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ENGINEERING AND DESIGN STANDARDS

City of Helena

Approved by City Commission on (Date)

City of Helena
Public Works Department
316 N. Park Avenue
Helena, MT 59623
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ACRONYMS

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AASHTO - American Association of State Highway and Transportation Officials

ADA - Americans with Disabilities Act

ADT – Average Daily Traffic

API - American Petroleum Institute

ASTM - American Society for Testing and Materials

AWWA - American Water Works Association

BMP - Best Management Practice

CMP - Corrugated Metal Pipe

CPT - Corrugated Polyethylene Tubing

CPE - Corrugated Polyethylene Storm Sewer Pipe

CP - Coalescing plate

DEQ – Montana Department of Environmental Quality

ESAL – Equivalent Single Axle Load

FHWA – Federal Highway Administration

HDPE - High Density Polyethylene Pipe

ITE - Institute of Transportation Engineering

LID – Low Impact Development

LOS – Level of Service

MDT - Montana Department of Transportation

MPWSS - Montana Public Works Standard Specifications- Latest Edition

MSE - Mechanically Stabilized Earth

MUTCD - Manual of Uniform Traffic Control Devices

NRCS - Natural Resources Conservation Service

PVC - Polyvinyl Chloride Pipe

RCP - Reinforced Concrete Pipe

ROW- Right-of-Way

SC - Spill Control

SDF – System Development Fee

SWPPP – Storm Water Pollution Prevention Plan

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1. GENERAL PROVISIONS

1.1. INFRASTRUCTURE ACCEPTANCE POLICY

Interim use of the underground utilities will be considered only after all required information is presented. The City will accept the new utilities for interim use and maintenance after the completion of the preliminary punch list items that affect the use and adequacy of the utility. A letter of acceptance for interim use will then be issued from the City Engineer and sent to the developer and the community development department for their files. The developer/owner will be responsible for the complete installation of all required infrastructure, even though the interim use of the utilities is allowed before final acceptance. Financial guarantee will be required for the punch list items that have not been accepted by the City prior to filling the final plat, annexation, or issuance of the building permit when the property is already within the City limits.

The purpose of this policy is to define the procedures and parameters by which the City of Helena will accept developer/owner-installed publicly owned and maintained infrastructure:

1.1.1. Interim Use

If a developer/owner wishes to begin construction of structures in an approved subdivision or any other property that has required infrastructure improvements, the public works department will require the following items be completed prior to the interim or final use of the new facilities:

- The water, sewer, and storm water utilities will be completely installed, inspected, tested, and accessible to City personnel.
- All permanent and temporary BMP's must be functional and maintained not only at the time of interim acceptance but through final site stabilization.
- A comprehensive walk-through with City staff, the engineer and the developer.
- The engineer of record will certify that the utilities have been installed in accordance with the plans and specifications.
- Copies of the required tests are supplied to the engineering division as well as the affected utility. The tests include the log or tape of the TV sewer inspection, bacteriological tests, pressure tests, hydrant flow tests, and other testing as required.
- Electronic and paper as-built drawings certified by the engineer of record of the underground public utilities to be accepted. The electronic file must be AutoCAD compatible and acceptable by the City Engineering Department.
- Engineer's certification will include a preliminary punch list of items that remain to be completed upon the installation of the finished grade or pavement.
- Immediate repair or replacement of failures due to problems with materials and/or workmanship.
- A schedule for the completion of the balance of the improvements.

- A copy of the daily field inspection log, including construction progress photographs.
- All easements not included in the public right-of-ways for the water and sewer must be recorded prior to interim acceptance
- All rights-of-way for the part of the subdivision that is proposed for interim acceptance must be dedicated to the City.
- A bill of sale for ~~all of the~~the entire water and sewer infrastructure must be provided to the City. Roads must be completed to finished grade and accessible to emergency vehicles.
- City Staff will respond in write to a request for interim acceptance with in 15 working days from the date that the written request and all the required information has been received by the Engineering Department

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1.1.2. Final Acceptance

Final acceptance of the water, sewer, stormwater, and street will occur upon completion and acceptance of all required infrastructure development. Final acceptance will be ~~contemplated~~ granted upon the completion of the following items:

- A comprehensive walk-through with City staff, the engineer and the developer, including flow testing the curb and gutter.
- Completion of the final punch-list items.
- Inspection and repair of the previously accepted facilities found to be out of compliance with the interim acceptance conditions. The City reserves the right to require re-inspection and repair of the conditionally accepted utilities if damage from final construction is suspected.
- Final certification from the engineer that the entire development has been completed in accordance with the approved plans and specifications.
- Submission of final as-built drawings in an electronic format suitable for City archival.
- Submission of the complete set of daily field inspection logs and photographs.
- A Bill of Sale for all the infrastructure must be provided to the City.
- Copies of the required tests are supplied to the engineering division as well as the affected utility. The tests include the log or tape of the TV storm sewer main inspection, compaction tests, and other testing as required.
- City Staff will respond in write to a request for final acceptance with in 15 working days from the date that the written request and all the required information has been received by the Engineering Department

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Final acceptance of a completed utility system component can be granted prior to completion of the infrastructure development as a whole, if the City of Helena is provided with a financial guarantee (in the form of a bond or irrevocable letter of credit) that the remaining infrastructure components will be completed within a specific time frame and that the completed infrastructure operates independently of the guaranteed portion.

The required one-year warranty period for the final improvements begins on the date of final written acceptance of the installed infrastructure. Any required repairs to the utilities systems approved for interim use will also have a warranty for a one-year period following the final acceptance. A one year warranty TV inspection of all storm water and sanitary sewer main will be required 11 months after interim acceptance.

1.2. SYSTEM DEVELOPMENT FEES (WATER, SEWER)

Any party desiring to connect to the City water system or sanitary sewer system, or upgrade their water or sewer service shall be subject to a system development fee (SDF) in accordance with Helena City Code, 6-2-9 (Water SDF) and 6-3-7 (Sewer SDF) respectively.

1.3. UTILITY REBATE AGREEMENTS

Any party who has paid for the construction of an extension of a sewer main, or water main including installation of a hydrant, valve or other appurtenance to a sewer or water main in accordance with Helena City Code is eligible for a proportional rebate from any owner of adjacent property who subsequently applies to directly install a service connection to the extension or the subject water or sewer main.

The conditions under which rebates can be made are included in Helena City Code Sections 6-2-6-C and 6-3-4-B for water mains and sanitary sewer mains, respectively.

1.4. TEMPORARY WATER USE

Any water used from the City of Helena for Construction purposes including, but not limited to dust control, soil compaction, hydrostatic testing, masonry, and/or dry wall, shall be metered and costs for water charged at a rate established by the City Commission. No use of temporary water is allowed except with written authorization through the Engineering Department and Utility Maintenance Division Superintendent.

1.5. TEMPORARY SEWER USE

No discharge to the City's wastewater collection system is allowed except through an approved connection, or by special written authorization given by the City Engineer and Utility Maintenance Division Superintendent. Rates for the discharge to the City's System will be at rates established by the City Commission

1.6. STORMWATER

All on-site storm water facilities must be constructed and operational prior to construction of any impervious area. As-built drawings and a registered engineer certification must be supplied to the Department of Public Works prior acceptance or approval of the on-site storm water facilities.

All construction BMP's must remain in place and maintained in good working order until 70% of the disturbed area has been re-vegetated. The construction BMP's will be for water quality as required in the MS4 permit and protection of the City's storm water system.

1.7. DEVIATION PROCESS

Any deviations from these standards must be submitted in writing to the Public Works Department with justification for the request and the appropriate plan sheets. Once the deviation has been submitted City Staff will evaluate the request on a case by case basis and issue a response to the request in writing. Any request that needs an action by the City Commission or a State Agency will increase the review time.

2. WATER SYSTEMS

2.1. DESIGN REQUIREMENTS

Water systems shall be designed, constructed, and tested in accordance with the current editions of circular DEQ-1 – *Montana Department of Environmental Quality – Standards for Water Works and the Montana Public Works Standard Specifications* and these specifications.

2.2. DESIGN REPORT

All water main extensions will require the Design Engineer to submit a written report to the City Engineer addressing the fire and domestic flow requirements. For residential or non-residential developments that will utilize an average daily flow of less than 25,000 gallons at build-out, the report shall include data on test results at the nearest hydrant which shows the static pressure at zero flow from the hydrant and the residual pressure with available flow from the hydrant. At the discretion of the Public Works Department, the Design Engineer may be required to conduct hydraulic modeling to demonstrate compliance with the Section 2.4.1 of these standards. For residential or non-residential developments that will utilize an average daily flow of 25,000 gallons or more at build-out, or that require utilization of a pressure booster pump(s), the report will be required by the Public Works Department to include hydraulic modeling results that show the adequacy to meet fire and domestic flow requirements and the Section 2.4.1 of these standards. The normal operating range of pressure allowed for water system design is 50-110 psi or as approved by the Public Works Department with out the use of booster or fire pumps.

2.3. WATER SERVICE AREA – EXPANSION

The official water service area for the city is that area of the city within the boundaries of the city and currently served by city water, any areas presently served outside the city and any subsequently approved amendments thereto.

Applications for water service area enlargements shall be made on forms prescribed by the city manager and shall be accompanied by all documentation requested by the city. An application form is included in "Appendix A" of this standards document.

The property shall meet the following conditions prior to making application for enlargement of the service area:

- Contiguous to the boundary of the service area as the same exists;
- Entirely within the City's full service, urban planning area;
- Entirely within the City's facilities planning area; or
- Capable of being adequately served by extension of existing infrastructure.

2.4. WATER MAINS

2.4.1. Design Considerations

Hydraulic Analysis – The design of all water mains shall be based on a hydraulic analysis considering flow demands and pressure requirements. The main must be designed to

maintain a minimum normal working pressure of 35 psi, and maintain an absolute minimum pressure of 20 psi under all flow conditions. Maximum normal working pressures should not exceed 110 psi.

Fireflows - All mains shall be designed to provide adequate fire flows unless specifically waived by the City of Helena Public Works Department. The minimum required fire flow shall be 1750 gpm for residential housing or determined by the City Fire Marshal at a minimum of twenty pounds per square inch residual pressure at the hydrant during flow in order to meet adopted codes.

Diameter – All water main piping shall be at least 8-inch diameter, unless otherwise authorized by the director of public works. Larger diameters will be required in order to maintain the minimum pressure requirements of Montana Circular DEQ-1 *Standards for Water Works*. The City also may require over sizing of mains to meet overall system requirement.

2.4.2. Materials

Piping - All water main piping material shall be ductile iron unless specifically authorized by the City of Helena Public Works Department. Water main piping 12 inches in diameter or smaller shall be Class 52 or Class 300 wall thickness pipe material meeting AWWA C-151, American National Standard for Ductile Iron Pipe. All water main piping larger than 12 inches in diameter shall be Class 51 thickness pipe material meeting AWWA C-905 Standards.

If specifically allowed by the City of Helena Public Works Department, DR-14 Class 200 PVC pressure pipe 12 inches in diameter or smaller shall meet AWWA C-900 Standards and all PVC pipe larger than 12 inches shall meet AWWA C-905. The use of PVC pressure pipe will only be allowed in areas of high corrosion potential as determined on a case-by-case basis by the Public Works Department.

Acrylonitrile butadiene (NBR) gaskets will be required for water main installations in areas of known or suspected hydrocarbon contamination.

Fittings – All water main fittings, including tees, crosses, caps, plugs, reducers and elbows equal to or greater than $11^{1}/_{4}°$ shall be restrained mechanical joint. All mechanical joint restraints shall be "Megalug," Uniflange or equal. Joint restraint shall be in addition to meeting thrust block requirements in accordance with MPW.

2.4.3. Installation

Existing Valve Operation – In order to isolate sections of the existing water system to allow for new construction, it will be necessary to operate existing system valves. The City Water Department (457-8567) shall be notified when existing valves must be operated and shall undertake those operations.

Cover - The minimum cover for all water mains from top of pipe to final finished grade shall be six and one-half (6½) feet unless otherwise approved by the Public Works Director/City Engineer.

Encasement - All water main piping, fittings, valves, etc. (excluding PVC pipe) shall be encased in polyethylene wrap with a minimum thickness of 8 mils. All encasement shall be in accordance with AWWA C-105 Standards.

Electrical Thawing – Conductive brass wedges shall be installed at all joints to provide for electrical thawing. Electrical continuity shall be provided at all flexible, dresser-type couplings.

Tracer – 10-gauge copper coated tracer wire shall be installed along the top of the new PVC water main and shall be attached to all valve box risers. Six-inch wide detectable tape marked "WATER" shall be installed two feet below finished grade along the alignment of the new main and attached to all valve box risers.

Cathodic Protection – Cathodic protection is required for all water main valves, fire hydrants and fittings when PVC pipe is used.

Open Trenches – Trenches for the installation of water mains shall be properly backfilled as quickly as possible, but no more than 48 hours after initial digging. (*City Ordinances 7-2-8 and 7-2-9).*

Protection of Mains – When working near and/or exposing existing City water mains and service lines, workers shall utilize hand-digging within 2 feet of mains in order to avoid damage to those pipes. If damage occurs, the cost of repair and penalties in accordance with City Ordinance 7-2-7 can be imposed.

2.4.4. Extension

Any extension of an existing City water main must be extended through the entire frontage length of the property to be served, as required by Helena City Code 6-2-6.

Main extensions shall include all valves, pipe sizes, hydrants and appurtenances deemed necessary by the City.

Public mains may be connected, extended or looped in addition to the proposed extension to provide an adequate and functional water supply, and provide for future extensions to adjacent properties.

2.4.5. Sewer Line Crossings

Crossings - A minimum of 18-inches vertical separation is required when a water main or service connection crosses above or below a sanitary sewer, measured outside to outside of pipe. Please refer to MPWSS for further information on sewer line crossings.

Less than 18-inches vertical separation may be allowed when a gravity sewer at the crossing is made from a single 20-foot length of AWWA pressure pipe and the crossing is approximately 90°. Specific authorization from the Montana Department of Environmental Quality and the City of Helena Public Works Department is required for a vertical separation of less than 18-inches.

No exception of the minimum 18-inch vertical separation requirement is permitted when the sewage pipe is a force main.

Parallel – Unless specifically authorized by the Montana Department of Environmental Quality and the City of Helena Public Works Department, a minimum of 10-feet horizontal separation is required when a water main and sanitary sewer are installed parallel.

2.4.6. Tapping City Water

The City of Helena Water Department shall tap all water mains. Preparations for exposing the water main and preparing the water main for tapping, as well as scheduling for the CITY to make the tap are all responsibilities of the water main installer. The City of Helena Water Department can be contacted at (406) ~~447-1567~~457-8567. All taps require at least 24-hours notice to the Utility Maintenance Division of the City of Helena. If taps require main shutdown, 48-hours notice is required and the contractor is required to notify the affected water users.

Any person desiring to make connection to the City's water or sewer mains must make application in writing, and pay for the cost of tapping and any associated system development fees in accordance with Helena City Code.

All taps shall be made using a Mueller or Ford style FS303 stainless steel saddle for AWWA C900, DR 14 Class 200 PVC pipe.

Taps of sizes ¾-inch to 1-inch on ductile iron or cast iron mains require the city to do a direct tap and provide a properly sized corporation valve for mains of 6-inch and larger (currently up to 36-inch). Special provisions apply for ¾-inch and 1-inch taps on 4-inch cast iron or ductile mains. For integrity of the main, these taps require the use of a properly sized tapping saddle, which is required to be purchased and supplied by the plumbing contractor.

Taps for sizes 1½-inch and 2-inch on all sizes and types of mains (ductile iron, cast iron, PVC and steel) require a properly sized tapping saddle and corporation valve purchased and supplied by the plumbing contractor.

Taps of 4-inch and larger (6-inch, 8-inch, 10-inch and 12-inch) on ductile iron or cast iron mains require a tapping saddle, tapping valve and a valve box to be purchased and supplied by the plumbing contractor. All taps 16-inch or larger require contract tapping service or company. All taps 4-inch and larger must be air tested prior to tapping.

Bronze or stainless steel double strap or wide band tapping saddles are required on service lines up to 2" in diameter.

On all taps that require a saddle the plumbing contractor must provide and install the saddle.

PVC and steel mains require special restrictions and requirements as follows:

- All taps ¾-inch through 2-inch on PVC and steel mains require a tapping saddle and corporation valve. The city will supply corporations for ¾-inch and 1-inch taps. Plumbing contractors are required to purchase and supply tapping saddles for ¾-inch and 1" taps. Plumbing contractors must supply properly sized corporation valve and tapping saddle for taps of 1½-inch and 2-inch.

- Taps of 4-inch and larger (up to 12-inch) on PVC and steel mains require a tapping valve and a valve box to be purchased and supplied by the plumbing contractor. Taps 4-inch to 12-inch on steel mains 20-inch and larger require a welded-on saddle for tapping. All taps 14-inch or larger require contract tapping service or company.

2.4.7. Valves

Valves shall be installed in the distribution system at sufficient intervals to facilitate system repair and maintenance as determined by the Public Works Department, but in no case shall there be less than one valve every 600 feet. Generally, there shall be two valves on each tee and three valves on each cross.

All Gate Valves shall conform to AWWA C-515 Standards and shall open CLOCKWISE.

All Butterfly Valves shall conform to AWWA C-504 Standards and shall open CLOCKWISE.

All Tapping Valves shall open COUNTER CLOCKWISE

All water valve boxes shall have a concrete collar installed after paving and final grade adjustment. See Standard Drawing 2-1 for concrete collars.

All water valve boxes shall be aligned to allow a 4-inch diameter PVC pipe to be inserted in the valve box and centered over the valve nut.

All water valve boxes shall not be extended more than 50%.

2.4.8. Fire Hydrants

Unless otherwise approved by the Fire Marshal, the hydrants shall be spaced no further apart than one standard City block, which is approximately 400 feet. The Fire Marshal reserves the right to require additional fire hydrants if the demand of the structure(s) requires more flow than the minimum spacing provides. The placement of all hydrants shall be subject to approval of the City of Helena Fire Marshal.

Fire hydrants shall be 250 psig, 5¼-inch, 3-way, Mueller Super Centurion 250, Kennedy K81A, (or approved equal) conforming to AWWA C-502 Standards. All hydrants shall be painted OSHA yellow above the ground line.

All hydrants shall be equipped with a #4 pentagon (1¼-inch) operating stem nut and shall open in a CLOCKWISE direction. The direction of opening shall be indicated by a permanent arrow on the hydrant top.

All hydrants shall be designed for final grade of hydrant safety flanges set at 1½-inch to 3-inch above finished grade. Minimum bury depth hydrant shall be 7-feet with a maximum bury hydrant of 8.5 as determined by the by elevation of the safety flange. All hydrants shall have a solid one piece operating stem; the use of hydrant extension will only be allowed with prior approval of the Public Works Department and no other option exists.

Pipe deflection on hydrant leads shall be minimal and shall not result in finished hydrant more than 1° out of plumb.

The hydrant auxiliary valve shall be located in the street pavement or boulevard with a standard water valve and concrete collar. No valves or collars shall be located within the curb and gutter.

All hydrants shall be installed in accordance with City of Helena Standard Drawing 2-2.

2.4.9. Water Vaults

All underground vaults and manholes associated with the City's water system shall be constructed of pre-cast concrete sections meeting ASTM C478 or C-858.

All water vault manhole covers shall have the word "water" cast into the top surface.

All water vault manhole frames shall have a concrete collar patch poured after paving and final grade adjustment. See Standard Drawing 3-1

2.5. WATER SERVICE LINES

2.5.1. Materials

All service lines shall be a minimum of 1" in diameter.

All water service lines smaller than 4-inch diameter shall consist of Type K copper pipe meeting ASTM B88-62 from the main to the curb box. Poly pipe or PVC pipe maybe considered on a case-by-case basis in corrosive soil with approval from the Public Works Department.

All water service lines 4-inch diameter and larger shall consist of ductile iron pipe meeting AWWA C-151, American National Standard for Ductile Iron pipe

Stainless steel inserts are required for all compression-type fittings.

In accordance with Sections 1417 (a) and (b) of the Safe Drinking Water Act amendments of 1986 (Public Law 99-339), the use of solders and flux containing more than 0.2% lead and pipes and fittings containing more than 8% lead is prohibited in the installation and repair of residential or nonresidential plumbing connected to a public water supply system.

2.5.2. Installation

All water service lines must be so arranged that the supply to each separate house premises or buildings may be controlled by a separate shutoff valve and curb box placed within the right of way near the property to be served. One singular, identifiable entity will be responsible for all the water used through each service.

All individual condominiums or separate buildings must be served by individual service line from the main. In the cases where individual service lines are not feasible, one service will be allowed with only one master meter that is the responsibility of the condominium associations or one individual for payment. Multiple meters that are read and billed by the City of Helena will not be allowed on a single service. In cases where the street is less then 10 years old with a single service to the condominium lot, individual meters may be allowed with manifold and a master shutoff valve along with individual shutoff valves located within City ROW. See Standard Drawing 2-8

All water service lines shall be installed in accordance with City of Helena Standard Drawing 2-3 with a minimum of 6½- feet of cover from the top of service pipe to final finished grade.

All water service lines shall be encased in 8 mil polyethylene a minimum distance of three feet from the main.

All water service line connections to the water main must be made by a licensed plumber (Helena City Code 6-2).

At all locations where water service lines are installed beneath new curb, the face of the curb shall be stamped with a "W" in lettering at least 3 inches tall, for marking the water service location.

All crossings under existing curbs by tunneling are prohibited.

All services must be connected to a City main. Service lines may not be connected to fire hydrant leads.

A tracer wire must be install and tested for all poly pipe and PVC services

2.5.3. Curb Stops and Boxes

Curb Stops – All curb stops shall be installed in accordance with City of Helena Standard Drawing 2-3 and MPWSS. All curb stops shall have a bronze plug, tee head key with either a Minneapolis top thread or standard no thread, with a copper flare nut on both connections.

Curb Boxes – All curb boxes shall be extension-type having a minimum box length, fully retracted, of 6-feet. All curb boxes shall consist of a Minneapolis or arch pattern (Buffalo) Style and shall be Mueller, Ford or approved equal by the Director of Public Works. All curb boxes shall have screw-on or other type lid, which can be attached to the top of the riser. All curb boxes shall be within 1° of plumb and centered directly over the corporation stop nut. A 1" rigid pipe must be able to pass through the curb box and over the operating nut. The curb box should be protected and maintained until final occupancy. The curb box will be part of the final occupancy inspection for building permit.

