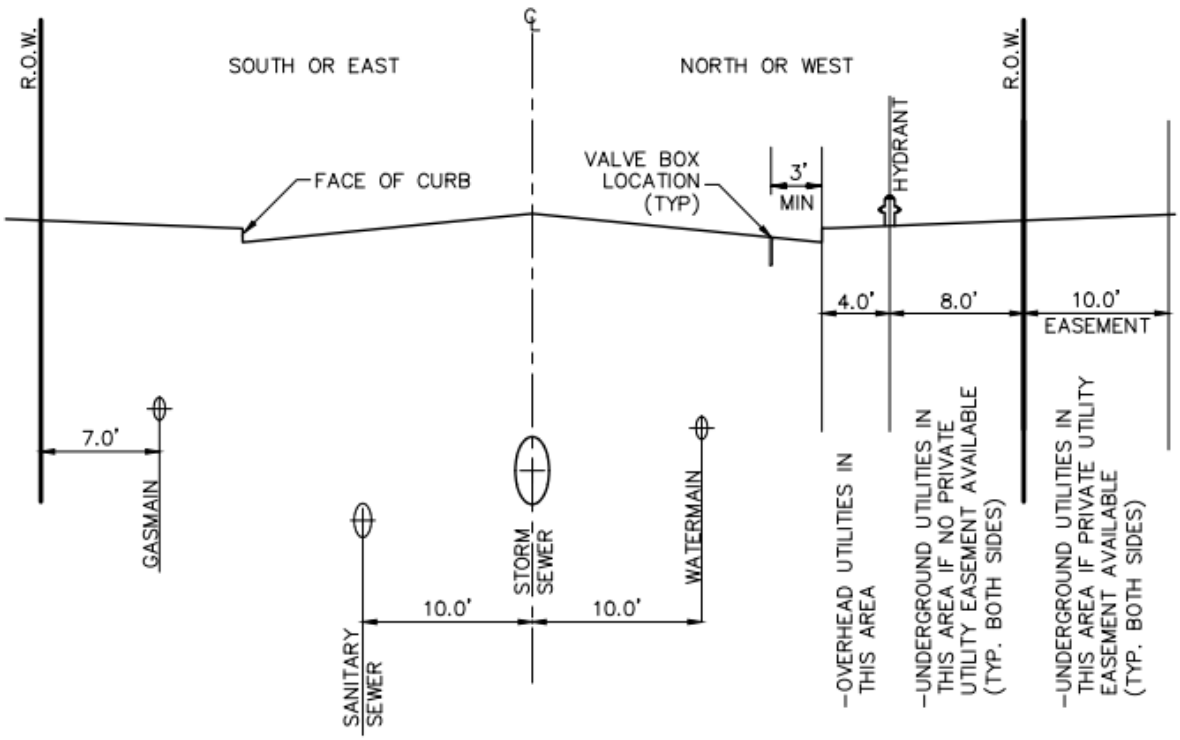
SECTION A-A

NOTES:
1. INLET MUST INCLUDE DRAINS TO STREAM MESSAGING

Storm Sewer Manhole

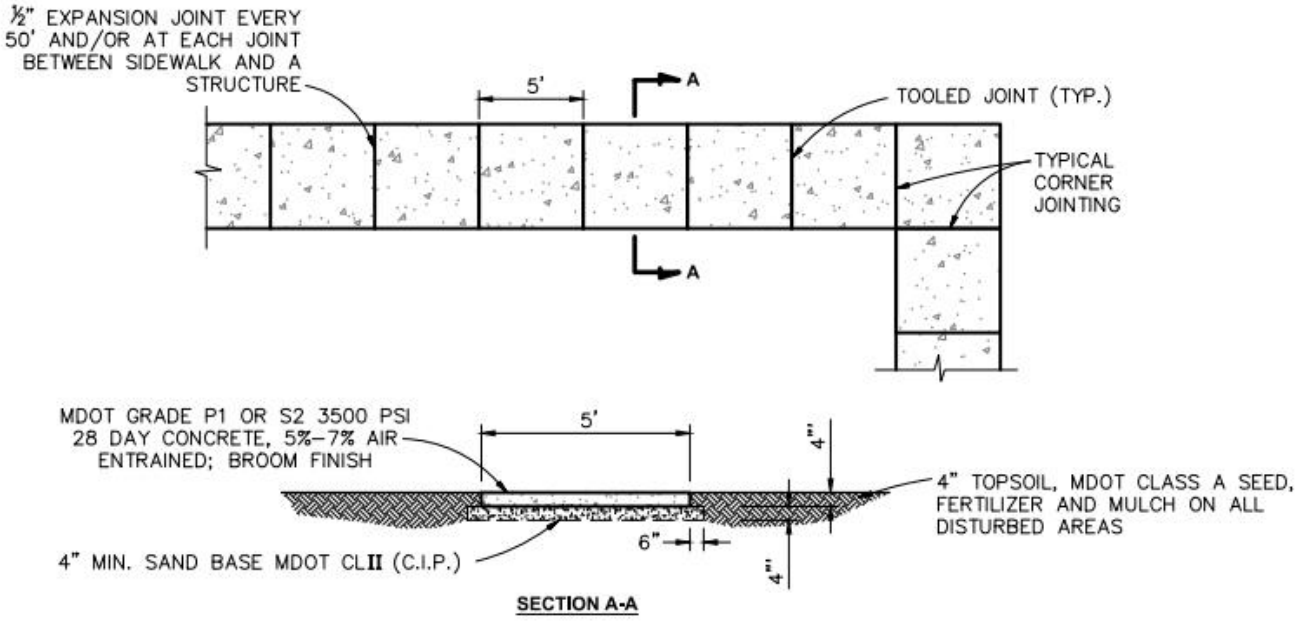


New Development Utility Layout



NOTES:
1. PRIVATE UTILITY EASEMENT REQUIRED FOR ALL NEW ROAD CONSTRUCTION.

Sidewalk

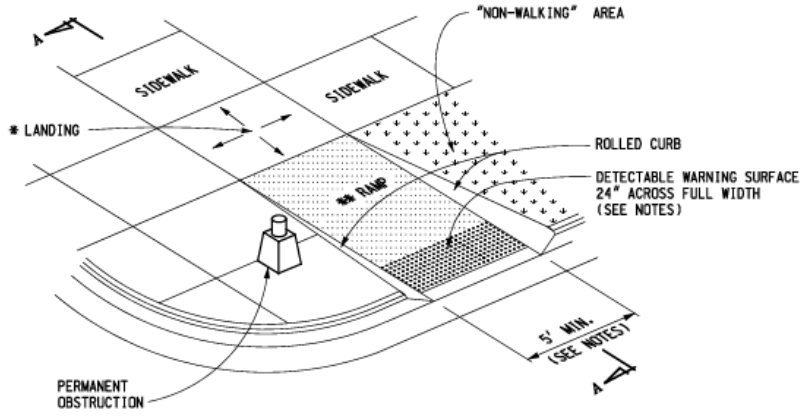


NOTES:
1. MAX CROSS SLOPE IS 2%
2. MAX RUNNING SLOPE IS 5%
3. 1' CLEAR ZONE TO BE PROVIDED FROM EACH EDGE OF SIDEWALK.
4. TOPSOIL TO BE SCREENED WITH NO STONES GREATER THAN ½" DIAMETER.
5. EROSION CONTROL BLANKET REQUIRED ON ALL SLOPES 1 ON 3 AND STEEPER

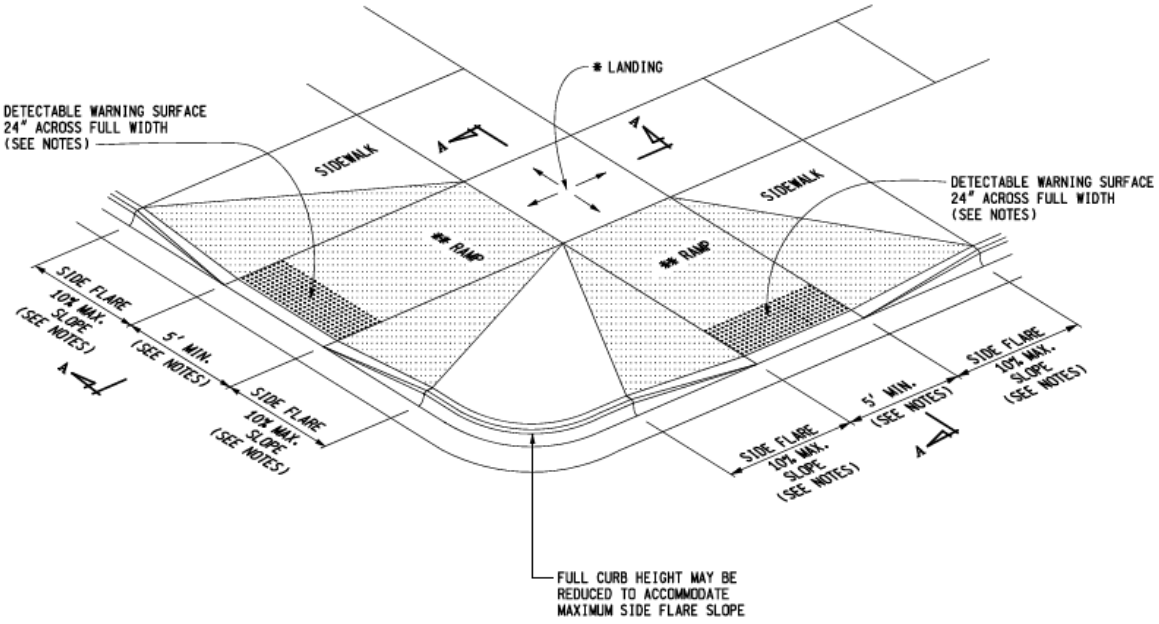
ADA Ramps

* MAXIMUM LANDING SLOPE IS 2.0% IN EACH DIRECTION OF TRAVEL. LANDING MINIMUM DIMENSIONS 5' x 5'. SEE NOTES.

** MAXIMUM RAMP CROSS SLOPE IS 2.0%. RUNNING SLOPE 5% – 7% (8.3% MAXIMUM). SEE NOTES.



CURB RAMP TYPE R
(ROLLED SIDES)

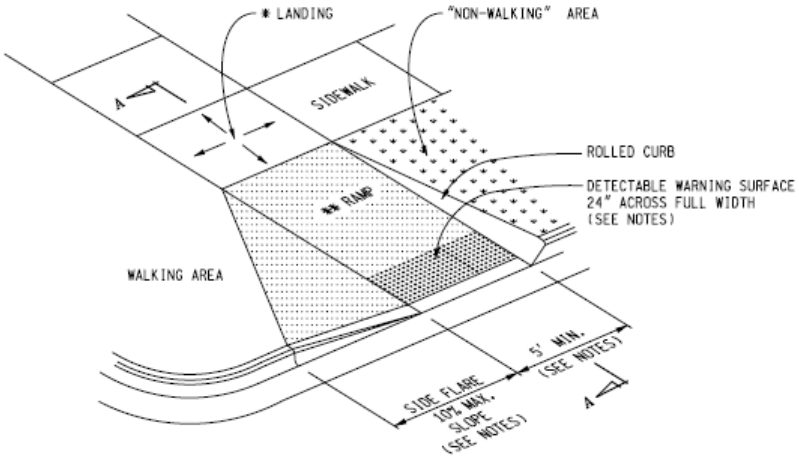


CURB RAMP TYPE F
(FLARED SIDES, TWO RAMPS SHOWN)

MDOT Michigan Department of Transportation PREPARED BY DESIGN DIVISION DRAWN BY: B.L.T. CHECKED BY: W.K.P.	DEPARTMENT DIRECTOR Paul C. Ajegba APPROVED BY: Gregg Brunner, P.E. Gregg Brunner Oct 14 2021 12:32 PM DIRECTOR, BUREAU OF FIELD SERVICES APPROVED BY: Bradley C. Wieferich Bradley C. Wieferich Oct 14 2021 11:01 AM DIRECTOR, BUREAU OF DEVELOPMENT	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT STANDARD PLAN FOR CURB RAMP AND DETECTABLE WARNING DETAILS	4-7-2022 F.H.W.A. APPROVAL	5-8-2020 PLAN DATE	R-28-J	SHEET 1 OF 7

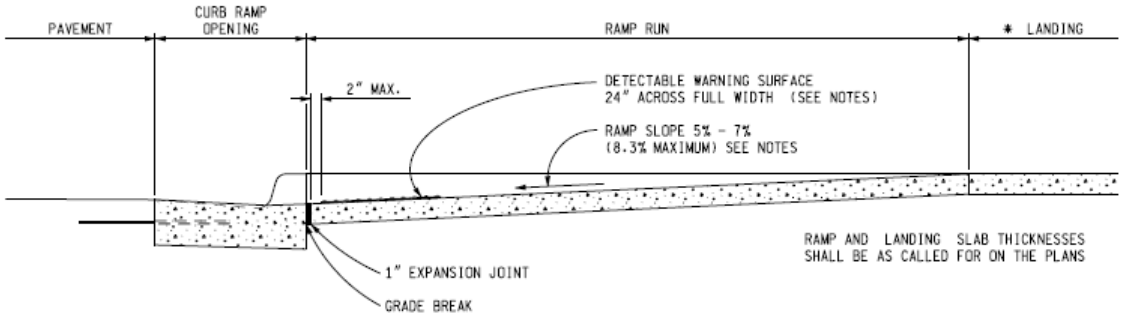
* MAXIMUM LANDING SLOPE IS 2.0% IN EACH DIRECTION OF TRAVEL. LANDING MINIMUM DIMENSIONS 5' x 5'. SEE NOTES.

** MAXIMUM RAMP CROSS SLOPE IS 2.0%. RUNNING SLOPE 5% - 7% (8.3% MAXIMUM). SEE NOTES.



CURB RAMP TYPE RF

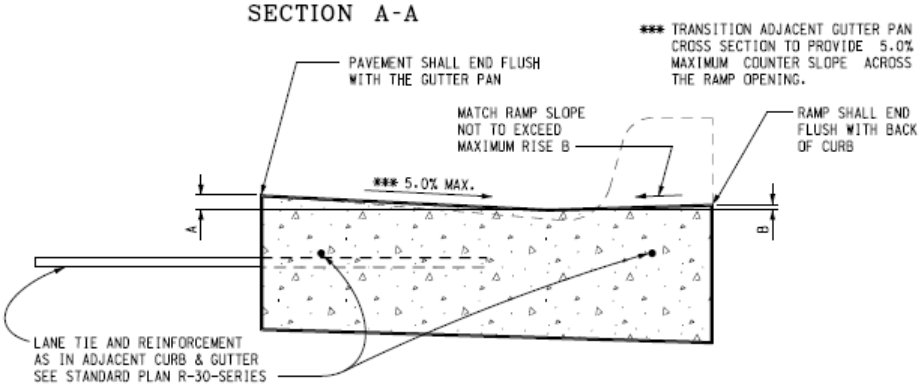
(ROLLED / FLARED SIDES)



SECTION A-A

CURB TYPE	MAXIMUM RISE (INCHES)	
	A	B
B1	3/4	1
B2	3/4	1
B3	3/4	1
D1	3/4	1
D2	3/4	1
D3	3/4	1
C1	1/2	1/2
C2	1/2	1/2
C3	3/4	1/2
C4	3/4	1/2
C5	1	1/2
C6	1	1/2
F1	1/2	1/2
F2	1/2	1/2
F3	3/4	1/2
F4	3/4	1/2
F5	1	1/2
F6	1	1/2

FOR CURB TYPES SEE STANDARD PLAN R-30-SERIES



SECTION THROUGH CURB RAMP OPENING

(TYPICAL ALL RAMP TYPES)

