CITY OF WALLED LAKE

1499 E. WEST MAPLE
WALLED LAKE, MI 48390

ENGINEERING DESIGN STANDARDS

Prepared by:

Boss Engineering
Howell, Michigan

October 5, 2016

TABLE OF CONTENTS

PART I. INTRODUCTION

1.0 GENERAL

1.1 Complete site improvement plans shall be submitted to the City of Walled Lake bearing the Seal of a licensed Professional Engineer licensed to practice in the State of Michigan.

1.2 Plans shall be submitted on 24" x 36" paper in black and white and shall be accurately and neatly prepared. Professional judgement shall be used in presenting the pertinent information in a neat manner.

1.3 Site plans shall consist of an overall plan for the entire development, drawn to a scale of not less than 1 inch = 30 feet for property less than 5 acres, or 1 inch = 50 feet for property 5 acres or more in size.

1.4 Information that should be included in the Site Plan shall be in conformance with the City of Walled Lake Site Plan Review Application.

1.5 The developer or their engineer shall be responsible for forwarding plans for approval to any private utility company whose facilities or easements may be affected by the proposed construction.

1.6 It shall be the developer's engineer and/or the contractor's responsibility to verify the existence and location of all existing underground utilities.

1.7 The grades of existing adjacent structures, utilities and topography shall be shown to a minimum distance of 100 feet beyond the property line.

1.8 All engineering construction plans shall contain the latest version of all applicable City of Walled Lake Standard Details.

2.0 PROCESS

2.1 An optional Concept Review will be available for initial discussion of relevant engineering topics including but not limited to storm water management, sewer service, water service, road access, etc.

2.2 Preliminary Engineering Review – A preliminary review will be performed during the Site Plan process as prescribed in the City of Walled Lake Zoning Ordinance. The goal of this review is to assure the proposed site plan is achievable from an engineering perspective. The review will focus on preliminary grading, storm water management, and utility services. Once the Preliminary Engineering review has been completed and Site Plan approval is granted by the City Planning Commission, the Applicant will be required to submit engineering drawings for Construction Plan Review.

2.3 Construction Plan Review – A comprehensive review will be performed on the detailed site engineering drawings for conformance with the City of Walled Lake and all applicable City, State and Federal Standards and requirements.

2.4 Permitting and Pre-Construction Meeting – The Applicant will be responsible for obtaining all City, County and State Permits including: City soil erosion, City right-of-way, water supply, wastewater disposal, County right-of-way, wetlands, floodplains, etc. All necessary permits shall be obtained prior to final approval. Once the Construction Plans have been approved, a pre-construction meeting with the Applicant or the Applicant's representative, and any related contractors, is required prior to any site work. The purpose of the pre-construction meeting is to verify that all relevant permits have been applied for and obtained, that all insurance and bonds have been provided and to schedule construction inspection.

2.5 Inspection – Inspections shall be performed as described herein Part II, Section 7.0. The Applicant shall coordinate with the City of Walled Lake an amount for an escrow account to be utilized for the construction inspection process. Items that require inspection are public utilities, any work within the Right-Of-Way and road construction. Additional construction inspection may be required on a case by case basis, at the discretion of the City of Walled Lake and its consultants.

PART II. ENGINEERING STANDARDS

1.0 SANITARY SEWER SYSTEM

1.1 All sanitary systems shall conform to the Oakland County Water Resources Commissioner “Sanitary Sewer System Design Standards”.

1.2 The plans shall include all applicable details found in the Oakland County Water Resources Commissioner “Sanitary Sewer Detail Sheets”.

2.0 WATER DISTRIBUTION SYSTEM

2.1 GENERAL

2.1.1 If the proposed improvements include the construction of public water main, the Applicant shall submit sufficient sets of water main only plans along with a completed Part 399 MDEQ permit application. This information will be forwarded by the City's Engineer to the MDEQ for permitting.

2.1.2 Water mains shall be looped whenever possible. All water mains that are not looped shall end with a hydrant and a gate valve.

2.1.3 All water mains shall be Ductile Iron Pipe Class 52.

2.1.4 All water mains shall be designed for a minimum working pressure of 150 psi.

2.1.5 The minimum size water main shall be 8 inches. Six inch mains may be used for single fire hydrant leads with a maximum length of 25 feet.

2.1.6 Water mains shall be installed with a minimum cover of 5'-6" from finish grade to top of pipe. In situations where water mains need to avoid utilities or other obstructions, the water main should be installed with vertical bends, properly anchored, to avoid the utilities and long sections of unnecessarily deep water mains.

2.1.7 All water mains shall have a horizontal clearance of 10 feet from storm sewer and sanitary sewer.

2.1.8 A minimum vertical clearance of 18 inches shall be maintained between water mains and storm sewers or sanitary sewers.

2.1.9 MDOT Class II sand shall be used as backfill in all water main trenches. Trench backfill shall be compacted to at least 95% of the maximum unit weight. The compaction shall be tested by an independent entity.

2.1.10 All water mains eight inches and larger shall be profiled.

2.1.11 Restrained joints or thrust blocks shall be used at all bends, tees, hydrants, caps or any other appurtenances where necessary to prevent lateral movement of the water main.

2.1.12 All water main shall rest on a minimum of 6" of compacted MDOT Class II sand.

2.1.13 Trench backfill shall be compacted in maximum 12 inch lifts.

2.2 LOCATION

2.2.1 All public water mains must be located within an easement or public right-of-way.

2.2.2 All public water mains, fire hydrants, valves, and other appurtenances not within the Right-Of-Way shall be centered in a 25-foot wide easement.

2.2.3 Water mains shall be located on opposite sides of roads from sanitary and storm sewers, where possible.

2.2.4 All easement descriptions and drawings will be required prior to final approval of the construction.

2.3 GATE VALVES

2.3.1 Gate valves shall be per current City of Walled Lake Standard Details.

2.3.2 Gate valves shall have a maximum spacing of 500 feet.

2.3.3 Gate valves shall be spaced so that no more than two hydrants are out of service at one time.

2.3.4 In single family home districts, gate valves shall be spaced so that no more than 26 single family homes are out of service at one time.

2.3.5 For any section of water main, no more than 4 valves shall have to be closed for isolation of the break.

2.3.6 All valves larger than 2" shall be located in a gate valve and well, not a box. This requirement excludes hydrant shut-off valves.

2.3.7 Gate valves shall be avoided in pavement areas.

2.3.8 On all water mains to be extended in the future, a 10-foot stub shall be installed with a gate valve and plug for future connection.

2.3.9 At high points in water mains where air can accumulate, provisions shall be made to remove the air by means of air relief valves.

2.3.10 When connecting to an existing water main, a tapping sleeve, gate valve and well will be required unless connection to the existing main can be made without interrupting service on the main.

2.4 HYDRANTS

2.4.1 Hydrants shall be per current City of Walled Lake Standard Details.

2.4.2 Hydrant leads shall be a minimum of 6 inch diameter with a maximum length of 25 feet. Fire hydrant leads that are longer than 25 feet sheet utilize 8 inch diameter pipe and an 8 inch by 6 inch reducer.

2.4.3 Hydrants shall be located at all dead end water mains.

2.4.4 Hydrants shall have a maximum spacing of 500 feet per the International Fire Code.

2.4.5 All exterior parts of a building shall be located within 250 feet of a hydrant. The distance from the hydrant to all exterior parts of the building is based on hose laying length, not radius.

2.4.6 Fire hydrants located in or near parking areas shall be protected with a 6 inch concrete curb or concrete-filled steel bollards with a yellow plastic sheathing.

2.4.7 No service leads shall be permitted from a 6 inch hydrant lead.

2.5 WATER SERVICES

2.5.1 Water service leads shall have a minimum 1 inch diameter and shall be sized according to the demand of the development.

2.5.2 Water services shall be constructed of type “K” copper.

2.5.3 Water service leads shall be located 10 feet away from sanitary service leads.

2.5.4 Domestic services shall have a separate connection, line, and valve from the fire service lines.

2.5.5 Gate valve and wells are required on all service lines greater than 2 inches.

2.5.6 A cross connection control plumbing detail (riser diagram) shall be provided to the owner of the water system.

2.5.7 All water services to the curb stop is the responsibility of the property owner.

2.6 PLAN & PROFILE

2.6.1 Plan and profiles shall be provided for all water main 8 inches in diameter and larger.

2.6.2 A plan view shall be located on the same sheet as the profile view and contain the same scale.

2.6.3 The following information shall be provided on the water main profile:

2.6.3.1 Length between appurtenances (tees, bends, valves, etc.)

2.6.3.2 Type, class, and size of pipes

2.6.3.3 Class of bedding

2.6.3.4 Rim elevations of all gate valves and wells

2.6.3.5 Finished grade elevations of all hydrants

2.6.3.6 Top of pipe elevations of pipes at all appurtenances (tees, bends, etc)

2.6.3.7 Existing and proposed ground elevation lines above the main

2.6.3.8 Location, elevation, and clearance for all utility crossings

2.6.3.9 Minimum bury depth

2.7 TESTING & FINAL ACCEPTANCE

2.7.1 The contractor shall fill, disinfect and pressure test all new water main construction under the supervision of the City's Engineer. Water main sterilization shall be in accordance with all local, State, and Federal regulations.

2.7.2 Prior to water main acceptance, it must pass a pressure test complying with the current specifications and procedures of the City of Walled Lake.

2.7.3 A set of Approved Record Drawings, an approved Bill of Sale, and a copy of any recorded easements required for construction, shall be submitted to the City prior to final acceptance of the water main.

3.0 STORM WATER MANAGEMENT SYSTEM

3.1 All storm water management systems shall conform to the Oakland County Water Resources Commissioner "Engineering Design Standards for Storm Water Facilities", with minor exceptions as described herein these Design Standards.

3.2 Where a site abuts or discharges into a County Drain, a full review must be performed by the Oakland County Water Resources Commissioner for the storm water management system prior to construction plan approval by the City.

3.3 Generally, in situations where an existing developed site is being redeveloped or an addition is being planned, the requirements for storm water detention/retention are as follows:

3.3.1 The applicant shall clearly present the impervious and pervious areas as well as the compound 'C' factor (coefficient of runoff) for both the existing development and the redevelopment/additions. The coefficients of runoff may range from 0.15 for grassed areas to 0.90 for impervious areas and 1.0 for open water. See Oakland County Water Resources Commissioner "Engineering Standards for Storm Water Facilities".

3.3.2 The difference in impervious area in the post-developed and pre-developed condition will be used to generate the required detention/retention volume for the development.

3.3.3 The same process as presented in the Oakland County Water Resources Commissioner "Engineering Standards for Storm Water Facilities" may then be used to calculate the required volume.

3.4 CULVERTS

3.4.1 Culverts shall be designed for a peak runoff for a 25 year – 24 hour storm event when the culvert is crossing under major city streets, and a 10 year – 24 hour storm event when the culvert is crossing under minor streets, private drives, or other embankments.

3.4.2 In general, culverts shall be designed in accordance with the FHWA "Hydraulic Design of Highway Culverts".

3.4.3 The minimum pipe size for a culvert is 12-inches.

3.4.4 Acceptable culvert materials include CMP and reinforced concrete.

3.4.5 Culverts shall utilize either wing walls and headwalls, or flared end sections.

3.4.6 Minimum cover over a culvert shall be 1.0 foot measured from top of pipe to finished grade for non-traffic areas and 1.0 foot measured from top of pipe to the bottom of the pavement section for traffic-areas.

3.4.7 The slope of the culvert shall be such that the culvert has sufficient capacity for the appropriate design storm event as well as to maintain non-erosive velocities of flow. The minimum design velocity shall be 2 feet per second.

3.4.8 Rip rap may be required at the inlet and outlet ends of the culvert pipe to mitigate potential scouring or erosive flow conditions. Rip rap shall be extended to 3 feet beyond the end of the pipe and shall be a minimum of 4 inches in size. Rip rap shall not consist of concrete.

3.4.9 The culvert shall extend beyond the edge of the embankment far enough to achieve a maximum 1V:3H slope.

3.4.10 The structural design of culverts shall conform to manufacturer's criteria and specifications for culvert materials and at a minimum, culverts within traffic areas shall be designed to withstand H-20 traffic loading.

3.5 UNDERGROUND DETENTION/RETENTION FACILITIES

3.5.1 When not under the jurisdiction of the Oakland County Water Resources Commissioner, underground detention/retention facilities will be permitted.

3.5.2 Volume requirements for underground storm water systems will be calculated the same as at-grade detention systems.

3.5.3 Underground detention systems shall be comprised of concrete, HDPE, or CMP.

3.5.4 When infiltration is a means of discharge, a minimum of two (2) soil borings must be performed within the footprint of the retention system to a minimum depth of 10 feet below the proposed bottom of the basin.

3.5.5 When an open bottom or perforated underground detention system is utilized, 40% stone voids may be used in the volume calculations.

3.5.6 Only volume above the outlet invert may be considered storage volume.

3.5.7 Water may be treated with the use of a mechanical pre-treatment unit or dedicated sediment isolation row.

3.5.8 Mechanical pre-treatment units must meet the requirements as set forth in the Oakland County Water Resources Commissioner's "Engineering Design Standards for Storm Water Facilities".

3.5.9 All underground detention/retention areas shall have provisions for access for maintenance. An agreement for operation and maintenance of all detention systems must be completed by the owner and submitted to the City prior to final acceptance of the project by the City of Walled Lake.