2.5.4. Service Line Meters

All meters shall remain the property of the City.

Water meters shall be purchased from the City by the water user and shall be installed by the water user as approved by the City.

All meters must have valves upstream and downstream of the meter in order to isolate the meter for servicing.

All meters must be installed in a horizontal line at a minimum of 18 inches and a maximum of 4 feet from the floor, and a minimum of 6 inches from any wall. The meter must also be located close to a floor drain.

All meters shall be located away from any electrical devices/equipment.

All meters larger than 2 inches shall be either turbine or compound meters and shall be installed in accordance with the manufacturer's recommendations, including a strainer and bypass with locking type valve.

2.5.5. Backflow Prevention

"Backflow" is defined as the undesirable reversal of water flow or the reversal of water flow containing other liquids, gases or other substances from a connected source that flows into the distribution pipes of the public water supply.

The City may require, at its discretion, the installation of appropriate backflow protection devices on new or existing service lines when the water user is involved in water use practices that pose a threat to the City's water system. All existing sources for water that are not part of the City of Helena's water system must be disconnected from the City's system.

2.5.6. Fire Sprinkler Systems

All fire sprinkler systems are required be designed to 90% of the maximum operating pressure with a pressure relief valve installed to protect the system from pressure surges. The City of Helena may move the existing Low Malben Pressure Zone to the maximum service elevation of 4009 feet and create the new Valley Pressure Zone to the maximum service elevation of 3819 feet. Any new system with a ground elevation that falls within the changing or new pressure zones, must design the system to the calculated design pressure received from the City Engineering Department. A Fire Pressure Zone Map is available in the City Engineering Department**.** A completed copy of Fire Flow Request Form shall accompany sprinkler system plans submitted to the City of Helena Fire Marshal.

3. SANITARY SEWER SYSTEMS

3.1. DESIGN REQUIREMENTS

Sanitary sewer systems shall be designed, constructed, and tested in accordance with the current editions of Circular DEQ-2 – *Montana Department of Environmental Quality – Design Standards for Wastewater Facilities and the Montana Public Works Standard Specifications*.

3.2. DESIGN REPORT

All sanitary sewer main extensions will require the Design Engineer to submit a written report to the City Engineer which addresses the design requirements listed herein. The design report shall demonstrate that all sanitary sewer main extensions have adequate capacity to convey wastewater from the anticipated service area and meet the minimum flow velocities and/or flow depth requirements in Chapter 30 of MDEQ Circular-2. The design capacity should be based on 112 gpd per capita for single family residence and an average of 2.39 people per residence

3.3. WASTEWATER SERVICE AREA

The official wastewater service area for the city is that area of the city within the boundaries of the city and currently served by city sewer, any areas presently served outside the city and any subsequently approved amendments thereto.

Applications for sewer service area enlargements, as specified in City Code 6-5-3, shall be made on forms prescribed by the city manager and shall be accompanied by all documentation requested by the city. An application form is included in "Appendix A~~**Error! Reference source not found.**~~of this standards document.

The property shall meet the following conditions prior to making application for enlargement of the service area:

Contiguous to the boundary of the service area as the same exists;

Entirely within the City's full service, urban planning area;

Entirely within the City's facilities planning area; or

Capable of being adequately served by extension of existing infrastructure.

3.4. SANITARY SEWER MAINS

3.4.1. Design Considerations

Slope – Gravity sewer mains shall be installed with slope adequate to maintain flow velocities of at least 2.0 feet per second when depth of flow is at or below 0.3 of the sewer main inside diameter, based on Manning's equation with a "n" value of 0.013. Recommended minimum pipe slopes listed in Section 33.41 of Circular DEQ-2 will be considered adequate.

Capacity - Public sanitary sewers and appurtenances shall be designed to accommodate peak hourly flows, including an allowance for infiltration, while flowing no more than half full when no additional connections are possible and a quarter full when future growth is anticipated. The development must up size the existing mains if the capacity of the sewer main is calculated to be three quarters full. The allowance for infiltration shall be 150 gallons per acre of coverage area, per day or otherwise approved by Public Works Department. The City may require, at its discretion, the capacity of the sewer to be increased.

Diameter – Gravity sewer mains shall have a minimum diameter of 8 inches. Increasing the diameter in order to meet the minimum pipe slope requirements will not be allowed.

Manholes- Shall be a minimum for 48" less the 13-feet of bury for all manholes with bury depth greater then 13-feet a minimum of 60" manhole is required.

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Flow Direction – On the infrastructure plans all sewer pipes shall be labeled as to the flow direction.

Accessibility - Sewer mains shall be installed in public right-of way where ever possible. Where mains can not be installed in ROW a 20' wide excusive easement with a 14' all-weather surface road must be constructed in the easement.

3.4.2. Materials

Gravity Piping – Gravity sewer main piping shall consist of any of the following materials:

PVC meeting ASTM D 3034, SDR 35 & 26 (8-inch to 15-inch)

PVC meeting ASTM D 679, SDR 26 or ASTM D F794 (18-inch and larger)

HDPE meeting ASTM D3350 and ASTM F714

Concrete meeting ASTM C14, C76 or C655

Other pipe materials specifically approved by the City of Helena

Pressure Piping – Pressure sewer piping (force mains) shall consist of PVC Pressure Pipe, ASTM 2241, Class 200 SDR 21, or AWWA C900 DR-18

Manholes – All manholes shall be constructed using pre-cast RCP unless specifically allowed by the Public Works Department in writing. Structural strength shall withstand H-20 design load.

All manholes installed at outfall lines must have PVC liner installed to protect against H2S gas.

Manhole Ring and Cover – Manhole cover shall have the City of Helena logo and stamped "Sewer" in compliance with City of Helena Standard Drawing 3-2

3.4.3. Installation

Alignment and Grade - Public sanitary sewers shall be installed with a straight alignment and grade between manholes as required in Montana Public Works Standard Specifications.

Location - Municipal wastewater system facilities shall be designed and constructed so that all such facilities are readily accessible for maintenance and repair. In addition, such facilities shall be situated so as to preclude the entrance of surface water into said facilities. All sewer mains shall be centered in the right-of-way or easement to the greatest extent possible.

Depth – Sanitary sewers shall be buried to a depth sufficient to prevent freezing and shall have a minimum depth of 4 feet. Shallower depths may be allowed by the City of Helena Public Works Department if suitable pipe insulating provisions have been made.

Manholes – All sanitary sewer manholes shall be installed in accordance with City of Helena Standard Drawing 3-3 and applicable MPWSS Drawings.

3.4.4. Extension

Any extension of an existing City sanitary sewer main must be extended through the entire frontage length of the property to be served, with a standard manhole located at the terminus of the new sewer main.

Sewer main extensions shall include all manholes, clean-outs and appurtenances deemed necessary by the City.

3.4.5. Water Line Crossings

Crossings - A minimum of 18-inches vertical separation is required when a sanitary sewer main crosses above or below a water main, measured outside to outside of pipe. Please refer to MPWSS for further information on water line crossings.

Less than 18 inches vertical separation may be allowed when the gravity sewer at the crossing is made using a single 20-foot length of AWWA pressure pipe and the crossing is approximately 90° and the length of pipe is centered over the crossing. Specific authorization from the Montana Department of Environmental Quality and the City of Helena Public Works Department is required for a vertical separation of less than 18-inches.

No exception of the minimum 18-inch vertical separation requirement is permitted when the sewage pipe is a force main.

Parallel – Unless specifically authorized by the Montana Department of Environmental Quality and the City of Helena Public Works Department, a minimum of 10-feet horizontal separation is required when a sanitary sewer main and water main are installed parallel.

3.5. SEWER SERVICE LINES

3.5.1. Materials

Gravity Sewer Service Piping – Gravity sewer service piping shall consist of the following materials for the following situations:

PVC meeting ASTM D 3034, SDR 35 & 26 or PVC Schedule 40 – Solvent Weld or SBR Gasket Joint for normal installations

PVC Schedule 40 or Cement Lined Ductile Iron for installations within 2 feet of a building foundation

PVC Schedule 40 for water main or water service crossing

PVC Schedule 40 with acrylonitrile butadiene (NBR) gaskets for installations in areas of hydrocarbon contamination.

Pressure Sewer Service Piping – Pressure sewer service lines shall consist of PVC Pressure Pipe, ASTM 2241, Class 200 SDR 21

3.5.2. Installation

All sanitary sewer service lines must be so arranged that the discharge from each separately owned house premises, or buildings on separate lots is a separate service line that connects to the main. The owner of each house or premises is liable for the charges for the wastewater service provided by the city to that owner's house or premises.

All sewer service lines shall be installed in accordance with MPWSS with a minimum of 4 feet of cover from the top of service pipe to final finished grade.

At all locations where sewer service lines are installed beneath new curb, the face of the curb shall be stamped with a "S" in lettering at least 3 inches tall, for marking the sewer service location.

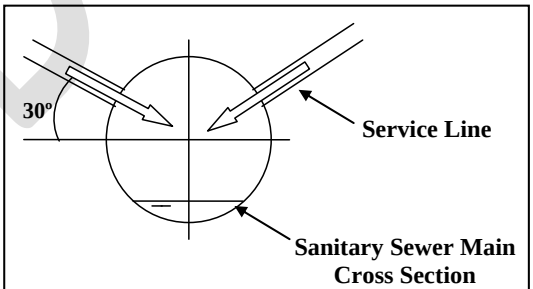
All service line crossings under existing curbs by tunneling is prohibited.

3.5.3. Tapping City Sewer

Any person desiring to make connection to the city's water or sewer mains must make application in writing and pay for the cost of tapping in accordance with Helena City Code 6-2-4.

All applications for service connection to the city's wastewater system must be made at the office of the Building and Safety Division of the Community Development Department on the form for that purpose. Every such application must be made by the owner of the property to be served or the owner's authorized agent and must include the nature of wastewater discharged into the system.

Taps on sewer or storm water pipes should be in the upper quadrant of the pipe in the 10 o'clock or 2 o'clock positions. See the following figure:



Sanitary Sewer Main Tapping Figure

All taps on large diameter sewer or storm pipe should be made with an "insert-a-Tee." Taps should be in the upper quadrant at the 10 o'clock or 2 o'clock positions. See above figure.

3.5.4. Metering when not on City Water

For new city sewer services which do not use the city water system or whose water consumption or wastewater discharge is not otherwise metered, the Helena Public Works Director shall require the installation of a suitable metering device in order to determine an equitable charge for sewer services.

3.6. LIFT STATION

3.6.1. Capacity

The design capacity for a lift station shall be designed to a reasonable capacity based on similar flows from comparable zoned areas. The designer shall provide a table in the design report for the design capacity for each non-residential lot. Multi-family lots with a 4-plex or greater are also considered commercial lots. During the building review process a letter from an engineer must be submitted certifying that the sewer capacity is not greater then the original design capacity of the lot. If the capacity for the building is greater additional capacity maybe required.

3.6.2. Building

The building shall be constructed of masonry block and similar to the architectural style of the existing lift stations. The building style must be compatible with the surrounding zoning. The developer must install sidewalk adjacent to all rights-of-way, a driveway, and curbcut so maintenance equipment can access the building and wet well.

3.6.2.1. Landscaping

All lift stations must have low-water/native vegetation and trees for the landscape screening with an irrigation system.

3.6.2.2. Fencing

All ~~l~~Lift stations must be fenced with an 8-foot high black vinyl coated chain link fence with 2-strand barbed wire top. A minimum of two lockable gates must be provided; one for pedestrian access and one double gate that is able to swing 180 degrees for allowing maintenance equipment to access the site.

3.6.3. Wet Well

Must be lined with a PVC coating or approved equal by the Public Works Department.

3.6.4. Piping

All piping must be stainless steel within the wet well and duct iron in the building. The pipe must also be configured to accommodate bypass pumping with a blind flanged tee after the last check valve.

All fittings should located out from under the lift station stab or location within a grated trench. All fittings must be accessible with out damaging the building.

3.6.5. Valving

All check valves must have external levers

A 3-way Dezerik plug valve must be installed at the point the two pumping lines join.

3.6.6. Safety

The wet well shall have a safety grate that is easily removable and integral to the hatch. The grate must be rated to at least 1000 lbs. of loading. In addition to the hatch with a safety grate, removable handrails must also be supplied.

A compressor and two full-face masks with a minimum 50' hoses will be require for a fresh air supply. SCBA will not be acceptable as a fresh air supply.

3.6.7. Pumps

The pumps shall be Gorman-Rupp, Paco, Flyght or approved equal by the Public Works Department

3.6.8. Telemetry

The telemetry must be designed in accordance with the "City of Helena Telemetry Design Standards"

3.6.9. Pigging Stations

Any lift station with a force main of more thaen 2000-feet and does not have an existing flow of 50% of the design capacity must have pigging stations for cleaning of the force main.

3.6.10. Odor Control

All vents from the wet well or force main must have a carbon filters.

3.6.11. On Site Generator

All lift stations must be supplied with an on-site generator. The generator must be a natural gas or diesel fuel unit located in a separate room within the building. An access door big enough to remove the generator for maintenance will be required..

4. STORM DRAINAGE SYSTEMS

4.1. STORMWATER REQUIREMENTS

The City of Helena is required to enforce stormwater requirements mandated by the Montana Department of Environmental Quality under the Small Municipal Separate Storm Sewer System (MS4) requirements of the National Pollutant Discharge Elimination System (NPDES). These regulations are addressed within these standards and are briefly summarized within this section.

In addition to these requirements, the City of Helena has developed additional requirements to meet the zoning, planning and maintenance objectives within the City.

4.1.1. Low Impact Development (LID)

Implementation of LID techniques are encouraged for all development and for larger storm runoff as long as they are properly designed. LID can provide substantial cost savings to a development if properly designed and constructed.

The entire runoff from the water quality storm must infiltrate, evapotranspire, or be captured for reuse for all new development ~~or redevelopment~~ projects meeting the requirements within these engineering standards. Analysis for LID must include completion of post-development runoff calculations and design analysis of the proposed control method.

4.1.2. Illicit Discharge

Per City Code Chapter 6-6, non-stormwater discharges shall not be released into the Small Municipal Separate Storm Sewer System (MS4). Prohibited discharges are those that could cause or contribute to violation of water quality standards in the receiving water body or could cause the City to be in violation of its MS4 permit.

4.1.3. Construction BMPs

Best management practices must be in place during regulated construction activities within the MS4. Regulated construction activities are listed in Section 6-6-3 and include development and redevelopment projects resulting in any land disturbance including, but not limited to, clearing and grubbing, grading, excavating, and demolition. Prior to conducting regulated construction activities, the following documents must be completed and approved by the City. The BMPs outlined within these documents must be in place at the construction site.

- Construction Activity Stormwater Permit
- Montana DEQ Notice of Intent form (submit copy to City)
- Stormwater Pollution Prevention Plan (submit copy to City)

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4.1.4. Post-Construction BMPs

New development and redevelopment activity requiring submittal and approval of a drainage plan must include design and construction of stormwater BMPs for use after completion of the construction. These BMPs must be selected and designed per the

requirements in these standards. The drainage plan shall be accompanied by a set of design plans, which are signed by a registered professional engineer within the state of Montana.

4.1.5. Post-Development Runoff

In order to reduce stormwater infrastructure and avoid problems caused by increasing runoff following site development, developments must not increase peak flow rates or runoff volume beyond the pre-development conditions for any design storm.

4.2. HYDROLOGIC ANALYSIS & DESIGN

4.2.1. General

When hydrologic analysis is required in order to demonstrate compliance with the City of Helena Stormwater City Code 6-6-15, a drainage plan shall be prepared by a~~the~~ Montana Registered Engineer. All drainage plans must include the design calculations necessary to support the proposal. The selection of ~~a~~ the appropriate best management practices (BMPs) must be completed by going through the selection process in HEC-22, Chapter 10.1, in conjunction with Section 4.5 of these standards. Drainage plans should incorporate the following in approximately this format:

Brief project summary:~~.~~

Provide a detailed figure for the existing site conditions and a detailed figure for the proposed site conditions that show the site boundary, basin/sub-basin/bypass area boundaries, wetlands, sensitive area buffers and setbacks, easements, two-foot contours, etc. State on each figure the total area and the amount of pervious and impervious area in each basin/sub-basin/bypass area. Show flow paths with slope, flow type, surface type, and run length. A separate figure may be required to show runoff treatment collection area if it is significantly different from the runoff control figure.

Describe existing conditions including structures, basins, bypass areas, flow type and flow paths, pervious/impervious areas, slopes, vegetation/surface and CN numbers, soil type, constants used (s,n,k,...), upstream offsite flow routing, "level I" offsite capacity analysis.

Describe proposed developed conditions including structures, basins, bypass areas, compensatory areas, flow type and flow paths, pervious/impervious areas, slopes, vegetation/surface and CN numbers, constants used (s,n,k ...), upstream offsite flow routing, source control BMP's runoff control, runoff treatment, nutrient control, frontage improvements and associated storm improvements, time of concentration, storage volume, release rates, and overflow route capacity. If something is not required, state that in the report.

Provide comparison of the pre-development and post-development flow rate and runoff volume for all design storms, including the water quality design storm. Ensure that post-development runoff volumes and rates do not exceed the pre-development conditions.

Describe the Low Impact Development (LID) techniques to be used onsite and explain why these techniques were chosen. State runoff control and runoff treatment design

assumptions. Describe method of analysis. Selection of water quality treatment BMPs must follow the process in HEC-22 Chapter 10.1.

Appendix: Show any calculations/figures required to support ~~your~~ the design including basin summary, time of concentration, weighted CN numbers, percent impervious area, level pool routing summary, state-discharge and state-storage tables, volume correction, conveyance system capacity calculations, and treatment system sizing and capacity calculations. Suggested CN values are given in HEC-22 Table 3-6.

4.2.2. Design Storms

The design storm for all hydrograph analyses is a 24-hour duration, standard SCS Type I rainfall distribution resolved to 10-minute time intervals. Refer to Table 4-1 for the City of Helena precipitation levels, taken from the State of Montana Precipitation Isopluvials, NOAA Atlas 2, and Vol. 1.

Analysis of the following storms shall be provided. Existing and post-development conditions shall be analyzed to quantify runoff control and runoff treatment needs:

Water quality Design Strom

- 2-year, 24-hour storm (stream bank protection
- 10-year, 24-hour storm (on-site conveyance)
- 25-year, 24-hour storm (conveyance-storm mains)
- 100-year, 24-hour storm (runoff control)

Table 4-1. Precipitation Levels for the City of Helena

Design Storm	Precipitation, inches
Water Quality Design Storm	0.5
2 year, 24 hour	1.3
5 year, 24 hour	1.7
10 year, 24 hour	1.9
25 year, 24 hour	2.4
50 year, 24 hour	2.7
100 year, 24 hour	2.9

Source: LID rainfall depth mandated under MS4 General Permit for the City of Helena

NOAA Atlas 2, Vol. 1, Isopluvials

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On-site conveyance is defined as any storm water pipes, inlets, etc.. that serve only one lot and will be maintained by the landowner. Conveyance-storm mains is defined as any inlet, pipes, etc… that is either "pass through flow" or serves two or more lots and will be maintained by the City of Helena.

4.2.3. Hydrologic Models

Runoff control (detention) facilities shall be designed using hydrograph analysis. Use the procedures and methods outlined in Chapter 3 of the HEC-22 Manual.

Conveyance systems may be designed using hydrograph-based computer modeling methods or the Rational Formula. Rational Method computation methods are described in Section 4.2.5.

Acceptable computer modeling packages:

- Stormshed™
- StormCAD™
- SWMM
- TR-20
- TR-55
- HSPF
- Hydrocad

Time of Concentration Calculations - Use the procedures and methods outlined in Chapter 3.2.2.3 of the HEC-22 Manual.

Curve Numbers -Curve numbers are set forth in Table 3-6 of the HEC-22 Manual.

Soil Types-–Use site-specific geotechnical information for the project site (when available) or the Soil Survey – Lewis and Clark County Area (MT630) – prepared by the Natural Resources Conservation Service (NRCS) to identify the hydrologic soil group.

4.2.4. Minimum Impervious Areas for Modeling Analysis

For single-family residential plat developments, use Table 3.6 of the HEC-22 Manual for minimum values. A higher percent impervious area shall be required if the proposed project plans indicate a greater impervious area coverage. Stormwater system designs shall take into account future build-out of the proposed development. For commercial and multi-family residential developments, use actual project values.

4.2.5. Rational Method

4.2.5.1. General

The Rational Method may be used with some specific limitations:

For use in predicting a conservative peak flow rate to determine the required capacity for conveyance facilities.

Drainage sub-basin area (A) shall not exceed 25 acres for a single calculation.

The time of concentration (T_c) must be computed using the method described below and shall not exceed 60 minutes. It shall be made equal to 5 minutes when computed to be less than 5 minutes.

Equation

The following is the traditional Rational Method equation:

$Q_R = C*I_R*A$

Q_R= peak flow (cfs) for a storm of peak rainfall intensity "I_R" of a given return frequency (R)

C = estimated runoff coefficient (ratio of rainfall that becomes runoff)

"C" Values

The allowable runoff coefficients to be used in this method are shown in Table 4-2 by type of land cover. These values were selected based off of the FHWA recommendations, as described in the HEC-22 Manual, Table 4-2. The values for single family residential areas were computed as composite values (as illustrated below) based on the estimated percentage of coverage by roads, roof, yards and unimproved areas for each density. For drainage basins containing several land cover types, the following formula may be used to compute a composite runoff coefficient "C_C".

$C_C = ((C_1 \times A_1) + (C_2 \times A_2) + \ldots + (C_n \times A_n)) / A_t$

where:

$A_{t=}$ total area (acres)

$A_{1,2,n=}$ areas of land cover types

$C_{1,2,n=}$ runoff coefficients for each area land cover type

Table 4-2. Runoff Coefficients - "C" Values for the Rational Method

Type of Drainage Area	Runoff Coefficient, C*
Business:	
Downtown areas	0.70 – 0.95
Neighborhood areas	0.50 – 0.70
Residential:	
Single-family areas	0.30 – 0.50
Multi-units, detached	0.40 – 0.60
Multi-units, attached	0.60 – 0.75
Suburban	0.25 – 0.40
Apartment dwelling areas	0.50 – 0.70
Industrial:	
Light areas	0.50 – 0.80
Heavy areas	0.60 – 0.90
Parks, cemeteries	0.10 – 0.25
Playgrounds	0.20 – 0.40
Railroad yard areas	0.20 – 0.40
Unimproved areas	0.10 – 0.30
Lawns:	
Sandy soil, flat, 2%	0.05 – 0.10
Sandy soil, average, 2-7%	0.10 – 0.15
Sandy soil, steep, 7%	0.15 – 0.20
Heavy soil, flat, 2%	0.13 – 0.17
Heavy soil, average 2-7%	0.18 – 0.22
Heavy soil, steep, 7%	0.25 – 0.35
Streets:	
Asphaltic	0.70 – 0.95
Concrete	0.80 – 0.95
Brick	0.70 – 0.85
Drives and walks	0.75 – 0.85
Roofs	0.75 – 0.95

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*Higher values are usually appropriate for steeply sloped areas and longer return periods because infiltration and other losses have a proportionally smaller effect on runoff in these cases.