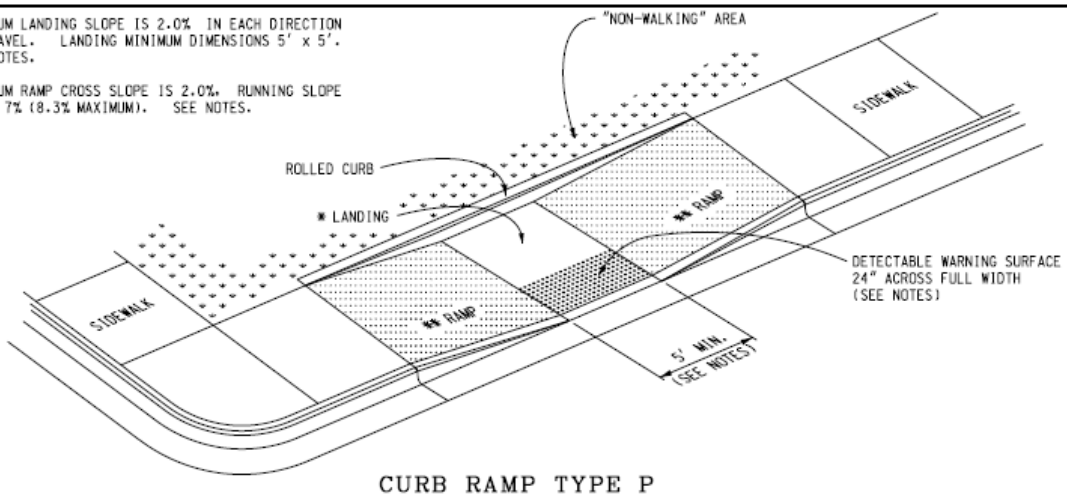
MICHIGAN DEPARTMENT OF TRANSPORTATION
BUREAU OF DEVELOPMENT STANDARD PLAN FOR

CURB RAMP AND DETECTABLE WARNING DETAILS

4-7-2022 F.H.W.A. APPROVAL	5-8-2020 PLAN DATE	R-28-J	SHEET 2 OF 7

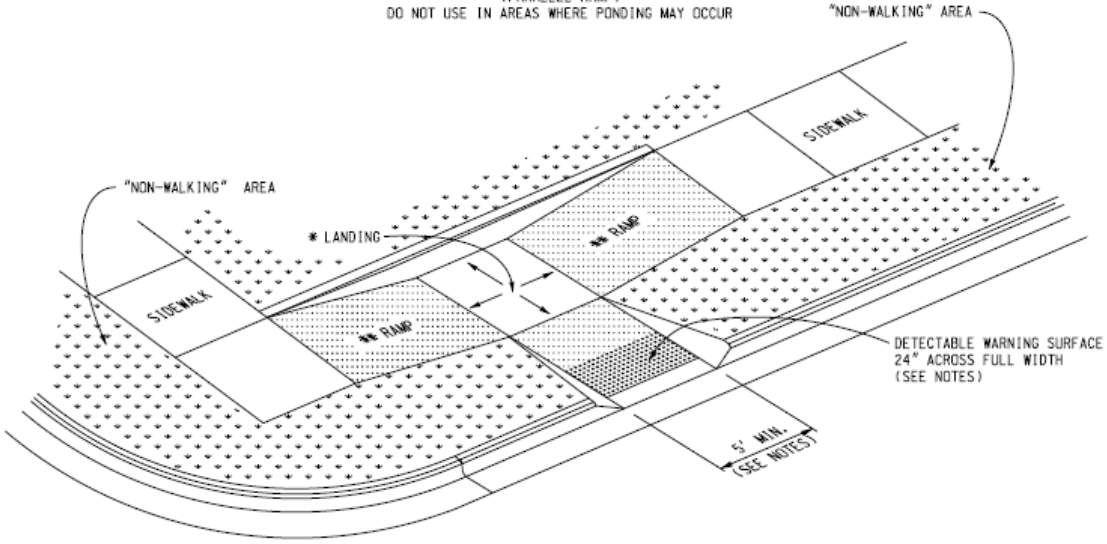
* MAXIMUM LANDING SLOPE IS 2.0% IN EACH DIRECTION OF TRAVEL. LANDING MINIMUM DIMENSIONS 5' x 5'. SEE NOTES.

** MAXIMUM RAMP CROSS SLOPE IS 2.0%, RUNNING SLOPE 5% - 7% (8.3% MAXIMUM). SEE NOTES.



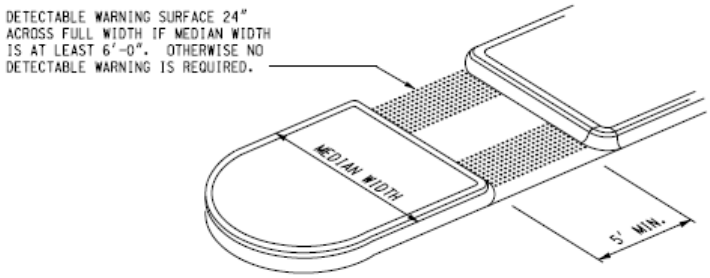
CURB RAMP TYPE P

(PARALLEL RAMP)
DO NOT USE IN AREAS WHERE PONDING MAY OCCUR



CURB RAMP TYPE C

(COMBINATION RAMP)



CURB RAMP TYPE M

(MEDIAN ISLAND)

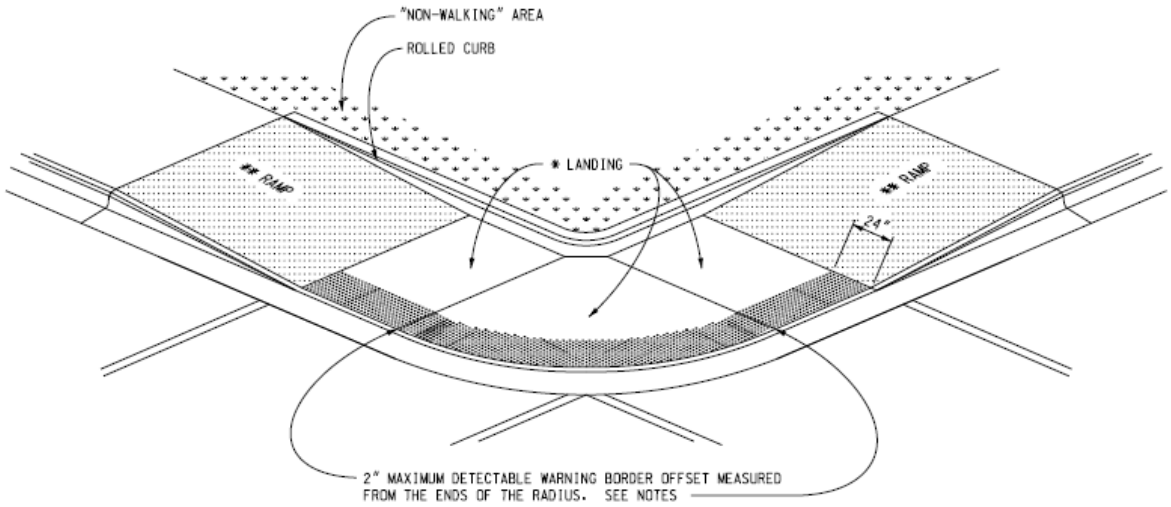
MICHIGAN DEPARTMENT OF TRANSPORTATION
BUREAU OF DEVELOPMENT STANDARD PLAN FOR

CURB RAMP AND DETECTABLE WARNING DETAILS

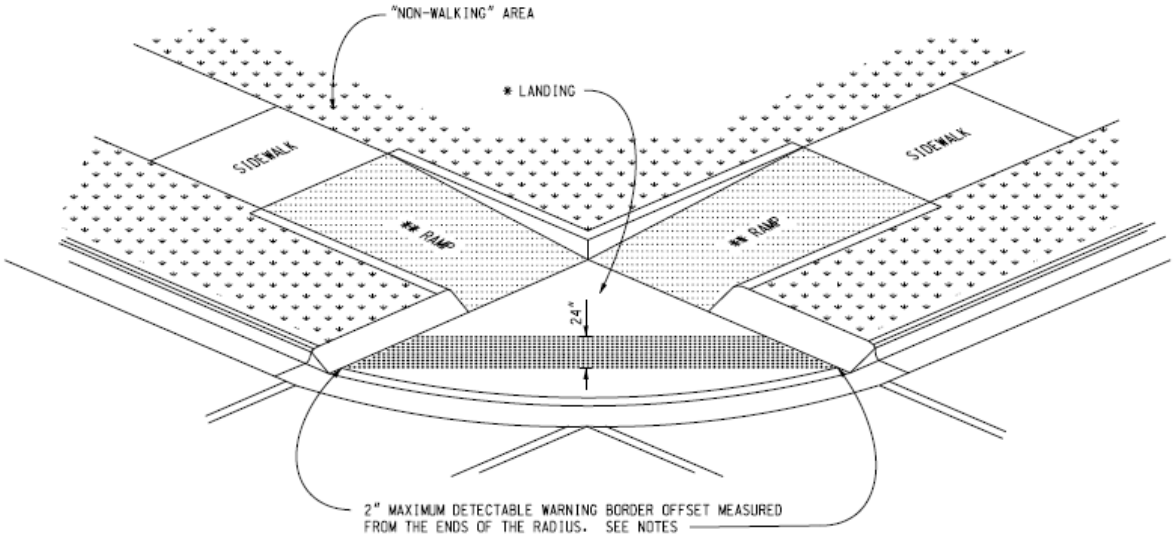
4-7-2022 F.H.W.A. APPROVAL	5-8-2020 PLAN DATE	R-28-J	SHEET 3 OF 7

* MAXIMUM LANDING SLOPE IS 2.0% IN EACH DIRECTION OF TRAVEL. LANDING MINIMUM DIMENSIONS 5' x 5'. SEE NOTES.

** MAXIMUM RAMP CROSS SLOPE IS 2.0%, RUNNING SLOPE 5% - 7% (8.3% MAXIMUM). SEE NOTES.



(RADIAL DETECTABLE WARNING SHOWN)



(TANGENT DETECTABLE WARNING SHOWN)

CURB RAMP TYPE D

(DEPRESSED CORNER)

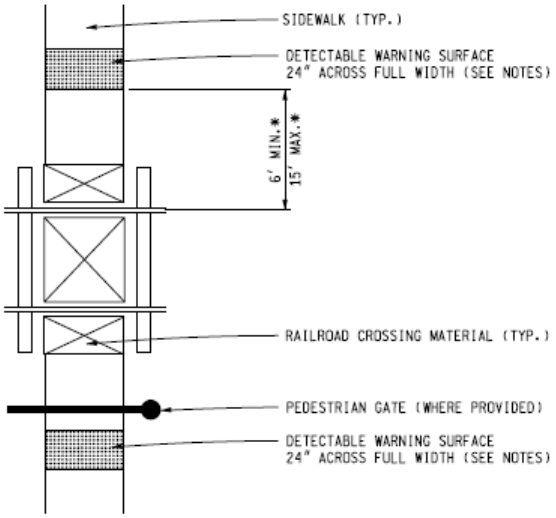
USE ONLY WHEN INDEPENDENT DIRECTIONAL RAMPS CAN NOT BE CONSTRUCTED FOR EACH CROSSING DIRECTION

MICHIGAN DEPARTMENT OF TRANSPORTATION
BUREAU OF DEVELOPMENT STANDARD PLAN FOR

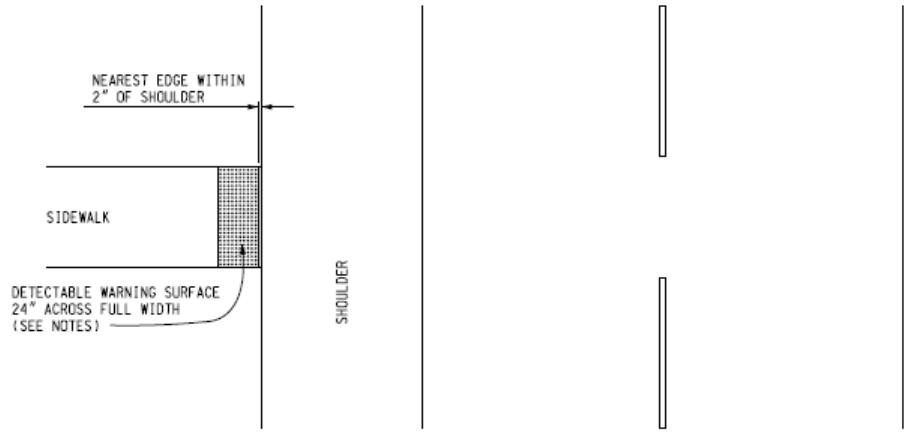
CURB RAMP AND DETECTABLE WARNING DETAILS

4-7-2022 F.H.W.A. APPROVAL	5-8-2020 PLAN DATE	R-28-J	SHEET 4 OF 7

* THE DETECTABLE WARNING SURFACE SHALL BE LOCATED SO THAT THE EDGE NEAREST THE RAIL CROSSING IS 6' MINIMUM AND 15' MAXIMUM FROM THE CENTERLINE OF THE NEAREST RAIL. DO NOT PLACE DETECTABLE WARNING ON RAILROAD CROSSING MATERIAL.



DETECTABLE WARNING AT RAILROAD CROSSING

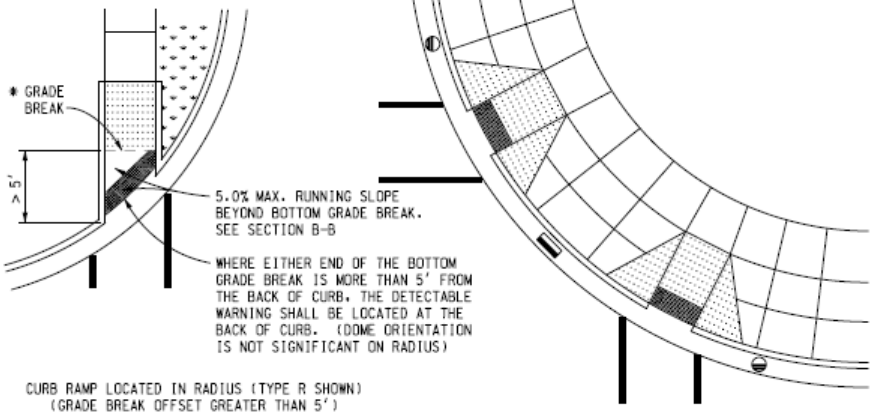


DETECTABLE WARNING AT FLUSH SHOULDER OR ROADWAY

MICHIGAN DEPARTMENT OF TRANSPORTATION
BUREAU OF DEVELOPMENT STANDARD PLAN FOR

CURB RAMP AND DETECTABLE WARNING DETAILS

4-7-2022 F.H.W.A. APPROVAL	5-8-2020 PLAN DATE	R-28-J	SHEET 5 OF 7



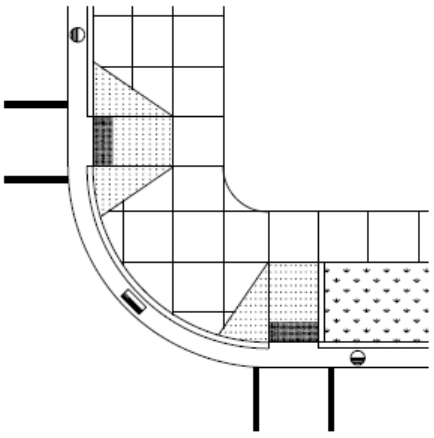
CURB RAMP LOCATED IN RADIUS (TYPE R SHOWN)
(GRADE BREAK OFFSET GREATER THAN 5')

CURB RAMP PERPENDICULAR TO RADIAL CURB (TYPE F SHOWN)

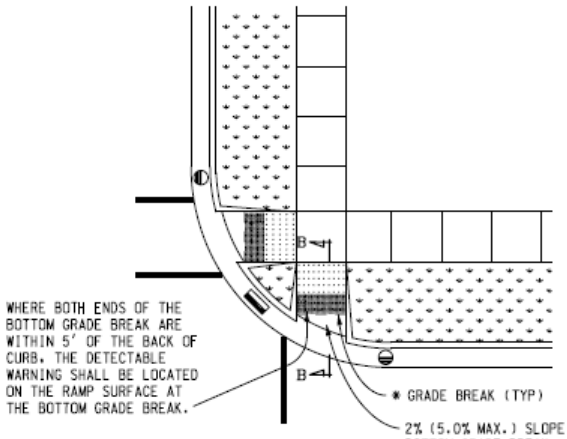
(USE WITH RADIAL CURB WHEN THE CROSSWALK AND CURB RAMP ARE NOT ALIGNED)

LEGEND

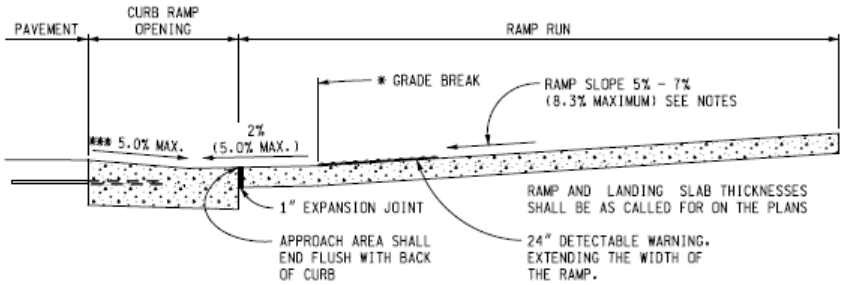
- SLOPED SURFACE
- DETECTABLE WARNING
- "NON-WALKING" AREA
- CROSSWALK MARKING
- PREFERRED LOCATION OF DRAINAGE INLET (TYP.)
- ALTERNATE LOCATION OF DRAINAGE INLET (TYP.)



CURB RAMP PERPENDICULAR TO TANGENT CURB
(TYPE F AND TYPE RF SHOWN)



CURB RAMP LOCATED IN RADIUS (TYPE R SHOWN)
(GRADE BREAK OFFSET LESS THAN 5')



SECTION B-B

* GRADE BREAKS AT THE TOP AND BOTTOM OF CURB RAMPS SHALL BE PERPENDICULAR TO THE DIRECTION OF TRAVEL.