3.6 SUITABLE OUTLET

3.6.1 A suitable outlet will be defined as a point of storm water discharge capable of handling the storm water discharge from the proposed development.

3.6.2 Suitable outlets within the City of Walled Lake are:

-Walled Lake (surface water body)
-Established County Drain
-Wetland with a positive outlet
-Enclosed Storm Sewer System
-Infiltration (when suitable soils are available)

3.6.3 When infiltration is proposed as a means of storm water discharge, a minimum of 2 soil borings must be performed and provided within the footprint of the basin to a minimum depth of 10 feet below the proposed basin bottom. The infiltrative capacity of the soils will determine whether it is considered a suitable outlet.

3.7 Easements may be necessary for the construction of a storm sewer or for the discharge of storm water.

3.8 Fencing will be required around basins when the basin side slopes exceed 1 foot vertical to 4 feet horizontal (1V:4H). Fencing shall be 4 feet in height, black vinyl coated chain link fence with an 8 feet wide access gate.

3.9 The use of Low Impact BMP's (Best Management Practices) such as rain gardens, bio-swales, etc. is encouraged.

3.10 PLAN & PROFILE

3.10.1 Plan and profiles shall be provided for all storm sewer 12 inches in diameter and larger.

3.10.2 A plan view shall be located on the same sheet as the profile view and contain the same scale.

3.10.3 The following information shall be provided on the water main profile:

3.10.3.1 Length between all storm structures

3.10.3.2 Type, class, size and slope of pipes

3.10.3.3 Class of bedding

3.10.3.4 Rim elevations of all storm structures

3.10.3.5 Invert elevations of pipes at all storm structures

3.10.3.6 Existing and proposed ground elevation lines above the sewer

3.10.3.7 Location and limits of sand backfill

3.10.3.8 Location, elevation, and clearance for all utility crossings

4.0 SITE GRADING & SOIL EROSION CONTROL

4.1 SLOPE REQUIREMENTS

4.1.1 Grading shall take into account the natural features of the land as much as possible.

4.1.2 Appropriate permits must be obtained from the MDEQ when grading within a regulated wetland or floodplain.

4.1.3 One foot contour lines shall be provided on plans for sites smaller than 10 acres. On sites larger than 10 acres, two foot contours may be utilized, or as directed otherwise by the City's Engineer.

4.1.4 The plans shall show all proposed finished grade elevations for structures, high points low points, swales, and other relevant or significant point in sufficient detail as to demonstrate the proposed surface flow patterns.

4.1.5 The site grading shall be performed to keep overland drainage in mind. If the storm drainage system fails, the site shall be graded so that storm water will drain to an approved outlet without flooding buildings or have any adverse effects on adjacent properties.

4.1.6 All sites shall be graded such that storm water is intercepted on-site and routed through an enclosed pipe storm sewer system or vegetated swale to an approved outlet.

4.1.7 The maximum slope for any non-paved area where pedestrian traffic is not anticipated is one foot vertical to 3 feet horizontal (1V:3H).

4.1.8 The maximum slope for any non-paved area where pedestrian traffic may occur is one foot vertical to 5 feet horizontal (1V:5H).

4.1.9 Slopes steeper than 1V:3H are discouraged and will not be permitted without the use of a retaining wall.

4.1.10 Sufficient details shall be provided for all retaining walls and structural calculations shall be provided for all retaining walls 3 feet in height or greater.

4.1.11 Refer to the Oakland County Water Resources Commissioner "Engineering Design Standards for Storm Water Facilities" for grading requirements for detention/retention ponds.

4.1.12 The minimum slope for grassed areas shall be 1.0%.

4.1.13 Drainage features such as storm structures and swales shall be a minimum of 10 feet from all buildings as well as a minimum of 0.5 feet below finished grade at the building edge to promote positive drainage away from the structure.

5.0 SOIL EROSION & SEDIMENTATION CONTROL

5.1 PURPOSE

5.1.1 The purpose of soil erosion and sedimentation control is to protect our States land and water resources from unnecessary degradation.

5.2 GENERAL

5.2.1 All soil erosion control measures shall conform to Part 91 (Soil Erosion and Sedimentation Control) of the National Resources and Environmental Protection Act (NREPA).

5.2.2 The development should be planned and designed to fit the topography of the site.

5.2.3 The total acreage of disturbed area shall be presented on the plans

5.2.4 The location of the limits of earth disruption shall be shown on the plans.

5.2.5 The smallest practical area of land should be exposed for the shortest period of time.

5.2.6 The timing and sequence of proposed earth changes shall be provided.

5.2.7 A schedule of installation of soil erosion control measures, both temporary and permanent, shall be provided.

5.2.8 A maintenance schedule of soil erosion control methods, temporary and permanent, shall be presented on the plans.

5.2.9 All temporary and permanent facilities constructed for the conveyance of storm runoff around, through or from the earth change area shall be designed to limit the flow to a non-erosive velocity.

5.2.10 All temporary and permanent facilities constructed for the conveyance of storm runoff around, through or from the earth change area shall be designed to limit the flow to a non-erosive velocity.

5.2.11 Sediment caused be accelerated soil erosion shall be removed, to the extent possible, from runoff water before it leaves the site of the earth change activity.

5.2.12 Temporary soil erosion and sedimentation control facilities shall be removed only after permanent soil erosion control measures have been implemented.

5.2.13 A stone tracking mat shall be provided for each site and shall conform to the most current City of Walled Lake standards.

5.2.14 All applicable City of Walled Lake Soil Erosion and Sedimentation Control Details shall be provided on the plans.

6.0 PAVING

6.1 ROADS

6.1.1 For roads under the jurisdiction of the RCOC, all improvements shall be designed to meet their requirements. Roads within the boundaries of the City of Walled Lake that are under the jurisdiction of the Road Commission of Oakland County are Pontiac Trail and West Maple.

6.1.2 Roads shall be designed to meet current AASHTO standards.

6.1.3 Horizontal Alignment

6.1.3.1 The sight distance is to be designed based on current AASHTO standards.

6.1.3.2 Horizontal curves in proposed streets which appear to be continuous shall be not less than 230 foot centerline radius.

6.1.3.3 The centerline of construction shall coincide with the centerline of the Right-Of-Way.

6.1.3.4 Perpendicular intersections shall be used where possible. The use of skewed intersections is discouraged.

6.1.3.5 The minimum radius at intersections in a residential or commercial development is 25 feet. The minimum radius at an intersection for an industrial development is 35 feet.

6.1.4 Vertical Alignment

6.1.4.1 A vertical curve will be required when a change in grade of 1.0% or more occurs. The minimum length of vertical curve is 100 feet.

6.1.4.2 Continuous vision along the vertical alignment of all streets shall be designed based on current AASHTO standards.

6.1.4.3 Vertical curves shall be designed in accordance with the Road Commission for Oakland County's Design Standards for Crest and Sag Vertical Curves. (Minimum design speed shall be 35 mph)

6.1.5 Road Profiles shall be provided for all proposed roads.

6.1.5.1 Road stationing shall be shown on plan and profile views

6.1.5.2 Proposed vertical alignment at centerline of road

6.1.5.3 Existing ground line at centerline of road

6.1.5.4 Elevations at each station for the centerline of road

6.1.5.5 Lengths and slopes of sections of road

6.1.5.6 Vertical curve information including length, PVI, PVC, PVT stations and elevations. 'K' curve number, High/Low Point elevation and station, and algebraic difference between slopes

6.2 GRADES

6.2.1 Industrial

Minimum Grade – 1.0 percent
Maximum Grade – 4.0 percent (preferred), grades up to 6.0 percent under special conditions

6.2.2 Collector Roads

Minimum Grade – 1.0 percent
Maximum Grade – 6.0 percent

6.2.3 Residential Roads

Minimum Grade – 1.0 percent
Maximum Grade – 6.0 percent

6.2.4 Parking Lots

Minimum Grade – 1.0 percent for asphalt (0.80 percent for concrete)
Maximum Grade – 5.0 percent

6.2.5 Accessible parking spaces shall have minimum and maximum slopes as set by ADA requirements. Spot elevations must be provided on plans to assure compliance.

6.2.6 The grades within a street intersection shall not exceed 2.0 percent for a distance of 100 feet from the point of intersection of centerline.

6.2.7 Vertical curves will be required at all intersection grades where the algebraic difference in grade exceeds 0.8 percent.

6.3 CROSS SECTIONS

The minimum required pavement cross sections shall be as follows:

6.3.1 Industrial

- 10 inches concrete 3,500 PSI
- 10 inches 21AA aggregate

6.3.2 Collector Roads

- 2 inches MDOT 36A
- 2 inches MDOT 13A
- 2 inches MDOT 13A
- 8 inches 21AA aggregate

6.3.3 Residential Roads

- 2 inches MDOT 36A
- 2 inches MDOT 13A
- 8 inches 21AA aggregate

6.3.4 Parking Lots

- 2 inches MDOT 36A
- 2 inches MDOT 13A
- 8 inches 21AA aggregate

6.3.5 Concrete Pavement

- 8 inches concrete 3,500 PSI
- 8 inches 21AA aggregate

6.3.6 Any work within the Right-Of-Way that includes restoration work on an existing road, the pavement cross section shall be either the cross section as provided above or shall match the existing cross section of the road, whichever is greater.

6.3.7 Alternative pavement designs may be submitted to the City for consideration.

6.4 DRIVE APPROACHES

6.4.1 Drive approaches located on an Oakland County Road shall comply with Oakland County standards.

6.4.2 Drive approaches on City roads shall follow standards as described herein.

6.4.3 The maximum slope on a drive approach shall be 3.0 percent and the minimum 1.0 percent.

6.4.4 Where a sidewalk continues through a drive approach, the sidewalk shall be designed to meet current ADA requirements.

6.4.5 Where possible the high point shall set on the Right-Of-Way line on the approach as to avoid undetained and untreated storm water drainage into the Right-Of-Way.

6.5 SIDEWALKS

6.5.1 The minimum sidewalk width shall be 5 feet.

6.5.2 Sidewalks shall extend along the entire frontage of the property.

6.5.3 Sidewalks shall extend through all drive approaches.

6.5.4 Sidewalks shall be constructed of a minimum of 4 inch concrete, except at drive approaches where they shall be a minimum of 6 inches thick. Depth at drive approaches should be evaluated for each site as heavier uses such as commercial or industrial may warrant additional concrete thickness.

6.5.5 The concrete shall have a 28-day compressive strength of 3,500 pounds per square inch.

6.5.6 Proposed grades shall be provided intermittently along the length of the sidewalk.

6.5.7 Sidewalks shall have a maximum transverse slope of 2.0% and a maximum longitudinal slope (running slope) of 5.0%. Sidewalks that have a longitudinal slope greater than 5.0% are considered ramps and shall conform to current ADA requirements.

6.5.8 All sidewalks shall be designed to meet current ADA requirements.

6.5.9 Curb drops at intersections shall be designed to meet current ADA requirements.

6.5.10 Sidewalk ramps shall be designed to the current MDOT standards.

7.0 RECORD DRAWINGS

7.1 Two sets of record drawings shall be submitted to the City by the design engineers for review.

7.2 Record drawings must be prepared for any public utilities and storm water detention/retention facilities. The City reserves the right to require additional record drawing information at their discretion at the cost of the Applicant.

7.3 Generally, record drawings shall contain the following:

7.3.1 Plans shall be provided in both hard copy and electronic format. The minimum scale shall be 1 inch = 50 feet.

7.3.2 All record drawings shall bear the seal of a Registered Professional Engineer licensed to practice in the State of Michigan.

7.3.3 All as-built lengths and elevations shall be labeled "As-Built" and shall be measured to 0.01 feet.

7.4 The following shall be submitted for each individual system:

7.4.1 Storm Water Detention/Retention Facilities

7.4.1.1 An as-built shall be performed on the basin as to determine if the as-built basin has sufficient volume per the approved plans.

7.4.1.2 Side slopes of the as-built basin shall be measured to determine if they have been built according to the approved plans.

7.4.1.3 All pertinent information on the outlet control/overflow structure including but not limited to the rim elevation, freeboard elevation, outlet invert elevation, restrictor orifice sizes and elevations as well as structure sizes.

7.4.1.4 As-built storm system plans shall be accompanied with a letter (8.5"x11") signed and sealed by the design engineer certifying that the detention/retention basin is sized according to the approved plans with the appropriate side slopes and outlet configuration.

7.4.2 Water Distribution System

7.4.2.1 An as-built shall be performed on the water system that locates the gate valves, gate wells, hydrants and all appurtenances with their associated rim elevations and top of pipe elevations.

7.4.2.2 The plans must indicate the as-built lengths and sizes for the water system as well as top of pipe elevations at all appurtenances and at a minimum of every 50 feet.

7.4.3 Sanitary System

7.4.3.1 An as-built shall be performed on the sanitary system that locates the sanitary manholes and cleanouts and their associated rim elevations and invert elevations.

7.4.3.2 The plans must indicate the as-built lengths, sizes and slopes for the sanitary sewer.

8.0 INSPECTION

8.1 The Applicant shall coordinate with the City of Walled Lake an amount for an escrow account to be utilized for the construction inspection process. Items that require inspection are public utilities, any work within the Right-Of-Way and road construction.

8.2 Roadways (public and private) – Observation on the subgrade and aggregate base. Full observation curb & gutter and pavement placement.

8.3 Sidewalks (public) – Spot observation on sidewalk construction.

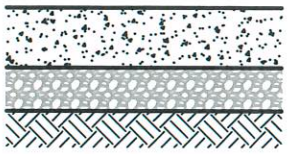
8.4 Sanitary Sewer (public) – Full observation of construction.