"IR" Peak Rainfall Intensity

The peak rainfall intensities (I_R) for the specified design storm return frequencies ($_R$) are shown in Table 4-3.

Table 4-3. Precipitation Intensity Values, Inches/Hour

Duration		Return Period					
	WQ	**2 year**	**5 year**	**10 year**	**25 year**	**50 year**	**100 year**
5 minutes	1.10	2.60	3.56	4.21	5.10	5.80	6.84
10 minutes	0.73	1.87	2.70	3.25	4.01	4.60	5.18
15 minutes	0.59	1.46	2.08	2.50	3.08	3.52	3.96
30 minutes	0.40	0.90	1.25	1.49	1.82	2.08	2.33
60 minutes	0.25	0.52	0.71	0.84	1.02	1.16	1.30

Source: Derived fromcombination of 2-year through 100-year storm data.
Model Drainage Manual, Chapter 7, Hydrology, Montana Department of Transportation, Hydraulics Section, 1995.
Note: Duration (time of concentration) must not be less than 5 minutes or greater than 60 minutes

"TC" Time of Concentration (Rational Method Only)

The time of concentration is defined as the time it takes runoff to travel overland (from the onset of precipitation) from the most hydraulically distant location in the drainage basin to the point of discharge. Note that when the C_C of a drainage basin exceeds 0.60, it may be important to compute the T_C and peak rate of flow from the impervious area separately. The computed peak rate of flow for the impervious surface alone may exceed that for the entire drainage basin using the total drainage basin T_C. The higher of the two peak flow rates shall then be used to size the conveyance facility. The T_C is computed by summation of the travel times(s) (T_t) of overland flow across separate flow path segments defined by the six categories of land cover from the chart published in 1975 by the NRCS shown in Table 4-4.

The equation for time of concentration is:

$Tc = T_1, + T_2 + \ldots + T_n$

where:

$T_{1,2,n}$ = consecutive flow path segments of different land cover category or having significant difference in flow path slope

Table 4-4. Kr values For Tt using the Rational Method

Land Cover Category	K_r (feet/sec)
Forest with heavy ground litter and meadow	2.5
Fallow or minimum tillage cultivation	4.7
Short grass pasture and lawns	7.0
Nearly bare ground	10.1
Grassed waterway	15.0
Paved area (sheet flow) and shallow gutter flow	20.0

Travel time for each segment is computed using the following equation:

$T_t = L/60V$ (minutes)

[Note, the T, through an open water body (such as a pond) shall be assumed to be zero with this method.]

where:

L = the distance of flow across a given segment (feet)

V = avg velocity across the land cover (feet/second)

Average velocity (V) is computed using the following equation:

$V = k_r \sqrt{S_O}$

where:

k_r = time of concentration velocity factor (feet/second) (see Table 4-4)

S_O = slope of flow path (feet/feet)

4.2.6. Flood Plain/Floodway Analysis

Use methods defined in Helena City Code Title 11, Chapter 37, for determination of floodplain/floodway requirements.

4.2.7. Pipe System Analysis and Sizing

Refer to HEC-22 Manual, Section 7 for design parameters. Table 7-7 of HEC-22 provides minimum pipe slopes based on pipe size and flow.

The flows computed at structures (manholes and catch basins) may be used to estimate the water surface profile along the pipe system.

4.2.8. Run-off Control and Conveyance

All runoff control facilities and conveyance systems shall be installed to prevent damage or nuisance water to adjacent properties and the public right-of-way due to the proposed development.

Consider drainage system reliability in terms of layout, specification of materials and methods of installation, and the influence of other activities in the area both during and after construction.

Minimize the frequency and difficulty of future maintenance by analyzing potential system failures and failure remedies. Access structures shall be accessible to City-owned maintenance equipment such as 5 CY dump trucks and vactor-type trucks.

Visual impact and potential problems such as mosquito breeding, landscaping, odors, etc. shall be addressed.

4.2.9. Off-Site Capacity Analysis

Stormwater runoff should be treated as close to the source as possible. An offsite capacity analysis is required whenever location of discharge and/or rate of discharge will be changed by a proposed development.

The analysis must be submitted with the drainage plan.

4.2.9.1. Analysis.

Physically inspect the existing on- and off-site drainage system and investigate any known problems. The analysis must extend from the proposed project discharge location to the point downstream where the site runoff would join the existing drainage course.

On a map (minimum USGS 1:24000 Quadrangle Topographic Map) delineate the upstream tributary drainage areas to the site and to the downstream system.

Describe in narrative form observations regarding the makeup and general condition of the drainage system. Include such information as pipe sizes, channel characteristics, and drainage structures.

Specifically, the analysis must identify on the map, and describe in the narrative any evidence of the types of existing or anticipated problems.

At each existing and/or predicted drainage problem location identified in the analysis, develop hydrographs or Rational Method peak flow rates for the 100-year, 24-hour design storm events for the total composite drainage area tributary to that location for existing runoff conditions, excluding the proposed project site runoff.

Determine the capacity of the existing drainage system. Non-survey field data (hand tapes, hand level and rods, etc.) and computations using Manning's equation for normal flow are acceptable for this analysis.

At each existing and/or predicted drainage problem location, compute the proposed project's developed runoff hydrograph. Evaluate impacts of adding the controlled

peak runoff from the proposed project site to the peak runoff from the total composite drainage area tributary to these locations.

Additional information may be required to determine that impacts have been adequately mitigated and to verify the capacity of the conveyance system.

4.2.9.2. Solutions to Identified Drainage Problems

For any anticipated off-site problem resulting from the development or redevelopment, the Developer must demonstrate that the proposed project has been designed to mitigate the anticipated problem.

As an alternative, the Developer, with approval by the City, may arrange with the owners of the off-site properties to install measures which will correct the existing or mitigate the anticipated problem.

In some cases, existing public drainage system problems may already be scheduled for correction by the City. In these cases, the Developer should contact the City Engineering Division to determine current capital improvement project schedules.

Any proposed drainage easements must be executed by the affected property owners and be recorded prior to approval for construction.

4.3. CONVEYANCE DESIGN

4.3.1. General Construction

All construction on City rights-of-way shall be done in accordance with the City's standards and the procedures and methods set forth in the MPWSS as modified herein.

Prior to the final inspection, the Contractor shall clean the storm drain system and any off-site drainage systems affected by construction activities by a method approved by the City.

Wastewater from such cleaning operations shall not be discharged to the storm drainage system or surface waters nor shall it be discharged to the City sanitary sewer system without prior approval by the City Wastewater Superintendent.

Prior to the installation of impervious surfacing, detention facilities shall be installed and operational. Remaining permanent BMPs need to be established as soon as practicable following completion of construction. Permanent BMPs used during construction shall be restored to original design conditions once construction is complete (i.e. sediment and compacted soil must be removed).

Prior to occupancy of any single phase of a phased development, storm drainage facilities shall be completed and operational to provide conveyance, runoff control, and water quality treatment for the phase for which occupancy is requested.

Contractor shall provide Manufacturer's Certificate of Compliance when requested by the City for all pipe, fittings, precast concrete products, castings, and manufactured fill materials to be used in the project.

Testing of the drainage system, by the Contractor, when required by the City, shall conform to the testing requirements for the particular component of the system as set forth in the MPWSS and issued permits.

Documentation for the newly installed drainage facilities required by these standards or issued permits shall be submitted and approved prior to construction acceptance. This includes a registered engineer's certification and as-built drawings for all on-site storm water facilities, including on-site detention/retention ponds.

4.3.2. Connections/Modifications to Public Drainage System

When connecting existing metal storm pipe to new catch basins, the Contractor shall treat the newly exposed end of the pipe per the following.

Provide enamel linings and coatings in accordance with the following:

- Provide minimum dry film of 5 mils of acceptable asphalt base material.
- Provide coating subject to following additional requirements.
- Do not use enamel lined or coated steel pipe exposed to temperatures below 10 DegF.
- Do not handle enamel-lined or coated pipe when temperature of pipe is below 20 DegF.
- Galvanize surface in accordance with hot dip method using any grade of zinc acceptable to ASTM B6.

Where new pipe is connected to existing, the Contractor shall verify the type of existing pipe and join in kind with new. If the existing pipe is of a nonapproved material, the Contractor shall connect the new to the existing with an appropriate coupling device. The appropriate coupling device shall be approved by the City Engineer prior to installation.

The following connections to a pipe system shall be made only at structures:

- When the inletting pipe is greater than 8 inches in diameter; or
- When roadway, driveway or parking lot runoff is conveyed; or
- When commercial and multi-family stormwater pipes connect to the municipal conveyance system; or
- When connecting to CMP conveyance systems.

Roof/footing/yard drain pipes, 8 inches or less in diameter, from single family residences, may be connected to the existing stormwater conveyance system by core drilling the appropriate sized hole and installing a saddle tee on concrete, PVC and DI stormwater pipes only.

For profile wall PVC or CPE pipe, an insert-tee or saddle tee may be used. For new stormwater conveyance systems, roof/footing/yard drain pipes shall be connected with tee fittings.

When a connection is made without the benefit of a structure, a clean-out shall be provided upstream of each tee on the inletting private drainage system pipe.

When connecting pipes at structures, match crowns when possible.

4.3.3. Open Channel Design Criteria and Design Considerations

Open channels are preferred, wherever possible, to improve infiltration, retention, flow velocity, runoff volume, and sediment settling.

4.3.3.1. Minimum Diameter, Slope, and Velocity

Use the criteria set forth in Chapter 5.2 of the HEC22 Manual as modified herein.

4.3.3.2. Freeboard Requirements

Minimum freeboard requirements for open channels shall be one half (0.5) foot below the top of bank for the design flow rate.

4.3.3.3. Bank/Slope Protection and Revegetation

Rock riprap for channel armoring shall conform to the Montana Department of Transportation Standard Specifications for Road and Bridge Construction, Section 613, Riprap and Slope and Bank Protection.

Topsoil: Topsoil will be available from onsite stockpiles as specified in MDT's Standard Specifications. Any additional topsoil that may be required shall be furnished by the Contractor from approved offsite sources. Topsoil shall be considered to be natural surface soil capable of producing satisfactory agricultural crops, certified weed-free and shall be free of matter that may be harmful to plant growth or a hindrance to grading, seeding, and maintenance operations.

Fertilizer: Commercial fertilizer shall contain a minimum of 27% nitrogen, 14% phosphate, 0% potash, be uniform in composition, dry and free-flowing and delivered in containers labeled in accordance with applicable state regulations and bearing the warranty of the producer for the grade furnished.

Soil Amendments: Manure shall be well-rotted, certified weed-free, pulverized and sterilized and may be furnished in bulk. Mulch shall consist of threshed straw of oats, wheat, barley, rye, or rice – free of mold.

Seed: Seed shall be labeled in accordance with U.S. Department of Agriculture Rules and Regulations under the Federal Seed Act in effect on date of seed purchase. Seed that has become wet, moldy, or otherwise damaged in transit or in storage will not be acceptable. Seed shall contain not less than 85% pure live seed.

Seed mixes for bioswales and roadside ditches are as follows:

Lawn Areas: Seed to be planted in lawn areas disturbed by construction shall be as shown in Table 4-5.

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Table 4-5. Revegetation Seed Mix in Lawn Areas

Species	Pounds per acre pure live seed	% of pure live seed	Max. % weed seed
Helmin Thosporium (Merion Bluegrass)	10	85	0.5

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Natural Areas: Seed to be planted in areas where natural grasses have been removed or otherwise disturbed shall be a mixture as shown in Table 4-6.

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Table 4-6. Revegetation Seed Mix in Natural Areas

Species	Pounds per acre pure live seed	% of pure live seed	Max. % weed seed
Thickspike Wheatgrass "Critana"	8	81	0.5
Streambed Sheat (Wheat Grass)	6	81	0.5
Slender Wheat Grass	6	81	0.5

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Use the methods in Chapter 5.1 of the HEC22 Manual except as modified herein.

Swales shall be located no closer than 10 feet to any structure foundation measured horizontally from the edge of the swale at the freeboard elevation.

4.3.3.4. Maintenance Access

Provide maintenance access for inspection and debris removal by conventional equipment. Large channels will need access for dump trucks and loaders. For small channels, foot or pickup truck access is adequate.

4.3.4. Storm Sewer Mains

4.3.4.1. Design Considerations

Off-site stormwater flows passing through the site shall be conveyed by a hydraulically adequate conveyance system as set forth herein.

Where trench lines may convey groundwater, seepage barriers shall be installed.

Catch basins or manholes are required when joining pipes of different materials (does not apply to "taps") and ~~,~~at slopes or aliment changes. Vertical or horizontal bends are not permitted.

4.3.4.2. Hydraulic Criteria

Use the methods set forth in Chapter 7 of the HEC-22 Manual to design storm drains except as modified herein.

Design conveyance systems shall have non-pressurized (non-surcharged) flow during the 25-year design storm; except ~~th~~at the last pipe run upstream of a detention facility or open outfall (into a stream or lake) may be inundated during the 100-year event to a maximum distance of 200 linear feet or to the first manhole that would overflow, and if all the other conditions of the Engineering Standards are met. This also applies for those outfalls into streams where the outfall elevation is set at the bank-full water surface elevation (2-year storm) according to Section 4.3.8.1.

4.3.4.3. Storm Drain Pipe and Culvert Materials

Only the pipe materials listed are approved for use in storm drain systems and culverts. Pipe systems shall meet MPWSS, as modified herein, for the materials shown below.

Reinforced Concrete Pipe (RCP)

RCP meeting ASTM C-76 with a joint conformation to ASTM C-443, providing a water tight O-Ring gasket joint. The maximum fill depth is 15 feet for class III pipe and 25 feet for class V pipe. Minimum cover is 2 feet from the top of pipe to the finished grade or as recommended in writing by the manufacturer.

For pipes with a fill depth greater than 25 feet, pipe type shall be determined on a case-by-case basis with back up calculations provided by the Developer and pipe manufacture.

Solid Wall Polyvinyl Chloride (PVC) Pipe

PVC pipe must be at least SDR 35 and meet the requirements of ASTM D 3034 for diameters up to 15 inches and ASTM F 679, Type I for sizes 18 to 36 inch diameter.

The maximum fill depth is 25 feet.

Profile Wall PVC Pipe

Profile wall PVC pipe shall conform to AASHTO M 304. Joints shall be an integral-bell gasketed joint conforming to ASTM D 3212. Elastomeric gasket material shall conform to ASTM F 477.

The minimum pipe diameter shall be 8 inches. The maximum pipe diameter shall be 36 inches or the diameter for which a supplier has a joint conforming to ASTM D 3212, whichever is less.

Fittings for profile wall PVC pipe shall meet the requirements of AASHTO M 304 and shall be injection molded, factory welded, or factory solvent cemented.

The maximum fill depth is 25 feet.

Corrugated Polyethylene Storm Sewer Pipe (CPE)

Corrugated polyethylene storm sewer pipe shall meet the requirements of AASHTO M-294 and M-252, Type S.

The minimum pipe diameter shall be 8 inches. The maximum pipe diameter shall be 36 inches or the diameter for which a supplier has a joint conforming to ASTM D 3212, whichever is less. The City of Helena may allow CPE greater then 36" in diameter on a case by case basis.

Joints for corrugated polyethylene culvert pipe shall be classified as "watertight." Watertight joints shall be made with a sleeve or with a bell spigot and shall conform to ASTM D 3212 (10.8 psi) using elastomeric gaskets conforming to ASTM F 477. Gasketed joints shall be lubricated as recommended by the producer during installation.

"Soil-tight" joints shall not be permitted.

Fittings for corrugated polyethylene storm sewer pipe shall be blow molded, rotational molded, or factory welded.

Thermoplastic pipe fittings shall meet the requirements set forth in AASHTO M 294 and M-252.

CPE pipes should have a smooth interior wall.

CPE may used under the traveled roadway for local roads only. CPE will not be allowed under the traveled roadway for all other road classifications.

The maximum fill depth shall be per manufacturer's fill height tables, calculated per AASHTO Section 12, Load Resistance Factor Design. 80% compaction should be used in the calculation unless adequate compaction testing is done as determined by the City Engineer.

High Density Polyethylene (HDPE) Pipe

HDPE pipe shall only be used outside of the traveled roadway. Primary use of this material includes steep slope installations and overbank drains.

HDPE shall be manufactured in accordance with ASTM F 714 or ASTM D 3035. Resin shall be Type III - C5P34 as set forth in ASTM D1248. The minimum Standard

Dimension Ratio (SDR) is 32.5 with a design working pressure rating of at least 50 psi at 25 degrees C.

HDPE pipe and fittings shall be joined by the butt fusion process per ASTM D 2657 and the manufacturer's specific recommendations. Mechanical (bolted) flange connections may be used to facilitate pipeline installation.

HDPE pipe fittings shall be manufactured in accordance with ASTM D 2683 or ASTM D 3261.

4.3.4.4. Pipe Bedding

Pipe bedding material shall be in accordance with MPWSS for Trench Excavation and Backfill for Pipelines & Appurtenant Structures.

Crushed rock may be used as bedding for pipes if it conforms to the Montana Public Works MPWSS.

Excavated material may be used as pipe bedding when it has been demonstrated by the Developer to meet gradation and compaction requirements.

4.3.4.5. Trench Backfill

Trenches shall be backfilled in accordance with MPWSS as modified herein. All backfill within the pipe compaction zone shall be compacted to a minimum of 95% of maximum dry density per ASTM D 1557 (Modified Proctor).

Excavated material may be used as trench backfill when it has been demonstrated by the Contractor to meet gradation and compaction requirements.

4.3.4.6. Laying Storm Sewer Pipe

Laying pipe shall be in accordance with the MPWSS and include the following:

Existing flows shall be diverted away from the pipe segment being worked on by methods approved by the City.

Methods of construction for storm drain pipelines and culverts shall conform to the Montana Public Works Specifications as modified herein.

4.3.4.7. Abandoning Facilities

Abandoning Pipe In Place

The Contractor shall completely fill the pipeline to be abandoned with sand, concrete, or controlled density fill; ~~or remove it.~~

Abandoning Structures

Abandonment of structures shall be completed only after piped systems have been properly abandoned. Structures within the public right -of-way, a public easement or which are part of the publicly-owned and maintained system must be removed completely or abandoned provided no conflicts with new utilities or improvements arise. At a minimum the top 24" of the structure must be completely removed prior to abandonment of the structure.

4.3.4.8. Locators

Installation of all non-linear plastic pipe, lot stubs and underdrains shall include a locator wire. The locator wire shall be installed on top of and secured to the pipe. The Contractor shall furnish and install a No. 12 AWG solid copper wire between drainage structures and extend the wire at least 1 foot in to the structure.

Ends of each storm drain stub at the property line shall be capped and located with a 2-inches X 4-inches board, embedded to the stub cap, with a copper locator wire attached, and marked permanently "STORM". The stub depth shall be indicated on the marker.

4.3.4.9. Storm Drain Trench

Trenches shall be excavated to the width, depth, and grade as set forth in Standard Details herein. Material excavated that is unsuitable for backfill shall not be used for filling on or around surface water facilities.

In paved areas within the public right-of-way, provide a neat vertical cut in existing pavement by saw cutting.

4.3.4.10. Utility Location

4.3.4.10.1. Sewer Main Setbacks

Mains shall be installed in accordance with Section 5.6 of this document and ~~not~~ be located:

Underneath any structure (e.g. buildings, sheds, decks, rockeries or retaining walls which run parallel to the pipeline, carports, etc.); and

Within the 1: 1 plane from the bottom edge of the pipe or structure to the finished grade at a building or structure; and

Within the 1: 1 plane from the bottom edge of the pipe or structure to the property line at finished grade when an easement is not provided on the adjacent property; and

Within one half of a minimum 20 foot easement width of a structure; and

Where such facilities interfere with other underground utilities; and

Where allowable design loads would be exceeded.

4.3.4.10.2. Clearances / Other Utilities

All clearances listed below are from edge-to-edge of each pipe.

Check for crossing or parallel utilities. Maintain minimum vertical horizontal clearances. Avoid crossing at highly acute angles (the smallest angle measure between utilities should be between 45 and 90 degrees

Horizontal clearances from storm main:

Cable TV	5 feet

Gas	5 feet
Power	5 feet
Sewer	~~10feet~~5feet
Telephone, Fiber Optics	5 feet
Water	10 feet

Vertical clearances from storm main:

Cable TV	12 inches
Gas	12 inches
Power	12 inches
Sewer	12 inches
Telephone, Fiber Optics	12 inches
Water	18 inches

Where storm sewer pipes cross over or below a water main, one full length of pipe shall be used with the pipes centered for maximum joint separation.

At a minimum, the following utilities shall be shown on the plans: cable television, natural gas, power, sanitary sewer, telephone, water, and telecommunications companies.

All water main crossings must account for effects of frost from stormwater piping and that measures have been taken to prevent the freezing of water inside water mains.

For crossings of sanitary sewer pipes, the WQB-1 and WQB-2 (Montana DEQ Circulars) for water/wastewater systems and Montana Department of Environmental Quality criteria will apply.

4.3.4.10.3. Encasing Requirements

Reinforced concrete and thermoplastic pipelines shall be encased in a steel or ductile iron casing when crossing under the following improvements where the ability to remove and replace pipe without disturbance to the improvement is needed.

Crossing under rockeries over five (5) feet high (measured from the bottom of the base rock to top of wall);

Crossing under retaining wall footings over five (5) feet wide; or

Crossing under segmental block, crib, and reinforced earth-type retaining walls.

Casings shall extend beyond the facing, footing and backfill reinforcement zone a minimum of 5 feet or a distance equal to the depth of the pipe whichever is greater. The carrier pipe shall be supported by casing spacers when the casing

length exceeds 10 feet. ~~w~~Where casing spacers are not used, the carrier pipe shall not be more than 10 feet in length ~~(no~~and no pipe joints will be allowed inside casing~~)~~.