*** TRANSITION ADJACENT GUTTER PAN CROSS SECTION TO PROVIDE 5.0% MAXIMUM COUNTER SLOPE ACROSS THE RAMP OPENING.

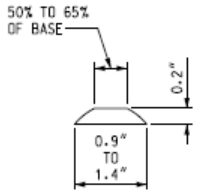
SEE SHEET 2 FOR CURB RAMP OPENING DETAILS.

CURB RAMP ORIENTATION

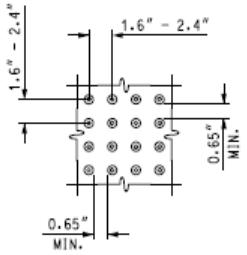
MICHIGAN DEPARTMENT OF TRANSPORTATION
BUREAU OF DEVELOPMENT STANDARD PLAN FOR

CURB RAMP AND DETECTABLE WARNING DETAILS

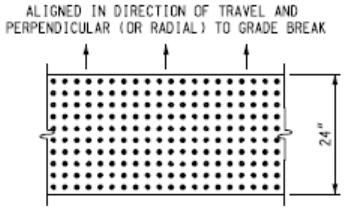
4-7-2022 F.H.W.A. APPROVAL	5-8-2020 PLAN DATE	R-28-J	SHEET 6 OF 7



DOME SECTION



DOME SPACING



DOME ALIGNMENT

DETECTABLE WARNING DETAILS

****EGR-Metal detectable warning plates only****

NOTES:

DETAILS SPECIFIED ON THIS PLAN APPLY TO ALL CONSTRUCTION, RECONSTRUCTION, OR ALTERATION OF STREETS, CURBS, OR SIDEWALKS IN THE PUBLIC RIGHT OF WAY.

CURB RAMPS ARE TO BE LOCATED AS SPECIFIED ON THE PLANS OR AS DIRECTED BY THE ENGINEER.

RAMPS SHALL BE PROVIDED AT ALL CORNERS OF AN INTERSECTION WHERE THERE IS EXISTING OR PROPOSED SIDEWALK AND CURB. RAMPS SHALL ALSO BE PROVIDED AT MARKED AND/OR SIGNALIZED MID-BLOCK CROSSINGS.

SURFACE TEXTURE OF THE RAMP SHALL BE THAT OBTAINED BY A COARSE BROOMING, TRANSVERSE TO THE RUNNING SLOPE.

SIDEWALK SHALL BE RAMPED WHERE THE DRIVEWAY CURB IS EXTENDED ACROSS THE WALK.

CARE SHALL BE TAKEN TO ASSURE A UNIFORM GRADE ON THE RAMP. WHERE CONDITIONS PERMIT, IT IS DESIRABLE THAT THE SLOPE OF THE RAMP BE IN ONLY ONE DIRECTION, PARALLEL TO THE DIRECTION OF TRAVEL.

RAMP WIDTH SHALL BE INCREASED, IF NECESSARY, TO ACCOMMODATE SIDEWALK SNOW REMOVAL EQUIPMENT NORMALLY USED BY THE MUNICIPALITY.

WHEN 5' MINIMUM WIDTHS ARE NOT PRACTICABLE, RAMP WIDTH MAY BE REDUCED TO NOT LESS THAN 4' AND LANDINGS TO NOT LESS THAN 4' x 4'.

CURB RAMPS WITH A RUNNING SLOPE ≤5% DO NOT REQUIRE A TOP LANDING. HOWEVER, ANY CONTINUOUS SIDEWALK OR PEDESTRIAN ROUTE CROSSING THROUGH OR INTERSECTING THE CURB RAMP MUST INDEPENDENTLY MAINTAIN A CROSS SLOPE NOT GREATER THAN 2% PERPENDICULAR TO ITS OWN DIRECTION(S) OF TRAVEL.

DETECTABLE WARNING SURFACE COVERAGE IS 24" MINIMUM IN THE DIRECTION OF RAMP/PATH TRAVEL AND THE FULL WIDTH OF THE RAMP/PATH OPENING EXCLUDING CURBED OR FLARED CURB TRANSITION AREAS. A BORDER OFFSET NOT GREATER THAN 2" MEASURED ALONG THE EDGES OF THE DETECTABLE WARNING IS ALLOWABLE. FOR RADIAL CURB THE OFFSET IS MEASURED FROM THE ENDS OF THE RADIUS.

FOR NEW ROADWAY CONSTRUCTION, THE RAMP CROSS SLOPE MAY NOT EXCEED 2.0%. FOR ALTERATIONS TO EXISTING ROADWAYS, THE CROSS SLOPE MAY BE TRANSITIONED TO MEET AN EXISTING ROADWAY GRADE. THE CROSS SLOPE TRANSITION SHALL BE APPLIED UNIFORMLY OVER THE FULL LENGTH OF THE RAMP.

THE MAXIMUM RUNNING SLOPE OF 8.3% IS RELATIVE TO A FLAT (0%) REFERENCE. HOWEVER, IT SHALL NOT REQUIRE ANY RAMP OR SERIES OF RAMPS TO EXCEED 15 FEET IN LENGTH NOT INCLUDING LANDINGS OR TRANSITIONS.

DRAINAGE STRUCTURES SHOULD NOT BE PLACED IN LINE WITH RAMPS. THE LOCATION OF THE RAMP SHOULD TAKE PRECEDENCE OVER THE LOCATION OF THE DRAINAGE STRUCTURE. WHERE EXISTING DRAINAGE STRUCTURES ARE LOCATED IN THE RAMP PATH OF TRAVEL, USE A MANUFACTURER'S ADA COMPLIANT GRATE. OPENINGS SHALL NOT BE GREATER THAN $\frac{1}{2}$". ELONGATED OPENINGS SHALL BE PLACED SO THAT THE LONG DIMENSION IS PERPENDICULAR TO THE DOMINANT DIRECTION OF TRAVEL.

THE TOP OF THE JOINT FILLER FOR ALL RAMP TYPES SHALL BE FLUSH WITH THE ADJACENT CONCRETE.

CROSSWALK AND STOP LINE MARKINGS, IF USED, SHALL BE SO LOCATED AS TO STOP TRAFFIC SHORT OF RAMP CROSSINGS. SPECIFIC DETAILS FOR MARKING APPLICATIONS ARE GIVEN IN THE "MICHIGAN MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES".

FLARED SIDES WITH A SLOPE OF 10% MAXIMUM, MEASURED ALONG THE ROADSIDE CURB LINE, SHALL BE PROVIDED WHERE AN UNOBSTRUCTED CIRCULATION PATH LATERALLY CROSSES THE CURB RAMP. FLARED SIDES ARE NOT REQUIRED WHERE THE RAMP IS BORDERED BY LANDSCAPING, UNPAVED SURFACE OR PERMANENT FIXED OBJECTS. WHERE THEY ARE NOT REQUIRED, FLARED SIDES CAN BE CONSIDERED IN ORDER TO AVOID SHARP CURB RETURNS AT RAMP OPENINGS.

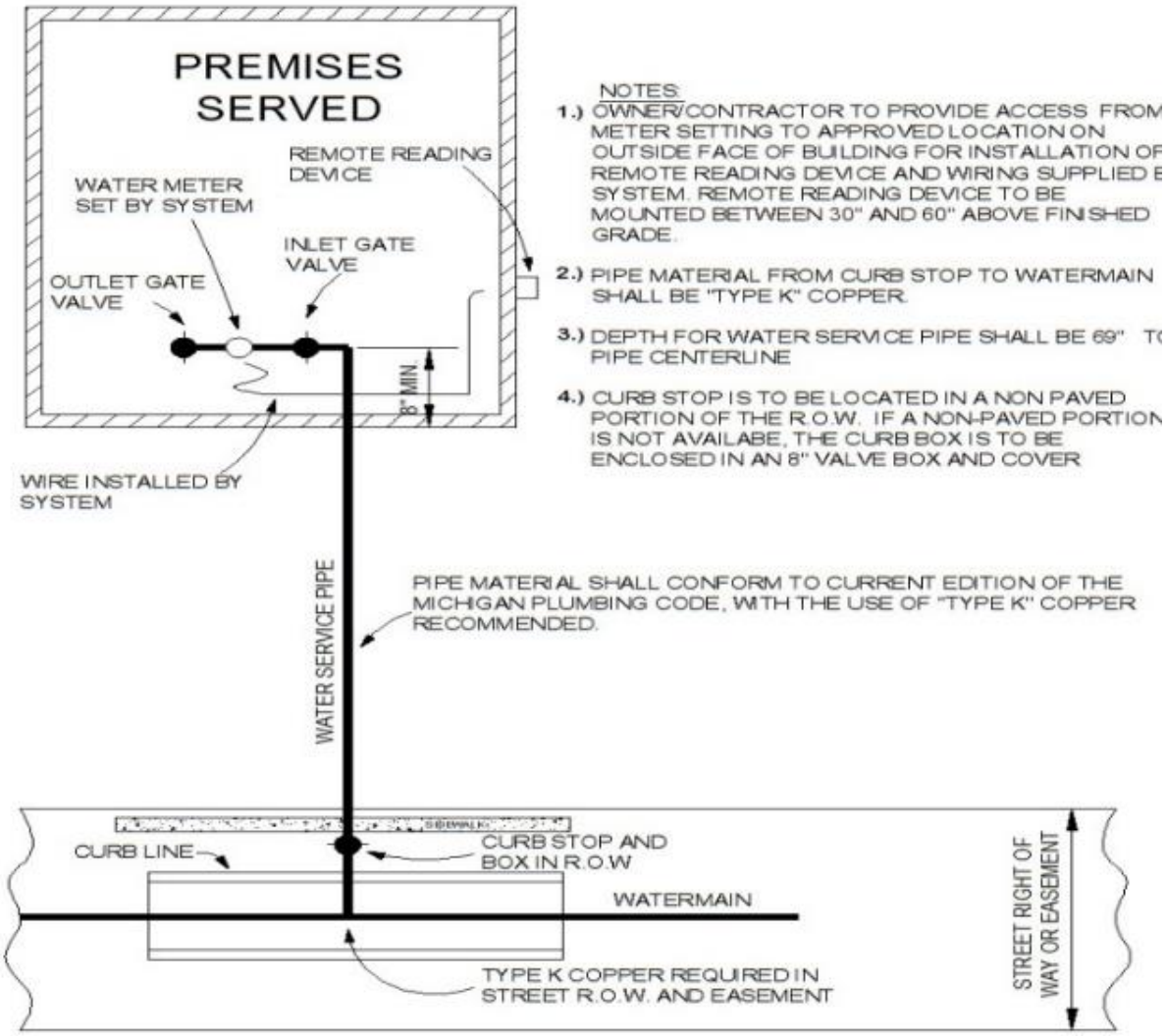
DETECTABLE WARNING PLATES MUST BE INSTALLED USING FABRICATED OR FIELD CUT UNITS CAST AND/OR ANCHORED IN THE PAVEMENT TO RESIST SHIFTING OR HEAVING.

MICHIGAN DEPARTMENT OF TRANSPORTATION
BUREAU OF DEVELOPMENT STANDARD PLAN FOR

CURB RAMP AND DETECTABLE WARNING DETAILS

4-7-2022	5-8-2020	R-28-J	SHEET
F.H.W.A. APPROVAL	PLAN DATE		7 OF 7

Residential 1" Water Service



NOTES:

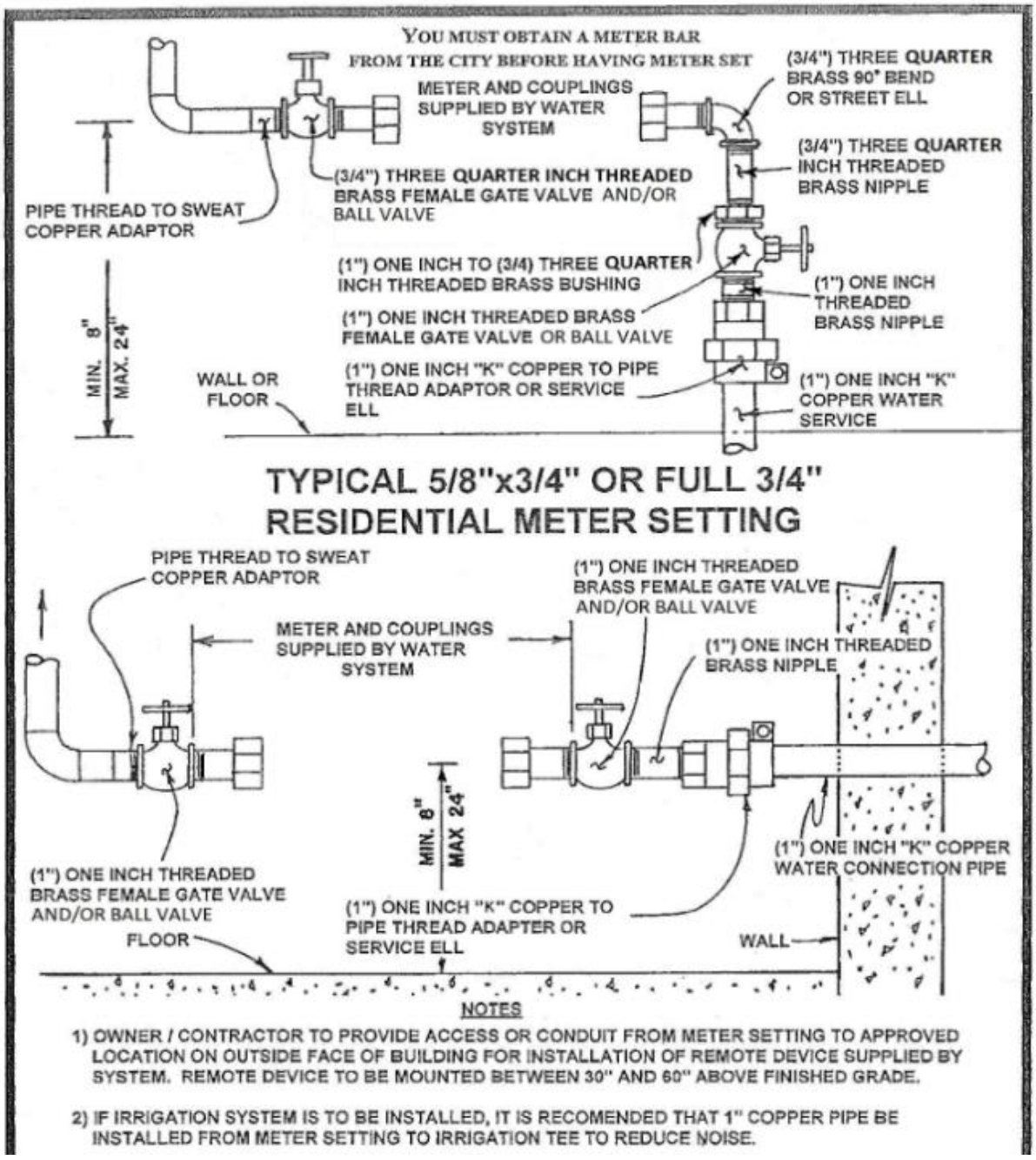
1.) OWNER/CONTRACTOR TO PROVIDE ACCESS FROM METER SETTING TO APPROVED LOCATION ON OUTSIDE FACE OF BUILDING FOR INSTALLATION OF REMOTE READING DEVICE AND WIRING SUPPLIED B SYSTEM. REMOTE READING DEVICE TO BE MOUNTED BETWEEN 30" AND 60" ABOVE FINISHED GRADE.

2.) PIPE MATERIAL FROM CURB STOP TO WATERMAIN SHALL BE "TYPE K" COPPER.