8.5 Water main (public) – Full observation of construction.

8.6 Storm Sewer (public) – Full observation of construction.

8.7 Additional inspection and observation may be required, on a case by case basis, at the discretion of the City of Walled Lake.

8.8 The contractor shall provide backfill density testing for all public utility construction and work within the public road Right-Of-Way.



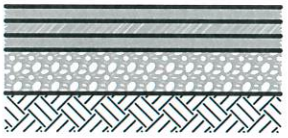
10" CONCRETE – 3,500 PSI

10" 21AA GRAVEL

COMPACTED SUBBASE

INDUSTRIAL – CONCRETE SECTION

(NO SCALE)

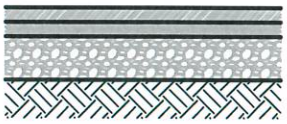


2" MDOT 36A
2" MDOT 13A
2" MDOT 13A
8" 21AA GRAVEL

COMPACTED SUBBASE

COLLECTOR ROAD – ASPHALT SECTION

(NO SCALE)



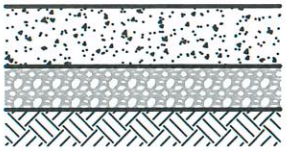
2" MDOT 36A
2" MDOT 13A
8" 21AA GRAVEL

COMPACTED SUBBASE

RESIDENTIAL ROAD – ASPHALT SECTION

(NO SCALE)

	CITY OF WALLED LAKE	DRAWN BY: ST
		SCALE NOT TO SCALE
		DATE 6/6/2016
	TITLE ASPHALT & CONCRETE CROSS SECTIONS	SHEET NO. P-1



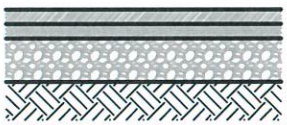
8" CONCRETE – 3,500 PSI

8" 21AA GRAVEL

COMPACTED SUBBASE

CONCRETE SECTION

(NO SCALE)



2" MDOT 36A
2" MDOT 13A

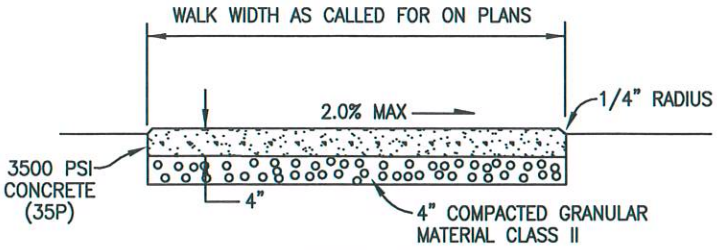
8" 21AA GRAVEL

COMPACTED SUBBASE

PARKING – ASPHALT SECTION

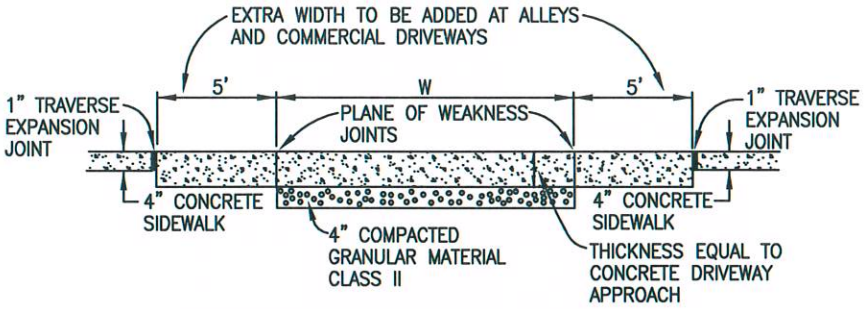
(NO SCALE)

CITY OF WALLED LAKE		DRAWN BY: ST
		SCALE NOT TO SCALE
		DATE 6/6/2016
TITLE ASPHALT & CONCRETE CROSS SECTIONS		SHEET NO. P-2



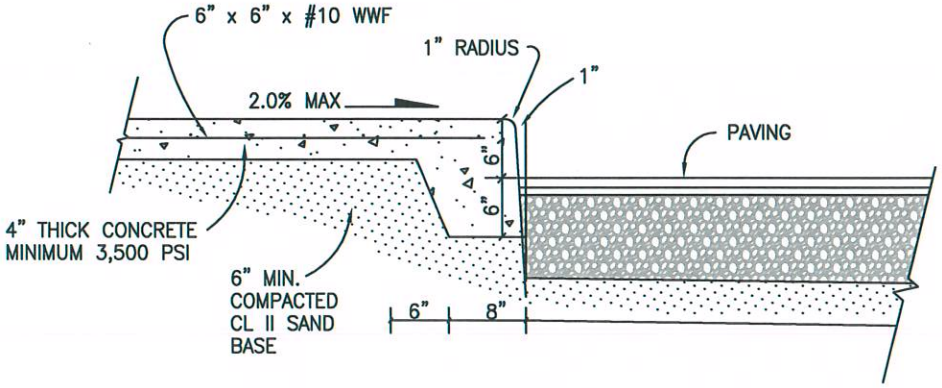
4" CONCRETE SIDEWALK

(NO SCALE)



THICKENED CONCRETE SIDEWALK

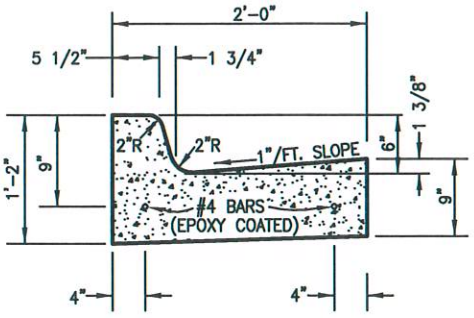
(NO SCALE)



INTEGRAL CONCRETE WALK / CURB DETAIL

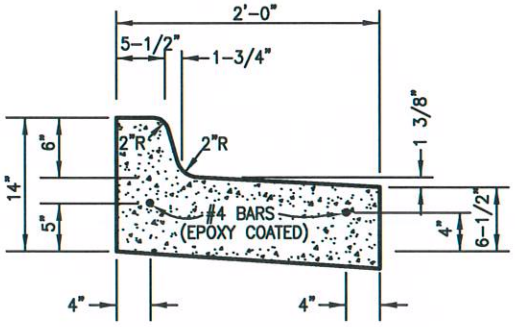
(NO SCALE)

	CITY OF WALLED LAKE	DRAWN BY: ST SCALE NOT TO SCALE DATE 6/6/2016
	TITLE SIDEWALK & INTEGRAL CURB AND WALK	SHEET NO. P-3



CONCRETE CURB & GUTTER
TYPE F

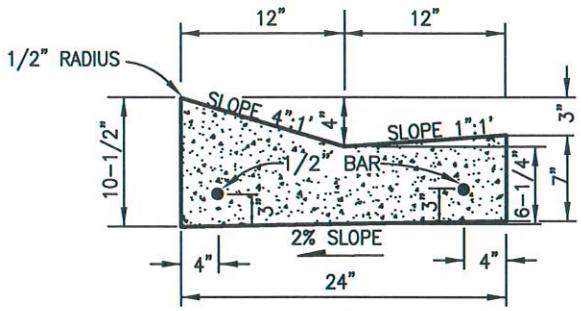
(NO SCALE)



CONCRETE CURB & GUTTER
TYPE F – MODIFIED

(NO SCALE)

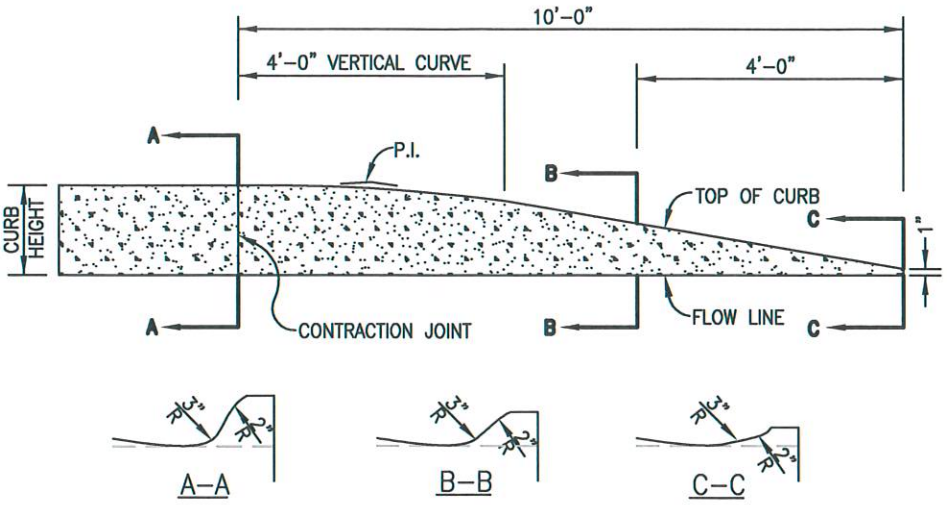
CITY OF WALLED LAKE		DRAWN BY: ST
		SCALE NOT TO SCALE
		DATE 6/6/2016
TITLE	F-4 CURB & GUTTER	SHEET NO. P-4



"VALLEY TYPE"
MOUNTABLE CURB & GUTTER DETAILS

(NO SCALE)

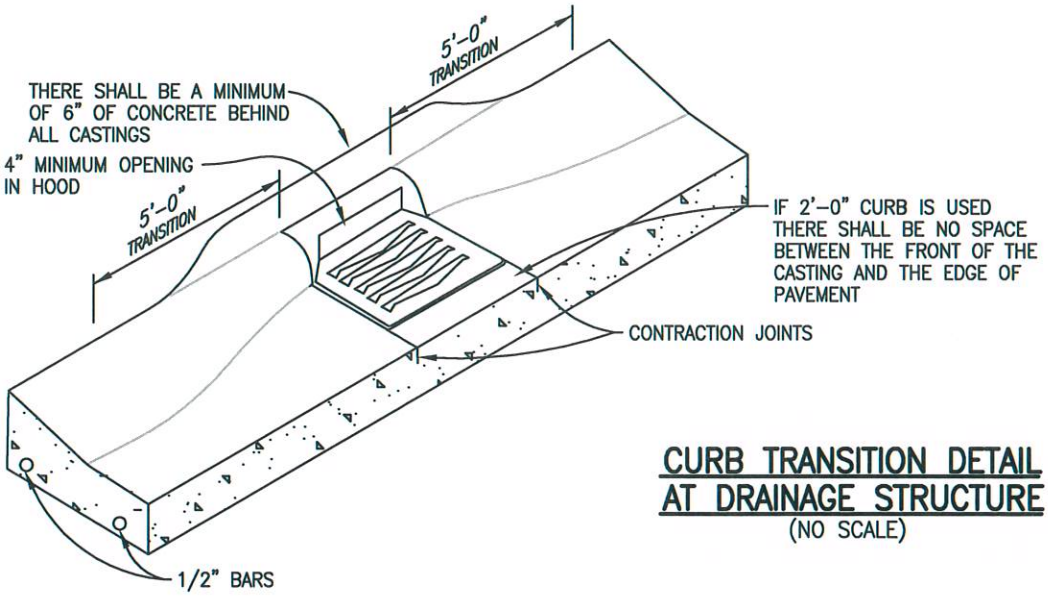
CITY OF WALLED LAKE		DRAWN BY: ST
		SCALE NOT TO SCALE
		DATE 6/6/2016
TITLE MOUNTABLE CURB & GUTTER		SHEET NO. P-5



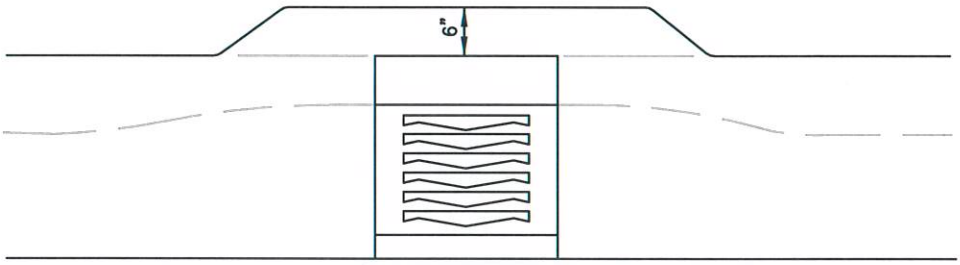
CONCRETE CURB AND GUTTER ENDINGS

(NO SCALE)

CITY OF WALLED LAKE		DRAWN BY: ST
		SCALE NOT TO SCALE
		DATE 6/6/2016
TITLE		SHEET NO.
CURB ENDING		P-6

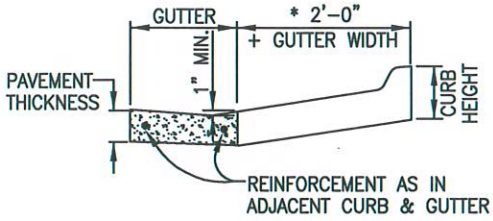


CURB TRANSITION DETAIL AT DRAINAGE STRUCTURE
(NO SCALE)