If the cover is less than 3 feet between the bottom of footing or base rock, a casing is required regardless of wall height.

4.3.5. Manholes, Catchbasins, and Inlets

4.3.5.1. Design Considerations

Stormwater inlets in a roadway shall be located in the curb line and shall be fitted with bike and pedestrian safe vaned grates. All grates within the traveled path must be ADA approved.

A through-curb inlet frame shall be used where conditions limit the effectiveness of a flat grate inlet. Examples of such conditions are where a high likelihood of clogging from leaf fall or other debris exists, in sag vertical curves, intersection curb returns, and when the structure is a surface drainage end point, such as in a cul-de-sac.

Bi-directional vaned grates shall be used in sag vertical curves.

4.3.5.2. Spacing Requirements

Table 4-7. Pipe Sizes and Lengths between Structures

Upstream Structure to Downstream Structure	Pipe Diameter (inches)	Minimum Pipe Slope (%)	Maximum Structure Spacing (ft)
Inlet/MH to Inlet/MH	12	2.0%	150-300
Inlet/MH to CB	8	2.0%	100
Inlet/MH to CB	12	1.0%	150
CB to CB	8	1.0%	150-300
CB to CB/MH	12 or greater	0.5%	150-300
MH to MH	12 or greater	0.5%	400

A type 2 catch basin is required to be installed at a minimum every 800 linear feet of storm drain pipeline.

Maximum spacing between grates shall be:

150 feet on surface grades less than 1%; and

200 feet on surface grades from 1% to 3%; and

300 feet on surface grades over 3%; or

as required by grate flow capacities.

The number and size of pipes that may be connected to any one structure is limited in order to maintain the integrity of the structure. For structural integrity, minimum undisturbed wall (edge of pipe opening to edge of pipe opening) shall be 8 inches for

48-inch and 60-inch. diameter structures. For 72-inch and 96-inch diameter structures, the minimum undisturbed wall between openings is 12 inches. Detailed plans of structures with multiple pipes or angled connections may be required to ensure proper structure selection.

4.3.5.3. Materials

Precast concrete products for manholes, inlets, and catch basins shall comply with the MPWSS.

Metal castings for frames, grates, and rectangular covers shall conform to the MPWSS as modified herein. Rings and covers shall be designed per the City of Helena Utilities Division Standards (see Sewer Engineering Standards).

All catch basin grated covers in roadways shall be ductile iron grates with cast iron frames, per these engineering standards or approved equal. Vaned gates shall be used.

All grated covers shall have in raised letters "Outfall to Stream, Dump No Pollutants".

All Manhole ~~round~~ covers ~~and rectangular covers~~ shall have City of Helena logo and stamped "STORM" in compliance with City of Helena Standard Drawing 4-9~~the word "STORM"~~ in block letters at least two (2) inches high, recessed so as to be flush with the surface.

Dipping, painting, welding, plugging or any repair of defects shall not be permitted in accordance with AASHTO M 306.

All structure ladders, when used, shall be firmly attached using stainless steel hardware and extend to the bottom of the structure.

Vertical ladders or steps shall be installed immediately under the cover or grate opening to a walkable surface on all structures exceeding four feet deep to the pipe invert.

When connecting to a concrete structure, openings must be core-drilled unless an existing knockout is available. Connections shall be made with watertight rubber boots, sand collars, manhole adapters, or other approved watertight connectors ~~except for :~~except for: 1) concrete; 2) ductile iron; 3) corrugated metal pipe. For 1, 2, and 3 above, connections shall be made with non-shrink Portland Cement Grout to make a watertight connection.

4.3.5.4. Structure Backfill

Structure backfill shall conform to the MPWSS.

4.3.5.5. Adjusting Manholes and Catch Basins to Grade

Where shown on the approved plans or as directed by the City, existing manholes, catch basins and inlets shall be adjusted to conform to finished grade in accordance with standard detail Adjusting Manholes and Catch Basins to Grade of the MPWSS as modified herein.

Where riser bricks (blocks) are used to bring the frame to grade, the maximum height of the brick shall be two rows. If more than two rows of bricks are required, a precast riser section shall be used along with no more than two rows of bricks to complete the adjustment.

Bricks, grade rings and risers shall be wetted just prior to being used and laid with "shov joints." Special care shall be taken to see that all joints are well filled with mortar.

4.3.5.6. Construction Considerations

Keep existing and new manholes, catch basins, and inlets free of construction debris, including dirt, rocks, and mud, during installation and/or during nearby construction activity.

4.3.5.7. Maintenance Access

Where no direct maintenance vehicle access from a maintenance access road can be provided or when greater than 15 feet from a roadway, all structures shall be channelized and shall not have catchments. Provide an oversized catch basin to compensate for lost catchments at the first available access point for maintenance vehicles.

The maximum manhole spacing on conveyance pipelines which do not have any stormwater inlets shall be 400 feet.

4.3.6. Culverts & Bridges

4.3.6.1. Design Flow Rate

Culvert and Bridges shall be sized to accommodate the peak runoff from a 100-year, 24-hour storm.

4.3.6.2. Bridges

Bridges shall conform to Montana Department of Transportation requirements.

4.3.6.3. Hydraulic Criteria - Culverts

Use methods set forth in Chapter 4.3 of the HEC-22 Manual as modified herein to design culverts. Determine capacity by analyzing inlet, outlet, and barrel controls.

When an abrasive bed load is anticipated or when velocities exceed 10 feet per second, protective measures shall be implemented to minimize pipe damage.

4.3.6.4. Freeboard Requirements - Culverts

The water surface elevation for the 100-year storm shall be at least one (1) foot below the crown of the culvert for all culverts equal or greater to 4-feet in diameter to allow for the passage of floating debris.

4.3.6.5. Material and Depths for culverts shall meet the criteria set forth in Section 4.3.4.3

4.3.6.6. Minimum Diameter, Slope, and Velocity

The minimum diameter of any driveway culvert shall be 12-inches. Where minimum cover requirements can be met, an 18-inch diameter culvert shall be used to minimize debris blockages.

Headwalls, cut-off walls, and/or anti-seep collars shall be provided on culverts where the hydraulic piping of bedding and backfill materials is possible.

4.3.6.7. Maintenance Access

Provide maintenance access to the upstream and downstream ends of the culvert for inspection and debris removal.

4.3.7. Roadway Laterals and Service Connections

4.3.7.1. Roadway Laterals

For roadway laterals, the minimum diameter is 8-inches provided:

- Length of pipe does not exceed 100 feet
- pipe slope is greater than or equal to 2%
- only one stormwater inlet contributes surface runoff to the roadway lateral

4.3.7.2. Service Connections

Private drainage systems shall comply with all criteria for stormwater systems set forth herein unless specifically exempted.

All service connections shall be connected to any existing storm water conveyance system within 100 feet and downslope of the property line

For individual single family residences, conveyance pipes shall be a minimum of 4-inches in diameter. Connections to the municipal storm drain system shall be a minimum of 6-inches. For joint-use lines between single family homes, that portion of the line which is jointly used shall be 6-inches in diameter minimum. Minimum slopes for single family storm drain lines (footing and conveyance): 2% on 4-inch and 6-inch diameter, and 0.5% on 8-inch diameter (if used). The minimum velocity in all storm drain conveyance systems for the conveyance design storm (25-year, 24-hour) is 3 feet per second.

For driveways, parking lots and situations not listed above, the minimum diameter for conveyance pipes shall be 8-inches.

Any storm line with a 20% slope or greater shall provide pipe anchors and hill holders according to the applicable storm drainage standard details.

4.3.7.3. Maintenance Access

All stormwater facilities shall be accessible for maintenance and operation.

When vehicle access is necessary, access roads shall be provided in dedicated tracts or dedicated access easements. The minimum clear driving lane width ~~is~~shall be 12 feet.

Gates and/or bollards are required when necessary to restrict access to stormwater facilities. Cables and/or chains stretched across access roads are not acceptable.

4.3.7.4. Private Drainage Systems

Property owners/developers who install private storm drainage facilities that are not connected to the MS4 system and not accepted by the City are required to perform maintenance of all private storm drainage facilities to ensure that those facilities function as designed. Private storm drainage facilities located within the MS4 boundary are required to submit a copy of the O&M completed for the stormwater facility to the City Utilities Division annually.

In areas having an existing piped conveyance system, the stormwater outfalls for parking lot, driveway, and roadway drainage shall be made by the following (in order of preference):

Connecting the conveyance pipeline to an existing manhole or catch basin; or

Constructing a new manhole or catch basin on the existing storm drainage pipeline and connecting the conveyance pipeline to this new structure.

In areas having an existing piped conveyance system, the stormwater outfalls for roof, footing, and yard drains may be made by the two methods mentioned above or by the following (in order of preference):

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Connecting the private drainage pipe to an existing storm drain manhole, catch basin or stub-out if provided within 100 feet and downslope of the property line; or

Coring the abutting conveyance pipeline and installing a saddle tee and providing a clean-out outside of the public right-of-way; or

Coring the abutting profile wall conveyance pipeline (PVC or corrugated polyethylene only; CMP may not be blind tapped) and installing an insert tee and clean-out outside of the right-of-way; or

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Installing a tee fitting in the abutting conveyance pipeline and providing a clean-out outside of the public right-of-way; or

Connecting the private drainage pipe to an existing sidewalk drain; or

Providing a new sidewalk drain if the closest existing drainage system or stub-out is greater than 100 feet and downslope of the property line.

Outfalling to an open channel or stream, provided that the drainage path continues downstream to an established, known and well-functioning conveyance system, adequate erosion protection is provided and permits from other agencies are obtained, as needed.

When a project includes the construction of a drainage system, private drainage systems shall connect to the proposed storm drain manholes, catch basins, stub-outs, or tees. The use of sidewalk drains shall not be permitted.

4.3.7.5. Roof, Footing, and Yard Drains

Roof and footing drain pipes shall be separate lines which may only be joined as a non-perforated pipeline at an elevation at least one (1) foot below the lowest footing drain invert elevation. The minimum cover over the storm drain stub at the property line shall be six (6) feet.

Clean-outs (4-inch minimum diameter) with factory manufactured fittings, shall be provided at all junctions and bends greater than 45 degrees. The maximum spacing between clean-outs shall not exceed 100 feet.

Roof, footing and yard drains shall not be connected to the sanitary sewer system.

Roof, footing and yard drains shall not be located within the public right-of-way except where connecting to the municipal stormwater system.

Roof, footing and yard drain systems serving more than one parcel shall be within private utility easements.

Roof, footing, and yard drainage may be conveyed over steep banks in single wall, corrugated polyethylene tubing (CPT) provided:

> The footing drainage system and the roof downspout system shall not be interconnected unless such connection is at least 1 foot below the footing drainage system and down slope of the building foundation.
>
> CPT for overbank drains shall be a continuous piece of tubing from the top of the slope to the discharge point at the bottom of the slope. No joints between the connection to the roof, footing, and yard drains and the discharge point will be allowed. CPT is not allowed in the right-of-way.

4.3.7.6. Maintenance

Roof, footing, and yard drainage systems, drainage systems on commercial and multi-family properties, drainage facilities within private easements, and drainage facilities otherwise denoted as private, shall be designed to provide access for maintenance and operation by the owners of such facilities.

4.3.8. Outfalls

4.3.8.1. Design Considerations

Use methods set forth in Chapter 7.1.5 of the HEC-22 Manual as modified herein.

Storm drain pipelines shall not be installed above ground.

Outfalls shall discharge at the bank-full water surface elevation (2-yr storm) in open channels or streams.

Conveyance systems downstream of detention facilities or water quality treatment facilities shall be designed to prevent backwater conditions in those facilities.

The use of pumped systems or backflow preventers shall not be used to prevent flooding due to backwater conditions.

4.3.8.2. Energy Dissipation

When discharging to an existing ditch, swale, or stream, energy dissipation is required to minimize erosion. Design energy dissipation measures pursuant to FHWA HEC-14, "Hydraulic Design of Energy Dissipators for Culverts and Channels," as modified herein.

For exit velocities in excess of 10 fps, provide an engineered energy dissipater. Riprap and gabions are not sufficient.

4.3.8.3. Materials

Acceptable pipe materials for all outfall sections of storm pipe shall include those listed in Section 4.3.4.3 of these Standards, except that PVC pipe is not permitted due to light sensitivity and degradation

4.3.8.4. Maintenance Access

Provide maintenance access for inspection and debris removal.

4.4. Post-Construction BMP Requirements

Post-construction (permanent) BMPs are required for one of two reasons within these standards, runoff control (quantity) or water quality. The purpose of runoff control BMPs is to mitigate the impacts of increased storm runoff volumes and flow rates on receiving streams. Runoff control BMPs are only applicable to projects that discharge stormwater to a drainage system or surface water and are not required for infiltration or detention systems that do not leave the site. The purpose of water quality BMPs is to reduce pollutant loads and concentrations in stormwater runoff to maintain or restore beneficial uses of receiving waters.

Low impact development techniques can be considered both runoff control and water quality BMPs.

For some new developments and redevelopments, multiple BMPs may be required to achieve the water quality or runoff control requirements. BMPs can be used in conjunction with each other, either in series or in parallel. Commonly, a pre-settling basin is used prior to other BMPs to reduce sediment loading to the second treatment system (i.e. a pre-treatment pond may be utilized prior to an infiltration chamber to reduce clogging of the infiltration facility).

4.5. RUNOFF CONTROL

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4.5.1. Design Considerations

Use the criteria set forth in Chapter 6 of the City of Helena Stormwater Ordinance and design guidelines Chapter 8 of the HEC-22 Manual as modified herein to plan, design and construct stormwater detention systems.

Runoff control is required for any development that increases the impervious area by 5,000 or more square feet.

When existing conditions make stormwater detention impossible for a portion of a site, compensatory storage volume and reduction of the release rates may be allowed if the bypass area and detention system are tributary to one drainage basin both prior to and after development. The peak rate of runoff (developed condition) from the bypass areas shall be subtracted from the allowable release rate to determine the detention system release rate. In no case shall the runoff from the entire site exceed the pre-development flow rate.

Runoff control systems shall be designed to promote LID techniques, reduce runoff, maximize reliability, minimize maintenance needs, maximize the distance between the inlet and outlet in order to improve runoff quality, and minimize hazards to persons or property (both on-site and off-site), nuisance problems and risk of failure. LID technquies are generally effective runoff control systems by infiltrating the runoff of retaining it for future uses.

In areas of high groundwater, the groundwater collection system flows shall bypass the detention system.

Runoff control facilities that serve multiple sites are subject to all of the engineering and design requirements contained in the Stormwater Ordinance and these Standards. Conceptual site plans for all sites to be served by the proposed stormwater facilities shall be submitted to the City for review. Construction of the facilities must occur in conjunction with the first project to be served by the runoff control facilities.

The 100-year water surface shall not surcharge roof, footing and yard drains, or underdrains.

Street and parking overlays are considered to be routine maintenance and are not considered to be redevelopment.

Runoff control facilities for the right-of-way shall be owned and operated by the City and shall be separate from private on-site systems. In a plat where the stormwater facilities will be owned and operated by the City, runoff from the right-of-way and private properties in the plat may be combined and controlled in a single facility. Private detention systems may accommodate public drainage (e.g., from a public right-of-way) if a hold harmless agreement is completed by the developer and recorded against the property, and the proposal meets all the other design requirements of the Utility.

Drainage basins may be considered as separate if tributary areas drain to different stormwater conveyance networks via separate drainage routes that do not join at any point downstream within ¼-mile.

4.5.2. Discharge Locations - LID

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The purpose of low impact development is to maintain the pre-development stormwater conditions following site development. To accomplish this, LID techniques are generally small and constructed near the source. For those sites/developments where LID techniques are required, the water quality storm must be infiltrated, evapotranspired, or captured for reuse.

4.5.2.1. Unconcentrated Flow

Where no downstream drainage system exists adjacent to the property and the runoff from the project site was previously unconcentrated flow, the downstream drainage system shall be extended to the property line and all runoff from the property shall be conveyed across the downstream properties to an approved discharge location. The Developer shall secure drainage easements from the downstream owners and record such easements prior to drainage plan approval.

4.5.2.2. Dispersion Systems

Dispersion systems when allowed shall be designed to mimic existing unconcentrated flow patterns.

4.5.2.3. Alternate Discharge

If the Developer demonstrates that easements per Section 4.5.3.4 herein are not reasonably obtainable as determined by the City, then all runoff shall be conveyed to a dispersal and/or infiltration system per these engineering standards.

4.5.2.4. Temporary Discharges to the Sanitary Sewer

Surface water runoff into the sanitary sewer system is prohibited. Temporary discharges into the sanitary sewer system must meet with the approval of:

The Engineering Division of the Public Works Department

Wastewater Treatment Plant Supervisor, and

Utilities Maintenance Supervisor.

The City of Helena Pretreatment Coordinator, under the WWTP Supervisor and the Utility Maintenance Supervisor, will determine the:

- Location of connection to the sanitary sewer,
- Method for the connection and pre-connection requirements, i.e., settling tanks, sump pump, etc.
- Time of discharge
- Duration, rate and volume of the discharge
- Other applicable discharge conditions

The Developer is responsible for first obtaining discharge approval from the City of Helena City Engineer prior to requesting permission from the City.

4.5.3. Water Quality Best Management Practices

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4.5.3.1. General

When required by the Stormwater Ordinance, surface water Best Management Practices (BMPs) shall be implemented to protect water quality in accordance with Chapter 10 of the HEC-22 Manual and the Engineering Standard Details included in the appendix as modified herein. These standards define approved water quality BMPs for new development and redevelopment in Helena.

Runoff treatment facilities that serve multiple sites are subject to all of the engineering and design requirements contained in the Stormwater Ordinance and these Standards. ~~Conceptual~~ A site plan~~s~~ for all sites to be served by the proposed stormwater facilities shall be submitted to the City for review. Construction of the facilities must occur in conjunction with the first project to be served by the runoff treatment facilities.

4.5.3.2. Source Control BMPs

Source Control BMPs are preventive best management practices and include site design, use of alternative products, operation and maintenance procedures (good housekeeping), etc. The goal of source control BMPs is to keep contaminants associated with a development's activities from entering the storm and surface water system rather than removing contaminants (i.e.: runoff treatment later).

LID techniques control sources by infiltrating the runoff or retaining it for future uses and preventing it from entering into the storm and surface water system.

4.5.3.3. Runoff Treatment BMPs

Runoff treatment BMPs are categorized by the type of contaminants most effectively removed. New development and redevelopment projects may be subject to multiple treatment requirements. These categories are:

- Low impact development designed to maintain pre-development runoff characteristics following site development.
- Conventional Pollutant Treatment designed to remove particulates and contaminants typically associated with particulates, such as heavy metals.
- Oil/Water Separation designed to remove and contain oil.
- Nutrient Treatment designed to remove suspended and dissolved nutrients.

Runoff treatment of the water quality storm is required for the following reasons:

- Low Impact Development – For projects requiring completion and approval of a drainage plan. The entire runoff from the water quality storm must infiltrate, evapotranspire, or be captured for reuse.
- ~~Conventional Pollutant Treatment – Applicable to projects located within or to be annexed into the City limits and having greater than 5,000 square feet of contaminant generating area. Conventional treatment is required to reduce total suspended solids concentrations by 80 percent. Conventional pollutant treatment can typically be met with properly designed LID techniques, though a pre-settling basin may be desired to improve sediment removal and facility maintenance.~~
- Oil/Water Separation – The following facilities are required to have oil/water separation. Only the contaminant containing surfaces are required for treatment.

- For parking lots of any size without an API or CP separator, Spill Control (SC) separator(s) shall be installed.
- A baffle-type (API) or coalescing plate (CP) separator is required at:
  - vehicle fueling/service stations
  - fuel storage and distribution facilities
  - vehicle maintenance and repair facilities (including those at automobile dealers)
  - heavy equipment storage and maintenance facilities
  - outdoor storage areas for trucks, industrial machinery and equipment
  - fleet vehicle facilities
  - high-turnover, uncovered parking lots (no size limitations) including but not limited to fast food restaurants, convenience markets, supermarkets, shopping centers, discount stores, retail stores, movie theaters, athletic clubs, banks, etc. Typically, office buildings, apartments, light industry, and schools do not have "high-turnover" parking.

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The Developer generally can choose whether to use a CP or API separator, using the HEC-22 Manual sizing criteria. API separators designed per the HEC-22 Manual tend to be quite large (minimum length is 45 feet) and may not be feasible.

~~Nutrient Treatment – For projects located within or to be annexed into the City limits and having greater than 5,000 square feet of contaminant generating area. Nutrient treatment is required in order to reduce total nitrogen concentrations by 30 percent and total phosphorus concentrations by 50 percent. Nutrient removal requirements may be met with properly designed LID techniques.~~

4.5.3.3.1. General

Runoff treatment BMPs intercept and remove contaminants from stormwater runoff. If stormwater runoff does not flow offsite, either by surface water or groundwater flow, runoff treatment can be eliminated. Runoff treatment BMPs are designed as part of the onsite stormwater system and must treat the water quality design storm (0.5 inches within 24 hours).

For all development~~ or redevelopment~~, the runoff treatment facility shall be sized to treat at a minimum, an area equivalent to the area to be disturbed by the proposed project. Areas which are not anticipated to produce contaminants are not required to be treated.

Runoff treatment for both conventional pollutants and nutrients is not required for contaminant-generating disturbed areas totaling less than 5,000 square feet. This exemption does not apply to source control and oil/water separation requirements.

Runoff treatment facilities for the right-of-way shall be owned and operated by the City and shall be separate from private onsite systems. If the treatment area is less than 5,000 square feet, runoff treatment is not required. In a plat where the stormwater facilities will be owned and operated by the City, runoff from the right-of-way and private properties in the plat may be combined and treated in a single facility.

If "clean" runoff is routed to the water quality facility, those flows must be included in the sizing calculations for the facility. Drainage from landscaped and vegetated areas, especially areas in native vegetation, should not be mixed with untreated runoff from streets and driveways, if feasible. Once runoff from non-contaminant generating areas is combined with runoff from contaminant--generating areas, it cannot be discharged without treatment.

Drainage basins may be considered as separate if tributary areas drain to different streams, or if areas drain to Tenmile Creek or Prickly Pear Creek via separate drainage routes that do not join at any point prior to Lake Helena.

Proprietary BMPs shall be evaluated on a case-by-case basis through the deviation process and Chapter 10 of the HEC22 Manual.