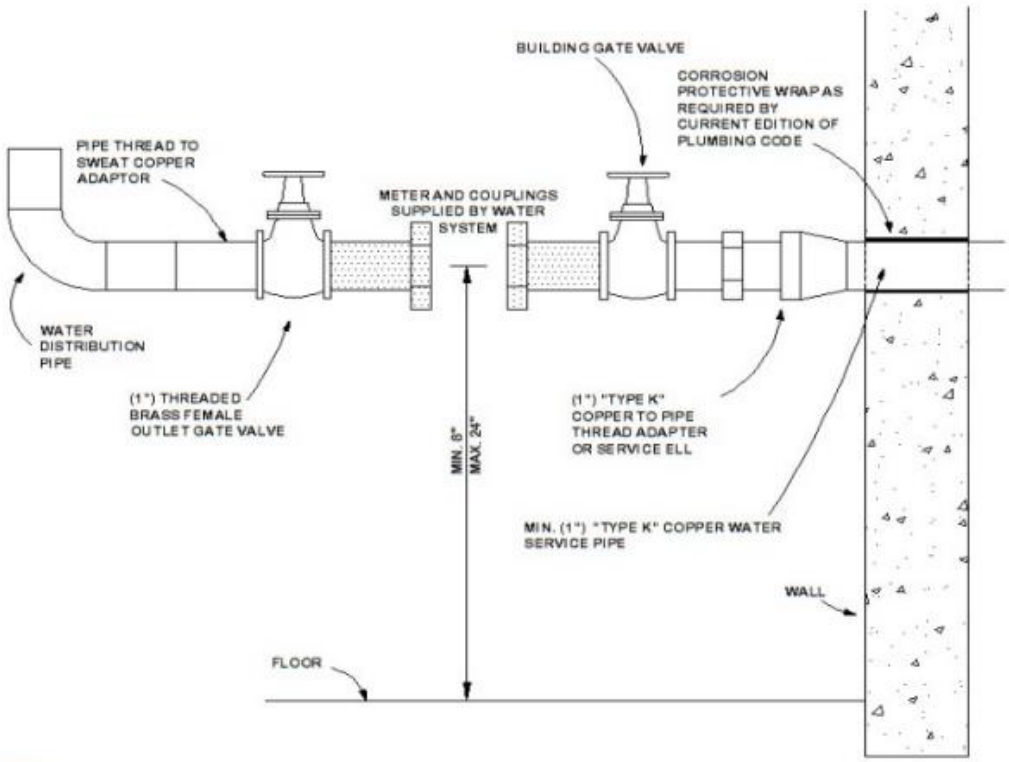
3.) DEPTH FOR WATER SERVICE PIPE SHALL BE 69" TO PIPE CENTERLINE

4.) CURB STOP IS TO BE LOCATED IN A NON PAVED PORTION OF THE R.O.W. IF A NON-PAVED PORTION IS NOT AVAILABE, THE CURB BOX IS TO BE ENCLOSED IN AN 8" VALVE BOX AND COVER

Residential 5/8" x 3/4" Meter Setting



Residential 1" Meter Setting



NOTES:

1.) OWNER/CONTRACTOR TO PROVIDE ACCESS OR CONDUIT FROM METER SETTING TO APPROVED LOCATION ON OUTSIDE FACE OF BUILDING FOR INSTALLATION OF REMOTE READING DEVICE SUPPLIED BY WATER SYSTEM. REMOTE READING DEVICE TO BE MOUNTED BETWEEN 30" AND 60" ABOVE FINISHED GRADE.

2.) IF IRRIGATION SYSTEM IS TO BE INSTALLED, IT IS RECOMENDED THAT 1" COPPER PIPE BE INSTALLED FROM METER SETTING TO IRRIGATION TEE TO REDUCE NOISE.

3.) INLET VALVE MUST BE SAME SIZE AS WATER SERVICE PIPE.

4.) METER SETTING DEFINED AS:
STARTING AT THE BUILDING GATE VALVE AND ENDING AT THE OUTLET GATE VALVE AFTER METER. (INCLUDING ALL PIPING AND FITTINGS IN BETWEEN)

5.) ALL PIPING IN METER SETTING TO BE THREADED BRASS. NO BALL VALVES OR GALVANIZED FITTINGS/PIPING ALLOWED IN METER SETTING.

6.) LOCATE METER MIN. 12" FROM OUTSIDE WALL AND 24" MAX. FROM OUTSIDE WALL.

7.) IF THERE ARE ANY QUESTIONS ABOUT THE METER SETTING/OR OPTIONAL IRRIGATION CONTACT: WATER DEPT. METER MAINTENANCE 616-456-3904

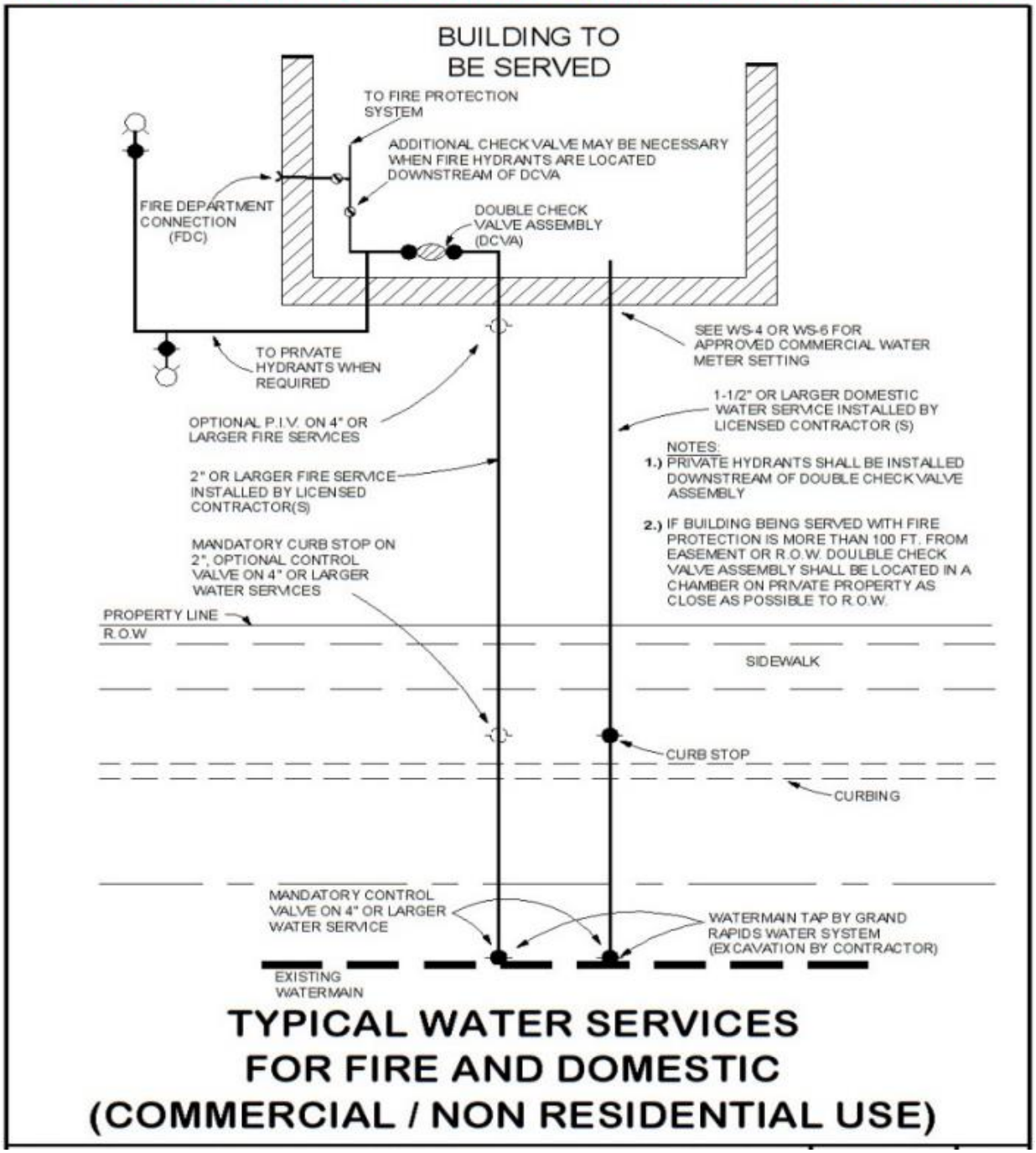
8.) NO SWEATING OF FITTINGS WITHIN METER SETTING.

9.) CONTRACTOR TO OBTAIN AND INSTALL GRAND RAPIDS WATER SYSTEM SUPPLIED METER BAR AND COMPRESSION FITTING PRIOR TO HAVING METER SET.

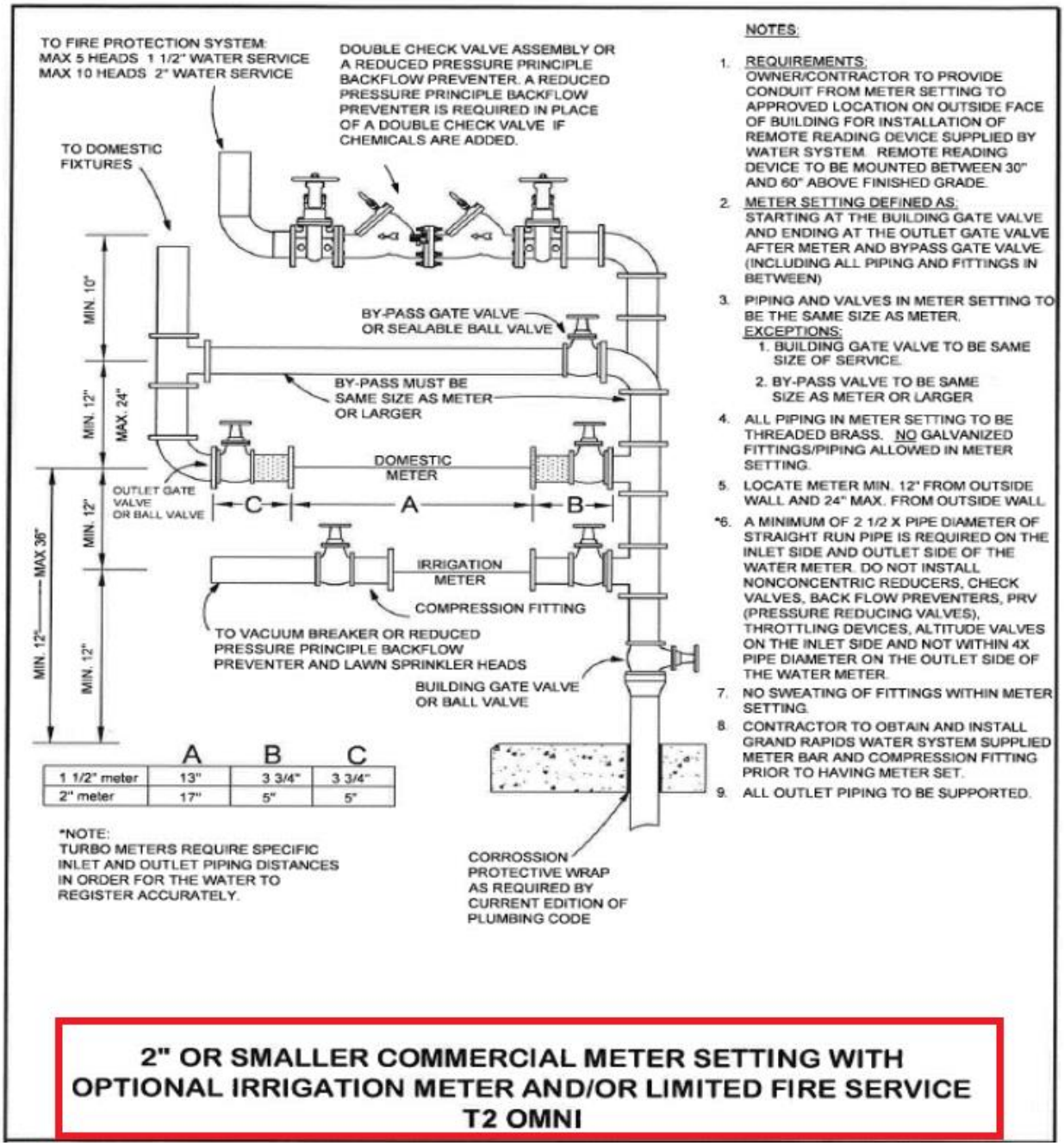
10.) IF WATER NEEDS TO BE TURNED OFF FOR REPAIRS, CONTACT CITY OF GRAND RAPIDS WATER DEPT. METER MAINTENANCE 616-456-3249

11.) BUILDING VALVE MUST BE SAME SIZE AS WATER SERVICE PIPE

Water Services for Fire and Domestic-Commercial/Non-Residential



2" of Smaller Commercial Meter Setting



	A	B	C
1 1/2" meter	13"	3 3/4"	3 3/4"
2" meter	17"	5"	5"

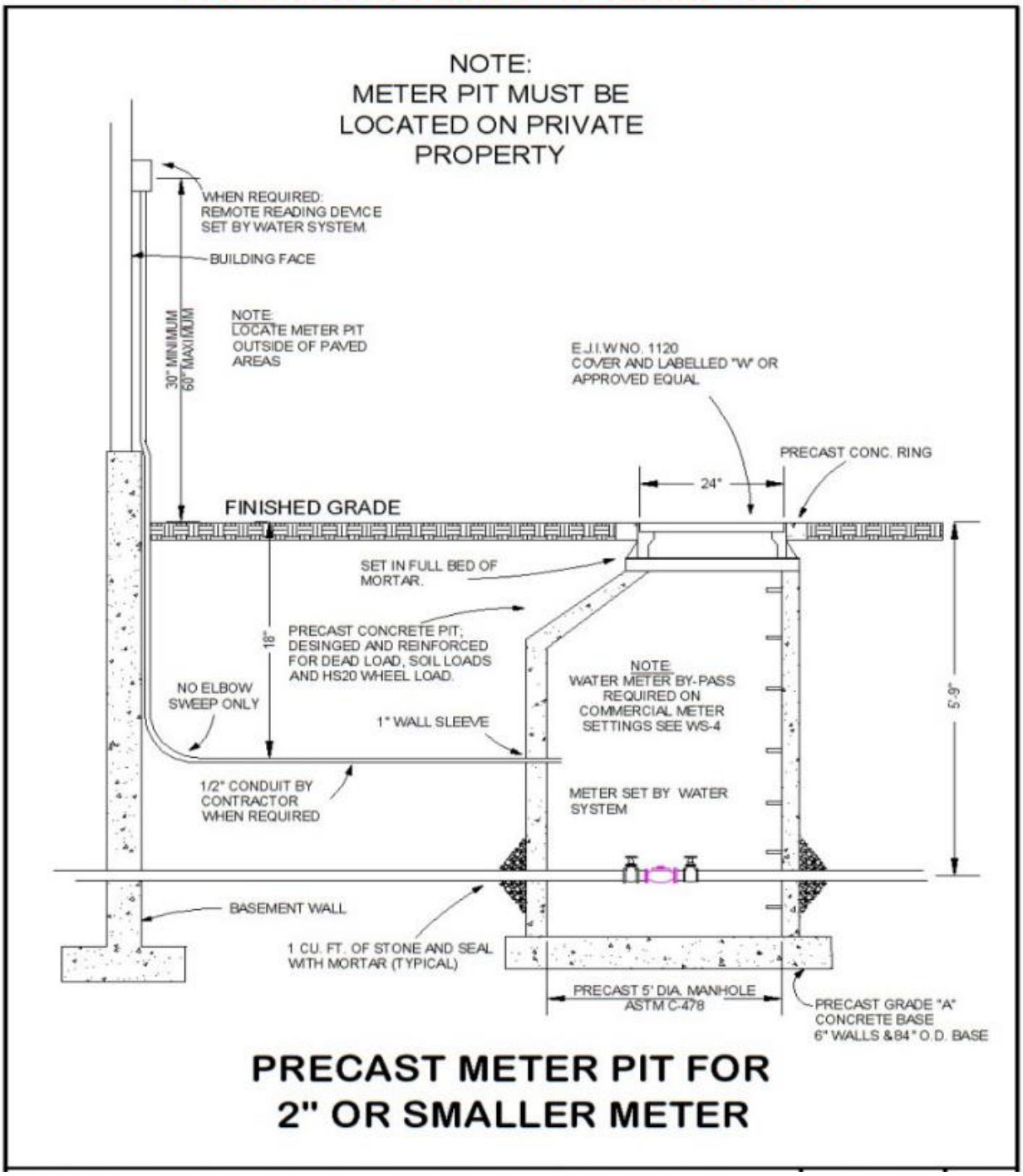
*NOTE:
TURBO METERS REQUIRE SPECIFIC INLET AND OUTLET PIPING DISTANCES IN ORDER FOR THE WATER TO REGISTER ACCURATELY.