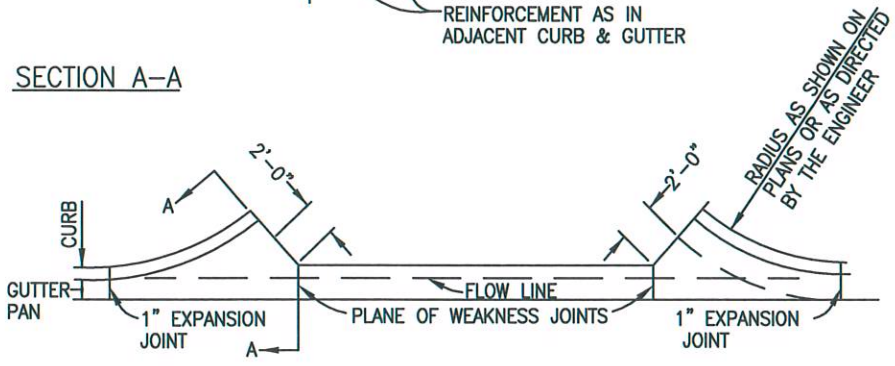


PLAN VIEW
(NO SCALE)

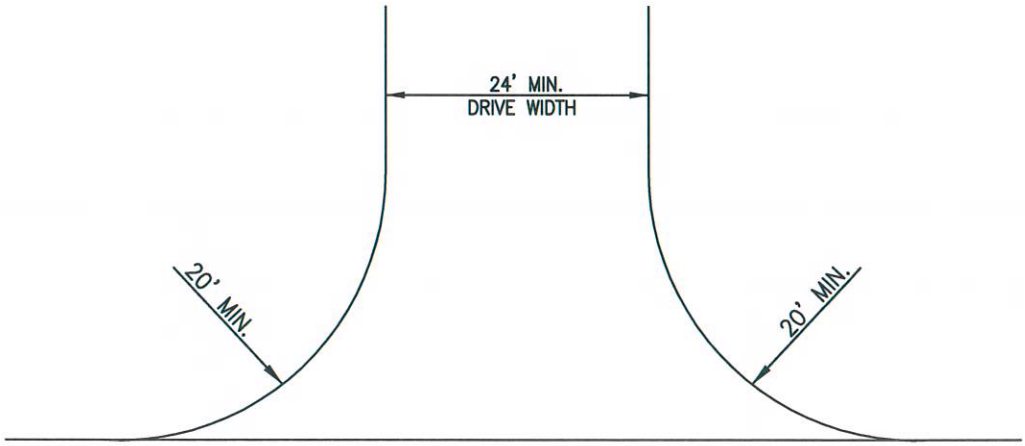
CITY OF WALLED LAKE		DRAWN BY: ST
		SCALE NOT TO SCALE
		DATE 6/6/2016
TITLE: CURB TRANSITION AT STRUCTURE		SHEET NO. P-7



SECTION A–A



* TO EDGE OF GUTTER OR FACE OF INTEGRAL CURB.

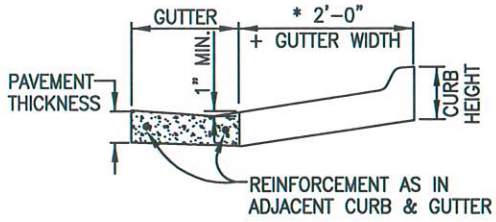


CITY OF WALLED LAKE

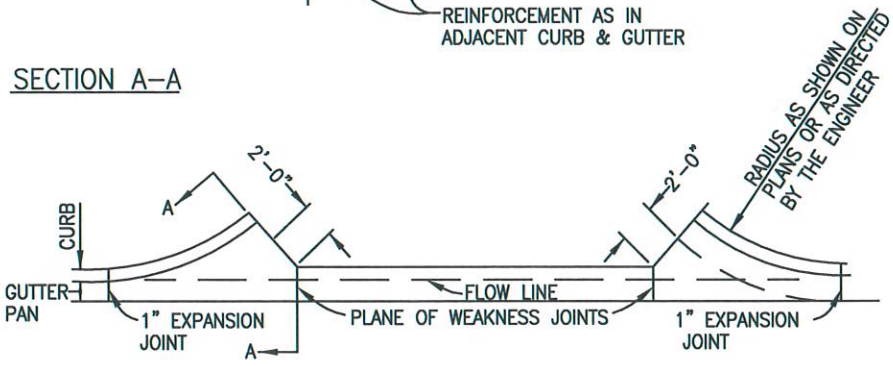
TITLE

COMMERCIAL DRIVE APPROACH

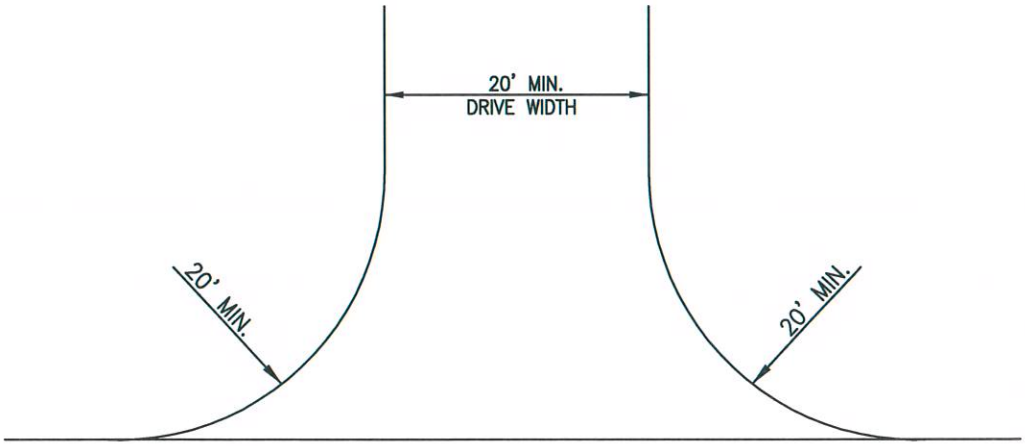
DRAWN BY:	ST
SCALE	NOT TO SCALE
DATE	6/6/2016
SHEET NO.	P–8



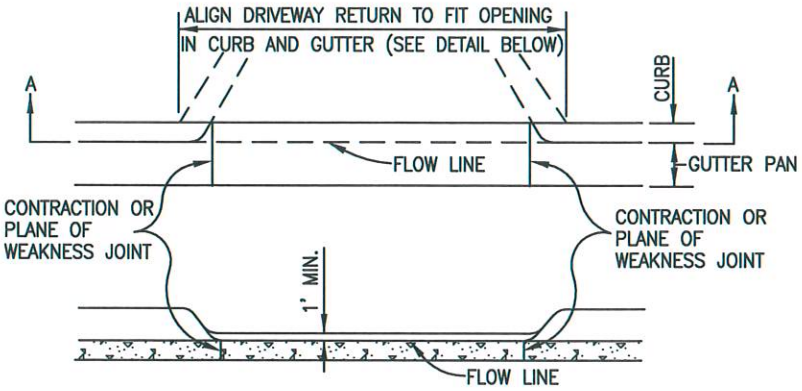
SECTION A–A



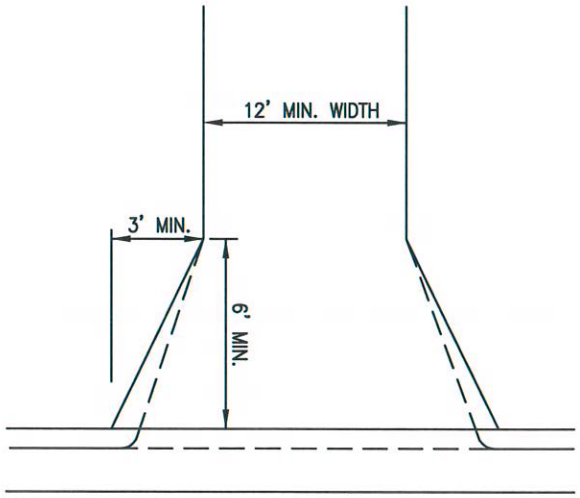
* TO EDGE OF GUTTER OR FACE OF INTEGRAL CURB.



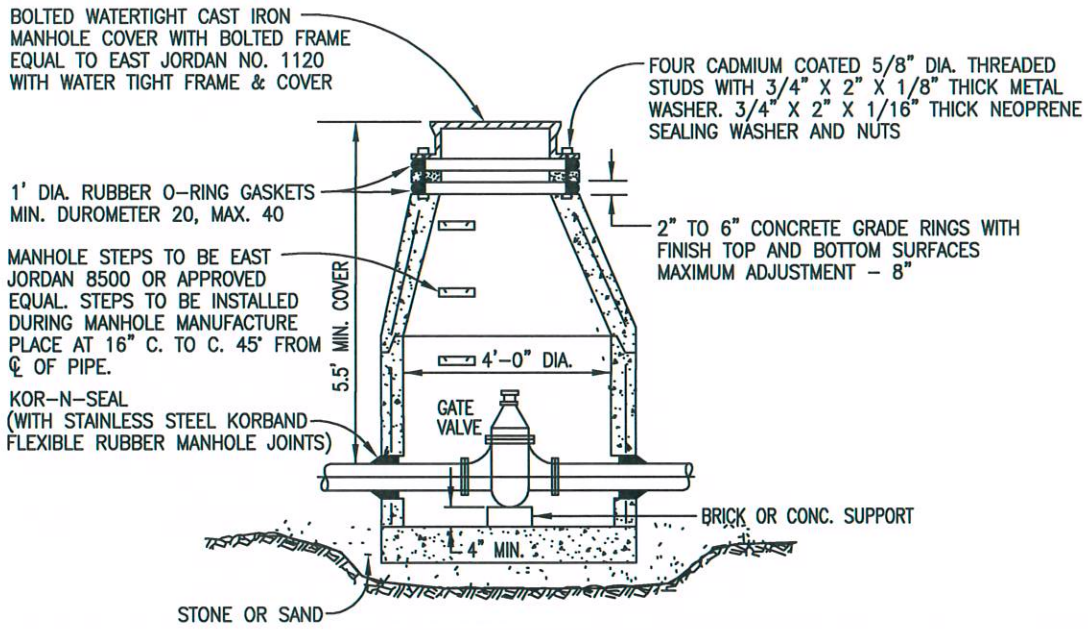
	CITY OF WALLED LAKE	DRAWN BY: ST SCALE NOT TO SCALE DATE 6/6/2016
	TITLE MULTI–FAMILY RESIDENTIAL	SHEET NO. P–9



SECTION A–A



	CITY OF WALLED LAKE	DRAWN BY: ST SCALE NOT TO SCALE DATE 6/6/2016
	TITLE SINGLE FAMILY RESIDENTIAL	SHEET NO. P–10

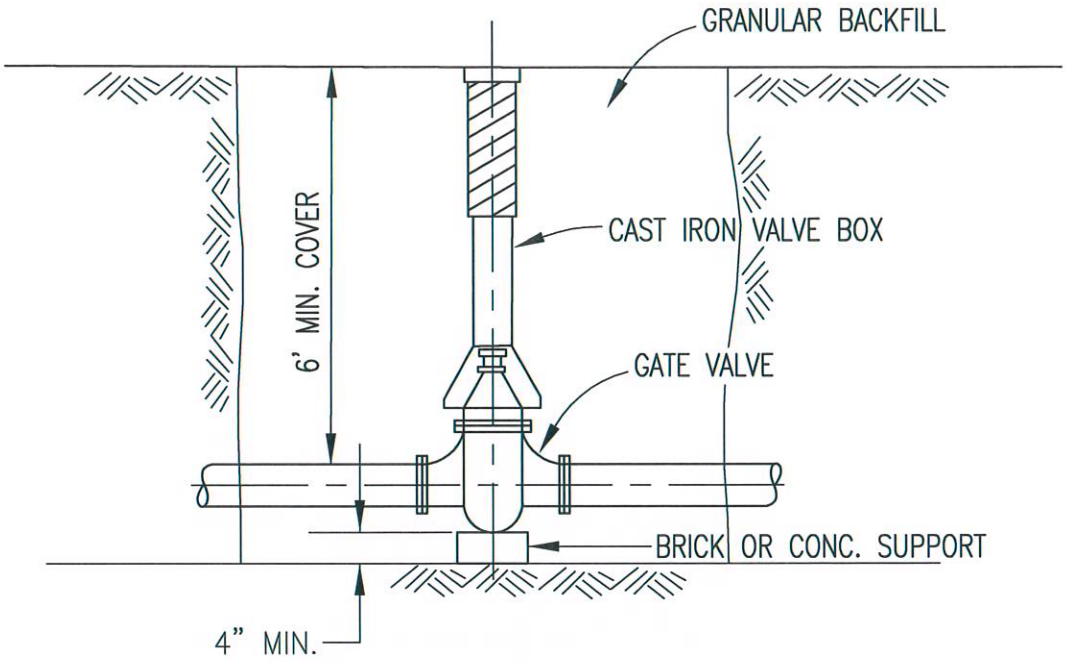


WATERMAIN GATE WELL

(NO SCALE)

GATE VALVE
- MUELLER OR EJIW
- RESILIENT WEDGE GATE VALVE
- MECHANICAL JOINT
- GATE KEY ACCESSIBLE
- 220 EJIW WATER GATE RING & COVER
- RIGHT HAND OPEN