Surface water from uncovered garbage dumpster areas shall discharge to the sanitary sewer

Uncovered garbage dumpster areas may also be designed to sheet flow to landscaped areas: if approved by the City, if no adverse downstream impacts would result, and if the proposal otherwise meets all the requirements of these Standards.

4.5.3.4. Easement Requirements

4.5.3.4.1. General

Drainage facilities that are constructed to serve predominantly public property or public right-of-way shall be publicly owned and shall be dedicated to the City.

Where possible, public conveyance systems shall be constructed within the public right-of-way. When site conditions make this infeasible, public utility easements or dedicated tracts shall be provided. Private drainage facilities shall be constructed outside of the public right-of-way, on private property.

When vehicle access for maintenance is required, a dedicated tract or access easement shall be provided. The access easement conditions shall prohibit the property owner from installing any landscaping, improvements, retaining walls, etc., which would hinder access to the drainage facility or necessitate restoration of access easement area.

4.5.3.4.2. Easement Width Requirements

For pipes and vaults, the required utility easement width shall be: 1) ~~the~~a minimum 20 feet; or 2) determined by extending a line from the bottom edge of the structure or the bottom of the excavation at the outside diameter for pipes, at a 1H : IV slope until it intercepts the finished grade, whichever is greater.

For pipes/vaults 5 feet and greater in width, the minimum utility easement width shall be outside dimension plus 15 feet, rounded to the nearest whole foot, but not less than 20 feet in width.

For open channels to be maintained by the City, the utility easement width shall include the entire width of the channel (top-of-bank to top-of-bank or width at freeboard elevation) plus maintenance access when deemed necessary by the City. For privately-maintained open channels, the private utility easement width shall be, at minimum, the width of the channel at freeboard elevation.

For maintenance access roads, the minimum access easement width shall be 15 feet.

Storm drainage facilities shall be located in the center of the easement.

4.5.3.4.3. Easement Documentation Requirements

All easements shall be shown on the project plans and shall be designated either "private" or "public".

All property documentation shall be properly executed. Easement/tract documents shall include a map, the Lewis and Clark County Assessor number of affected properties, property legal description, Geocode, and owners' names.

Easements shall be dedicated to and approved by the City prior to acceptance of a public drainage system. ~~Grantee shall be the "the City of Helena, a municipal corporation, its heirs, successors, or assignees."~~

~~Indemnification and hold harmless agreements to hold the City harmless shall be included in recorded documents where maintenance access across private property and/or pumping of storm drainage is deemed necessary by the City.~~

Bills of sale for all drainage facilities appurtenant to public easements or tracts shall be given to the City with the executed real property documents that transfer property rights to the City. Grantor shall pay all title policy and recording fees necessary to transfer rights to the City.

4.5.3.5. Post-Construction BMPs

4.5.3.5.1. Low Impact Development

Low impact development techniques are required for projects requiring completion and approval of a drainage plan. The entire runoff from the water quality storm must infiltrate, evapotranspire, or be captured for reuse. Where it is impracticable to use LID techniques due to soil or other site conditions, a Deviation must be approved by the City Engineer.

LID design guidelines and considerations are provided by numerous governmental agencies including the USEPA, US Department of Defense (DOD),

and various municipalities. ~~For the purpose of these standards, the *Low Impact Development Technical Guidance Manual for Puget Sound* (2005) shall be used for LID design within Helena. The City Engineer must approve proposed design variations due to differing climates and hydrology of the two geographic areas.~~

Approved LID techniques include:

- Proper site planning and layout
- Protecting existing vegetation and minimized site disturbance
- Re-establishing native, drought tolerant plants
- Bioretention (rain gardens)
- Soil amendments
- Rainwater harvesting
- Infiltration

In addition, the City is not opposed to the following LID techniques though they may be more difficult to design, construct, and maintain:

- Permeable paving
- Vegetated roofs

4.5.4. Runoff Control – Detention Facilities

4.5.4.1. Design Considerations

Generally, u~~U~~pstream off-site runoff must bypass the proposed detention facilities unless the existing peak runoff rate from the upstream off-site area for the 100-year, 24-hour design storm event is less than 50 percent of the allowable release rate for the 100-year, 24-hour design storm event of the proposed project and no existing water quality treatment is changed.

4.5.4.2. Sites with Existing Stormwater Detention Systems

When runoff control is required on a site with an existing detention system, the Developer may choose one of the following options:

Retain the existing detention system to control runoff from existing impervious surfaces and design a second system per the current codes to control runoff from new portions of the development; or

Retain the existing detention system, modify the control structure and add volume as needed to meet the current codes for runoff control; or

Replace the existing detention with a system designed to meet the current codes for runoff control.

4.5.4.3. Multi-Purpose Use

Detention facilities designed for multiple use (sport courts, neighborhood parks, play areas, picnic areas, etc.) are allowed but must be approved by the City of Helena Park and Recreation Department.

Storage for runoff from more frequent storms shall be stored separately from the multiple use areas. At a minimum, the detained volume for the 2-year, 24-hour design storm shall be used to size the separate facilities.

Multi-use amenities shall be anchored to prevent floatation. Maintenance of multi-use amenities will be by others and Developer shall make arrangement for such maintenance.

4.5.4.4. Control Structures

Use the criteria and methods set forth in Chapter 8 of the HEC-22 Manual except as modified herein.

Allowable release rates shall be achieved using a tee type flow restrictor to meter flows.

All restrictor devices to be maintained by the City shall be equipped with a shear gate.

Restrictor devices on privately maintained detention facilities may use a gasketed end cap.

Clearances

The minimum clearance between the rim of the overflow standpipe and the bottom side of the structure's top slab shall be no less than 0.5 feet.

The minimum clearance between the flow restrictor (standpipe, orifices, shear gate, etc) and the steps/ladder rungs shall be 2 feet.

Orifices

Minimum orifice is 1 inch in diameter without screening.

When screening is provided to prevent blockage, the orifice size may be reduced to a minimum of 0.5-inch.

A notch weir may be incorporated into the tee-type flow restrictor when a floatable baffle is provided.

4.5.4.5. Detention Ponds

Use the criteria and methods set forth in Section 10.3 of the HEC-22 Manual as modified herein.

Stormwater detention ponds may be used as interim sedimentation facilities if cleaned and restored to approved plan conditions following completion of all on-site construction.

Stormwater shall be routed through a catch basin prior to discharging to the pond in order to facilitate the easy removal of transported sediments and debris.

Provide debris barriers or trash racks on the detention pond outlet to protect the outlet from blockage or plugging.

4.5.4.6. Embankments

Embankment material for detention ponds shall conform to the guidelines set forth in the MPWSS and the Montana State Department of Natural Resources and Conservation Dam Safety guidelines. Pond vegetation should be established using the materials described in Section 4.3.3.3, open channels, of these standards.

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Fill placed around structures in the berm embankment shall be placed in four (4) inch maximum lifts and compacted to 95 percent of ASTM D- 1557.

The maximum embankment height is measured from the downslope toe to the crest of the embankment.

All embankments for detention facilities 6 feet and higher shall be designed, inspected and certified by a civil/geotechnical engineer. The civil/geotechnical engineer shall submit a letter certifying that all embankment design requirements have been met during embankment construction.

Anti-seep collars shall be placed on all conveyance pipes and trenches within the embankment.

The maximum height of rockeries subject to inundation due to fluctuating pond levels is four (4) feet. The exposed face of the rockery shall be above the permanent pool elevation. Rockery drains shall drain through the detention system.

Ponds may be designed with retaining walls only as approved by the City on a case-by-case basis. Public safety shall be a primary design consideration.

4.5.4.7. Detention Pond Setbacks

Detention ponds shall not be located:

within the 1:–1 plane from the pond bottom to the finished grade at an adjacent building; and

within the 1:-1 plane from the pond bottom to the property line when an easement is not provided on the adjacent property; and

where such facilities interfere with other underground utilities.

The top of a cut embankment and the toe of a fill embankment shall be setback at least 5 feet from property lines.

For ponds where the maximum design water depth is less than three (3) feet deep, the minimum bottom width is 6 feet.

For ponds where the maximum design water depth is 3 feet deep and greater, the minimum bottom width shall be three times the maximum design water depth.

The pond bottom shall be sloped at 0.5% towards the outlet for drainage to help facilitate maintenance.

All detention ponds must be designed to detain the 2-year 24-hour storm for a minimum of 12 hours for water quality.

4.5.4.8. Maintenance Access

Use the criteria set forth in HEC-22 Chapter 10.4.2 of the HEC-22 Manual as modified herein.

A vehicle access ramp shall be provided to the bottom of the detention pond when the bottom width is 15 feet or greater and/or when the height of the interior pond embankment and/or wall is greater than 4 feet. The grade of the access ramp shall be no steeper than 20%.

Gates and/or removable bollards may be required to restrict access to drainage facilities. Cables and chains stretched across access roads are not acceptable.

4.5.4.9. Safety

Fencing shall be required when vertical walls are used, when more than 25% of the perimeter side slopes are steeper than 3 H:-1V, and when the permanent ("dead") pool depth exceeds 3 feet.

4.5.4.10. Emergency Overflow & Spillways

Use the criteria set forth in Chapter 8.4.4.4 of the HEC-22 Manual as modified herein.

All detention storage facilities shall include a provision for non-erosive control of overflows. Overflows shall be directed to a safe discharge path to protect adjacent and downstream properties from damage. Provide calculations and data to support the design.

Surface detention ponds shall be provided with a minimum of two controlled emergency overflows - the primary overflow in the control structure and the secondary overflow in the engineered embankment.

The crest of the secondary overflow shall be at least 0.5 feet above the crest of the primary overflow.

4.5.4.11. Vegetation & Landscaping

Detention pond landscaping shall comply with the requirements of the MPWSS and as specified herein. Ponds with walls higher than 6 feet shall be landscaped as specified herein. Deciduous trees shall not be utilized in and around detention ponds. However, deciduous shrubs and shrub/trees may be used in the understory to provide needed diversity for a pleasing appearance.

All ponds shall be landscaped to provide for slope stability, erosion control, and low maintenance. Landscape materials shall be fully compatible with use as a stormwater detention facility including runoff treatment.

Floatable or erodible material (i.e., wood chips, beauty bark, straw mulch, etc.) shall not be allowed in the pond interiors.

Vegetation on pond embankments shall be limited to shallow rooted varieties.

Vegetation shall be placed into topsoil above or adjacent to the engineered embankment.

Where detention pond landscaping shall be maintained by the Utilities Department, landscaping shall be ~~irrigated,~~ low maintenance, and drought tolerant and shall

consist of native plant species. Lawn or turf grass is not allowed. Utilize plant species native to the State of Montana to the maximum extent practicable.

For City maintained facilities, all plant material shall be guaranteed for a period of one (1) year after acceptance. Defective materials shall be promptly replaced in like kind and size. The guarantee period may be extended for those defective materials which are replaced.

4.5.4.12. Underground Detention Systems

Use the criteria and methods set forth in Chapter 10.6 of the HEC-22 Manual as modified herein.

All stormwater shall be routed through a catch basin prior to discharging to detention vaults or pipes to facilitate the easy removal of transported sediments and debris.

Detention Vault/Tank Setbacks

Detention vaults/tanks shall not be located:

underneath any structure (e.g. buildings, sheds, decks, carports, retaining walls, etc.); and

within the 1:–1 plane from the bottom edge of the vault or the bottom of the excavation at the outside diameter for tanks, to the finished grade at an adjacent structure foundation; and

within the 1:–1 plane from the bottom edge of the vault or the bottom of the excavation at the outside diameter for tanks, to the property line when an easement is not provided on the adjacent property; and

where such facilities interfere with other underground utilities.

If vaults are constructed above ground, they shall be provided with visual screening and landscaping.

Minimum Size

The minimum diameter of a detention pipe shall be 36-inches.

The minimum height of any detention vault shall be 42-inches.

Materials-Vaults

Materials for stormwater detention vaults shall conform to MPWSS and be as approved by the City of Helena Building Division.

Any metal structural components shall be protected from corrosion and have a low maintenance coating. The Developer shall submit proposed metal protective coatings with supporting documentation for review prior to drainage plan approval. Coatings shall have a 50-year design life.

For precast vaults, sealing between riser sections shall be accomplished by placing Portland cement mortar, compressible neoprene foam gaskets, asphaltic mastic

material, or asphalt impregnated gasket materials between sections, as recommended by the manufacturer to produce a water-tight seal.

Tanks or Pipe

Only the pipe materials listed in section 4.3.4.3 are approved for use in stormwater detention facilities. Materials shall meet the materials defined in the MPWSS as modified herein.

All corrugated metal pipe and pipe arch shall be furnished with annular ends, neoprene gaskets, and lap type couplings.

CPE is not allowed for underground detention.

Structural Design

Use the criteria set forth in Chapter 10.6 of the HEC-22 Manual and by the City Building Official. Note that where the top of a vault is in a traveled way, additional loading requirements to accommodate fire trucks will apply.

Hydrostatic Pressure & Buoyancy

Use the criteria set forth in Chapter 10.6 of the HEC-22 Manual as modified herein.

If permanently lowering the groundwater in the vicinity is not feasible, then pipes and vaults shall be designed to accommodate hydrostatic loading and buoyancy effects.

Footing Drains and Underdrains

When the design of vaults does not take into account buoyancy or hydrostatic pressure, footing drains shall be provided. Footing drains shall be backfilled to within 2 feet of the top of the vault with Gravel Backfill for Drains conforming to MPWSS. The gravel backfill shall be protected from contamination by soil fines.

Clean-outs on footing drains and underdrains shall be provided every 100 feet and at bends or drain pipe junctions. Connection to the stormwater conveyance system shall be at a point where the hydraulic grade line in the conveyance pipe does not affect the free draining ability of the footing drains or underdrains.

Footing drains and underdrains shall be a minimum of 6-inch diameter PolyVinyl chloride (PVC) pipe, SDR 35, with laser-cut slotted perforations.

Footing drains shall be backfilled with material that conforms to the MPWSS.

Maintenance Access

Use the criteria set forth in Chapter 10.6.3 of the HEC-22 Manual as modified herein. Since underground detention facilities are subject to confined space entry regulations, such facilities shall be designed to facilitate safe inspection and maintenance.

Access structures at each end of the facility shall be required. Spacing between access openings shall not exceed 50 feet. Covers, grates, and hatches shall be bolt locking. If the vault or pipe contains cells, one access minimum per cell is required.

Access openings shall be 24 inches in diameter and centered over a ladder and/or steps. For control structures, accesses must be located so that an 8-inch rigid vactor

tube can reach the sump directly from the top, and so that a person entering the structure can step off the ladder or steps onto the floor.

The opening shall allow visual inspection of the restrictor pipe, while maintaining vertical vactor access to the sump area.

In order to achieve both requirements, it may be necessary to increase the control structure size, provide two 24-inch access openings or a hatched cover that conforms to the loading requirements given the proposed location.

Orifice elbows shall be located on the side of the stand pipe nearest the ladder for clear visual inspection from above.

Gates and/or removable bollards may be required to restrict access to drainage facilities.

Cables and/or chains stretched across access roads are not acceptable.

4.5.4.13. Infiltration Systems/Retention Basins

Design Consideration

Use the criteria set forth in Chapter 10.5 and 10.6 of the HEC-22 Manual as modified herein.

Infiltration systems for runoff control shall be designed to infiltrate the 100-year, 24-hour design storm volume in 24 hours or less after the storm is over. Soil capabilities must be confirmed by geotechnical investigation.

The Developer shall demonstrate through: 1) Infiltration testing; 2) Soil logs; and 3) A written opinion of a licensed civil/geotechnical engineer, that sufficient permeable soils exists on the site for an infiltration system meeting the requirements herein and site-specific conditions to function properly.

The infiltration rate shall be measured at a depth equal to the proposed bottom grade of the facility.

A detention system may be required in conjunction with the infiltration system to meter flows to an infiltratable rate.

Infiltration areas shall not be: 1) driven on or across by any vehicles or equipment, 2) used for material storage or stockpiles, or 3) used for vehicle or equipment parking.

Infiltration areas shall be secured with temporary fencing prior to clearing the site.

Approval of an infiltration system shall obligate the owner to repair, replace, or reconstruct the infiltration system if it fails to operate as designed. The maintenance and operation schedule for an infiltration system shall include such a provision.

Roof downspout infiltration systems are not acceptable.

Depth to seasonal high water table, bedrock, hardpan or other impermeable layer shall be no less than 3 feet below the bottom of roof downspout infiltration systems and 5 feet below the bottom of all other infiltration facilities.

The maximum infiltration rates for the various soil types is set forth in herein Table 4-8. The maximum rate used to calculate the design infiltration rate shall be the lesser of the values set forth in Table 4-8 and the measured rate.

Table 4-8. Maximum Infiltration Rates for Soil Types

Soil Texture Class (U.S.D.A.)	Infiltration Rates (Inches per Hour)
Coarse sands, cobbles	20
Medium sand	8
Fine sand, loamy sand	2.4
Sandy loam	1
Loam	0.5

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To obtain the design infiltration rate, the following safety factors shall be applied depending on the test method selected. The safety factor shall be applied to the lesser infiltration rate, either the measured rate, or the tabulated rate in Table 4-8.

EPA Method: F.S. = 2.0

ASTM Method: F.S. = 1.75

Infiltration facilities shall not be located: 1) within 20 feet of any structure, property line, protected area or another infiltration system; or 2) within the 1:-1 plane from the bottom edge of the excavation to the finished grade at the structure foundation, whichever is greater, except as provided herein.

Infiltration facilities shall be setback at least 50 feet from downhill slopes which are 15% or greater.

General Data Requirements

Provide a written report which includes as a minimum: 1) Site characteristics that pertain to the proposed infiltration system; 2) Soils report with soil logs; 3) Written civil engineer's opinion of site suitability and recommended design infiltration rate; 4) Infiltration test data and results; 5) Engineering calculations supporting the design; and 6) Site plan.

All elevations shall be based on NAVD 88 datum.

Geotechnical Report Requirement

An adequate number of test holes shall be located over the proposed site to substantiate representative conditions for the final layout of the development. As a minimum condition, one test hole shall be located in each infiltration area for each 5,000 square feet of tributary area runoff to be infiltrated. Test hole locations shall be clearly identified in the geotechnical report and labeled on the drainage plan.

Soil logs must be submitted to describe soil type and depth and a site map shall be submitted showing the location of each test hole.

Test pits or borings shall extend at least three (3) feet below the bottom of roof downspout systems and five (5) feet below the bottom of all other infiltration facilities. Soil logs shall include the depth to the seasonally high ground water table and impervious strata. The wet season water table elevation measurements shall be made during the period when the water table elevation is expected to be at its maximum.

The geotechnical report shall address the potential impact of the infiltration system on downslope areas both on-site and off-site.

An inspection of the soil by a civil/geotechnical engineer shall be made after the system is excavated, before the gravel backfill is placed, to confirm that suitable soils are present. The geotechnical report shall be amended to reflect this inspection and confirmation of suitable soils.

Infiltration Test Requirement

The design infiltration rate shall be determined using the following test methods: 1) EPA Falling Head Percolation Test Procedure (Design Manual - On-site Wastewater Treatment and Disposal Systems, EPA, 1980); or 2) the double ring infiltrometer test (ASTM D3385).

The test hole or apparatus is filled with water and maintained at depths above the test elevation for not less than 4 hours.

Following the saturation period, the rate shall be determined in accordance with the specified test procedures, with a head of 0.5 feet of water.

Provide data sheets for the selected infiltration test performed.

Testing to be performed by or under the direct supervision of licensed civil engineer. The report shall bear the stamp of ~~such~~ said licensed civil engineer.

Overflows

Each runoff control infiltration facility shall provide emergency surface storage at least 10% of the 100-year, 24-hour design storm volume, a minimum of 0.5 feet deep, on the site prior to discharging runoff to a safe overflow route. The overflow route shall have the capacity for the 100-year, 24-hour flow in the event of system failure. The surface storage is intended to make the owner aware of a problem with the infiltration system. Overflows shall be routed to the municipal storm drainage system, in accordance with Section 4.3. The overflow route shall be shown on the plan.

Runoff Treatment

Inflow to runoff control and runoff treatment infiltration facilities shall be pre-treated for debris and sediment removal. Where runoff is anticipated to also contain contaminants and pollutants, it shall be treated using the appropriate BMPs set forth in the HEC-22 Manual prior to being infiltrated.

Maintenance Access

Infiltration system components shall be accessible for periodic inspection and routine maintenance.

Infiltration systems, with pre-treatment facilities, which are not abutting a roadway shall be provided with access to accommodate maintenance vehicles and construction equipment. The minimum clear driving width shall be 12 feet.

Construction of Infiltration Systems

Construction of infiltration systems shall conform to Chapter 10.5 and 10.6 of the HEC-22 Manual except as modified herein.

Excavation of infiltration systems shall be done with a backhoe or excavator working at "arms length" to avoid the compaction and disturbance of the completed infiltration surface.

Gravel backfill for infiltration systems shall meet the requirements for coarse aggregate for Portland cement concrete, Grading No. 4 or 5 as listed in MPWSS.

The facility site shall be cordoned off so that construction traffic does not traverse the area.

An inspection by the civil/geotechnical engineer of record, of the exposed soil shall be made after the infiltration system is excavated to confirm that suitable soils are present.

Infiltration systems for runoff control shall not be utilized until construction is complete and disturbed areas have been stabilized, as determined by the City, to prevent sedimentation of the infiltration system. Temporary runoff control facilities may be needed to utilize this option.

4.5.4.14. Source Control BMPs

The goal of source control BMPs is to keep contaminants associated with a development's activities from entering the storm and surface water system rather than removing contaminants (i.e.: runoff treatment later). LID techniques are effective source controls by infiltrating the runoff or retaining it for future uses and preventing it from entering into the storm and surface water system. LID treatment methods are discussed in Section 4.5.3.5 and infiltration is discussed in Section 4.5.4.13

4.5.4.15. Runoff Treatment BMPs

4.5.4.15.1. Conventional Pollutant Treatment

Refer to Table 10.2 in the HEC22 Manual for approved conventional pollutant treatment BMPs. The selected BMPs shall be designed in accordance with Chapter 10.2 of the HEC22 Manual as modified herein.

Only runoff from conventional pollutant-generating surfaces must be treated using BMPs set forth herein. Conventional pollution-generating surfaces typically include driving surfaces (streets and roads), uncovered parking areas, driveways, and uncovered storage areas for wastes, materials, equipment, etc.

Drainage from surfaces that typically do not generate conventional pollutants include roof tops, sidewalks, and landscaping. Such runoff need not be treated for conventional pollutants and may bypass the conventional pollutant treatment facility, if feasible.