NOTES:

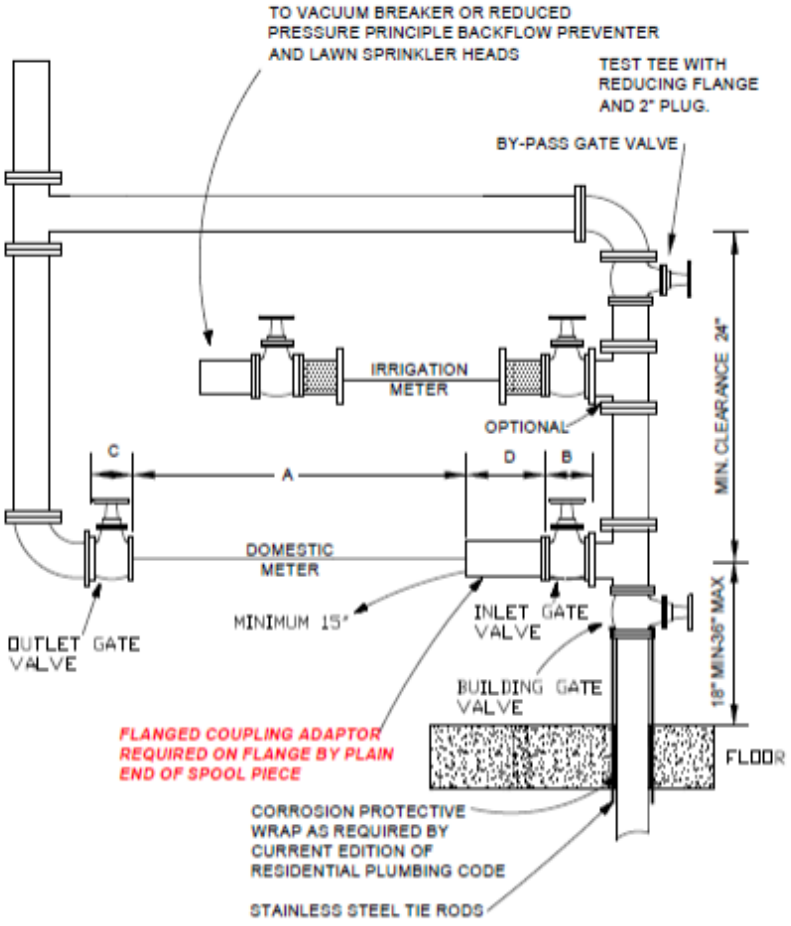
1. REQUIREMENTS:
OWNER/CONTRACTOR TO PROVIDE CONDUIT FROM METER SETTING TO APPROVED LOCATION ON OUTSIDE FACE OF BUILDING FOR INSTALLATION OF REMOTE READING DEVICE SUPPLIED BY WATER SYSTEM. REMOTE READING DEVICE TO BE MOUNTED BETWEEN 30" AND 60" ABOVE FINISHED GRADE.
2. METER SETTING DEFINED AS:
STARTING AT THE BUILDING GATE VALVE AND ENDING AT THE OUTLET GATE VALVE AFTER METER AND BYPASS GATE VALVE. (INCLUDING ALL PIPING AND FITTINGS IN BETWEEN)
3. PIPING AND VALVES IN METER SETTING TO BE THE SAME SIZE AS METER.
EXCEPTIONS:
   1. BUILDING GATE VALVE TO BE SAME SIZE OF SERVICE.
   2. BY-PASS VALVE TO BE SAME SIZE AS METER OR LARGER
4. ALL PIPING IN METER SETTING TO BE THREADED BRASS. NO GALVANIZED FITTINGS/PIPING ALLOWED IN METER SETTING.
5. LOCATE METER MIN. 12" FROM OUTSIDE WALL AND 24" MAX. FROM OUTSIDE WALL.
*6. A MINIMUM OF 2 1/2 X PIPE DIAMETER OF STRAIGHT RUN PIPE IS REQUIRED ON THE INLET SIDE AND OUTLET SIDE OF THE WATER METER. DO NOT INSTALL NONCONCENTRIC REDUCERS, CHECK VALVES, BACK FLOW PREVENTERS, PRV (PRESSURE REDUCING VALVES), THROTTLING DEVICES, ALTITUDE VALVES ON THE INLET SIDE AND NOT WITHIN 4X PIPE DIAMETER ON THE OUTLET SIDE OF THE WATER METER.
7. NO SWEATING OF FITTINGS WITHIN METER SETTING.
8. CONTRACTOR TO OBTAIN AND INSTALL GRAND RAPIDS WATER SYSTEM SUPPLIED METER BAR AND COMPRESSION FITTING PRIOR TO HAVING METER SET.
9. ALL OUTLET PIPING TO BE SUPPORTED.

2" OR SMALLER COMMERCIAL METER SETTING WITH OPTIONAL IRRIGATION METER AND/OR LIMITED FIRE SERVICE
T2 OMNI

Prescast Meter Pit for 2" or Smaller Meter



Inside Meter Setting for 3" or Larger Meters



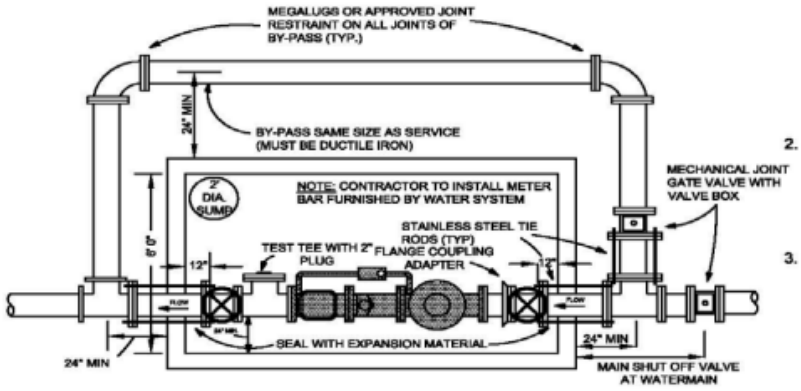
	A	B	C	D
3"	19 3/8"	7 1/2"	7 1/2"	15"
4"	23 3/8"	10"	10"	15"
6" AND UP	CONTACT WATER SYSTEM 456-3265			
ALL COMPOUND AND FIRELINE METERS				

NOTES:

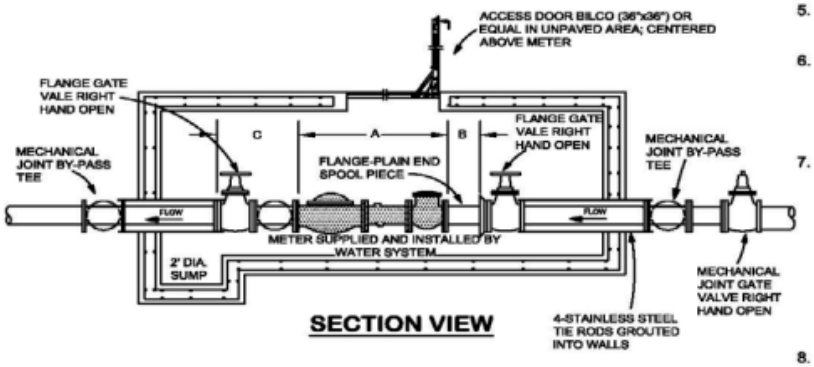
1. REQUIREMENTS:
   OWNER/CONTRACTOR TO PROVIDE CONDUIT FROM METER SETTING TO APPROVED LOCATION ON OUTSIDE FACE OF BUILDING FOR INSTALLATION OF REMOTE READING DEVICE SUPPLIED BY WATER SYSTEM. REMOTE READING DEVICE TO BE MOUNTED BETWEEN 30" AND 60" ABOVE FINISHED GRADE.
2. METER SETTING DEFINED AS:
   STARTING AT THE BUILDING GATE VALVE AND ENDING AT THE OUTLET GATE VALVE AFTER METER AND BYPASS GATE VALVE. (INCLUDING ALL PIPING AND FITTINGS IN BETWEEN)
3. PIPING AND VALVES IN METER SETTING TO BE THE SAME SIZE AS METER.
   EXCEPTIONS:
   1. BUILDING GATE VALVE TO BE SAME SIZE OF SERVICE.
   2. BY-PASS VALVE TO BE SAME SIZE AS METER OR LARGER
4. ALL PIPING IN METER SETTING TO BE DUCTILE IRON. NO GALVANIZED FITTINGS OR PIPING ALLOWED.
5. ALL FITTINGS IN METER SETTING TO BE FLANGED.
6. FLANGE COUPLING ADAPTER PROVIDED BY WATER DEPT. IS REQUIRED IN THE METER SETTING AND IS TO BE INSTALLED WITH ENOUGH FLEXIBILITY (1/4" TO 1/2") TO ALLOW FOR METER INSTALLATION.
7. A MINIMUM OF 2 1/2 X PIPE DIAMETER OF STRAIGHT RUN PIPE IS REQUIRED ON THE INLET SIDE AND OUTLET SIDE OF THE WATER METER. DO NOT INSTALL NON CONCENTRIC REDUCERS, CHECK VALVES, BACK FLOW PREVENTERS, PRV (PRESSURE REDUCING VALVES), THROTTLING DEVICES, ALTITUDE VALVES ON THE INLET SIDE AND NOT WITHIN 4X PIPE DIAMETER ON THE OUTLET SIDE OF THE WATER METER.
8. IF THERE ARE ANY QUESTIONS ABOUT THE METER SETTING/OR OPTIONAL IRRIGATION CONTACT: WATER DEPT. METER MAINTENANCE 616-456-3265

INSIDE METER SETTING FOR 3" OR LARGER METERS
T2 OMNI

Pit Meter Layout and Meter Setting for 3'' and Larger Meter



PLAN VIEW



SECTION VIEW

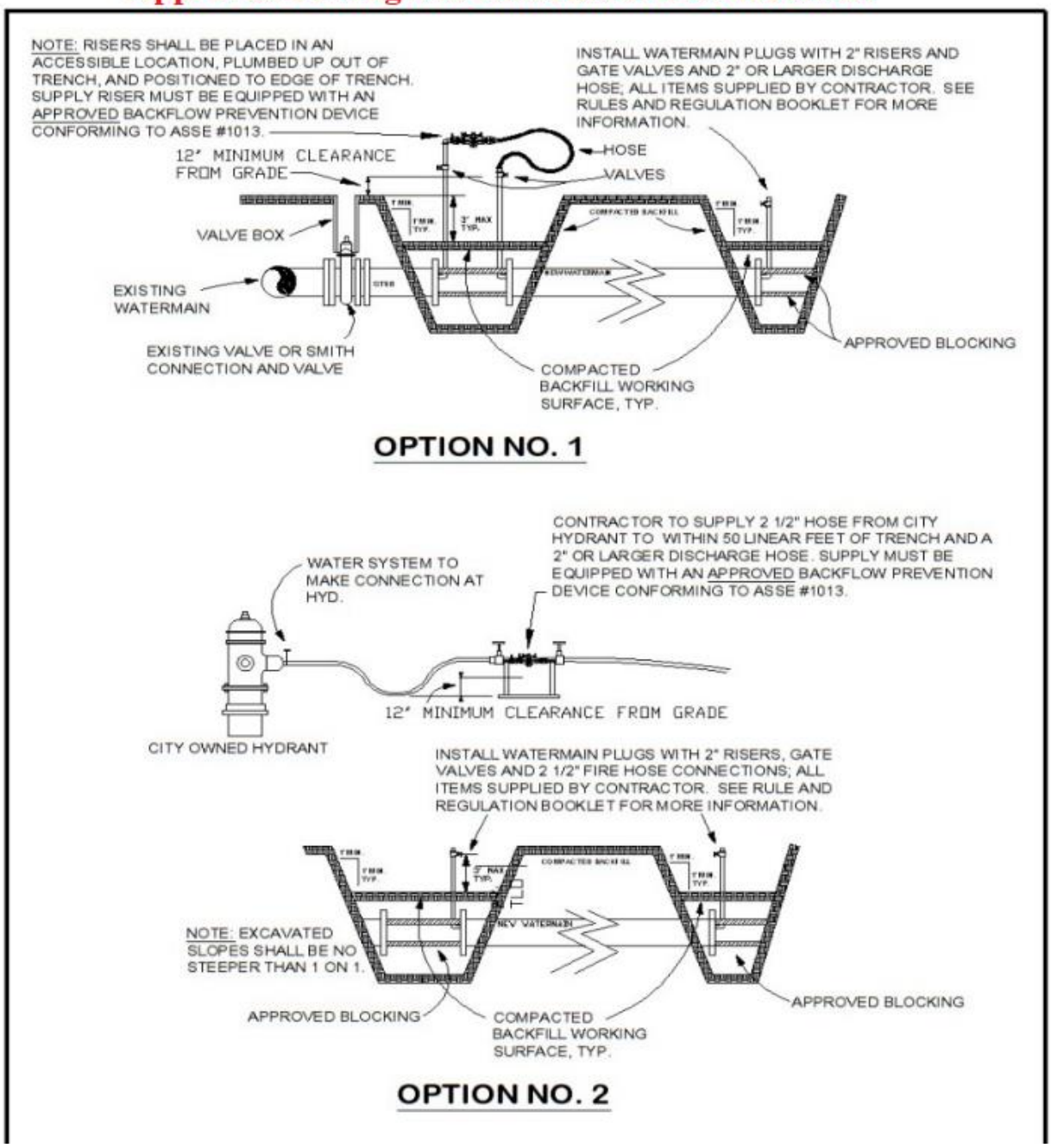
	A	B	C
3"	19 3/8"	7 1/2"	7 1/2"
4"	23 3/8"	10"	10"
6" AND UP	CONTACT WATER SYSTEM 456-3265		
ALL COMPOUND AND FIRELINE METERS			

PIT LAYOUT AND METER SETTING FOR A 3" & LARGER METER T2 OMNI

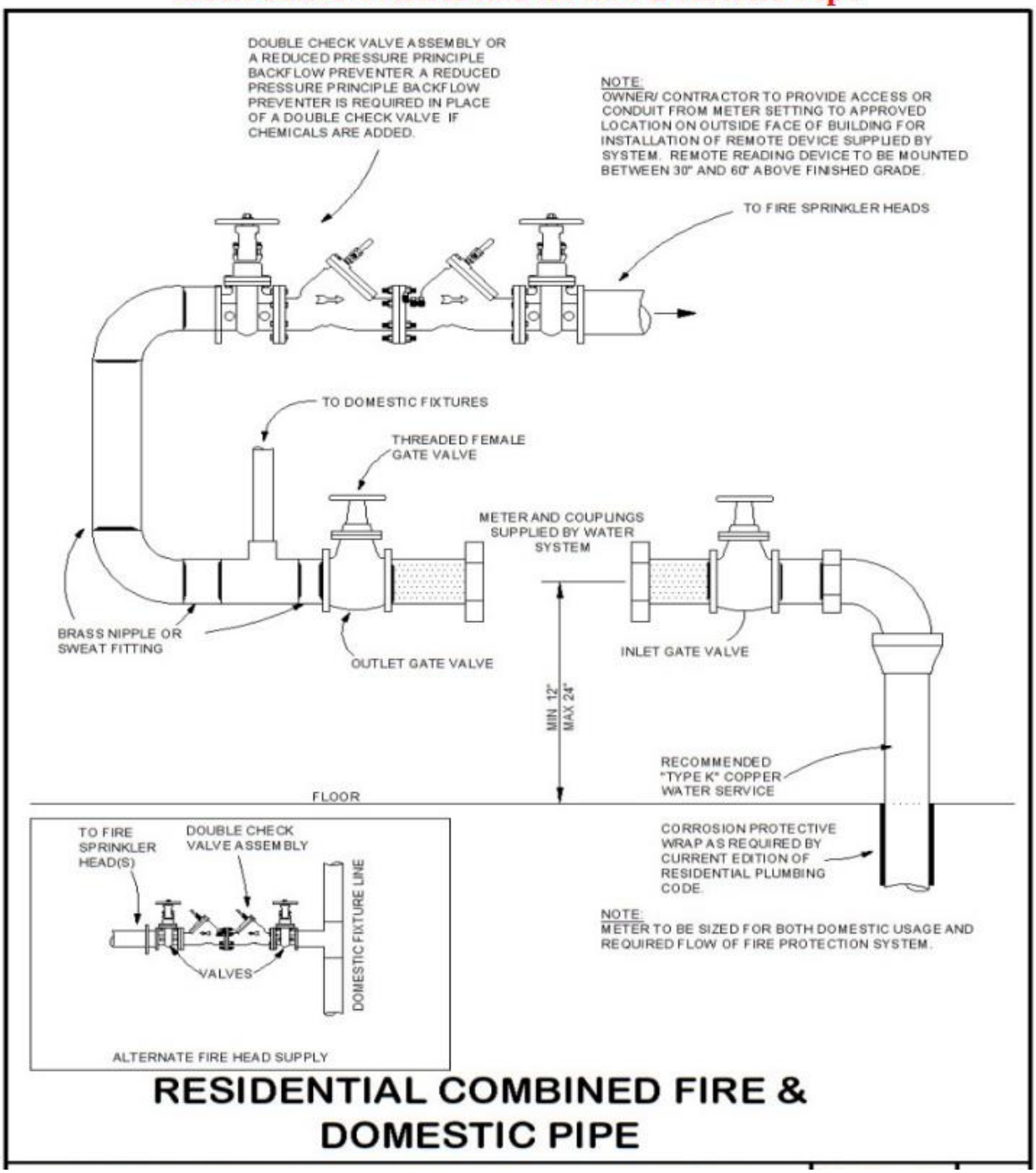
NOTES:

1. REQUIREMENTS: OWNER/CONTRACTOR TO PROVIDE CONDUIT FROM METER SETTING TO APPROVED LOCATION ON OUTSIDE FACE OF BUILDING FOR INSTALLATION OF REMOTE READING DEVICE SUPPLIED BY WATER SYSTEM. REMOTE READING DEVICE TO BE MOUNTED BETWEEN 30" AND 60" ABOVE FINISHED GRADE.
2. METER SETTING DEFINED AS: STARTING AT THE BUILDING GATE VALVE AND ENDING AT THE OUTLET GATE VALVE AFTER METER AND BYPASS GATE VALVE. (INCLUDING ALL PIPING AND FITTINGS IN BETWEEN)
3. PIPING AND VALVES IN METER SETTING TO BE THE SAME SIZE AS METER.
   EXCEPTIONS:
   1. BUILDING GATE VALVE TO BE SAME SIZE OF SERVICE.
   2. BY-PASS VALVE TO BE SAME SIZE AS METER OR LARGER
4. ALL PIPING IN METER SETTING TO BE DUCTILE IRON. NO GALVANIZED FITTINGS OR PIPING ALLOWED.
5. ALL FITTINGS IN METER SETTING TO BE FLANGED.
6. FLANGE COUPLING ADAPTER PROVIDED BY WATER DEPT. IS REQUIRED IN THE METER SETTING AND IS TO BE INSTALLED WITH ENOUGH FLEXIBILITY (1/4" TO 1/2") TO ALLOW FOR METER INSTALLATION.
7. A MINIMUM OF 2 1/2 X PIPE DIAMETER OF STRAIGHT RUN PIPE IS REQUIRED ON THE INLET SIDE AND OUTLET SIDE OF THE WATER METER. DO NOT INSTALL NON CONCENTRIC REDUCERS, CHECK VALVES, BACK FLOW PREVENTERS, PRV (PRESSURE REDUCING VALVES), THROTTLING DEVICES, ALTITUDE VALVES ON THE INLET SIDE AND NOT WITHIN 4X PIPE DIAMETER ON THE OUTLET SIDE OF THE WATER METER.
8. IF THERE ARE ANY QUESTIONS ABOUT THE METER SETTING/OR OPTIONAL IRRIGATION CONTACT: WATER DEPT. METER MAINTENANCE 616-456-3265
9. BEFORE PURCHASING MATERIALS FAX DRAWING TO: WATER DEPT. METER MAINTENANCE AT 616-456-3265
10. REINFORCED CONCRETE METER PIT TO BE DESIGNED AND REINFORCED FOR DEAD LOAD, SOIL LOAD AND HS20 WHEEL LOAD.
11. METER PIT MUST BE PLACED ON PRIVATE PROPERTY.
12. METER TO BE SUPPLIED AND INSTALLED BY WATER SYSTEM. CONTRACTOR TO INSTALL METER BAR FURNISHED BY WATER SYSTEM

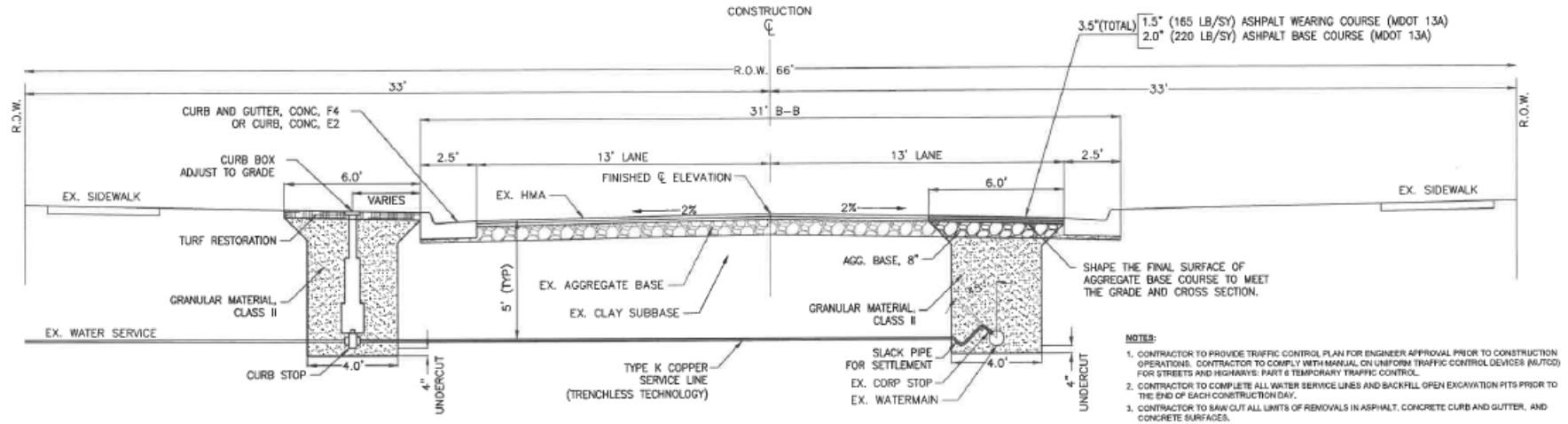
Approved Testing and Chlorination Connections



Residential Combined Fire and Domestic Pipe



Water Service-Long Side

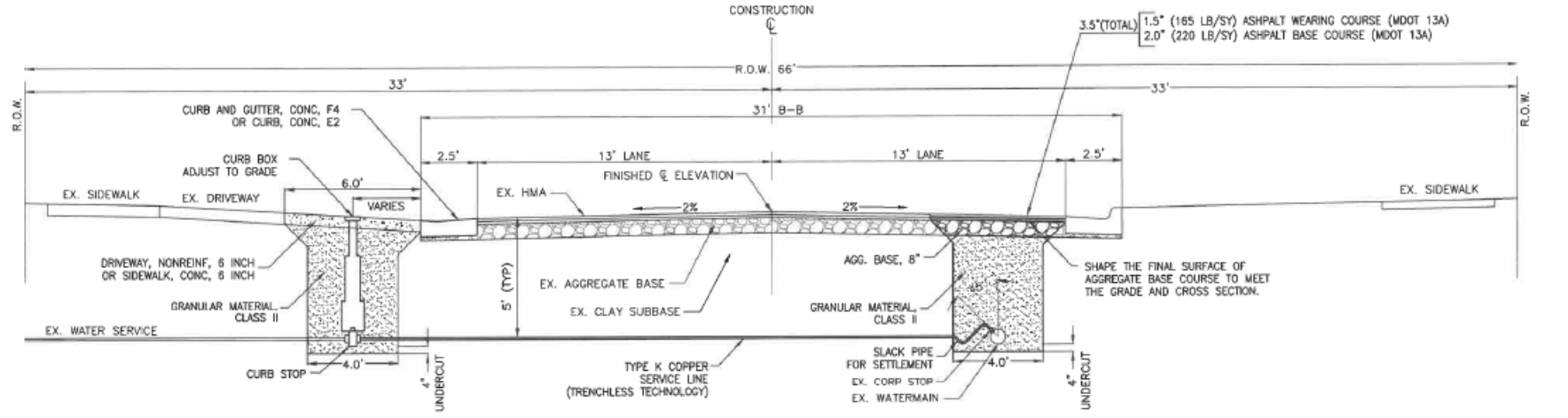


WATER SERVICE, LONG SIDE, TURF RESTORATION

N.T.S.

NOTES:

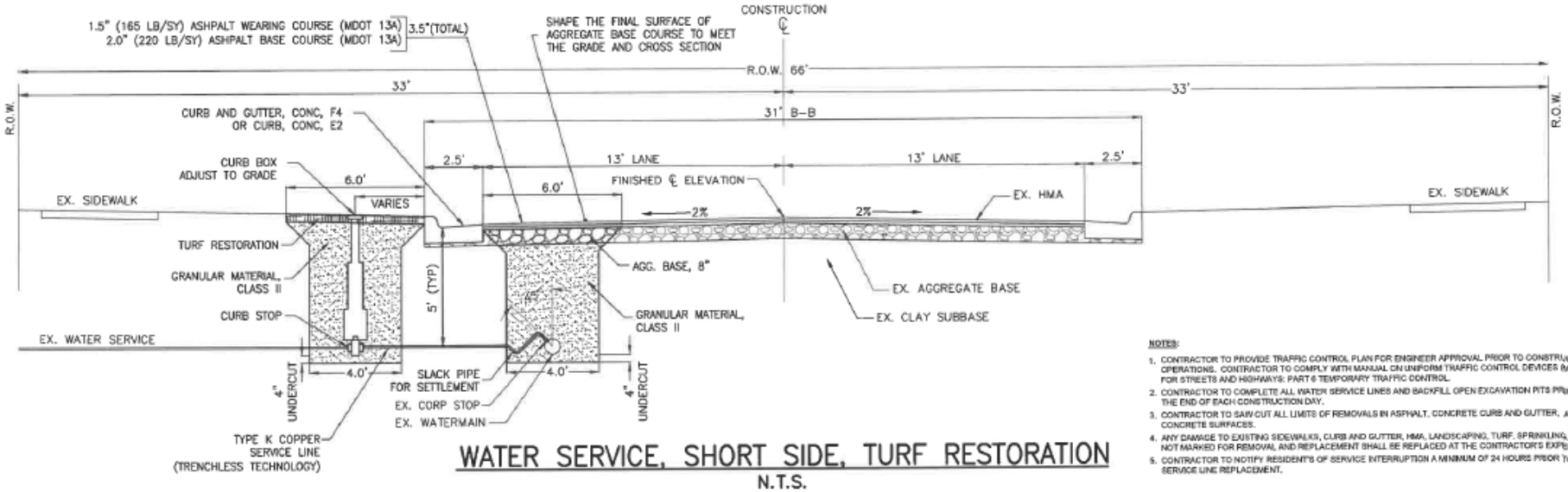
1. CONTRACTOR TO PROVIDE TRAFFIC CONTROL PLAN FOR ENGINEER APPROVAL PRIOR TO CONSTRUCTION OPERATIONS. CONTRACTOR TO COMPLY WITH MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES (MUTCD) FOR STREETS AND HIGHWAYS: PART 6 TEMPORARY TRAFFIC CONTROL.
2. CONTRACTOR TO COMPLETE ALL WATER SERVICE LINES AND BACKFILL OPEN EXCAVATION PITS PRIOR TO THE END OF EACH CONSTRUCTION DAY.
3. CONTRACTOR TO SAW CUT ALL LIMITS OF REMOVALS IN ASPHALT, CONCRETE CURB AND GUTTER, AND CONCRETE SURFACES.
4. ANY DAMAGE TO EXISTING SIDEWALKS, CURB AND GUTTER, HMA, LANDSCAPING, TURF, SPRINKLING, ETC. NOT MARKED FOR REMOVAL AND REPLACEMENT SHALL BE REPLACED AT THE CONTRACTOR'S EXPENSE.
5. CONTRACTOR TO NOTIFY RESIDENTS OF SERVICE INTERRUPTION A MINIMUM OF 24 HOURS PRIOR TO SERVICE LINE REPLACEMENT.



WATER SERVICE, LONG SIDE, DRIVEWAY/SIDEWALK RESTORATION

N.T.S.

Water Service-Short Side

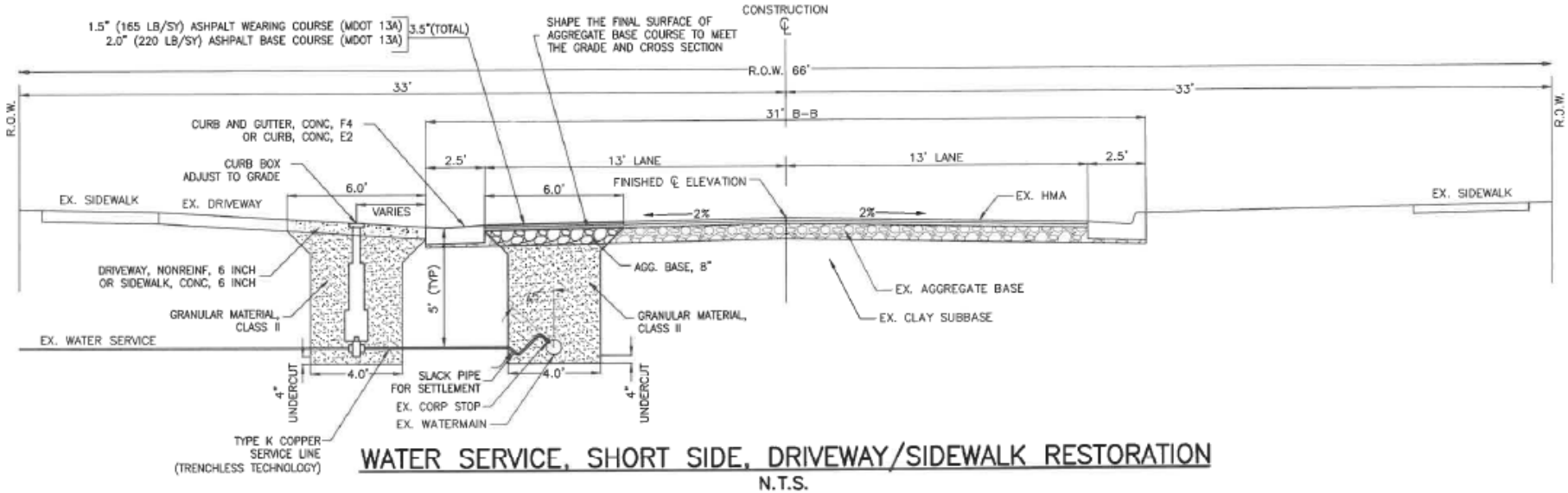


WATER SERVICE, SHORT SIDE, TURF RESTORATION

N.T.S.

NOTES:

1. CONTRACTOR TO PROVIDE TRAFFIC CONTROL PLAN FOR ENGINEER APPROVAL PRIOR TO CONSTRUCTION OPERATIONS. CONTRACTOR TO COMPLY WITH MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES (MUTCD) FOR STREETS AND HIGHWAYS: PART 6 TEMPORARY TRAFFIC CONTROL.
2. CONTRACTOR TO COMPLETE ALL WATER SERVICE LINES AND BACKFILL OPEN EXCAVATION PITS PRIOR TO THE END OF EACH CONSTRUCTION DAY.
3. CONTRACTOR TO SAW CUT ALL LIMITS OF REMOVALS IN ASPHALT, CONCRETE CURB AND GUTTER, AND CONCRETE SURFACES.
4. ANY DAMAGE TO EXISTING SIDEWALKS, CURB AND GUTTER, HMA, LANDSCAPING, TURF, SPRINKLING, ETC. NOT MARKED FOR REMOVAL AND REPLACEMENT SHALL BE REPLACED AT THE CONTRACTOR'S EXPENSE.
5. CONTRACTOR TO NOTIFY RESIDENT'S OF SERVICE INTERRUPTION A MINIMUM OF 24 HOURS PRIOR TO SERVICE LINE REPLACEMENT.



WATER SERVICE, SHORT SIDE, DRIVEWAY/SIDEWALK RESTORATION

N.T.S.

WATER MAIN SPECIFICATIONS

4.01 DESCRIPTION OF WORK

The work shall consist of constructing water mains of the specified size or sizes in a trench, and shall include the construction and/or installation of all appurtenances thereto as shown on the Plans and as described in these Specifications.

Excavating, trenching, and backfilling shall be as specified in Section 2.

4.02 MATERIALS

All materials furnished by the Contractor shall conform to the Specifications that follow. Where reference specifications are used, they shall be considered as referring to the current edition of latest issue.

The Contractor shall furnish, in triplicate, certification by the manufacturer of water pipe, valves, hydrants and other materials that these materials meet the requirements of the appropriate tests for the kind and class of material as required in these Specifications or shown on the Plans.

Certifications of conformance shall be submitted and shall be approved by the Engineer before these materials are used in the proposed construction.

4.02.01 Water Pipe and Fittings

a. General. Unless otherwise specified, all water pipe and fittings shall be ductile iron, Class 53, meeting the requirements specified herein. All water pipe, fittings, and materials shall be ANSI/NSF Standard 61 certified, and clearly stamped on the exterior of the pipe wall.

b. Ductile Iron Pipe. All ductile iron piping shall conform to the requirements of ANSI Specifications A 21.51 (AWWA C151). The class shown shall meet the requirements of ANSI Specification A 21.50 (AWWA C150) except that the minimum wall thickness shall be Class 53.

c. Ball Joint Pipe (River Crossing Pipe). Where ball joint pipe is specified or indicated on the Plans, the pipe shall be Ball Joint River-Crossing Pipe by American Pipe, Clow, U.S. Pipe, or approved equal. Joints shall be of an approved type which shall provide 15 degrees deflection at each joint with no reduction in the pipe waterway. All or a portion of the pipe shall be furnished in short lengths when necessary to provide the required curvature.

d. Fittings. All tees, bends, and other fittings shall conform to the requirements of ANSI Specification A 21.53 (AWWA C153, latest edition) for the same or greater working pressure as the pipe. All fittings shall be ductile iron.

Mega-lug joint restrainer glands may be used in lieu of restrained joint pipe where restraint is required. Mega-lugs shall be as manufactured by EBAA Iron Inc.

e. Plugs for dead ends shall be Push-on Restrained Plugs for push-on joint pipe, and shall be mechanical joint plug with mega-lug joint restraints for mechanical joint type.