CITY OF WALLED LAKE		DRAWN BY: ST
		SCALE NOT TO SCALE
		DATE 6/6/2016
TITLE: GATE VALVE AND WELL		SHEET NO. W-1

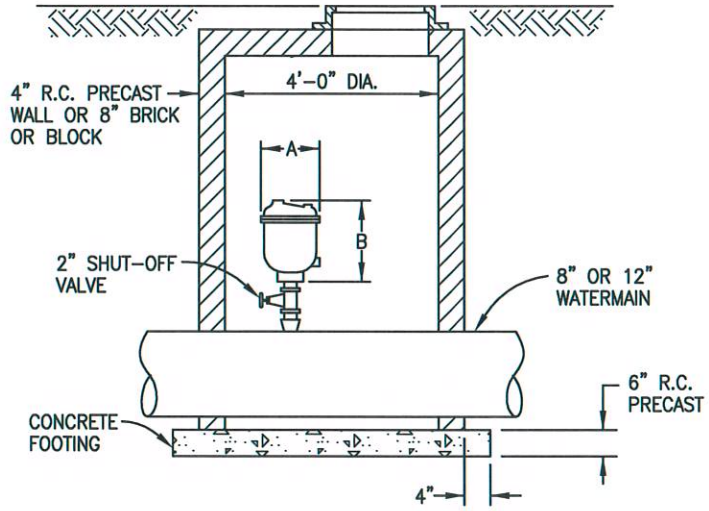


STANDARD GATE VALVE & BOX

(NO SCALE)

	CITY OF WALLED LAKE	DRAWN BY: ST SCALE NOT TO SCALE DATE 6/6/2016
	TITLE **GATE VALVE AND BOX**	SHEET NO. **W-2**

GENERAL DIMENSIONS				
VALVE SIZE (INLET)	OUTLET	A (SQ.)	B	WGT. (LBS.)
1" NPT 1-1/2" NPT 2" NPT	1/2" NPT	6-3/8"	9-7/8"	24



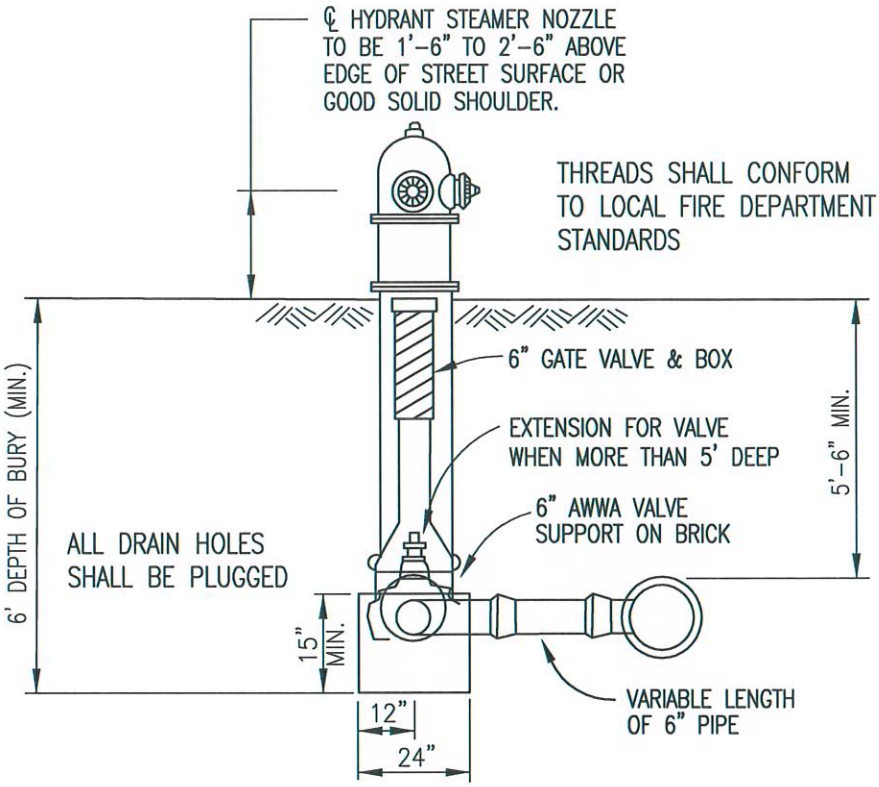
NOTE:

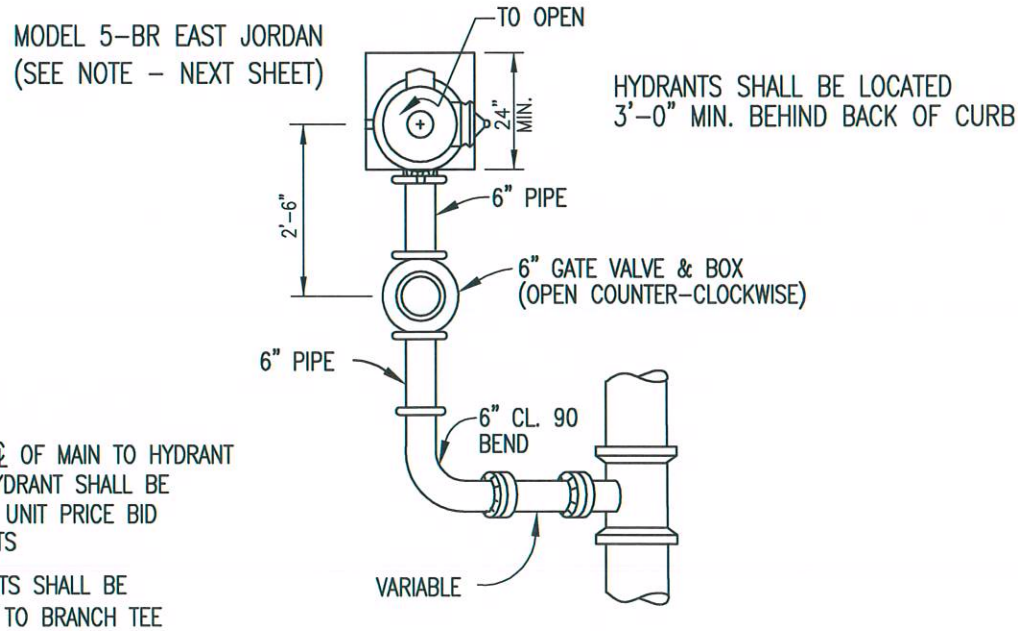
AIR RELEASE VALVE SHALL BE A GOLDEN-ANDERSON INDUSTRIES INC. FIG. 920 OR AN ENGINEER APPROVED EQUAL.

TYPICAL AIR RELEASE VALVE

(NO SCALE)

	CITY OF WALLED LAKE	DRAWN BY: ST SCALE NOT TO SCALE DATE 6/6/2016
	TITLE AIR RELIEF VALVE	SHEET NO. W-3





NOTE:

1. ALL WORK FROM ℄ OF MAIN TO HYDRANT AND INCLUDING HYDRANT SHALL BE PAID FOR BY THE UNIT PRICE BID FOR FIRE HYDRANTS
2. ALL 6" D.I.P. JOINTS SHALL BE RESTRAINED BACK TO BRANCH TEE
3. PUMPER NOZZLE TO FACE STREET
4. ALL HYDRANTS TO BE FIELD PAINTED PER LOCAL FIRE DEPARTMENT STANDARDS

HYDRANT ASSEMBLIES

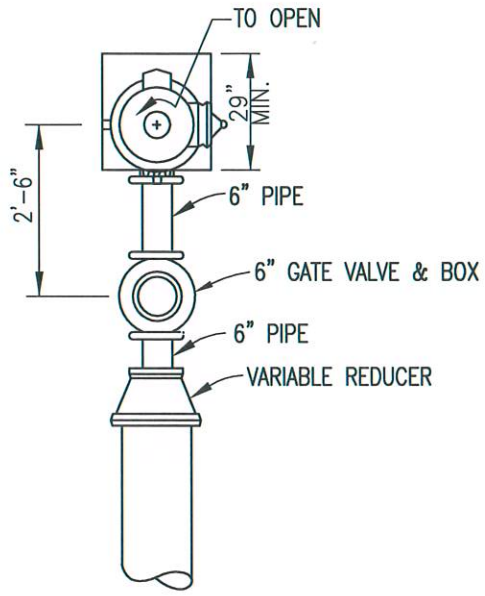
(NO SCALE)

CITY OF WALLED LAKE

DRAWN BY:	ST
SCALE	NOT TO SCALE
DATE	6/6/2016
SHEET NO.	W-4

TITLE

FIRE HYDRANT



HYDRANT ASSEMBLIES

(NO SCALE)

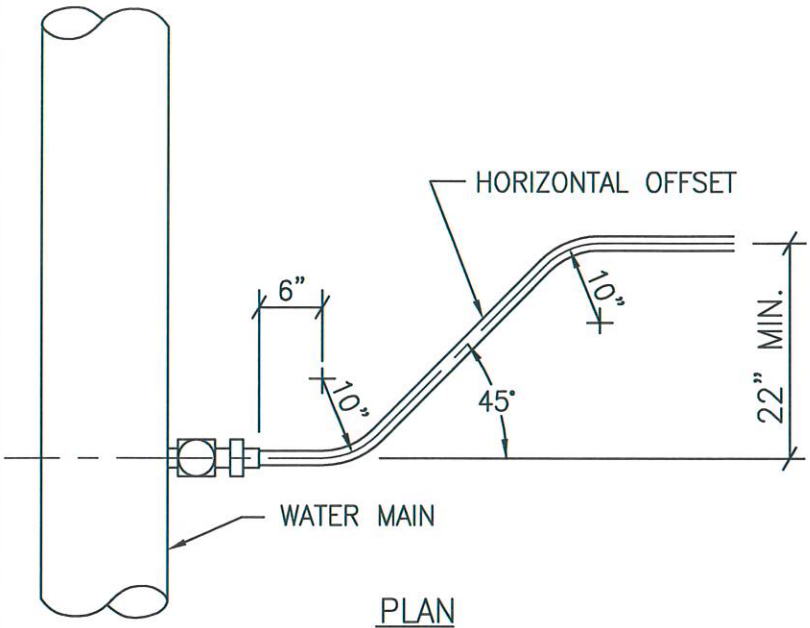
FIRE FLOW NOZZLE© SPECIFICATION FOR CITY OF WALLED LAKE FIRE DEPARTMENT.
EAST JORDAN 5BR FIRE HYDRANT

- TWO 2–1/2" NST (HOSE NOZZLE)
- ONE 4–1/2" NST (PUMPER NOZZLE)

THE NOZZLE COMPLETE AND FITTINGS SHALL BE OF A LEAD FREE BRASS ALLOY AND ALUMINUM FORGED ALLOY, ENSURING LONG LIFE FREE FROM OXIDATION AND LEAD, WHICH MAY CONTAMINATE PUBLIC WATER SUPPLIES. THE NOZZLE SHALL BE COLORED RED USING A BAKED POWDER COAT FINISH.

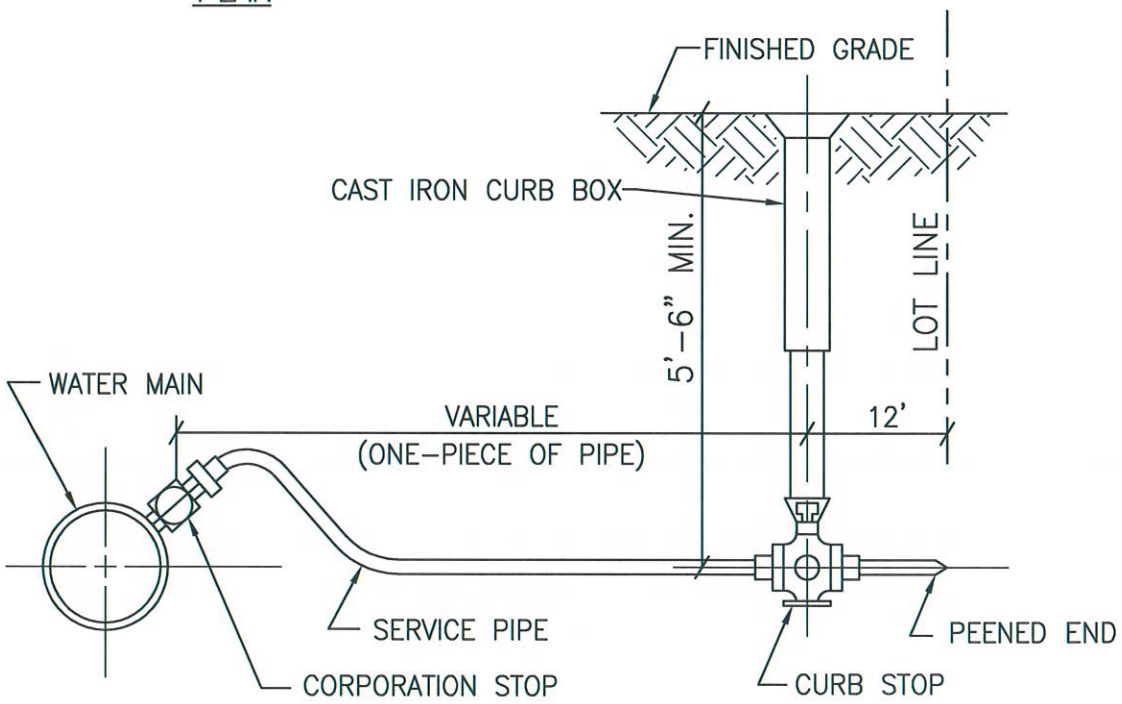
ALL FIRE HYDRANTS SHALL BE PROVIDED WITH A NEW CONCEPT TOOLS NO. 41002 HYDRANT FLAGS.