4.5.4.15.2. Nutrient Treatment

Nutrient treatment BMP facilities shall be sized to treat all stormwater discharging to the BMP. Nutrient treatment is not required for runoff which does not come in contact with chemical storage and application areas or areas inaccessible to animals. Treatment should achieve 50 percent reduction of total phosphorus and 30 percent reduction of total nitrogen, depending on influent concentrations and design.

Typical nutrient treatment BMPs are discussed in the HEC-22 Manual and may include:

- Detention ponds
- Infiltration basin
- Bioretention
- Vegetative practices

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4.5.4.15.3. Oil/Water Separation

The Developer generally can choose whether to use a CP or API separator, using the HEC-22 Manual sizing criteria. API separators designed per the HEC-22 Manual tend to be quite large (minimum length is 45 feet) and may not be feasible.

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4.5.4.15.4. Design Requirements for Spill Control (SC) Separators

Locate an SC separator upstream from the detention system, or immediately before leaving the site if there is no detention system. Locating the SC separator upstream of detention system helps to contain the spill in a smaller area, prevent the flow restrictor orifice from plugging with floating debris and reduce sediment deposition in the detention facility. If there are multiple outfalls into the detention system or water quality facilities (other than oil/water separators), then an SC separator must be included in the last catch basin in each tributary line draining a potential spill area.

For pipes 8-inches or less in diameter, a catch basin (CB) fitted with a 15-inch tee is sufficient. Maximum allowable depth from grate/cover to invert is 4 feet.

For a 12-inch outlet 48-inch catch basin is required.

For a 18-inch outlet 54-inch catch basin is required.

The maximum outlet pipe diameter is 18 inches.

For Type 2 SC separators, a four foot sump is needed. The SC separator shall have a 2-foot tee section protruding down into the sump.

Sizing Criteria: Use the methods outlined in the HEC22 Manual.

High-Flow Bypass: A high flow bypass is required if the separator is not capable of treating the 100-year storm peak runoff rate. Bypassing storm flows greater than the treatment capacity of the separator prevents "flushing" during peak

events, substantially increases the effectiveness of the oil/water separator, and reduces size requirements.

Drainage Area: Uncontaminated water (roof runoff, pervious area runoff, etc.) should not drain to the oil/water separator.

Location: On sites with runoff control and runoff treatment facilities, the API or CP separator shall precede those facilities as specified in the HEC22 Manual. An exception to this requirement may be made for vault/tank type detention systems.

Presettling chamber (forebay): A presettling chamber is needed upstream of CP separators, unless the separator is downstream of a vault/tank detention system. A presettling chamber reduces maintenance needs by removing sediment and floatables. A properly sized SC separator can act as a presettling chamber for CP separators. If an API or CP separator is located downstream of the vault/tank detention facility, provide a floatables baffle.

4.5.5 Wetlands

When wetland discharge and recharge requirements apply, stormwater runoff to the existing wetland shall be limited to: 1) 50 percent of the existing 2-year design storm peak runoff rate for the area tributary to the wetland; 2) a rate as determined by a qualified wetlands biologist; or 3) a rate specified by a resource agency having jurisdiction over wetlands, in order to maintain the hydroperiod and protect the characteristic uses of the wetland. Runoff in excess of the specified rate shall be bypassed around the wetland.

When a wetland is allowed to be filled, runoff treatment and conveyance equivalent to that provided by the existing wetland to be filled is required in addition to any other runoff treatment required by these standards and applicable codes.

4.5.4.16. Control Structures Material and Construction

Precast concrete products for control structures shall comply with the MPWSS.

Flow restrictors in detention control structures shall be fabricated from 0.060" aluminum pipe, PVC pipe (Profile Wall, Schedule 40 or SDR 35), CPE, or HDPE (SDR 32.5).

Pipe support materials shall match restrictor (if metal). For plastic materials, aluminum (3-inch Width x 0.060-inch Thick) or stainless steel (3-inch Wide x 0.090-inch Thick) shall be used. Pipe supports shall be fastened to the structure wall with 5/8-inch stainless steel expansion bolts or lag and shield.

Orifice plates shall be fabricated from aluminum plate (0.125-inch), high density polyethylene (HDPE) sheeting (0.25-inch), or PVC sheeting (0.25-inch). Orifice plates shall be bolted to the flange on the flow restrictor with stainless steel hardware. Orifices may be fabricated by drilling the specified diameter hole in an end cap.

Protective screening for orifices less than 1 inch in diameter shall be hot-dipped galvanized, 0.5-inch x 0.5-inch "hardware cloth" or polymer geo-grid with the approximate same size openings.

4.5.4.17. Maintenance Access

All stormwater detention system control structures shall be accessible for maintenance and operation.

In single family residential subdivisions, control structures, which are not abutting a roadway, shall be provided with dedicated tracts at least 15 feet wide to accommodate maintenance vehicles. The minimum clear driving width shall be 12 feet.

In multi-family and commercial developments, control structures which are not abutting a roadway shall be provided with access to accommodate maintenance vehicles. The minimum clear driving width shall be 12 feet.

Maximum access road grades: 15% (paved), 10% (gravel)

Minimum turn-around radius: 25 feet or hammerhead.

Gates and/or removable bollards are required to restrict access, as necessary, to drainage facilities.

4.5.4.18. Off-Site Water Quality Analysis and Mitigation

When an offsite water quality analysis is required by the Stormwater Ordinance, include such analysis in the project drainage plan following the format of Section 4.2.1.

4.5.4.19. Operation and Maintenance Schedule for BMPs and Facilities

For privately maintained stormwater systems, an operation and maintenance (O&M) schedule for source control, runoff control and runoff treatment BMPs must be approved by the Engineering Division prior to acceptance of the completed storm drainage system. The O&M schedule shall provide information regarding those unique facilities or features not covered by the maintenance sections of the Helena Utilities Maintenance Division.

O&M records from privately maintained facilities shall be submitted to the City annually to ensure proper maintenance is conducted.

4.5.4.20. Pumping Stations

Stormwater pumping stations are not acceptable for use within the City of Helena City Limits without approval from the City of Helena Public Works Department.

4.5.4.21. Non-Gravity Systems (Pumps)

Pump systems (includes the pumps, force mains, electrical and power supply equipment, structures and appurtenances) are not an approved method of conveying, storing, or treating stormwater. A deviation must be approved in order to pump stormwater. If the deviation for a pump system is approved, the system shall meet the following minimum requirements:

The pump system shall not be used to circumvent any code, engineering standard, or permit condition. The construction and operation of the pump system shall not violate any other City requirements.

The Developer shall demonstrate that the pump system is the only feasible alternative available to provide drainage.

Pump systems shall be owned, operated, maintained, repaired, and replaced (as needed) by property owner(s) served by such system.

Pumped flows shall not exceed the allowable discharge rates set forth herein Each pump shall be capable of discharging the design flow rate for the 100-year, 24-hour design storm.

If a stormwater detention system is not required the pump system shall have a storage facility (pond, tank, or vault) sized to hold 25 percent of the total volume of runoff for the developed tributary drainage area for the 2-year, 24-hour design storm.

The pump system ~~has~~ shall have dual, alternating pumps with emergency on-site, back-up power supply and an external alarm system for system failure and high water level indicator.

A safe emergency overflow route shall be provided, if possible.

The pump system shall discharge to an elevation higher than the downstream design water surface elevation to prevent backwater/backflow conditions.

A Maintenance and Operation Schedule shall be prepared and submitted for review prior to permit issuance.

A note on the approved plan shall stipulate that the private property owner(s) shall be responsible for any and all claims for injuries and damage due to the operation or non-operation of the pump system.

4.6. EASEMENT REQUIREMENTS

4.6.1. General

Drainage facilities that are constructed to serve predominantly public property or public right-of-way shall be publicly owned and shall be dedicated to the City.

Where possible, public conveyance systems shall be constructed within the public right-of-way. When site conditions make this infeasible, public utility easements or dedicated tracts shall be provided. Private drainage facilities that are required by City Code shall be constructed with in an easement outside of the public right-of-way, on private property.

When vehicle access for maintenance is required, a dedicated tract or access easement shall be provided. The access easement conditions shall prohibit the property owner from installing any landscaping, improvements, retaining walls, etc., which would hinder access to the drainage facility or necessitate restoration of access easement area.

4.6.2. Easement Width Requirements

For pipes and vaults, the required utility easement width shall be: 1) ~~the~~a minimum 20 feet; or 2) determined by extending a line from the bottom edge of the structure or the bottom of the excavation at the outside diameter for pipes, at a 1~~-~~H ~~-~~:~~-~~IV slope until it intercepts the finished grade, whichever is greater.

For pipes/vaults 5 feet and greater in width, the minimum utility easement width shall be outside dimension plus 15 feet, rounded to the nearest whole foot, but not less than 20 feet in width.

For open channels to be maintained by the City, the utility easement width shall include the entire width of the channel (top-of-bank to top-of-bank or width at freeboard elevation) plus maintenance access when deemed necessary by the City. For privately-maintained open channels, the private utility easement width shall be, at minimum, the width of the channel at freeboard elevation.

For maintenance access roads, the minimum access easement width shall be 15 feet.

Storm drainage facilities shall be located in the center of the easement.

4.6.3. Easement Documentation Requirements

All easements shall be shown on the project plans and shall be designated either "private" or "public".

All property documentation shall be properly executed. Easement/tract documents shall include a map, the Lewis and Clark County Assessor number of affected properties, property legal description, Geocode, and owners' names.

Easements shall be dedicated to and approved by the City prior to acceptance of a drainage system. Grantee shall be the "the City of Helena, a municipal corporation, its heirs, successors, or assignees."

Indemnification and hold-harmless agreements to hold the City harmless shall be included in recorded documents where maintenance access across private property and /or pumping of storm drainage is deemed necessary by the City.

Bills of sale for all drainage facilities appurtenant to public easements or tracts shall be given to the City with the executed real property documents that transfer property rights to the City. Grantor shall pay all title policy and recording fees necessary to transfer rights to the City.

4.7.SEDIMENT AND EROSION CONTROL

4.7.1. General

All projects shall adhere to the Lewis and Clark Conservation District Sediment and Erosion Control Ordinance except as modified herein.

The objective of the Sediment & Erosion Control Standards is to minimize erosion of disturbed areas during the construction of a project. Erosion and subsequent sediment transport can have a significant impact on the water quality of receiving surface waters. Sediment loads to surface waters increase turbidity, increase water temperatures, degrade fish habitat and spawning areas, and depress dissolved oxygen concentrations. Moreover, toxic substances, trace metals and nutrients which are absorbed to soil particles can be

transported into surface waters as well. The addition of these substances to surface waters degrades the existing water quality.

Additional Erodion and Sediment Control measures may be found in the Field Manual on Sediment and Erosion Control (SEC Field Manual) Best Management Practices for Contractors and Inspectors (Fifield, 2002, ISBN 0-9707687-1-0). This reference provides specific guidance on accepted Best Management Practices to reduce erosion and sediment during construction activities. The Best Management Practices include the management, techniques, and methods for control of accelerated erosion and sediment damage resulting from the activities of man.

4.7.2. Purpose

It is the purpose of these Engineering Standards to enact a comprehensive and coordinated erosion and sediment control program for the conservation and protection of land, water, and other resources of the City of Helena and thereby

- Encourage the use of land in accordance with its capabilities and treat it according to its needs;
- Prevent degradation of lands, streams, reservoirs, and lakes;
- Protect and promote the health, safety, and general welfare of the people.

4.7.3. Compliance with Sediment and Erosion Control Standards

No land occupier or person may cause or conduct, contract for, or authorize any activity which causes accelerated erosion or sediment damage within the City of Helena.

Failure of any land occupier to follow the Best Management Practices may be considered only as evidence to show that the land occupier is causing or has caused accelerated erosion or sediment damage; compliance with selected Best Management Practices or practices which the City Engineer deems appropriate is required when the City Engineer determines that a violation of these standards exists.

Any person planning to engage in construction/subdivision activities shall submit an erosion and sediment control plan to the City Engineer for approval prior to any disturbance of land within the City of Helena City Limits.

Construction Activity Stormwater Permit

The permit shall contain, as a minimum, the following information:

- Name, address, and telephone number of the applicant;
- Topographic map showing location of the proposed activity;
- Soils information;
- Time schedule indicating the anticipated starting and completion dates of the development sequence and the estimated time of exposure for areas of soil disturbance prior to the completion of effective measures for erosion and sediment control.

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Executed copy of the state-standard Notice of Intent

Executed copy of the Stormwater Pollution Prevention Plan

4.7.4. Emergency Land Management Practices

No prior notification is required for emergency land management practices necessitated by and initiated during or immediately after fire, flood, windstorm, earthquake, structural failure or other catastrophic events. Within five days after commencement of such activity, the land occupier shall notify the City Engineer of the action with an explanation of why emergency action was necessary. Reasonable care must be taken to minimize soil disturbance and erosion during the conduct of emergency land management practices.

4.7.5. Liability

Neither the approval of a permit or any other action of the City of Helena under the provisions of these Standards shall relieve any person from the responsibility for damage to any person or property otherwise imposed by law, nor impose any liability upon the City of Helena or the City Engineer for damage to any person or property.

4.7.6. Minimum Requirements During Land Disturbing Activity

Land-disturbing activities shall require as a minimum that:

- Whenever feasible, as determined by the Public Works Department, ~~natural~~ existing vegetation shall be retained, protected, and supplemented.
- Stripping of vegetation, regrading and other development activities shall be conducted in such a manner so as to minimize erosion.
- Cut and fill operations must be kept to a minimum.
- Development plans must conform to topography and soil type so as to create the lowest practical erosion potential.
- The disturbed area and the duration of exposure to erosive elements shall be kept to a practicable minimum.
- Disturbed soil shall be stabilized as quickly as practicable.
- Temporary vegetation or mulching shall be employed to protect exposed critical areas during development.
- Permanent vegetation and structural erosion control measures must be installed as soon as practicable.
- To the extent necessary, sediment in run-off water must be trapped by the use of debris basins, sediment basins, silt traps, or similar measures until the disturbed area is stabilized.
- Adequate provisions must be provided to minimize damage from surface water to the cut face of excavations or the sloping surfaces of fills.
- Cuts and fills may not endanger adjoining property.

- Fills may not encroach upon natural water courses or constructed channels in a manner so as to adversely affect other property owners.
- Grading equipment must cross flowing streams by the means of bridges or culverts except when such methods are not feasible and provided, in any case, that such crossings are kept to a minimum.

Stormwater Pollution Prevention Plan The Stormwater Pollution Prevention Plan (SWPPP) shall follow the Montana DEQ SWPPP Form (MTR 100000) and shall include at least the following items:

- The nature of the construction activity, including a proposed time table for major activities.
- Estimates of the total area of the site, and all other sites if project is a phased development that is expected to undergo clearing, excavation, and/or grading.
- A site map indicating areas of total development and, as a minimum, all areas of soil disturbance, areas of cut and fill, drainage patterns and approximate slopes anticipated after major grading activities, areas used for the storage of soils or wastes, location of all erosion control facilities or structures and areas where vegetative practice are to be implemented, the location of impervious structures (including buildings, roads, parking lots, outdoor storage areas, and etc.) after construction is completed, springs, wetlands and other surface waters, and the boundary of 100 year flood plains, if determined.
- The nature of fill material to be used, the existing soils located at the site, and the characteristics of such soils. Soil surveys are good sources of soil characteristics. The Natural Resources Conservation Service, the Forest Service and the Bureau of Land Management produce soil surveys. If possible, include information on the soil series and/or mapping units found at the site.
- The names of the receiving water(s) and the size, type and location of each outfall or, if the discharge is to a municipal storm sewer, a letter of approval from the municipality which authorizes use of the storm sewer and the location of any storm sewer discharge to public waters.

The SWPP should contain a description of best management practices (BMPs) appropriate for the site, which shall be implemented to control erosion per the requirements in Section E of the DEQ SWPPP form. The following minimum components shall be addressed along with a schedule for implementation unless approved otherwise in writing by City of Helena City Engineer.

Visible or measurable erosion which leaves the construction site is prohibited. Visible or measurable erosion is defined as:

- Deposits of mud, dirt, sediment or similar material exceeding ½ cubic foot in volume in any area of 100 square feet or less on public or private streets, adjacent property, or into the storm and surface water system, either by direct deposit, dropping, discharge, or as a result of the action of erosion; or

- Evidence of concentrated flows of water over bare soils; turbid or sediment laden flows; or evidence of on-site erosion such as rivulets on bare soil slopes, where the flow of water is not filtered or captured on the site using the techniques in the approved erosion control plan; or
- Earth slides, mud flows, earth sloughing, or other earth movement which leaves the property.
- Measured turbidity greater than 5 NTUs above background turbidity.

NOTE: Under no condition shall sediment be discharged to surface waters or natural wetlands. Under no condition shall the sediment be washed into the storm sewers or drainageways.

Contractors also need to address controls for the pollutants addressed in the Stormwater Ordinance. These pollutants include but not limited to: oils, grease, paints, fuel (gasoline and diesel), concrete truck wash down areas, raw materials for manufacturing concrete (sand, aggregate, and cement), solvents, litter, debris and sanitary waste management.

4.7.7. Best Management Practices

Refer to the SEC Field Manual for information regarding sediment containment systems, outlet structures, using barriers to remove sediment, and sizing criteria for best management practices and Table 4-9.

4.7.8. Clearing and Grading Standards Notes

All c~~C~~learing & grading construction must be in accordance with City of Helena Erosion and Sediment Control Standard Details (4-7 and 4-8), Uniform Building Code, permit conditions, Montana Department of Environmental Quality permit, and all other applicable codes, ordinances, and standards. The design elements within these plans have been reviewed according to these requirements. Any Deviation from adopted erosion and sediment control standards is not allowed unless specifically approved by the City of Helena City Engineer prior to construction.

It shall be the sole responsibility of the applicant and the professional civil engineer to correct any error, omission, or variation from the above requirements found in these plans. All corrections shall be at no additional cost or liability to the City of Helena. All details for structural walls, rockeries over four feet in height, geogrid reinforced rockeries and geogrid reinforced modular block walls, must be stamped by a professional engineer and must receive a City of Helena building permit.

A copy of the approved plans must be on-site during construction. The applicant is responsible for obtaining any other required or related permits prior to beginning construction.

All location of existing utilities have been established by field survey or obtained from available records and should, therefore, be considered only approximate and not necessarily complete. It is the sole responsibility of the contractor to independently verify the accuracy of all utility locations and to discover and avoid any other utilities not shown which may be affected by the implementation of this plan.

The area to be cleared and graded must be flagged by the contractor and approved by the City Engineer prior to beginning any work on the site.

A reinforced silt fence must be installed and shall be located as shown on the approved plans or per the City Engineer, along slope contours and down slope form the building site.

A hard-surface construction access pad is required per Standard Detail 4-7 for commercial construction sites. This pad must remain in place until paving is installed.

Any excavated material removed from commercial construction site and deposited on property within city limits must be done in compliance with a valid clearing & grading permit. Locations for the mobilization area and stockpiled material must be approved by the City Engineer at least 48 hours in advance of any stockpiling.

To reduce the potential for erosion of exposed soils the following Best Management Practices (BMPs) are required.

Preserve natural vegetation for as long as possible or as required by the City Engineer.

Install catch basin inserts as required by the City Engineer or permit conditions of approval.

Install a temporary sediment pond, a series of sedimentation tanks, temporary filter vaults, or other sediment control facilities. Installation of exposed aggregate surfaces requires a separate effluent collection pond onsite.

Contractor shall be responsible for cleanup of mud and debris tracked on to city streets.

Turbidity monitoring may be required as a condition of clearing and grading permit approval. If required, turbidity monitoring must be performed in accordance with an approved turbidity monitoring plan and as directed by the City Engineer. Monitoring must continue during site (earthwork) construction until the final sign-off by the City Engineer.

References

- HEC-22 FHWA Urban Drainage Design Manual
- Montana Public Works Standards Specifications
- Montana Department of Transportation Model Drainage Manual
- NOAA Atlas 2, Montana Precipitation Isopluvials
- City of Bellevue, Washington Engineering Standards
- City of Boise Stormwater Design Standards
- Eastern Washington Drainage Design Manual
- King County Surface Water Design Manual
- US Department of Defense Unified Facilities Criteria UFC 3-210-10 – Design: Low Impact Development Manual

- US Environmental Protection Agency Post-Construction Stormwater Management in New Development and Redevelopment website -

Table 4-9. Guide to Mulch Materials, Rates and Use

Mulch Material	Quality Standards	Application/1000 sf	Application/acre	Depth of Application	Remarks
Gravel, slag, or crushed stone	Washed, ¾" – 1-1/2 size		9 cu yds		For short slopes and around woody plants & ornamentals. Use where subject to foot traffic. Approx. 2,000 lb/cu yd
Hay or straw	Air dried, free from unwanted seeds &coarse material	75-100 lbs. or 2-3 bales	1-1/2 to 2-1/2 tons or 90-120 bales		Use where the mulching effect is to be maintained for less than 3 months. Anchor by crimping, covering with netting, spraying with tackifier and/or kept moist.
Plastic sheeting	Minimum 6-mil thickness				Anchor with sandbags or tires on 10-foot grid in all dirctions. Overlap edges.
Jute mat, woven straw blanket, synthetic fiber blanket	N/A	N/A			Use on slopes greater than 2:1 in addition to hydroseed or wood fiber with tackifier.
Wood fiber cellulose (partially digested wood fibers)	Dyed green should not contain growth inhibiting factors.	25-30 lbs.	1,000-1,500 lbs.		If used on critical areas, or steep slopes, double the normal application rate. Apply w/hydromulcher. No tie-down required.
Wood fiber applied with hydroseeding or alone		1.25 tons per acre			Use 90 gal/acre tackifier for slopes less than 2:1, 120 gal/acre for steeper than 2:1.
Bark chips				Minimum of 2 in. depth	Do not use on slopes steeper than 6%.
Wood chips (hog fuel)	Treat with 12 lbs. nitrogen fertilizer per ton			Minimum of 2 in. depth	Don not use on slopes steeper than 15%.
Hydroseed	Use mix recommended by City of Helena or State of Montana Department of Transportation.				Use MDT slope mix required on all 2:1 or steeper slopes after October 1.

All mulches will provide some degree of (1) erosion control, (2) moisture conservation, (3) weed control, and (4) reduction of soil crusting.