All plugs shall be inserted in the bell end of the pipe.

f. Special Fittings or other appurtenances may be required or desirable in certain instances. The Contractor shall review the use of such items with the Engineer before they are ordered. In no case shall materials other than those specifically covered by the Specifications be utilized or installed without prior approval of the Engineer.

g. Joints. Unless otherwise specified, all pipe joints shall be rubber gasket joints conforming to the requirements of ANSI Specification A 21.11 (AWWA C111) for bolted mechanical joints or push-on joints. Joints on fittings shall be bolted mechanical joints. In areas of soil or ground water contamination, special joint gasket materials shall be used to prevent deterioration or permeation of the gasket material.

h. Cement Mortar Lining. All pipe and fittings shall be cement lined in accordance with the requirements of ANSI Specification A 21.4 (AWWA C104) for a standard cement lining.

4.02.02 Gate Valves All gate valves shall be resilient-seated gate valves with non-rising stems conforming to the requirements in AWWA C515. Unless otherwise specified, valve ends shall be mechanical joint. Gate valves shall be as manufactured by East Jordan Iron Works, Inc.

Direction of opening and the design of the operating nut shall be left to open. Where no standard is established, the valve shall open by turning the operating nut counter clockwise (to the left) and the operating nut shall be the standard two-inch square nut.

4.02.03 Butterfly Valves – Tight shut off butterfly valves for water system distribution valves, 24" and less, shall be designed for direct bury and operated through a standard valve box. Butterfly valves shall be Pratt Ground-Hog.

Valves furnished under this specification shall conform to ANSI/AWWA C504, except as herein modified. Unless otherwise noted on the Plans, these valves shall be the same nominal size as the water main.

Valves shall be Class 150-B and have mechanical or restrained joint ends in accordance with ANSI/AWWA C110.

4.02.04 Hydrants All hydrants shall conform to the requirements of AWWA C505 for post-type hydrants with compression type shutoff. Unless otherwise specified, all hydrants shall be furnished as East Jordan Iron Work, (EJIW) Traffic Model 5-BR.

Nominal Valve Opening	5 inch diameter
Inlet Connection	6 inch mechanical joint
Bury Length – Measured from bottom of connecting pipe to ground line	6 feet
Hose Nozzle	2-22 inch hose nozzles
Pumper Nozzle	1-4 inch pumper nozzles

Hydrants shall be painted the standard color for the water system, shall open by turning counter-clockwise with the standard 1 inch square operating nut and shall have ANSI B 26 National Standard nozzle threads.

4.02.05 Cast Iron Valve Boxes shall be EJIW Model 8560. The cover shall be marked with the word "WATER." The base section shall be the proper size to fit over the bonnet of the valve on which the box is set. The valve box shall be a minimum of 5 inches inside diameter and shall be sufficient length to extend from the bonnet of the valve to the established final grade of the pavement or ground surface. The valve box shall be approved by the Engineer before installation.

4.02.06 Water Services Materials for water services shall be as follows:

Copper Water Pipe shall be Type K conforming to ASTM B 88 with 1" minimum diameter installed with flared fittings. Services larger than 1" shall match existing unless otherwise approved.

Corporation Stops shall be 1" Mueller H-15000 or McDonald 4701-22 Mac-PAX 12" and 2" shall be the Ball Valve type McDonald Model 47-1 BT compression fitting with Mueller thread. Contractor will reuse existing corporation stops for service line replacement. In case of damage requiring corporation stop replacement, coordination will be made with the City of East Grand Rapids who will provide material and labor to tap the main and replace the corporation stop.

Curb stops valves shall be ball valve type Ford, Ball Valve Curb Stop – Minneapolis Pattern (FB22444MNL) or approved equivalent.

Curb boxes shall be A.Y. McDonald, Curb Box (5614). The lids of all boxes shall be marked with the word "WATER" or the letter "W." Buffalo Boxes are not permitted.

4.02.07 Materials for Valve Chambers and Other Structures

a. Blocks. Blocks shall be standard 6" x 6" x 12" curved units with a curb radius equal to the radius of the structure. All blocks shall conform to the requirements of the current specifications for concrete masonry units for construction of manholes, ASTM Designation C-139. Block construction shall be allowed only by special permission from the Engineer.

b. Brick. Concrete brick shall conform to the requirements for Grade S-11 of the current specifications for concrete building brick, ASTM Designation C-55.

c. Cement Mortar. Mortar shall consist of one part of Air Entraining Portland Cement, and two parts of masonry sand. These proportions shall be measured by volume.

The sand and cement shall be mixed dry in a clean tight box until a mixture of uniform color is produced, after which water shall be added until the required consistency is obtained. Mortar shall be mixed only in such quantities as needed for immediate use. The re-tempering of mortar will not be permitted.

1. Cement. Air Entraining Portland Cement shall conform to the requirements for Type 1A of the current specification for Air Entraining Portland Cement, ASTM Designation C-175.

2. Masonry Sand shall conform to the requirements of "Masonry Sand, 2MS" of the Current Standard Specifications of the MDOT.

3. Water for mixing mortar shall be obtained from the public water supply unless otherwise approved by the Engineer.

d. Precast Units. Precast reinforced concrete risers and precast reinforced concrete cone sections shall conform to the requirements for reinforced concrete manhole risers and tops, ASTM Designation C-478.

e. Concrete. Concrete for structures, valve chamber bases, and similar items shall meet the requirements of the current Standard Specifications of the MDOT for Grade M concrete with strength of 3000 psi at 28 days.

f. Steel Reinforcement shall conform to the requirements for steel reinforcement of the current Standard Specifications of the MDOT.

g. Castings. Castings shall conform to the requirements for gray iron castings of AASHTD M105. Castings shall be Class 30 gray iron.

Covers and rings and similar combinations of castings shall be machined to provide an even bearing surface.

All exposed surfaces of castings shall be completely coated with coal tar pitch varnish to which sufficient oil has been added to make a smooth coating, tenacious when cold, and shall not be tacky or brittle nor have any tendency to scale off.

Unless otherwise specified, castings shall be East Jordan No. 1120, Neenah No. R-1764, with solid cover and a 2-inch "W" and the current year embossed on the cover.

h. Manhole Steps. Unless otherwise specified on the Plans or in the Standard Details, steps for concrete block construction shall be MA Industries #PS-1PF.

Steps for precast construction shall be polypropylene coated steel, MA Industries #PS-1PF.

i. Waterproofing. All structures located in areas with permanent or seasonal high water tables shall be waterproofed. The materials and methods for

waterproofing shall be in accordance with the requirements of the current MDOT Specifications, and approved by the Engineer.

4.02.08 Concrete Thrust Blocks If permitted by the Engineer, concrete for thrust blocks and/or anchorage of fittings, hydrants, and similar items shall meet the requirements of the current Standard Specifications of the MDOT for Grade M concrete. Grade M concrete shall have the strength of 300 psi at 28 days.

4.03 HANDLING OF MATERIALS

The Contractor shall use care and proper equipment during the unloading and distribution of water main materials on the job site to insure the materials are not damaged.

Pipe and /or fittings shall not be rolled or skidded off the truck beds against previously unloaded materials.

4.04 INSPECTION OF MATERIALS BY CONTRACTOR

It shall be the responsibility of the Contractor to inspect all materials for cracks, flaws, or other defects before they are incorporated into the work. Any materials found to be defective or damaged shall be promptly removed from the job site.

4.05 PIPE LAYING

4.05.01 Alignment and Grade The water main shall be laid true to the alignment and grades shown on the Plans with fittings, valves, and hydrants at the required locations. Unless otherwise specified or required, the pipe shall be laid with the center 5 feet 9 inches below the street grade.

4.05.02 Inspection Before Installation. Before lowering and while suspended, the pipe shall be inspected for defects and rung with a light hammer to detect cracks. Any defective, damaged, or unsound pipe shall be rejected. Furthermore, all pipes, fittings, and special castings shall be carefully examined for defects, and no pipe, fitting, or special casting shall be laid which is known to be defective. If any such pipe, fitting, or special casting shall be discovered to be defective after being laid, it shall be removed and replaced with sound pipe, sound fitting, or a sound casting by the Contractor at his expense.

4.05.03 Manner of Handling Materials Proper implements, tools, and facilities satisfactory to the Engineer shall be provided and used by the Contractor for the safe and convenient prosecution of the work. All pipe, fittings, valves, and hydrants shall be carefully lowered into the trench piece by

means of derrick, ropes, or other suitable tools or equipment, in such a manner as to prevent damage to pipe or pipe coating. Under no circumstances shall pipe or accessories be dropped or dumped into the trench.

4.05.04 Pipe Kept Clean. All dirt or other foreign matter shall be removed from the inside of the pipe before it is lowered into its position in the trench, and it shall be kept clean by approved means during and after laying.

Whenever work is stopped for the day, a standard plug shall be securely placed in the end of the pipe. No tools or other articles shall be stored in the pipe at any time.

4.05.05 Placing The pipe shall be placed on the prepared subgrade and held firmly in place during subsequent pipe jointing and embedment operations. As each length of pipe is placed in the trench, the spigot end shall be centered in the bell and the pipe pushed home and brought to the correct line and grade. Care shall be exercised to prevent joints from opening up as successive lengths of pipe are placed. The Contractor shall take the necessary precautions when using a trench box to prevent joint separation when the box is pulled ahead.

Unless otherwise directed, pipe shall be laid with bell ends facing in the direction of laying, and for lines on an appreciable slope, bells shall, at the direction of the Engineer, face upgrade.

4.05.06 Cutting Pipe The cutting of pipe for inserting valves, fittings, or closure pieces shall be done in a neat and workmanlike manner without damage to the pipe or cement lining and so as to leave a smooth end at right angles to the axis of the pipe.

When machine cutting is not available for cutting pipe 20 inches in diameter or larger, the electric-arc cutting method, using a carbon or steel rod, will be permitted. Only qualified and experienced workmen shall be used on this work.

Flame cutting of pipe by means of an oxyacetylene torch shall not be permitted.

4.06 PIPE JOINTS

4.06.01 General Unless otherwise specified or required, joints may be mechanical joints or push-on joints at the option of the Contractor.

Pipe joints shall be made in strict accordance with the pipe manufacturer's recommendations unless otherwise specified herein. All lubricants, gaskets, and

other materials required to make the joints shall be furnished by the pipe manufacturer.

4.06.02 Mechanical Joints

a. Cleaning and Assembly of Joint. The last 8 inches outside of spigot and inside of the bell of mechanical joint pipe shall be thoroughly cleaned to remove oil, grit, excess coating, and other foreign matter from the joints, and then painted with a soap solution made by dissolving one-half cup granulated soap in one gallon of water. The cast iron gland shall then be slipped on the spigot end of the pipe with the lip extension of the gland toward the socket, or bell end. The rubber gasket shall be painted with the soap solution and placed on the spigot end with the thick edge toward the gland.

b. Bolting of Joint. The entire section of the pipe shall be pushed forward to seat the spigot end in the bell. The gasket shall then be pressed into place within the bell; care shall be taken to locate the gasket evenly around the entire joint. The cast iron gland shall be moved along the pipe into position for bolting, all the bolts inserted, and the nuts screwed tightly with the fingers. All nuts shall be tightened with a suitable (preferably torque-limiting) wrench. The torque for various sizes of bolts shall be as follows:

Size	Range of Torque
Inch	foot.- pound.
5/8	40-60
3/4	60-90
1	70-100
1-1/4	90-120

Nuts spaced 180 degrees apart shall be tightened alternately in order to produce an equal pressure on all parts of the gland.

c. Permissible Deflection at Joints. Whenever, in the opinion of the Engineer, it is necessary or desirable to deflect mechanical joint pipe in order to form a long radius curve, the amount of deflection shall not exceed the following maximum limits in Table I.

TABLE I

Maximum Deflection Full Length Pipe – Mechanical Joint Pipe

Size of Pipe In	Deflection Angle Deg. – Min.	Maximum Deflection Inches		Approx. Radius Of Curve Produced By Succession of Joints Feet	
		18 ft. Length	20 ft. Length	18-ft. Length	20-ft. Length
4	8-18	31	35	125	140
6	7-07	27	30	145	160
8	5-21	20	22	195	220
10	5-21	20	22	195	220
12	5-21	20	22	195	220
14	3-35	13-1/2	15	285	320
16	3-35	13-1/2	15	285	320
18	3-00	11	12	340	380
20	3-00	11	12	340	380
24	2-23	9	10	450	500
30	2-23	9	10	450	500
36	2-05	8	9	500	550

4.06.03 Push-On Joint Pipe

a. Cleaning and Assembly of Joints. The inside of the bill and the outside of the spigot end shall be thoroughly cleaned to remove oil, grit, excess coating,

and other foreign matter. The circular rubber gasket shall be flexed inward and inserted in the gasket recess of the bell socket.

A thin film of gasket lubricant shall be applied to the inside surface of the gasket, the spigot end of the pipe, or both. Gasket lubricant shall be as supplied by the pipe manufacturer and approved by the Engineer.

The spigot end of the pipe shall be entered into the socket with care to keep the joint from contracting the ground. The joint shall then be completed by forcing the plain end to the bottom of the socket with a forked tool or jack type of tool or other device approved by the Engineer. Pipe that is not furnished with a depth mark shall be marked before assembly to assure that the spigot end is inserted to the full depth of the joint. Field-butt pipe lengths shall be filed or ground to resemble the spigot end of such pipe as manufactured. Assembly instructions are available from the pipe manufacturer and shall be closely followed.

b. Permissible Deflection at Joints. Whenever, in the opinion of the Engineer, it is necessary or desirable to deflect slip joint pipe in order to form a long radius curve, the amount of deflection shall not exceed the following maximum limits in Table II.

TABLE II

Maximum Deflection Full Length Pipe – Push-On Joint Pipe

Size of Pipe In	Deflection Angle Deg	Maximum Deflection Inches		Approx. Radius Of Curve Produced By Succession of Joints Feet	
		18-ft Length	20-ft Length	18-ft Length	20-ft Length
4	5	19	21	205	230
6	5	19	21	205	230
8	5	19	21	205	230
10	5	19	21	205	230
12	5	19	21	205	230
14	3	11	12	340	380
16	3	11	12	340	380
18	3	11	12	340	380
20	3	11	12	340	380
24	3	11	12	340	380
30	3	11	12	340	380
36	3	11	12	340	380

Insofar as possible, the Contractor shall do the work in the locations shown on the drawings, with minor adjustments allowable if approved by the Engineer. Deflections in pipes and fittings shall be made with sufficient number of joints being deflected to allow for clearance of underground structures. The maximum deflection permissible shall be limited to that allowed in the deflection tables.

4.06.04 Electrical Thawing Devices

a. General. A device to provide electrical conductivity from one pipe length to another shall be furnished on all new water mains and also on all cut-ins to existing water main. Thawing devices shall be capable of carrying a minimum of 500 amperes of current through the pipe joint without damage to the gasket in the joint.

b. Serrated Silicon Bronze Wedges. Serrated wedges can be used with push-on joints only, 3 per joint for 3" through 12" pipe; 4 per joint for larger diameter pipe. Each wedge shall be driven into the opening between the plain end and the bell until snug. When four wedges are used, they shall be inserted side by side in pairs.

c. Conductive Push-On Gaskets. Gaskets having metal contact strips which are molded or inserted into the gasket may be used in lieu of wedges in push-on joints.

The gasket seating surface should be thoroughly cleaned prior to assembly.

d. Cable or Strip Conductor. May be used for all types of joints. Conductor shall be sufficiently flexible to withstand minor ground and pipe movement. When it is necessary to bond conductor strips to cut lengths of pipe in the field, the strips shall be welded to the pipe by exothermic welding.

e. Payment. Furnishing and placing electrical thawing devices will not be paid for separately but shall be considered incidental to furnishing and laying the pipe.

4.07 SETTING OF VALVES, FITTINGS AND HYDRANTS

4.07.01 General Requirements for Valves and Fittings Valves, fittings, plugs, and caps shall be set and joined to the pipe in the manner specified for cleaning, laying, and jointing pipe.

Each valve shall be cleaned and tested for operation before it is installed. Valves and curb stops shall be set with stems plumb and at the exact location shown on the Plans or as directed.

4.07.02 Setting Valve Boxes. Cast iron valve boxes shall be firmly supported and maintained plumb over the operating nut of the valve with the box cover flush with the finished grade. The valve box shall be supported so no shock or stress is transmitted to the valve. After box is set to grade, there shall be a minimum of two complete revolutions of the threaded portion of box remaining on the unit.

4.07.03 Valve Chambers. When specifically required, all 12-inch and larger valves and such other valves as may be designated on the Plans shall be set in precast concrete valve chambers with the operating nuts readily accessible for operation through the manhole opening. Valve chambers shall be constructed in accordance with the Standard Details or as shown on the Plans.

Castings shall be set to the required elevation in full mortar beds or otherwise secured as shown on the Plans. The use of brick or wooden wedges to hold the castings in place will not be permitted. The mortar shall be allowed to set before any work is performed that might disturb the castings.

Castings in pavement areas shall be adjusted to grade after the bituminous base course is laid and prior to placing the wearing bituminous course. Castings in curb and gutter shall be adjusted after the forms are placed and prior to placing the concrete.