CITY OF WALLED LAKE		DRAWN BY: ST
		SCALE NOT TO SCALE
		DATE 6/6/2016
TITLE	FIRE HYDRANT	SHEET NO. W–5



PLAN

SERVICE PIPE	CORPORATION STOP	CURB STOP	SERVICE BOX
3/4"	3/4"	3/4"	2-1/2"
1"	1"	1"	2-1/2"
1-1/4"	1-1/4"	1-1/4"	3"
1-1/2"	1-1/4" x 1-1/2"	1-1/2"	3"
2"	1-1/2" x 2"	2"	3"



SECTION

CURB BOX
- ARCH PATTERN CURB BOX
- STAINLESS STEEL ROD

WATER SERVICE LATERAL

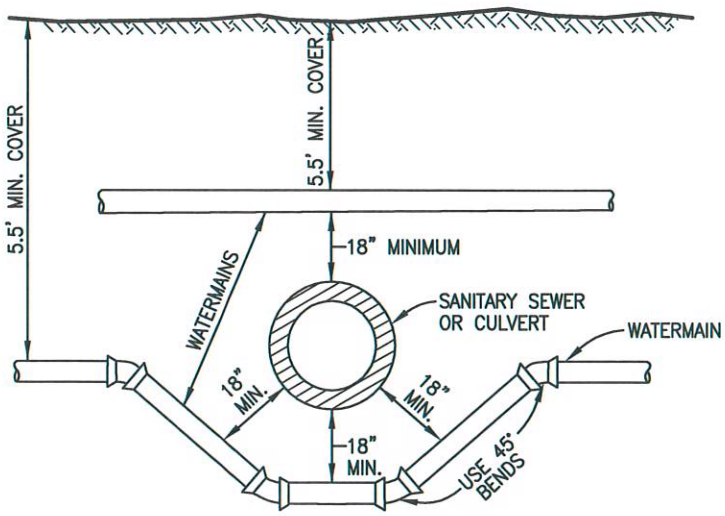
SCALE: NONE

CITY OF WALLED LAKE

TITLE

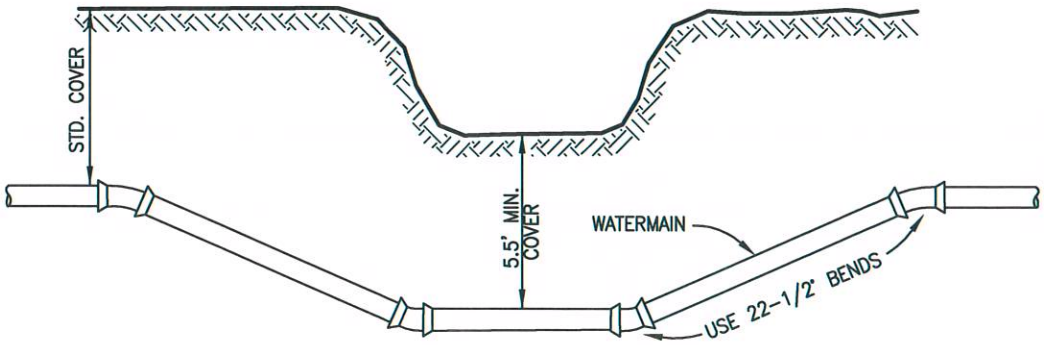
WATER SERVICE

DRAWN BY: ST
SCALE NOT TO SCALE
DATE 6/6/2016
SHEET NO. W-6



WATERMAIN RELOCATION
SEWER OR CULVERT CROSSING

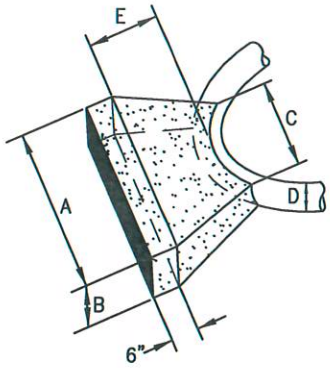
(NO SCALE)

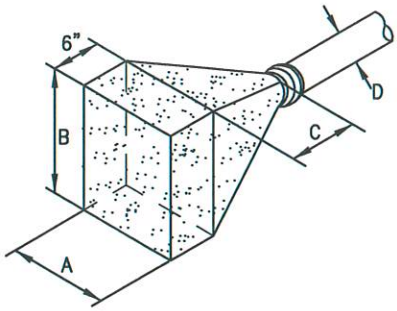


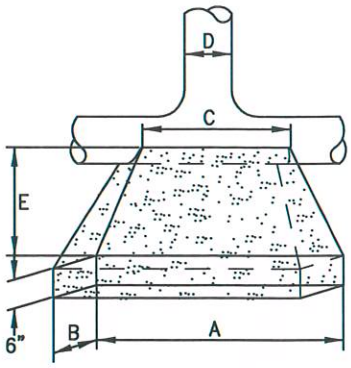
DITCH & STREAM CROSSING

(NO SCALE)

	CITY OF WALLED LAKE	DRAWN BY: ST
		SCALE NOT TO SCALE
		DATE 6/6/2016
	TITLE UTILITY CROSSING	SHEET NO. W-7







FOR 90° BENDS OR SMALLER

D	A	B	C	E
20"	8'	6'-6"	3'-6"	2'-6"
16"	6'	4'-0"	2'-6"	2'-0"
12"	4'	3'-0"	2'-0"	1'-9"
10"	3'	3'-0"	2'-0"	1'-9"
8"	3'	2'-0"	2'-0"	1'-6"
6"	2'	1'-6"	2'-0"	1'-3"

FOR PLUGS

D	A	B	C MIN.
20"	7'-0"	5'-0"	2'-6"
16"	4'-10"	4'-10"	2'-0"
12"	4'-4"	3'-0"	1'-9"
10"	3'-0"	2'-0"	1'-6"
8"	2'-10"	2'-6"	1'-6"
6"	1'-6"	1'-6"	1'-3"

FOR TEES

D	A	B	C	E MIN.
20"	6'-6"	4'-6"	3'-6"	3'-0"
16"	4'-8"	4'-8"	2'-6"	2'-9"
12"	4'-0"	3'-0"	2'-6"	2'-6"
10"	3'-0"	2'-0"	2'-0"	2'-3"
8"	2'-8"	2'-0"	2'-0"	2'-3"
6"	2'-0"	2'-0"	2'-0"	2'-3"

NOTE:

3000 PSI CONCRETE TO BE USED. THRUST BLOCK TO ABUTT & REST AGAINST UNDISTURBED SOIL.

THRUST BLOCK DETAILS

(NO SCALE)

PIPE RESTRAINT SCHEDULE
GROUND BURIED PRESSURE PIPE – DUCTILE IRON AND PVC PIPE

PIPE DIAMETER	TEES, 90° BENDS	45° BENDS	22-1/2° BENDS	11-1/4° BENDS	DEAD ENDS	REDUCERS (ONE SIZE REDUCTION) *	REDUCERS (TWO SIZE REDUCTION) *
4	13	5	3	1	40	----	----
6	19	8	4	2	58	31	----
8	24	10	5	2	75	30	70
12	34	14	7	3	107	57	116
16	43	18	9	4	139	59	137
20	52	22	10	5	169	59	134
24	61	25	12	6	199	60	132
30	73	30	15	7	242	85	168
36	84	35	17	8	281	84	188

LENGTHS OF PIPE RESTRAINT ARE GIVEN IN FEET.

IF REQUIRED PIPE DIAMETER IS NOT LISTED IN THIS TABLE, THE NEXT LARGEST PIPE DIAMETER SHALL BE USED.

THIS TABLE IS BASED ON A TEST PRESSURE OF 180 PSI (OPERATING PRESSURE PLUS WATER HAMMER). FOR OTHER TEST PRESSURES, ALL VALUES TO BE INCREASED OR DECREASED PROPORTIONALLY.

THE VALUE PROVIDED OF RESTRAINT LENGTH ARE IN EACH DIRECTION FROM THE POINT OF DEFLECTION OR TERMINATION EXCEPT FOR TEES, AT WHICH ONLY THE BRANCH IN THE DIRECTION OF THE STEM.

IF TIE RODS ARE USED, USE FOUR RODS MINIMUM AND ADD 1/8-INCH TO BAR DIAMETER AS CORROSION ALLOWANCE.

* SIZE REDUCTION IS BASED UPON THE PIPE DIAMETER SHOWN IN THIS TABLE.

BASED UPON:		
	INTERNAL PRESSURE:	180
	PIPE DEPTH:	5
	BEDDING CLASS:	TYPE 4
	SOIL TYPE:	GOOD SAND
	SAFETY FACTOR:	2

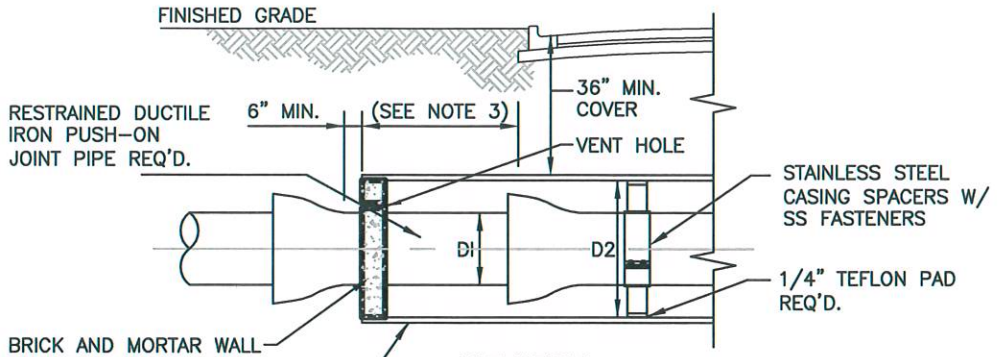
CITY OF WALLED LAKE

DRAWN BY: ST
SCALE NOT TO SCALE
DATE 6/6/2016

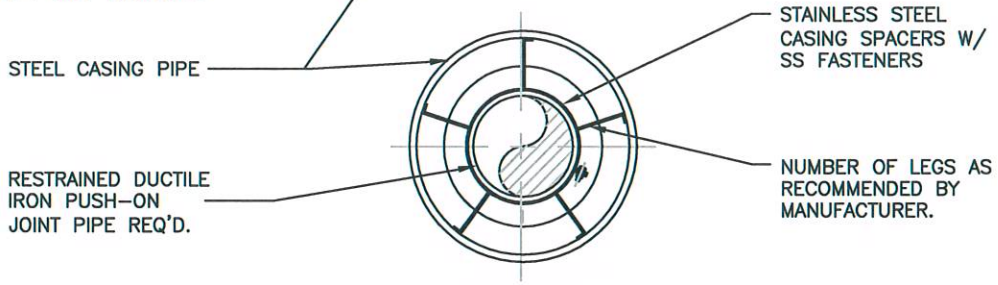
TITLE

THRUST BLOCKS & PIPE RESTRAINTS

SHEET NO. W-8



ELEVATION



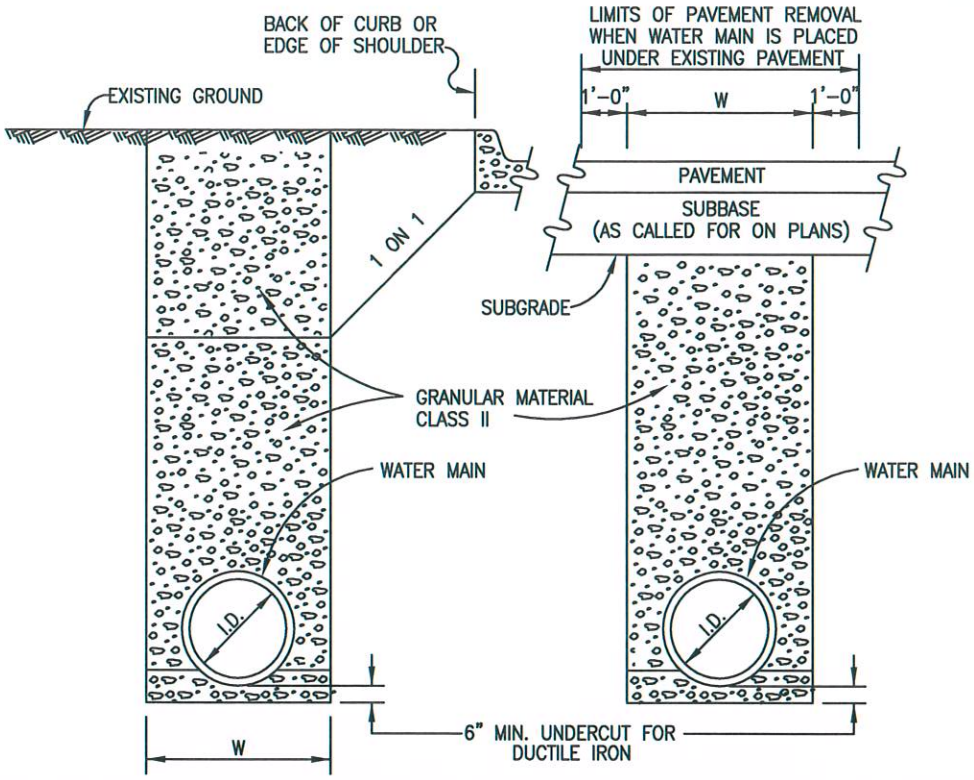
SECTION

CARRIER PIPE AND CASING PIPE SIZES (MIN.)										
CARRIER PIPE NOM. DIA. (DI)	2	4	6	8	10	12	14	16	20	24
CASING PIPE NOM. DIA. (D2)	6	14	16	18	22	24	30	30	36	48
WALL THICKNESS (IN.)	0.250	0.250	0.250	0.250	0.250	0.250	0.312	0.312	0.375	0.500
WALL THICKNESS (IN.) RAILROAD	0.250	0.250	0.250	0.312	0.375	0.375	0.500	0.500	0.563	0.625

NOTES:

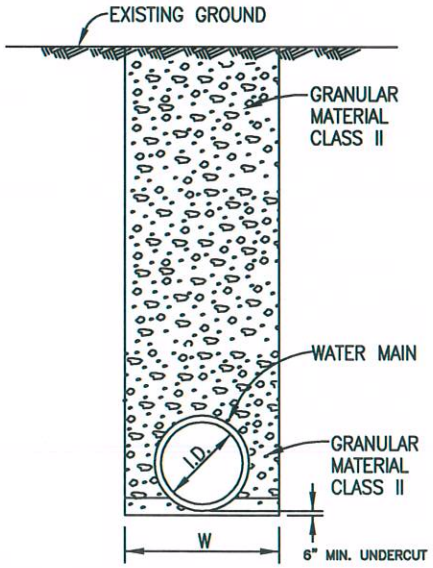
1. WHEN CONSTRUCTION IS WITHIN MDOT OR RAILROAD JURISDICTION, ADDITIONAL REQUIREMENTS OF EACH AGENCY SHALL BE MET.
2. STAINLESS STEEL CASING SPACERS ARE REQUIRED AS SHOWN.
3. WHERE PRACTICAL, CASING SHALL EXTEND A MIN. OF 5' BEYOND EDGE OF PAVEMENT OR LONGER AS REQUIRED BY LOCAL PERMITTING AGENCIES.
4. A MINIMUM OF 3 CASING SPACERS PER 20 LINEAR FEET OF INSTALLED CARRIER PIPE SHALL BE PROVIDED.