5. TRANSPORTATION STANDARDS

5.1. OVERVIEW

5.1.1. Purpose

It is the purpose of this section to establish minimum standards for public and private transportation facilities for vehicles, public transit, pedestrians, and bicycles, here~~in~~after constructed or improved as a condition of City approval of a development, or a transportation project constructed by the City of Helena. These standards are intended to implement Helena's Growth Policy ~~preserve our community's quality of life~~ and to minimize total costs over the life of the transportation system.

5.1.2. Definitions

Work and phrases in these standards have the same general meaning as those contained in the City of Helena Subdivision Regulations, the Zoning Ordinance of the City of Helena, and the Montana Public Works Standard Specifications (MPWSS). If terms are conflicting or unclear, the City Engineer will clarify the meaning and intent. These standards may be modified for exceptional cases if approved by the City Engineer, or if the City Commission authorizes a variance.

5.1.3. Functional Classifications – Purpose

The purpose of a functional classification system for city roads is to define varying levels and types of transportation infrastructure and to provide for the safe and efficient movement of people and goods, while at the same time preserving residential areas and maintaining the economic vitality of commercial and industrial areas. The system classifies transportation facilities as either urban or rural roads. Within urban roads, they are further divided into arterials, collectors or local roads.

Existing and proposed functional classification are as delineated in the most recent update of the Greater Helena Area Transportation Plan.

5.1.4. Functional Classifications – Urban Roads

Urban roads are classified as outlined below:

Major Arterial: The basic element of the City's road system. All other functional classifications supplement the major arterial network. Access to a Major arterial is generally limited to intersections with other major arterials or to the interstate system. Direct access is minimal and controlled. The purpose of a major arterial is to serve the major centers of activity, the highest traffic volume corridors, and the longest trip distances in an urbanized area. This classification of roads carries a high proportion of the total traffic within an urban area. The intended function is to provide for the expedient movement of traffic. Posted speed limits on major arterials typically range from 25 mph to 70 mph and typically carry greater than 15,000 vehicles per day.

Minor Arterial: Interconnects with and augments the Major arterial system. It also provides access to lower classifications of roads on the system and may allow for traffic to directly access destinations. They provide for movement within sub-areas of the city, whose boundaries are largely defined by the Major arterial road system. They serve through traffic, while at the same time provide direct access for commercial, industrial,

office and multifamily development but, generally, not for single-family residential properties. The purpose of this classification of road is to increase traffic mobility by connecting to both the Major arterial system and also providing access to adjacent land uses. Posted speed limits on minor arterials typically range from 25 mph to 55 mph and can carry between 5,000 and 15,000 vehicles per day.

Major Collector: Provides for land access and traffic circulation within and between residential neighborhoods, and commercial and industrial areas. It provides for the equal priority of the movement of traffic, coupled with access to residential, business and industrial areas. A collector roadway may at times traverse residential neighborhoods. Posted speed limits on collectors typically range from 25 mph to 45 mph and can carry ~~between 3,500~~between 3,500 and 5,000 vehicles per day.

Minor Collector: Provides for land access and traffic circulation within and between residential neighborhoods, and commercial and industrial areas~~ but to not have continuity through the subdivision~~. Future growth of the City outside the subdivision will have limited use of the roadway. It provides for the equal priority of the movement of traffic, coupled with access to residential, business and industrial areas. ~~-~~Posted speed limits on collectors typically range from 25 mph to 45 mph and can carry between 1,500 and 3,500 vehicles per day.

Local: Comprises all facilities not included in the higher systems. Its primary purpose is to permit direct access to abutting lands and connections to higher systems. Usually through-traffic movements are intentionally discouraged. Posted speed limits on local roads typically range from 25 mph to 35 mph and designed for less than 1,500 vehicles per day. All local streets must be designed to discourage speeds greater then 25 MPH with the use of the appropriate traffic calming measures.

5.2. TRANSPORTATION DESIGN STANDARDS

5.2.1. Roadway Design & Technical Criteria

This section sets forth the minimum design and technical criteria to be used in the preparation of all roadway plans. All roadway plans should be designed in conformance with MPWSS, the Americans with Disabilities Act (ADA), and applicable City of Helena ordinances and policies.

5.2.2. Sidewalks/Curb and Gutters

Roadway typical sections shall be as shown on the exhibits attached in "Appendix B" of this document. Deviations from these typical sections shall be made on a case-by-case basis and only after thorough review by the City Engineer and may require City Commission approval.

Concrete sidewalks or an asphalt multi-use path shall be constructed on both sides of all roadways unless otherwise approved by action of the City Commission.

Sidewalks shall be 6-inches thick across driveways and 4-inches thick elsewhere.

All sidewalks shall ~~have a~~be a minimum width of five (5) feet ~~along local roads~~. All multi-use paths shall be 10-feet wide.

Integral curb and gutter shall be used on all roadways. A minimum of 1½ inches fall from the lip of the gutter to the bottom of the gutter. The pavement must be installed between one-eighth (1/8) inch to one-quarter (1/4) inch above the gutter lip.

Pedestrian ramps shall be installed at all intersections and at certain mid-block locations for all new construction or reconstruction of curb and sidewalk. Pedestrian ramps shall be constructed in accordance with MPWSS and the Americans with Disabilities Act (ADA) requirements at the time of construction. Pedestrian ADA ramps must have a detailed design on the plans showing that all ADA requirements are met.

Guardrails may be required in certain situations adjacent to sidewalk. Guardrails shall be designed and constructed in accordance with the current American Association of State Highway and Transportation Officials (AASHTO) standards or as directed by the City Engineer.

5.2.3. Bicycle Facilities and Multi-Use Paths

The arrangement, type, and location of all bicycle paths, trails, and routes shall conform with the most recent update of the Greater Helena Area Transportation Plan. All new construction shall conform to the standards for bicycle lane facilities detailed herein and the AASHTO Guide for the Development of Bicycle Facilities. Bike lanes are required on all major collector or higher classified street, unless specifically excluded in the Greater Helena Transportation Plan or other commission approved non-motorized plan. For minor collector or lesser classified street, bike lanes will be discouraged unless indentified by the Great Helena Transportation Plan or other commission approved non-motorized plan.

On-Street Bike Lanes (Without On-Street Parking): Bicycle lanes on streets without on-street parking shall be at least five (5) feet wide, exclusive of the gutter pan. On existing streets where on-street bike lanes are being added and available right-of-way or improvement space is restricted, the width of the bicycle lane may be reduced to at least five (5) feet wide, inclusive of the gutter pan.

On-Street Bike Lanes (With On-Street Parking): Bicycle lanes on new and existing streets shall be at least five (5) feet wide, exclusive of the parking lane.

Multi-Use Paths or Trails: Multi-use paths or trails shall be at least ten (10) feet wide with an inside edge radius of at least fifteen (15) feet. The minimum asphalt pavement thickness shall be three (3) inches with a minimum of six (6) inches of high quality untreated aggregate base.

5.2.4. Driveway Standards – Curb Cut Requirements

Driveways along public and private roadways shall comply with the existing driveway and curb cut requirements as set forth under City of Helena Ordinance 1937. The purpose of this ordinance is to standardize, regulate and control the location, size, type, construction, maintenance and quantity of curb cuts, driveway aprons and sidewalk driveway crossings in the City of Helena from the standpoint of proper design, safe and efficient entry to and exit from City streets to private property, safety of vehicular traffic in the streets, and safety of pedestrian traffic on the sidewalk area.

5.2.5. Horizontal Alignment

Turning Radius: All roadways shall intersect at right angles as nearly as possible, with no roadways intersecting at an angle less than seventy five (75) degrees.

Curb Return Radius: Minimum curb returns shall be as shown in Table 5-1. A larger radius may be used with the approval of the City Engineer.

Design Speed: Design speed shall be as shown in Table 5.2. The design speed is typically higher then or equal to the posted speed limit. The design speed determines various geometric design features of roadways. In an urban area with a gridded transportation system the design speed is not a major factor because of the closely spaced intersections and mainly determines sight distance and turning radiuses.

Horizontal Curves: The minimum centerline radius for horizontal curves shall be as shown in Table 5.2. Variances from the requirements of Table 5.2 for local streets only may be considered on a case-by-case basis.

Table 5-1: Curb Return Radius at Intersections*

Street Classification	Local (ft)	Collector (ft)	Minor Arterial (ft)	Principal Arterial (ft)
Local	15	15	15	15
Collector	15	25	25	25
Minor Arterial	15	25	**	**
Major Arterial	15	25	**	**

* Measured from top back of curb
** Per AASHTO standards

Two streets meeting a third street from opposite sides shall meet at the same point, or their centerlines shall be off-set at least one hundred twenty five (125) feet.

Super-elevation: Super-elevation may be required for arterial roadways and selected collector roadways. Horizontal curve radius and super-elevation shall be in accordance with the recommendations of AASHTO. Super-elevation shall not be used on local roadways.

Spiral Curves: Spiral curves shall not be used on roadways within the City of Helena (State Highways excluded) except by written approval of the City Engineer.

Railroad Crossing: All railroad crossings on streets shall be concrete for the full width of the roadway.

Barricades: Wherever roadways terminate due to project phasing, subdivision boundaries, etc., barricades are required in accordance with the Manual of Uniform Traffic Control Devices (MUTCD) and City standards.

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Table 5-2: Alignment Controls

Street Type	Arterial		Collector		Local	
Terrain*	**Principal**	**Minor**	**Ordinary**	**~~Mountainous~~**	**Ordinary**	**~~Mountainous~~**
Centerline radius on curves (Min.)	**	**	300’	~~150’~~	150’	~~150’~~
Tangent length between reverse curves	**	**	100’	~~50’~~	50’	~~N/A~~
Stopping sight distance	**	**	360’	~~305’~~	200’	~~155’~~
Angle at intersection centerline	**	**	>75°	~~>75°~~	>75°	~~>75°~~
Length of tangent at intersection	**	**	150’	~~100’~~	100’	~~50’~~
Cul-de-sac length	N/A	N/A	N/A	~~N/A~~	~~700’~~600’	~~700’~~600’
Cul-de-sac right-of-way radius	N/A	N/A	N/A	~~N/A~~	55’	~~55’~~
Max. grade	10%	10%	10%	~~10%~~	10%	~~10%~~
Min. grade	**	**	0.5%	~~0.5%~~	0.5%	~~0.5%~~
Maximum grade within 75’ of intersection centerline	**	**	4%	~~4%~~	4%	~~4%~~
Design speed (mph)	50	45	45	~~40~~	~~30~~25	~~25~~
K Factor (min)						
Crest	**	**	79	~~44~~	19	~~12~~
Sag	**	**	61	~~64~~	37	~~26~~
Min. VCL						
Crest	**	**	90	~~90~~	50	~~50~~
Sag	**	**	70	~~70~~	50	~~50~~

* Mountainous terrain is defined as terrain which has a cross slope exceeding 15%.
** All design criteria shall be to AASHTO standards.

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5.2.6. Vertical Alignment

Permissible Roadway Grades: The minimum allowable grade for any roadway (or alley) is one-half (0.5) percent. The maximum allowable grade for any roadway is ten (10) percent per City Ordinance. The maximum grade for an alley is subject to the approval of the City Engineer.

Changing Grades: Continuous grade changes, or "roller-coastering", shall not be permitted. The use of grade breaks in lieu of vertical curves is not encouraged. Where the algebraic difference in grade (A) exceeds one percent (1.0%), a vertical curve is to be used.

Vertical Curves: All vertical curves shall be symmetrical. Design criteria for vertical curves are found in Table 5-2. The minimum grade within a sag (sump) vertical curve is one-half (0.5) percent. Minimum length of a vertical curve is shown in Table 5-2. All vertical curves shall be labeled, in the profile, with length of curve (L) and K (=L/A).

Intersections: The following additional criteria shall apply at intersections.

The grade of the "through" street shall take precedence at intersections. At intersections of roadways with the same classifications, the more important roadway, as determined by the City Engineer, shall have this precedence. Side streets shall be warped to match through streets.

The elevation at the point of tangency (PT) of the curb return on the through street is always set by the grade of the through street in conjunction with normal pavement cross slope.

Carrying the crown of the side street into the intersecting through street is not permitted.

At an arterial-arterial intersection, a more detailed review on the entire intersection's drive ability shall be performed by the designer and submitted for review and approval.

Curb Returns: Minimum fall around curb returns, when turning water, shall be three-tenths (0.3) of a foot for a fifteen (15) foot radius; four-tenths (0.4) of a foot for a twenty (20) foot radius; and one-half (0.5) of a foot for a twenty-five (25) foot radius. For all other curb return radii use a grade of one and one-quarter (1.25) percent within the return to establish minimum fall when turning water. The maximum fall around a curb return is four (4.00) percent. Show and label high point location, elevation and intersection of flow line in plan view, if applicable.

Connection with Existing Roadways: Connections with existing roadways shall be smooth transitions conforming to normal vertical curve criteria if the algebraic difference in grade (A) between the existing and proposed grade exceeds one (1.0) percent. When a vertical curve is used to make this transition, it shall be fully accomplished prior to the connection with the existing improvement. Field-verified slope and elevation of existing roadways shall be shown on the plans.

Offsite Design and Construction: The design grade, and existing ground at that design grade, of all roadways that dead end due to project phasing, subdivision boundaries, etc., shall be continued in the same plan and profile as the proposed design for at least five hundred (500) feet or to its intersection with an arterial roadway. This limit shall be extended to one thousand (1,000) feet when arterial roadways are being designed. If the offsite roadway adjacent to the proposed development is not fully improved, the developer is responsible for the design and construction of a transition with a four (4) foot road base shoulder for the safe conveyance of traffic from the improved section to the existing roadway. The following formula shall be applied to the taper or lane change necessary for this transition:

Speed Limit

40 MPH or Less $L = WS^2 / 60$

45 MPH or Greater $L = W \times S$

where:

L = length of transition in feet

W = width of offset in feet

S = speed limit or 85^{th} percentile speed (whichever is greater)

The City of Helena Engineering Department should be consulted for any unusual transition conditions. Grade breaks greater than one (1.0) percent are not allowed when matching existing dirt or gravel streets.

The cost of offsite pavement transitions shall be borne by the developer.

5.2.7. Sight Distance

Public and private roadways shall comply with the existing sight distance requirements as set forth under City of Helena Ordinance 2703. The intent and purpose of this ordinance is to reduce potential traffic accidents by evaluating and maintaining adequate visibility at intersection corners. Sight obstructions at intersections are a major contributing factor to traffic accidents. Sight obstructions are defined as anything that obstructs a driver's clear zone of visibility (i.e. bushes, shrubs, trees, fences, hedges, etc.).

5.2.8. Median Treatment

Median curbs should be integral curb and gutter (with spill curb) unless otherwise approved. Medians less than eight (8) feet wide should be capped with M-4000 concrete a minimum of three (3) inches thick. Wider medians should be topsoiled and seeded with an approved seed mix. The minimum median width is 4 feet. All medians or raised islands should be made clearly visible at night through the use of adequate reflectorization and/or illumination. Flexible delineators shall be placed at the beginning and end of all medians, and at the point of any horizontal alignment change. All median curbs shall be painted yellow.

5.2.9. Roadway Drainage

Drainage systems shall be designed in accordance with Section 4 of this document. Development plans, including a drainage report, for the drainage system are required for concurrent review with, and shall be considered a part thereof, of the roadway design.

Crosspans: Crosspans (valley gutters) shall be constructed in accordance with MPWSS. Crosspans are not allowed across collector or arterial roadways. Crosspans may be used parallel with collector or arterial roadways to convey storm runoff across residential roadways. Crosspans are required for storm water control at intersections where a storm water system is not accessible.

Inlets: Inlets shall be located to intercept the major curb flow at the point curb flow capacity is exceeded by the storm runoff. Inlets should be aligned with lot lines wherever possible.

Inlets shall also be installed to intercept cross-pavement flows at points of transition in super elevation. Due to the presence of pedestrian ramps, inlets are not allowed in the curb return, but will be located at the tangent points of the curb return.

Cross Slope: Except at intersections, or where super-elevation is required, roadways shall be level from top of curb to top of curb and shall have a three (3.0) percent crown for all streets with a grade less then or equal to six (6.0) percent. On streets where the grade exceeds six (6.0) percent a two (2.0) percent crown will be allowed. The cross slope will be measured from centerline to lip of curb, or lip of median curb to lip of outside curb on roadways with raised center islands. Parabolic or curve crowns are not allowed. Maximum pavement cross slope allowed is five (5.0) percent at warped intersections, as measured above. In no case shall the pavement cross slope at warped intersections exceed the grade of the through street. When warping side streets at intersections, the crown transition should be completed within seventy-five (75) feet horizontally for local streets, one hundred (100) feet horizontally for collector streets, and one hundred fifty (150) feet horizontally for arterial streets. Quarter crowing may be accepted on a case by case basis needing prior approval from the City Engineer.

Temporary Erosion Control: Temporary erosion control is required at the ends of all roadways that are not completed due to project phasing, subdivision boundaries, etc. Prevention of erosion at the roadway terminus shall be by methods approved by the City Engineer.

Sidewalk Chases: Stormwaters from concentrated points of discharge shall not be allowed to flow over sidewalks, but shall drain to the roadway by the use of chase sections. The use of sidewalk chases is discouraged, and their use is limited to situations where it is not possible to use standard storm inlets and piping.

Chase sections shall not be located within a curb cut of a driveway. Chase sections shall be identified by station and elevation.

5.2.10. Roadway Specifications

Pavement Thickness: Pavement thickness design must be completed for all new or reconstructed roadways and shall be based on the current AASHTO Guide for Design of Pavement Structures, or the current Asphalt Institute Manual Series No. 1 (MS-1) for thickness design. The Pavement Design Report, based upon specific site soil data and design year traffic loading conditions, shall be prepared by a Professional Engineer, or other qualified professional approved by the City Engineer, and submitted to the City Engineer along with the plans and specifications for the project. The design shall be based on at least a twenty (20) year performance period traffic volume; however, the minimum design lane eighteen thousand (18,000) lb Equivalent Single Axle Load (ESAL) used in the pavement design shall not be less than fifty thousand (50,000) lb ESAL. The minimum asphalt pavement thickness for any new roadway shall be three (3) inches. A minimum of six (6) inches of high quality untreated aggregate base shall be provided for designs utilizing asphalt pavement over untreated aggregate base. Where full depth asphalt is designed, an adequate stabilizer lift shall be included, consistent with unpaved roadway design practices, to provide a suitable sub-base capable of withstanding the traffic required for the initial construction of the roadway.

Utility Trenches: Utility trenches, which include water and sewer services, cut through asphalt newer thaen ten (10) years shall be saw cut the entire width of the ~~road~~ street and back filled with flowable fill material, complying with the requirements of Flowable Fill contained in the MPWSS, or compacted screened fractured ¾" gravel with approval from the City Engineering Department . The intent is to protect the integrity of the roadway riding surface and eliminate the potential for roadway failure due to failure of trench backfill material under a roadway.

Utility trenches on existing collector or higher classified streets shall be back filled with flowable fill and capped with either asphalt or concrete slurry (2 Sack) on the same day as the completion of the street opening.

When flowable fill is required but not available, compacted screened fractured ¾" gravel can be used with approval from the City Engineering Department.

Prior to any street opening an application with a traffic control plan shall be submitted to the City Engineering Department for review and approval. All street openings shall be for a maximum of 24-hours, unless there is written approval from the City Engineering Department. On collector of higher classified streets the street opening will be limited to 8:30 AM to 4:30 PM, if a multiday closure is required the trench shall be backfill each night, so the street can be open to traffic after 4:30 PM and not closed again until 8:30 AM.

All patches shall be a minimum of 6" of compacted road mix capped a minimum of compacted ¾" hot mix asphalt patch.

For temporary patches, when hot mix asphalt is not available, shall be a minimum of 6" of compacted road mix capped with a minimum of 6" of 2 sack concrete slurry. Cold mix asphalt can be used for on a case-by-case basis approved by the City Engineering Department. All temporary patches shall be replaced with hot mix asphalt as soon as hot mix asphalt is available.

All excavated materials (i.e., concrete, asphalt, dirt, rock, etc.) not suitable for back fill must be removed from the job site by the expiration of the permit In no case shall materials be placed to block access outside of signed closure or remain in the street or public right of way beyond the completion of the excavation work and removal of traffic control.

No tunneling under sidewalks, curb and gutter will be allowed. If the excavation extends under the curb, gutter, and sidewalk, the curb, gutter or sidewalk shall be removed at the closest joint past the extent of the trench.

All utility trenches, including the curb, gutter, and sidewalk, shall be warranted by the person or contractor requesting the street opening for two (2) years after acceptance by the public works department of the completed restoration to all portions of the right of way disturbed by the opening, including the road surface, curb and gutter, and sidewalk, and the proper disposal of all waste material.

~~All roadway plans that have a crossing of a utility transverse to the centerline of the roadway shall have a trench detail placed in the plans calling out for placement of flowable fill complying with the requirements of Flowable Fill, contained in the MPWSS.~~

5.2.11. Monumentation

Monuments in monument boxes shall be provided in new or reconstructed streets at all section corners, quarter corners, and sixteenth corners.

5.2.12. Complete Streets

All newly and reconstructed roadways shall be designed to accommodate and coordinate all modes of transportation, both motorized and non-motorized, and people of all ages and abilities. Complete street features include, but are not limited to, sidewalks, bicycle lanes, motor vehicle lanes, shared-use lanes and path, paved shoulders, street trees, landscaping, vegetative planting strips, curb and gutter, ADA curb ramps, crosswalks, refuge islands, pedestrian and traffic signals, directional signs, street furniture, bicycle parking facilities, public transportation stops and facilities, transit priority signalization, traffic calming devices such as rotary circles and curb bulb-outs, and surface treatments such as paving blocks, textures asphalt, and concrete, narrow vehicle lanes, raised medians, and dedicated transit lanes. All designs must be in ~~complaisance~~ compliance with City of Helena Resolution No. 19799.

5.3. RIGHT-OF-WAY STANDARDS

The typical roadway sections shown in "Appendix B" identify the minimum amount of right-of-way that ~~is~~ maybe necessary to accommodate full build-out of each type of facility. The Right-of-Way for new streets will be determined by the traffic study for the development along with all the relevant planning documents for the City of Helena that include but not limited to the Greater Helena Transportation Plan, Transit Plan, and Non-Motorized Pedestrian and Bike Route Plan. The features needed to for a street to be considered a complete street are listed in Table 5-3 of this section. Each road classification has a list of complete street features that must be considered and may or may not be required according to the discretion of city staff or the city commission. The complete street check list must be completed for each street. All ~~l~~local streets maybe considered with one checklist as one as long as all features ~~are~~ included in the typical section including on-street parking are the same.