4.07.04 Setting Hydrants

a. General. Hydrants shall be set at the locations shown on the Plans for as directed by the Engineer. The grade line on the hydrant shall be at the proposed finished grade unless otherwise directed by the Engineer. Adjustments to the proposed grade shall be made with approved hydrant extensions installed on a standard 6-foot hydrant.

b. Position of Nozzles. All hydrants shall stand plumb and shall have their nozzles parallel with or at right angles to the curb, with the pumper nozzle point normal to the curb. Hydrants having hose nozzles at an angle of 45 degrees shall be set normal to the curb. The nozzles shall be at the height indicated by the manufacturer, but not less than 18 inches above the established curb grade, or as directed by the Engineer.

c. Hydrant weep holes shall be left open. Stone shall be placed around every hole for drainage (7 cubic feet crushed rock or stone). In areas of high ground water, poor draining soils, and soil contamination, the weep holes shall be plugged.

4.08 ANCHORAGE

4.08.01 General. On all water main work, all hydrants, bends, tees, plugs, and other fittings shall be securely restrained by the use of mega-lugs, restraining glands, or restrained joints, or as approved by the Engineer according to the laying conditions encountered.

If approved by the Engineer, restraint with suitable metal rods and clamps or a tied joint may be used. Steel rods or clamps shall be galvanized or otherwise rustproofed by an approved method.

All hydrants, hydrant valves, and bends shall be rodded as follows:

4” thru 6” #4 Rod Size
8” thru 10” #6 Rod Size
12” thru 18” #8 Rod Size
20” thru 24” #10 Rod Size

Joint restraining glands shall be an acceptable means of joint restraint. Glands shall be mega-lug as manufactured by EBAA Iron, Inc.

Fastite gaskets may be used on 6” to 16” pipe on straight runs of pipe not at fittings.

Approval of anchorage by the Engineer shall not relieve the Contractor from his responsibility for the adequacy of the anchorage.

Where joints are to be restrained with mechanical devices (rods, glands, restrained joint), all joints shall be restrained in accordance with design methods recommended by the Ductile Iron Pipe Research Association (DIPRA).

Acceptable restraint lengths for common pipe sizes and fittings are outlined in the following Table III.

TABLE III

PIPE RESTRAINT LENGTH REQUIRED, FEET

Pipe Diameter	Tees, 90° Bends	45° Bends	22-1/2° Bends	11-1/4° Bends	Dead Ends	Reducers (one size)	**
4"	23	9	5	2	57		
6"	32	13	6	3	82	43	63
8"	41	17	8	4	104	43	55
12"	58	24	12	6	149	80	120
16"	74	31	15	7	192	82	110
20"	89	37	18	9	233	82	104
24"	104	43	21	10	272	82	99
30"	123	51	25	12	328	115	148
36"	141	58	28	14	379	115	140

** If straight run of pipe on small side of reducer exceeds this value, the no restrained joints are necessary.

NOTE: The length of restrained pipe required as shown in Table III is based on trench backfill being compacted to 95% of the maximum unit weight as measured by the modified Proctor, AASHTO T-180.

4.08.02 Hydrants. The bowl of each hydrant shall be tied to the pipe with rods or clamps, or restrained with Mega-lugs as shown on the Plans or as directed by the Engineer.

4.08.03 Plugs, Tees and Bends. On all water mains, all tees, plugs, and bends shall be securely restrained in accordance with Table III.

4.09 WATER SERVICES

4.09.01 General. The Contractor shall install water services when specified or when directed by the Engineer. Water services shall include the connection to the water main, the curb stop and box, and the water service piping.

Installation of water services shall meet the general requirements specified for water mains. All services shall be inspected by the Engineer before the trench is backfilled.

4.09.02 Location. The locations of water services shown on the Plans are approximate. These locations may be adjusted where necessary to best serve the various properties. Exact locations will be determined by the Engineer before the services are installed and prior to tapping the main.

4.09.03 Tapping the Main. Unless otherwise specified, all work of tapping the water main shall be performed by the Contractor using an approved tapping machine.

The Contractor shall keep an accurate record of measurements from the nearest valve or hydrant to each corporation or other connection to the main. These measurements shall be recorded on an as-build plan to be furnished by the Contractor to the Owner before final payment will be made to the Contractor.

4.09.04 Length and Depth. All water services shall be laid at a minimum depth of 5 feet 6 inches from the finished grade and at right angles to the street line and shall extend to a point ten feet outside the street right-of-way (property line) unless otherwise directed. No payment will be made for pipe laid beyond this point unless specifically ordered by the Engineer.

4.09.05 Setting Curb Boxes. Curb boxes shall be set plumb over the curb stop and shall be firmly supported without transmitting load or stress to the stop. When set to grade, there shall be a minimum of two complete revolutions of the barrel remaining on the threaded portion of the unit.

After backfilling is completed, all curb boxes shall be adjusted to finished grade and each curb stop shall be tested by operating with a standard curb wrench.

The location of all curb boxes shall be marked with a 2" x 2" wood marker until the as-built locations have been recorded and checked by the Engineer.

4.10 OPERATING VALVES AND INTERRUPTION OF SERVICE

Only Water Department personnel are authorized to open or close valves on mains in service in conjunction with the Contractor's work. The Contractor shall make the necessary arrangements with the Water Department for opening and closing valves, which shall be subject to such limitations on the time and location of shutoff as requirements of the water system shall impose.

The Contractor shall not operate any valve in any water main in service, except that in case of emergency he shall, with the approval and under the direction of the Water Department, operated such valves as directed to relieve the emergency. In case of emergency shutoff, the Contractor shall immediately notify the Fire Department and consumers affected of the time and probable duration of each shutoff.

4.11 WATER FOR FLUSHING

Water for flushing new mains will be provided by the Water Department at the closest hydrant or main in the existing system at no cost to the Contractor. However, if water is wasted unnecessarily or if additional flushing is required, as

when re-chlorination is necessary, the Contractor may be charged for such excessive amounts of water used.

The Contractor shall make the necessary connections from the existing system for filling and/or flushing the new mains.

4.12 LEAKAGE TESTS

All tests will be made by the contractor using his own equipment, operators, and supervision, under the direction of the Engineer. Tests shall not be made against an existing valve.

The water main shall be completely filled with water from the water supply and the main shall be subject to an initial hydrostatic test pressure of 160 pounds per square inch at the point of lowest elevation, and an average pressure of 150 pounds per square inch shall be maintained for at least two hours and for such longer time as the Engineer may require.

While the test pressure is being maintained, the leakage shall be measured by a method approved by the Engineer. Leakage is defined as the quantity of water to be supplied into the newly laid pipe necessary to maintain the specified leakage test pressure after the pipe has been filled with water and air expelled.

The test shall be repeated as necessary to maintain the test pressure for two hours. In all cases, the pressure shall be restored to 160 pounds when pressure drops 5 pounds during the two-hour period. The loss shall not exceed the allowance in the AWWA C600 latest edition, formula for the size of pipe and number of joints. Refer to the formula and Table IV below.

$$L = \frac{SD\sqrt{P}}{148{,}000}$$

TABLE IV

MAXIMUM ALLOWABLE LEAKAGE PER 1000 FEET

Size of Main	Gallons Per Hour
4"	0.33
6"	0.50

8"	0.66
10"	0.83
12"	0.99
16"	1.32
20"	1.66
24"	1.99

Defects in the pipe line that cause leakage in excess of the maximum allowable leakage shall be promptly corrected by the Contractor at no cost to the Owner and the main shall be retested until a satisfactory leakage test has been made. All work required for testing the water mains shall be considered incidental to laying the pipe and no specific payment will be made therefor.

4.13 CHLORINATING

All new mains or sections thereof shall be sterilized by the Contractor, using his own chlorinating equipment and operators, under the supervisor and direction of the Engineer. The disinfection procedure shall be in accordance with AWWA C651, latest edition.

After the leakage test has been satisfactorily completed, the pipe shall be thoroughly cleaned by flushing and refilling for chlorinating. The chlorinating solution shall then be pumped into the section of the main to be sterilized and shall be left in the main for a period of at least 24 hours. Following this period, the main shall be thoroughly flushed by the Contractor and samples will be taken by the Water Department for bacteriological analysis by a Michigan Department of Environmental Quality, Water Bureau, or Certified Laboratory. The Contractor shall not backfill that portion of the trench where the taps for chlorinating are located until the results of the bacteriological test are satisfactory. The cost of this work shall be included in the price bid for laying water pipe.

All pipe and fittings that are used for final hook up to the existing system and have not been subjected to the chlorination test shall be cleaned of all dust, dirt, and other deposits and then carefully swabbed with a chlorine solution containing a minimum of fifty parts per million of chlorine immediately before installation.

4.14 MEASUREMENT AND PAYMENT

4.14.01 General. All proposed construction shall be measured for payment by the Engineer in accordance with the items listed in the Proposal.

The unit price bid for each Proposal item shall be payment in full for completing the work, ready for use as specified.

Any materials that may be furnished and/or installed for the convenience of the Contractor, such as extra sleeves, appurtenances for testing, and similar items, will not be considered for payment whether or not the proposal contains a like item for the material used.

4.14.02 Water Pipe will be measured in linear feet in place, from end to end of the line of pipe, including the lengths of fittings, valves, and joints.

4.14.03 Fittings such as bends, tees, crosses, plugs, reducers, and sleeves, will be measured as single units, each, and will be defined according to the diameter of the pipe on which each is installed.

4.14.04 A "Cut-in" will be measured as a single group of two or more fittings, or fittings and valves, installed in an existing main as described in the Proposal Items and/or as shown on the Plans, and will be defined according to the diameter of the larger pipe in each.

4.14.05 Valves will be measured as single units, each, and will be defined according to the size of the valve.

4.14.06 Valve Boxes will not be measured separately but shall be included in the prices bid for furnishing and placing valves and/or curb stops.

4.14.07 Valve Chambers will be measured as single units, each, for the complete structure, exclusive of the valve.

4.14.08 Hydrants will be measured in single units, each, including hydrant extension to finished grade, unless specific items have been provided in the Proposal for hydrant extensions.

4.14.09 Anchorage. Thrust blocks and other anchorage for fittings and hydrants shall be incidental to installing the water main, unless specific items have been provided in the Proposal in which case anchorage will be measured in the units specified in the Proposal.

4.14.10 Water Services.

a. Water service pipe will be measured in linear feet in place from the centerline of the water main to the end of the service.

b. Corporation cocks will be measured in single units, each, according to the diameter of the water service piping.

c. Curb stops will be measured in single units, each, according to the diameter of the water service piping.

4.14.11 Special Items will be measured in the units indicated on the list of Proposal Items.

END OF SECTION

4.15 WATER MAIN BREAK PROCEDURES FOR REPAIR/DISINFECTION

4.15.1 Upon arrival at the site, evaluate the site for safety (including the appropriate PPE) and set up the appropriate traffic control measures. This may include: warning lights, strobe lights, arrow boards, traffic maintenance signs, cones, flagmen (if necessary), safety vests and/or other PPE. Locate and mark buried utility lines and valves in the vicinity. Check for potential contamination sources, such as septic systems, underground storage tanks, service connections without proper backflow prevention devices, and presence of multistory buildings.

4.15.2 If necessary, isolate the pipe section by slowly adjusting valve settings, maintaining positive pressure to reduce backflow or runoff contamination. Where possible, service disruptions should be minimized; however, it may be necessary to isolate certain areas to minimize the potential for contamination. Close or throttle valves, particularly service connections that do not have proper backflow prevention, as needed, to isolate the repair area. If possible, notify impacted customer of the potential disruption. Use caps or covers to protect existing mains or service connections.

4.15.3 Excavate the break. Provide the necessary benching, sloping and/or shoring depending on depth and conduct work in accordance with the Occupational Safety and Health Administration (OSHA) standards for trenching and excavation. Install temporary devices to divert surface water runoff around the repair site. Use portable dewatering pumps to maintain water levels at least one foot below the pipe invert during repair.

4.15.4 Repair the pipe using the appropriate materials (i.e., fittings, joints, gaskets, clamps), sizes and other necessary repair equipment. During the repair:

a. Maintain positive pressure, where possible, to prevent contamination from backflow into the pipe. At the start of, at least once during and at the end of the repair, confirm and document if positive pressure is maintained in the immediately vicinity of the break site by visually observing a steady flow or spray of water coming from the pipe, or observation of a hose bib or hydrant located near and at a higher elevation than the break site. Pressure above 20 psi should be maintained outside the immediate repair area. If pipe cannot be repaired under pressure, do no depressurize the pipe until the pipe is exposed.

b. Maintaining a dewatered trench to at least 1' below the pipe invert.
c. Visually inspect the interior and exterior of all new materials (pipes, fittings, valves, etc.) to ensure there is no visible damage, debris or contamination.

d. Remove any visible debris from exposed areas of the existing pipe.

e. Keeping all parts, tools and materials used in the repair in a clean and sanitary condition. Clean and disinfect prior to use or installation with a 1 percent chlorine solution. If any interior areas of the pipe were exposed to the environment during the repair, spray or swab any accessible upstream and downstream interior of the existing pipe areas with a 1 percent chlorine solution. If the repair requires new piping to be installed in any section, the new pipe must be inspected, cleaned and disinfected from both ends by swabbing with 1 percent chlorine solution.

f. Maintain pipe caps, plugs or other protective coatings until materials are ready to be installed.

g. Complete all pipe and fitting joints in the trench before stopping work. If work requires more than one day, store materials on-site in a secure area.

4.15.5 If needed, disinfect the pipe in accordance with the described outlined in AWWA Standard C651. For disinfection of repaired mains, the following methods can be used:

a. Tablet method: involves the use of calcium hypochlorite tables in the repaired or replaced pipe section and contact time with an initial free chlorine concentration of 25 milligrams per liter (mg/L). Note that pipe materials must be evaluated for compatibility and that this method may only be used when pipes and appurtenances are kept clean and dry during construction. Cleaning and flushing of the main prior to disinfection cannot be performed with this method.

b. Continuous feed method: involves filling the main with potable water to remove air pockets, then flushing to remove particulates, and refilling the main with chlorinated water at a dose of 25 mg/L until stable concentrations are reached within the pipe (i.e., a free chlorine residual of not less than 10 mg/L after a holding period of 24 hours).

c. Slug method: involves filling the main with potable water to remove air pockets, flushing to remove particulates, followed by slow flush with a high concentration of chlorine – 100 mg/L – for at least 3 hours. The use of cross connection control and backflow prevention must be used to ensure the high chlorine concentration does not affect the distribution system.

d. Spray method: involves a 30-minute exposure to free chlorine at not less than 200 mg/L. Refer to chlorination method 2 in AWWA Standard C652 – Disinfection of Water Storage Facilities. The slug method may be preferable as it requires reduced contact time. However, alternative methods (tablet method, continuous feed method, or spray disinfection) are available. Evaluate the scene and select the best method for disinfection based on site conditions, length and diameter of the main, type of joints present, available materials and equipment, type of break and associated risk for microbiological contamination. If highly chlorinated water is likely to impact fish or plant life or other downstream users), dechlorination must be performed to neutralize the remaining chlorine residual prior to discharge. If dechlorination is necessary, follow the procedures outlined in AWWA Standard C655 – Field Dechlorination.

4.15.6 Target a unidirectional flush towards the water main break. Open the necessary hydrants to complete the flush. Flush with potable water at a velocity of 3.0 feet per second (fps) in the pipe for a minimum of three pipe volumes to remove debris, and verify that the discharge is visually clear.

4.15.7 Check for typical system chlorine residual in the main using a field chlorine test kit and flush the pipe section until typical system residuals are detected (i.e., to at least 90% of ambient or pre-break levels and not more than 4.0 mg/L as required by State and Federal regulations). Collect samples from the immediate and surrounding areas around the repair site.

4.15.8 For high risk breaks, notify affected customers about the break, schedule, and concerns. Instruct customers to flush their home plumbing after repairs. If contamination was likely to occur, perform issue a precautionary boil water notice. In the event that a boil water advisory is needed, the City should immediately contact the appropriate staff the Kent County Health Department and Michigan Department of Environmental Quality to notify them of the situation and to coordinate the public notification.

4.15.9 For medium risk breaks where a full pipe section was required and high risk breaks, conduct coliform sampling in accordance with AWWA Standard C651. The main may be returned to service prior to the completion of the bacteriological results. Await until sample results are received and show the absence of coliforms. In the event that coliforms organisms are detected, repeat the flushing and resample for coliforms. If the confirmation coliform sample also shows the presence of coliforms, repeat disinfection using the continuous feed or slug method until no coliform organisms are present. For any positive coliform results, the Water Distribution Superintendent should immediately notify Michigan Department of Environmental Quality and follow any required procedures.

4.15.10 Flush hydrants, if needed, to remove any debris.

4.15.11 Return the main to service by opening any closed valves, using a sequence that avoids low or negative pressures.

4.15.12 Backfill and compact pipe bedding per applicable AWWA pipe installation standard.

4.15.13 Repair ground surface to at least original conditions.