CITY OF WALLED LAKE		DRAWN BY: ST
		SCALE NOT TO SCALE
		DATE 6/6/2016
TITLE		SHEET NO.
CASING PIPE		W-9



WATER MAINS UNDER ROADBED OR WITHIN INFLUENCE OF ROADBED

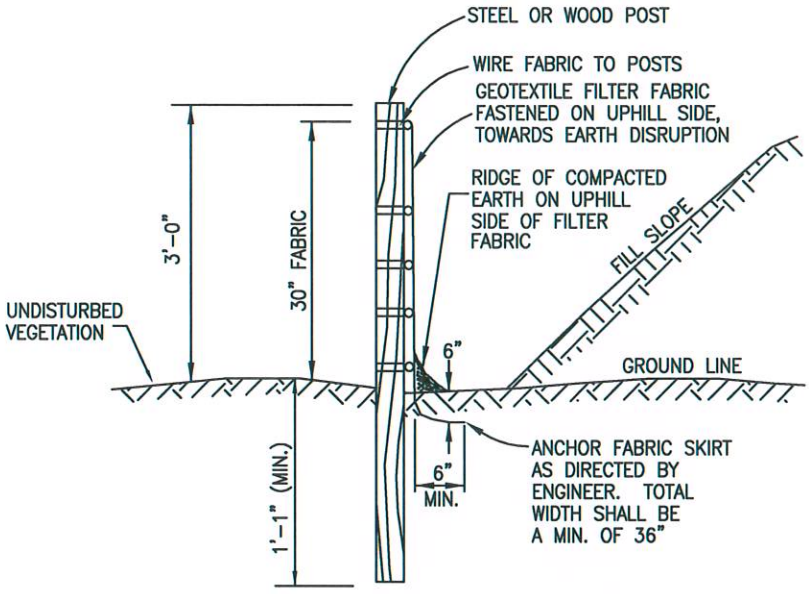
NO SCALE



WATER MAINS NOT UNDER ROADBED

NO SCALE

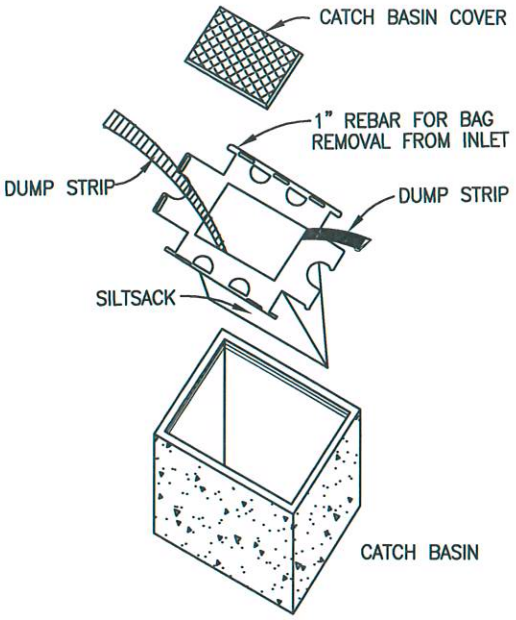
	CITY OF WALLED LAKE	DRAWN BY: ST SCALE NOT TO SCALE DATE 6/6/2016
	TITLE WATER MAIN TRENCH BACKFILL	SHEET NO. W-10

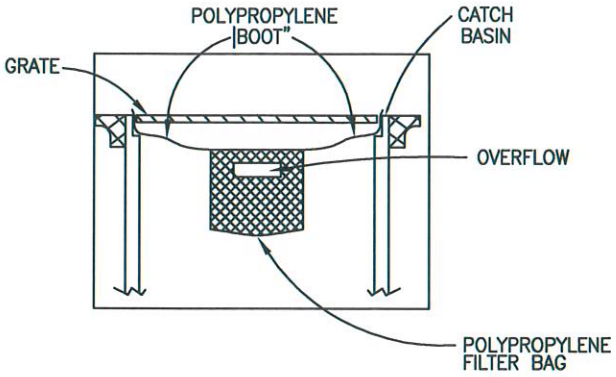


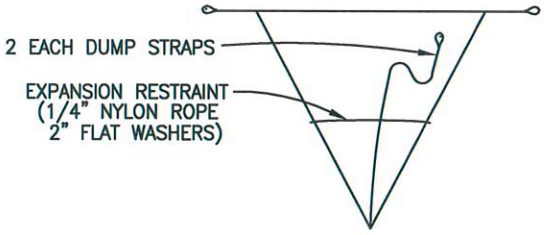
SILT FENCE DETAIL

NO SCALE

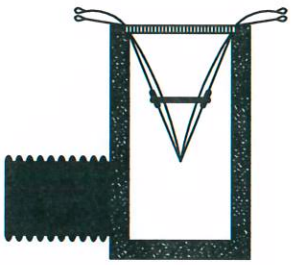
	CITY OF WALLED LAKE	DRAWN BY: ST SCALE NOT TO SCALE DATE 6/6/2016
	TITLE SILT FENCE	SHEET NO. SE-1







BAG DETAIL



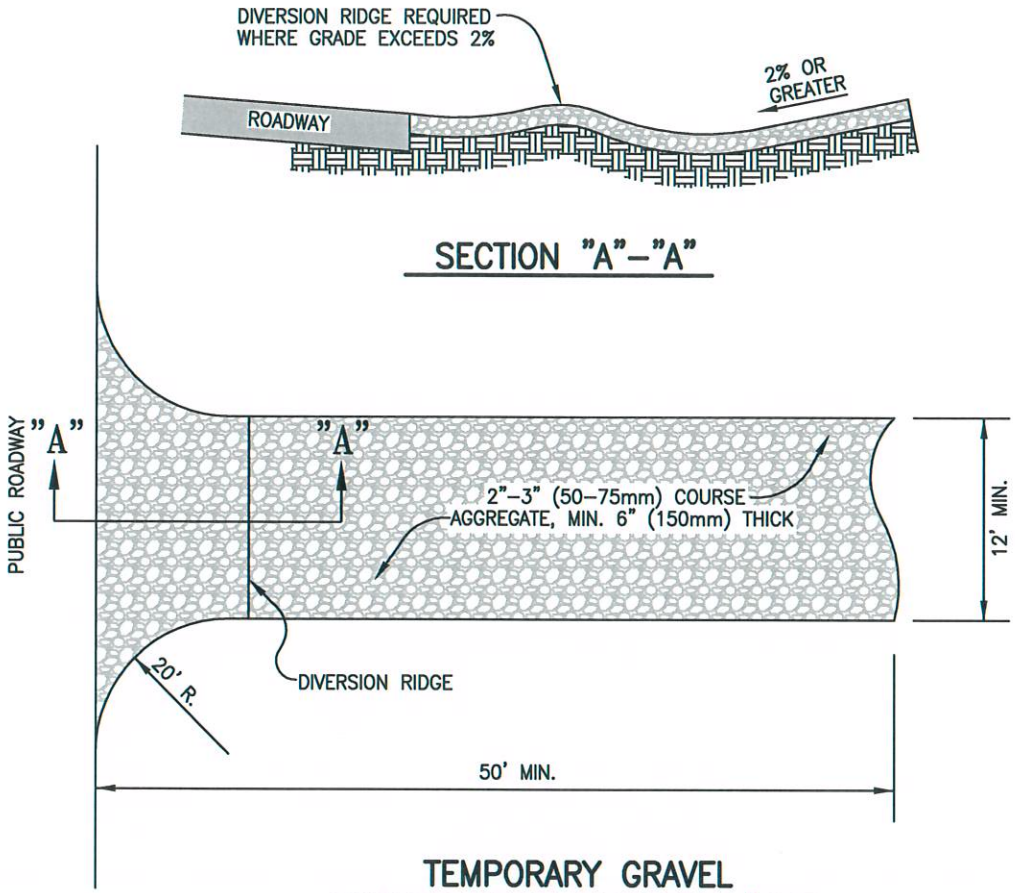
INSTALLATION DETAIL

NOTE:
TEMPORARY INLET SEDIMENT FILTER TO BE INSTALLED ON ALL PAVEMENT CATCH BASINS INLET FILTER TO BE SIMILAR TO "SILTSACK" AS MANUFACTURED BY BMP STORE (800-644-9223) OR "SILTSACK" AS MANUFACTURED BY ATLANTIC CONSTRUCTION FABRICS IN (800-448-3636). CLEAN FILTER AS NEEDED.

INLET SEDIMENT FILTER TEMPORARY

NO SCALE

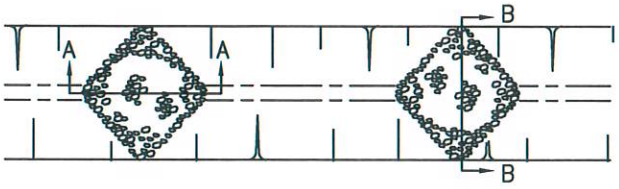
	CITY OF WALLED LAKE	DRAWN BY: ST SCALE NOT TO SCALE DATE 6/6/2016
	TITLE SILT SACK	SHEET NO. SE-2



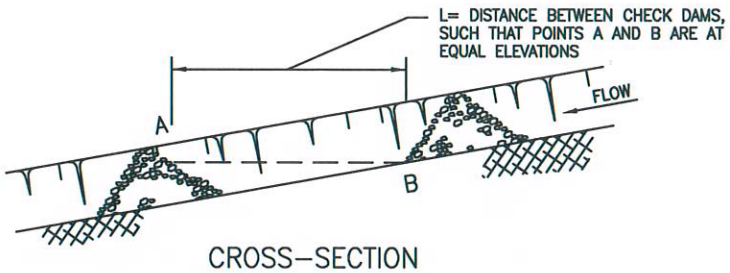
TEMPORARY GRAVEL CONSTRUCTION ENTRANCE/EXIT

NO SCALE

CITY OF WALLED LAKE		DRAWN BY: ST
		SCALE NOT TO SCALE
		DATE 6/6/2016
TITLE	TRACKING MAT	SHEET NO. SE–3

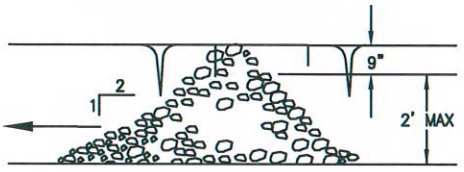


PLAN VIEW



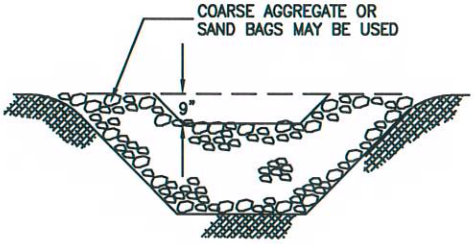
CROSS–SECTION

NOTE: CHECK DAMS GREATER THAN TWO FEET IN DEPTH MAY SERIOUSLY IMPACT THE FLOW CHARACTERISTICS OF THE DITCH.



SECTION A–A

NO SCALE



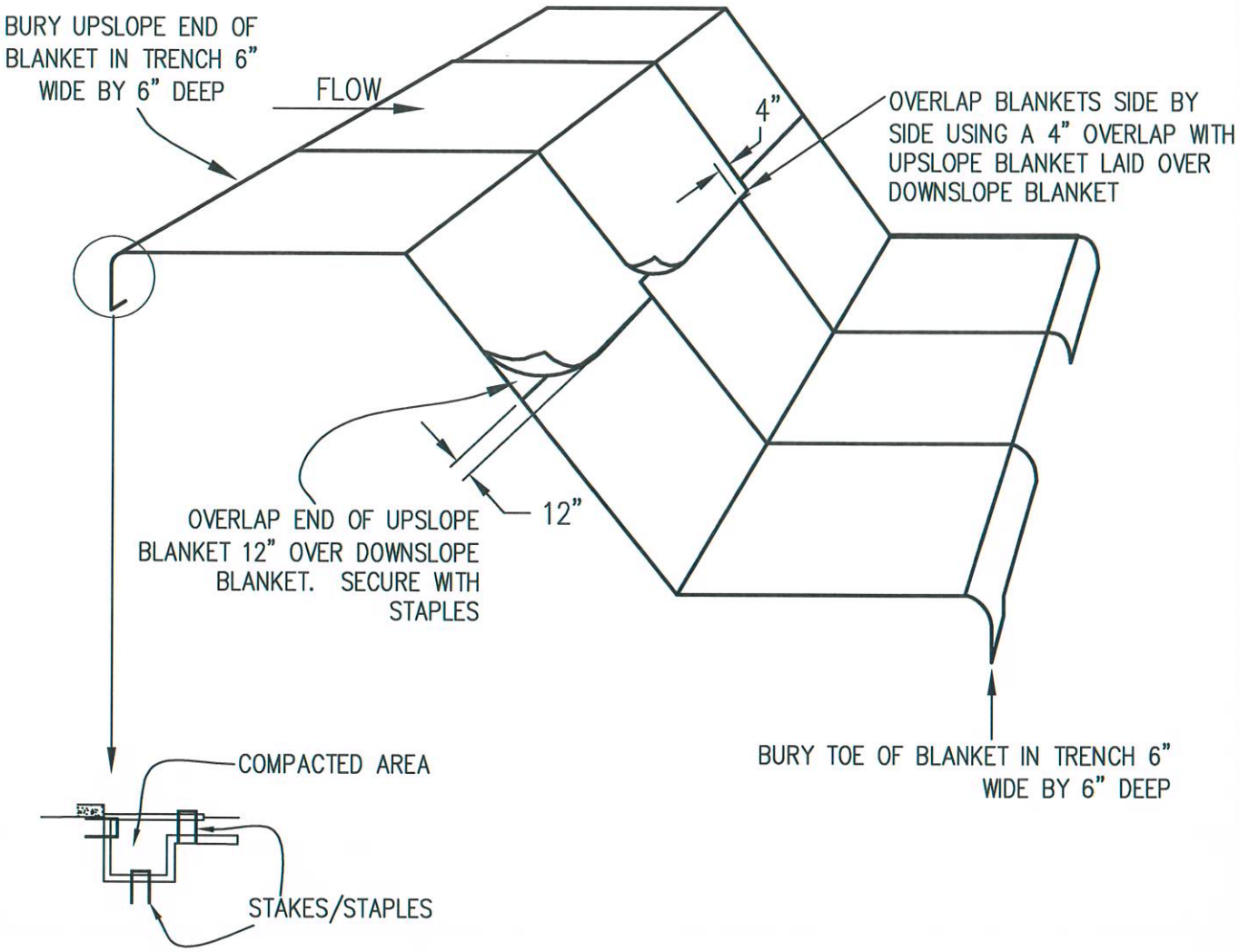
SECTION B–B

NO SCALE

CHECK DAM DETAIL

NO SCALE

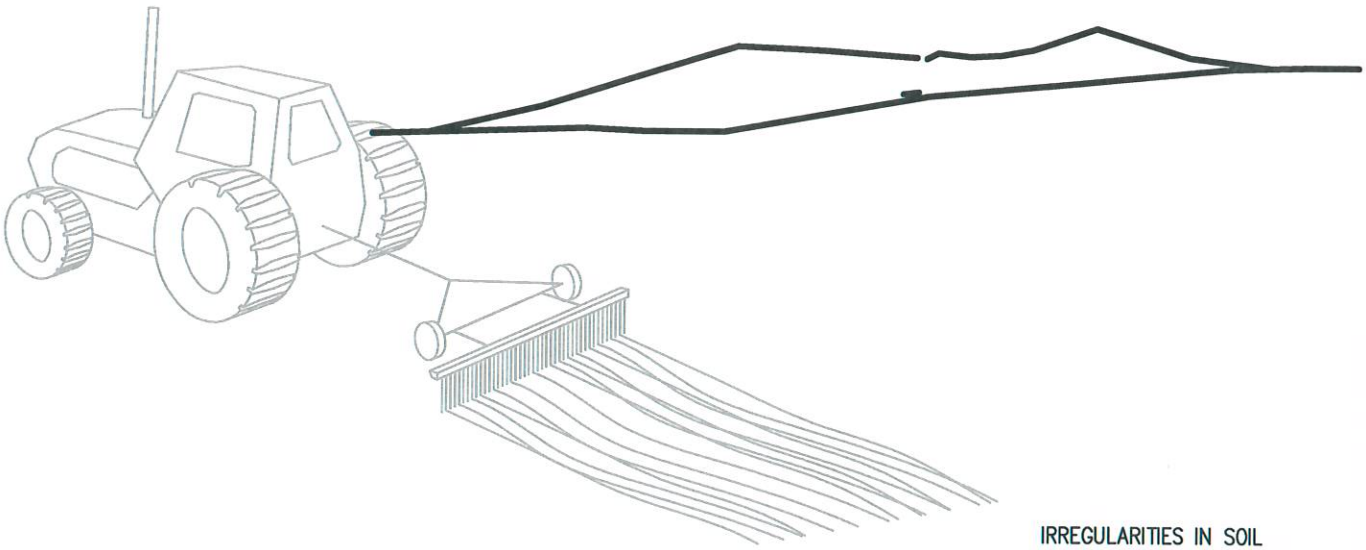
	CITY OF WALLED LAKE	DRAWN BY: ST SCALE NOT TO SCALE DATE 6/6/2016
	TITLE CHECK DAM	SHEET NO. SE–4



NOTES:

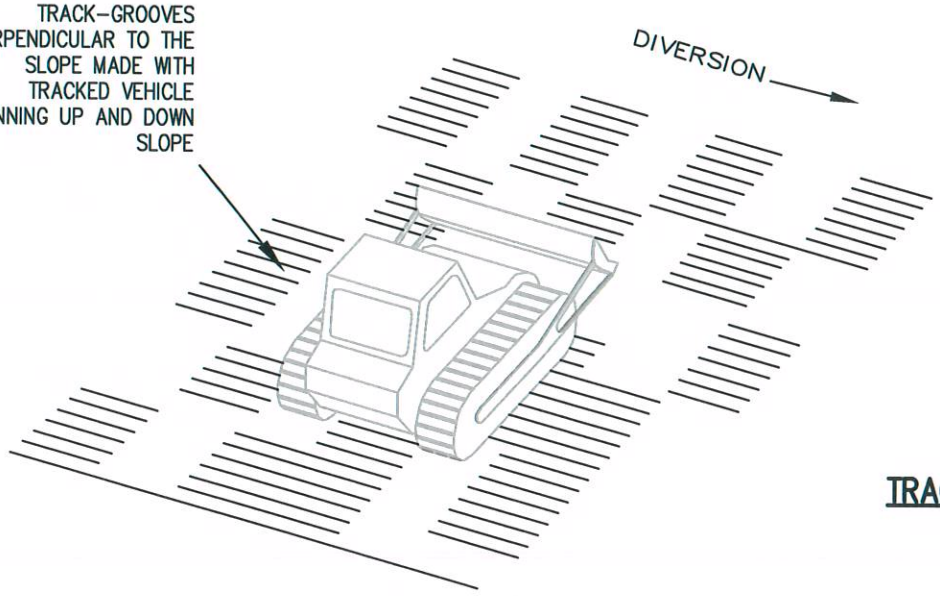
1. PLACE MULCH BLANKET PARALLEL TO FLOW AND ANCHOR SECURELY.
2. WHEN BLANKETS ARE USED IN FLOWING DITCH, BLANKETS SHOULD NOT OVERLAP IN DITCH CENTER PARALLEL TO FLOW.
3. STAPLES INSTALLED/SECURED ACCORDING TO MANUFACTURER'S SPECIFICATIONS.
4. WHERE POSSIBLE, CONSTRUCT WITH BIODEGRADABLE MATERIAL.

	CITY OF WALLED LAKE	DRAWN BY: ST SCALE NOT TO SCALE DATE 6/6/2016
	TITLE **EROSION BLANKETS**	SHEET NO. **SE-5**



IRREGULARITIES IN SOIL SURFACE CATCH RAINWATER AND PROVIDE SOME COVERAGE

SCARIFICATION



TRACKING

CITY OF WALLED LAKE

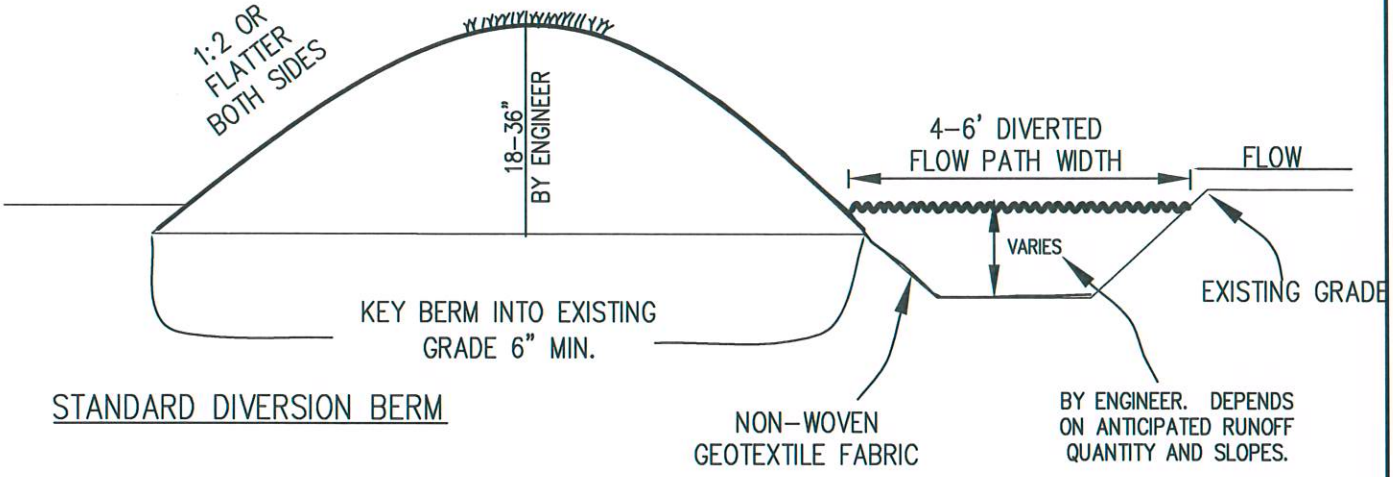
DRAWN BY: ST
SCALE NOT TO SCALE
DATE 6/6/2016

TITLE

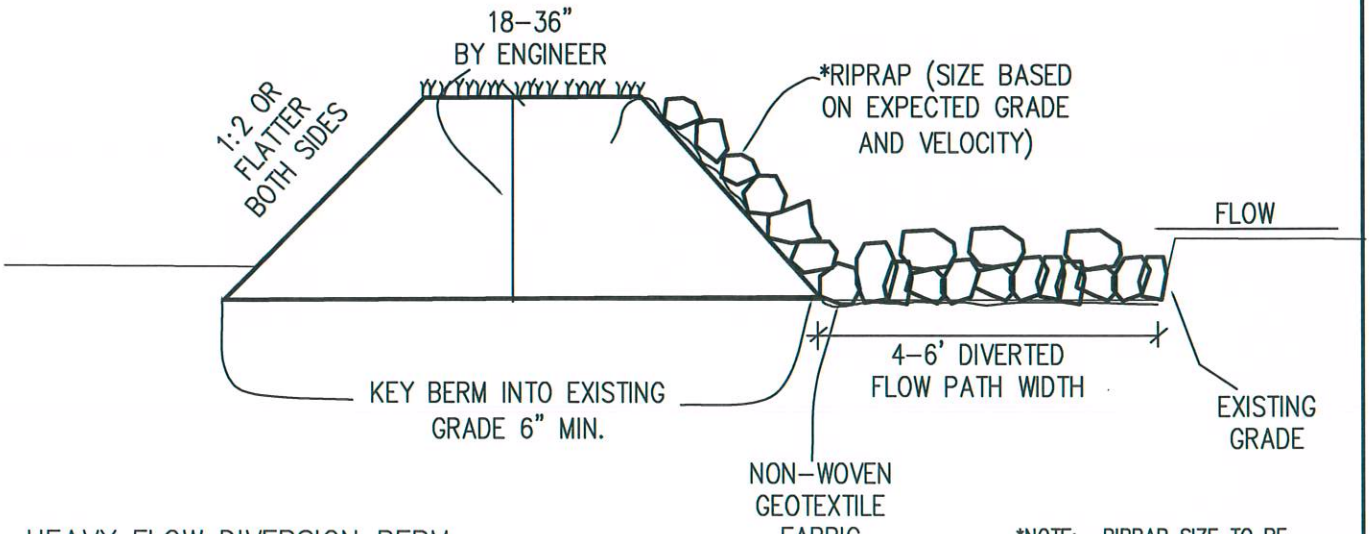
SURFACE ROUGHENING

SHEET NO.

SE-6



STANDARD DIVERSION BERM



HEAVY FLOW DIVERSION BERM

*NOTE: RIPRAP SIZE TO BE DETERMINED BY ENGINEER.

	CITY OF WALLED LAKE	DRAWN BY: ST SCALE NOT TO SCALE DATE 6/6/2016
	TITLE **DIVERSION BERM**	SHEET NO. **SE–7**