5.3.1 Existing ROW Hierarchy

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Although many existing roads within the City of Helena do not have the necessary right-of-way based on these standards, it shall be the policy of the City of Helena to attain the desired right-of-way widths on all new roadway and development projects. For existing ROW, the street shall be designed for a complete street. ~~h~~However if the ROW(**for existing streets Only**) is narrower then what is required and additional ROW can ~~not~~ be ~~attained~~ obtained the following list will set the hierarchy of which complete street features may be ~~except~~ exempt from ~~the~~ installation or the minimum set width ~~or from installation~~:

1. The Boulevard can be narrowed to not less then 4-feet for ~~local street~~Local Street and 5-feet for every other classification.

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2. ~~Eliminate o~~On-street parking on one or both sides of the street can be eliminated.
3. For collector and arterial streets the lane can be ~~neared~~ narrowed to 10-feet which includes the center turning lanes.

4. For collector and arterial streets the bike lane ~~shall~~ can be eliminated.

5. The boulevard can be completely eliminated. Commission Approval Required

6. Sidewalk on one side of the street can be eliminated. – Commission Approval Required

7. The minimum ROW widths for existing street will be evaluated on a case-by-case basis.

Table 5-3 Complete Street Component Matrix (minimum widths)

Street Feature	Local	Minor Collector	Major Collector	Minor Arterial	Major Arterial
Driving Lanes	*10' (2 lanes min.)	11' (2 lanes min.)	11' (2 lanes min.)	12' (2 lanes min.)	12' (4 lanes min.)
Sidewalk	10' (5' Each Side)	10' (5' Each Side)	10' (5' Each Side)	10' (5' Each Side)	10' (5' Each Side)
Bike/Ped Path (can replace sidewalks on one side) if required by the Greater Helena Trans Plan or proposed in the subdivision master plan	10' (5' additional each side of the street that the path replaces the sidewalk)	10' (5' additional each side of the street that the path replaces the sidewalk)	10' (5' additional each side of the street that the path replaces the sidewalk)	10' (5' additional each side of the street that the path replaces the sidewalk)	10' (5' additional each side of the street that the path replaces the sidewalk)
Curb and Cutter	4' (2' each side)	4' (2' each side)	4' (2' each side)	4' (2' each side)	4' (2' each side)
Buffer Strip	2' (1' each side behind sidewalk)	2' (1' each side behind sidewalk)	2' (1' each side behind sidewalk)	2' (1' each side behind sidewalk)	2' (1' each side behind sidewalk)
Parking Lane	12' (6' each side)	12' (6' each side)	12' (6' each side)	12' (6' each side)	12' (6' each side)
Bike lane			10' (5' each side)	10' (5' each side)	10' (5' each side)
Designated Share the Road Bike Route with sharrows and/or signs		4' (2' each side for wider travel lane) - if used in place of the Bike Lane	~~4' (2' each side for wider travel lane) - if used in place of the Bike Lane~~		
Boulevard	14' (7' each side)	14' (7' each side)	14' (7' each side)	14' (7' each side)	20' (10' each side)
Utility Corridor - for electric, phone, and cable- if not placed under sidewalk or street	4'	4'	4'	4'	4'
Bus Lanes				12'	12'
Bus Stops	8'	8'	8'	8'	8'
Center Medians				4' min.	4' min.
Center Turn Lanes			~~12'~~-11'	12'	12'
Storm Water Elements	Varies - if proposed by developer	Varies - if proposed by developer	Varies - if proposed by developer	Varies - if proposed by developer	Varies - if proposed by developer
Traffic Calming	Additional ROW maybe needed	Additional ROW maybe needed	Additional ROW maybe needed	Additional ROW maybe needed	Additional ROW maybe needed

At a minimum each side must have at least a sidewalk or Bike/Ped Path
All Streets must accommodate the complete streets policy and be consistent with the Greater Helena Transportation Plan
*9-Foot Driving Lanes maybe allowed for Local Streets with justification consistent with AASHTO and ITE Standards

5.4. TRAFFIC CALMING

Traffic calming is defined as a "combination of mainly physical measures that reduce the negative effects of motor vehicle use, alter driver behavior, and improve conditions for non-motorized street users". In simple terms, traffic-calming techniques are typically aimed at lowering vehicle speeds, decreasing truck volumes, and/or reducing the amount of cut-through traffic in a given area. If applied properly, these techniques result in a more pleasant environment for pedestrians and bicyclist.

Traffic calming applied to roadway designs for new development should be evaluated on a case-by-case basis and if utilized should be appropriate for the intended function of each street or street segment. Streets designed to function as part of the major street system should be designed primarily to move traffic in an efficient, convenient, and safe manner. Local streets and residential collectors should be designed to provide access to properties while discouraging through-traffic and higher travel speeds that often accompany it. New street designs and developments should consider traffic calming strategies to reinforce the appropriate functions of the designed streets. These would include layout and connectivity of street systems and pedestrian/bicycle facilities, intersection treatments, and basic design standards for width, curvature, parking, and landscaping. Specific traffic calming features which are easily incorporated into the design phase include: entrance treatments; narrow streets; short block lengths; small corner radii; surface valley gutters; "T" intersections; roundabouts; and landscaping to create a "closed-in" environment.

For existing facilities, the City has adopted a Traffic Calming Program which outlines the steps necessary to install traffic calming techniques, where appropriate, in response to neighborhood requests for assistance with traffic concerns.

Refer to the most recent update of the Greater Helena Area Transportation Plan for a list and description of traffic calming techniques.

5.5. BRIDGES

The City of Helena requires bridges to be designed in accordance with current Montana Department of Transportation (MDT) standards for "on-system" bridges and the AASHTO Standard Specifications for Highway Bridges for "off-system" bridges. At a minimum, the information to be included in a set of bridge design plans is summarized in this section.

5.5.1. Bridge Plans Sheet Sequence:

Title Sheet/Quantities Sheet;

General Layout of Structure Sheet;

Footing Plan Sheet;

Bent/Pier Sheet (by Bent Number);

Erection Plan Sheet;

Slab Detail Sheet;

Beam/Girder Sheet;

Detail Sheets (Camber, Splice Details, Diaphragm Details, Shoe/Joint Details, Barrier Rail); and

Standards Drawing Sheet.

5.5.2. Bridge Details & Detail Sheets

A complete set of bridge plans includes sufficient information for the contractor to successfully bid and complete the structural scope of the project. Details which are required to be included on plan sheets for projects within the City of Helena are as found in Chapter 5 of the MDT Structures Manual (Volume I). Any additional details that the bridge designer wants to include to supplement those listed in Chapter 5 of the MDT Structures Manual (Volume I) will be accepted.

All "on-system" bridge plans will be sent to the Montana Department of Transportation Bridge Bureau for their concurrent review of the project.

5.6. UTILITY CORRIDORS WITHIN NEW SUBDVISIONS OR UNDEVELOPED ANNEXATIONS

All new utility installations within the public ROW requires written approval from the City prior to installation, so as to assure that the new utilities do not incommode or endanger the public in the use of the street in accordance with MCA 69-4-101

All new utilities shall be placed underground except where underground installation is not feasible as defined in MCA 69-4-102(2). Transformers and junction boxes maybe installed above ground in locations approved by the City.

All new ~~U~~underground utilities~~, if~~ installed parallel to City owned utilities within~~placed within~~ the public street right-of-way ~~,~~ shall be located ~~at~~ horizontally at least ~~ten~~ five feet away from ~~any~~ the ~~public~~city ~~utilit~~owned utilities~~y~~. If 5-feet can not be maintained the utility must apply to the City Engineering Department for a deviation.

Utilities shall not be installed in street boulevards except above ground features such as Light Poles, Residential Transformers, and Secondary Pedestals, along with the associated wiring for these features, may be allowed providing that the placement of the these features will not interfere with the planting, growth, and care of boulevard trees or impede traffic sight ~~and are not allowed in street boulevards except as installed in perpendicular~~distance. Perpendicular crossings of the boulevard may be allowed if placed in such a manner not to prohibit the planting of boulevard. All utilities that are less the 4.5 feet in depth are encouraged to be installed in protective conduit whenever ~~greater than 4.5 feet in depth~~possible. ~~.~~ The protective conduit will allow for the maintenance and replacement of the utility without damaging any boulevard trees.~~Perpendicular crossings may be allowed less than 4.5 feet in depth but no less than 1.5 feet when such utility is installed in a protective conduit. The utilities must be placed in such a manor to not prohibit the installation of boulevard trees. Such underground facilities shall be installed after the street has been brought to grade and before it is surfaced, to eliminate the necessity for disturbing such surfacing for the connection of individual services.~~
All utilities shall be installed at the required depth relative to the finished grade of the finished surface.

As part of any subdivision or development involving the extension of City Utilities, the subdivider or developer shall provide engineered plans for all utilities including gas, power, phone, fiber, etc. on the infrastructure plans for review and approval. All applicable laws, rules and regulations of appropriate regulatory authority having jurisdiction over such facilities shall be observed.

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~~All utility plans must be submitted to the City for review and approval. If the utilities are part of a new subdivision, all the utilities shall be shown and designed as part of the infrastructure plans. All applicable laws, rules and regulations of appropriate regulatory authority having jurisdiction over such facilities shall be observed.~~

For new subdivision or location where the streets are less then 10 years old and ~~If~~ television, telephone, power, or natural gas ~~is~~ has not been installed ~~at the time of a development~~, provisions shall be made for installation ~~at a later date~~ without the cutting of paved roadways ~~and the plans must be submitted to the City for review and approval prior to installation~~.

Repairs to existing utilities shall follow the street opening process of the City of Helena and all requirements in Section 5.2.10 of this document.

5.7. LANDSCAPING REQUIREMENTS

Landscaping requirements shall comply with the requirements as set forth under the existing City of Helena Ordinance 2359. The intent of this ordinance is to enhance, conserve and stabilize property values and the roadside environment by encouraging pleasant and attractive surroundings; encourage preservation of existing trees on proposed building sites and along roadways; and contribute to the relief of heat, noise, wind and glare through the proper placement of living plants and trees.

5.8. TRAFFIC IMPACT STUDIES

Private or public developments which contribute two hundred (200) or more vehicle trips per day~~s~~ to the City Street System shall have a Traffic Impact Study completed by an Engineer with adequate experience and expertise in transportation engineering. Such study shall indicate the expected increase in traffic movements on the existing roadways serving the development, and shall determine existing conditions on roadways to be impacted by the development.

The Traffic Impact Study should present an objective technical analysis in a straightforward and logical manner that leads the reviewer through the analytical process to the resulting conclusions and recommendations. Sufficient detail should be provided so that the reviewer is able to follow the path and methodology of the study. All assumptions should be clearly documented with published sources referenced as necessary. All Traffic Impact Studies shall be signed and stamped by a licensed Professional Engineer registered in the State of Montana.

At a minimum, the Traffic Impact Study should include the following information:

Introduction: Provide an introduction with an overview and discussion of the development proposal. Include a vicinity map detailing the property location, area of analysis, a conceptual site plan reflecting the boundaries of the development, and information detailing the designated zoning and physical features of the site and surrounding area.

Existing Conditions: Include a discussion about the existing transportation network, roadway geometrics, traffic data collection, crash analysis, existing Level of Service (LOS), and existing roadway capacity analysis. Also include a discussion about nearby land developments and known transportation improvements.

Future Conditions: Discuss the future transportation conditions for the anticipated date of project completion. Include ambient background traffic growth and anticipated future developments.

Proposed Condition: Discuss the proposed development characteristics and determine the number of anticipated trips and traffic distribution expected to occur as a result of the development. Provide a trip generation analysis to determine traffic attributable to the development using the most recent Institute of Transportation Engineering (ITE) Trip Generation Manual. Determine trip distribution and assignment to the roadway network using standard engineering practice and methodology contained in the ITE Trip Generation Manual. Assess the traffic impacts attributable to the development using the results from the trip generation and. Evaluate intersection LOS and roadway capacity analysis.

Recommendations: Provide recommendations to remedy deficiencies in the transportation network caused by impacts from the development. These recommendations shall include the Engineer's recommended location, nature and extent of proposed transportation improvements including bike and pedestrians -associated with the development to ensure safe and efficient roadway operations and capacity, and compatibility with City standards and goals of the Greater Helena Area Transportation Plan.

Conclusion: Include a conclusion that provides a clear and concise description of the study findings and Engineer's recommendations.

5.9. TRAFFIC SIGNAL REQUIREMENTS

The need for new traffic signals will be based on warrants contained in the MUTCD and on City policies. In determining the location of a new signal, safety and community traffic circulation and progression will be the primary considerations.

The City of Helena requires traffic signal design and plans to be completed in accordance with current MDT standards as contained in Part II (Electrical) of the MDT Traffic Engineering Manual. The information to be included on these plans is summarized in this section.

5.9.1. Electrical Plans Sheet Sequence:

Title Sheet (if stand-alone traffic signal project);

Table of Contents Sheet (if stand-alone traffic signal project);

Electrical Quantity Summary Sheet;

Electrical Detail Sheets; and

Plan Sheets.

5.9.2. Electrical Details and Detail Sheets

A complete set of electrical plans includes sufficient information for the contractor to successfully bid and complete the electrical scope of the project. Details which are required to be included on plan sheets for projects within the City of Helena include:

- Schedules for signal and luminaire poles, conduit & wire, and loop detectors;
- Service wiring diagrams for signals, controllers and luminaries;
- Conduit installation and underground service wiring details;
- Pull box, pole base and watertight connection details;
- Details of photo-electric control installation and wiring;
- Signal and luminaire standard pole base and foundation details;
- Signal head and luminaire mounting and assembly details;
- Controller mounting, assembly, wiring, conversion and foundation details;
- Details of loop detector installation;
- Phasing detail and diagram; and
- Peak hour volume count diagrams.

Reference is made to Chapter 10 and Chapter 12 of the current MDT standards as contained in Part II (Electrical) of the MDT Traffic Engineering Manual for further information regarding specific components of the electrical details. All traffic signal plans will be sent to the MDT Traffic Bureau for their concurrent review of the project, regardless of it being on a MDT facility.

5.10. SIGNING AND PAVEMENT MARKING REQUIREMENTS

Street identification signs shall be installed at all new intersections in accordance with the MPWSS. All regulatory traffic control signs will be completed in accordance with the MUTCD. Stop signs shall be installed on local streets when they intersect with any collector or arterial streets.

All pavement markings shall be inlaid thermoplastic (refer to MPWSS) for all crosswalks, stop bars, words & symbols, and at intersections. Roadway centerlines, bike lanes, and outside lane lines, away from major intersections, shall be epoxy paint (refer to MPWSS).

Crosswalk markings should not be used indiscriminately. An engineering study should be performed before crosswalks are installed at locations away from traffic signals or stop signs. Mid-block crosswalks are discouraged.

5.11. STREET LIGHTING REQUIREMENTS

Street lighting along public and private roadways shall comply with the existing lighting requirements as set forth under City Code. The purpose of this ordinance is to encourage lighting practices and systems which will minimize light pollution, glare, and light trespass;

conserve energy and resources while maintaining nighttime safety, utility, and security; and reverse the degradation of the nighttime visual environment.

5.12. WORK ZONE TRAFFIC CONTROL

A Traffic Control Plan must be submitted to the City Engineer at least seven (7) days before construction begins for all work within the public right-of-way. The location and description of all traffic control devices must be shown on the Traffic Control Plan. The plan must be approved by the Police Department, Fire Department and Public Works Department prior to beginning construction. If the required traffic control devices are not in place, the Contractor will not be allowed to begin work on the project. All traffic control devices shall be kept in place and maintained in good visible condition throughout the project. The City Engineer, or the Engineer's representative, reserves the right to reject any traffic control device observed to be in inferior condition. Emergency access to the work area shall be maintained at all times. The MUTCD and the MDT Guidelines for Work Zone Safety shall be followed to provide information for the safety of the public.

All barricades and obstructions shall be protected at night by suitable signal lights which shall be kept illuminated from sunset to sunrise. Barricades shall be of substantial construction and shall be constructed to increase their visibility at night. Suitable warning signs shall be placed and illuminated at night to show in advance where construction, barricades or detours exist.

5.13. GEOTECHNICAL/SLOPE STABILIZATION CONSIDERATIONS

Due to the varied topography encountered throughout the City of Helena, special geotechnical considerations are often needed in the design of the various roadway projects. Maximum slope requirements for Earth Cut slopes and Earth Fill slopes under normal design conditions are 3:1.

There may be special circumstances where 3:1 slopes may not be feasible, such as in areas of limited right-of-way or where extremely mountainous terrain is present. In those cases, alternate means of slope retention may be warranted. In cases where the above referenced standard slopes cannot be met, a geotechnical report will be required if different slopes are being proposed, or conversely if the use of retaining walls are being considered. All geotechnical reports shall be signed and stamped by a licensed Professional Engineer registered in the State of Montana. The geotechnical report shall contain the basic information as listed below:

A description of the soil types encountered at the site in question and their properties;

An assessment of soil slope stability;

Recommendations for non-standard slopes, based on properties and information collected during field data collection and subsequent analysis;

A copy of any boring logs made during the field exploration process; and

Copies of all design calculations, exhibits, and a description of the design methodology used to arrive at the recommended design.

If the geotechnical report proves that other slope stabilization measures are necessary, such as soil pinning or retaining wall structures, a more detailed analysis shall be submitted for

review to the City Engineers office. Possible retaining wall types that can be utilized in the City of Helena are reinforced concrete wall, mechanically stabilized earth (MSE) walls, and timber structure walls. The following shall be included in the geotechnical report:

Information on settlement characteristics of the soil (i.e. amount of settlement expected, time rate of settlement, surcharge or camber if required);

Information on bearing capacity of the soil;

Information on expected skin friction of the soil (if piles or drilled shafts will be utilized); and

Information on soil pressure, stability, and alternates (if a soil retaining wall is being considered).

In areas of excessive fill or steep back slopes, roadside guardrail may be needed. Guardrail needs shall be as determined by AASHTO.

5.14. ACCESS MANAGEMENT & CONTROL

It shall be the policy of the City of Helena to review all projects for access management and control measures during the review phase of a project. The City reserves the right to mandate certain access control feature implementation should it be in the best interest of the traveling public or the City's concerns.

Refer to the most recent update of the Greater Helena Area Transportation Plan for a list and description of access management techniques.

5.15. TRANSPORTATION DESIGN SPECIFICATIONS

5.15.1. Transportation Standard Specifications

The standards for the design of City of Helena roads and bridges shall consist of the following references, in addition to items discussed in this document:

- City of Helena Subdivision Regulations;
- City of Helena Zoning Ordinance;
- MDT Structures Manual (Volume I);
- Montana Public Works Standard Specifications (Latest Edition);
- Manual on Uniform Traffic Control Devices (Latest Edition);
- MDT Guidelines for Work Zone Safety;
- The Americans with Disabilities Act (ADA);
- AASHTO Guide for Design of Pavement Structures;
- Asphalt Institute Manual Series No. 1 (MS-1);
- AASHTO Roadside Design Guide;
- MDT Traffic Engineering Manual;

- AASHTO Standard Specifications for Highway Bridges;
- Greater Helena Area Transportation Plan (Latest Edition);
- AASHTO Geometric Design of Highways and Streets
- City of Helena Ordinance 1937;
- City of Helena Ordinance 2359;
- City of Helena Ordinance 2703; and
- City of Helena Ordinance 2889.

5.15.2. Construction Plan Requirements for Transportation and Utility Improvements

The applicant shall submit to the City Engineer plans and specifications for street and utility construction. At a minimum, the plans and specifications shall include a vicinity map, a plan and profile, typical sections, roadway cross sections, necessary details for construction, special provisions, reference to applicable MPWSS, and any project specific specifications. The submitted plans must be signed and stamped by a licensed Professional Engineer registered in the State of Montana.

At a minimum the plan view shall include the road alignment at a scale of not less than one (1) inch to fifty (50) feet (where less detail is required, a scale of one (1) inch to one hundred (100) feet may be approved by the City Engineer) showing the following information:

- Centerline stationing on all intersecting streets, with bearings on centerlines;
- Curve data on all horizontal curves;
- Right-of-way;
- Relevant topography;
- All Existing and proposed utility locations;
- Street names in the new development (if applicable);
- Typical roadway section, which include roadway features including bike lanes, if necessary, right-of-way, station limits and pavement section showing placement of utilities;
- Existing and proposed drainage and water quality appurtenances;
- Sidewalk or Multi Use Path locations;
- Floodplain and wetland boundaries (if applicable);
- Signalization and striping/signing;
- Sufficient topographic data on and adjacent to the site; and
- Any further information as may be required by the City Engineer.

At a minimum the profile view shall show the relevant original ground lines using the same stationing as in the plan, control elevations, grade line showing the proposed grades, vertical curves, all bench marks, the vertical datum, and such further information as may be reasonably required by the City Engineer. For new streets, the relevant original ground lines will show the ground line at centerline at a minimum and also at the edges of the right-of-way if grade differences are significant (or alternatively, surveyed contour lines on the plan view will be acceptable). In addition, top back of curb grades shall be superimposed in the profile view and labeled with the corresponding slope to ensure minimums are either met or exceeded. The profile lines for roads extending to the perimeter of any development shall be extended a minimum three hundred (300) feet beyond the perimeter to include any change in contours that would affect the profile of the extension of the proposed road.

Any required construction notes shall be shown or referenced on the plans.

The cover sheet of all plans shall include a statement identifying that the latest edition of MPWSS will apply to the project. Plan and profile must be shown on the same sheet, with profiles on the bottom half of the sheet. Accepted sheet sizes are both full size (24 inches by 36 inches) and half size (11 inches by 17 inches). A north arrow shall be shown on each plan view sheet of the plans and adjacent to any other drawing that is not oriented the same as other drawings on the sheet. All detail drawings shall be included in the drawing set. A title block shall appear on each sheet of the plan set and shall be placed in the lower right-hand corner of the sheet, across the bottom edge of the sheet or across the right-hand edge of the sheet. The title block shall include the name of the project, the engineering firm, the sheet title and the owner (if not shown in the first sheet).

5.15.3. Transportation Design Specifications

The typical roadway section shall be as shown on the typical exhibit sections included in "Appendix B". The roadway section used shall be detailed on the construction plans submitted for each new roadway or improvement to an existing roadway. Any deviations from the standard roadway typical section will require approval from the City Engineer.

The typical section shall show the width of the right-of-way, width of roadway, type and compacted depth of surfacing and paving materials, and such other dimensions as may be necessary or required. The location and width of sidewalks, walkways, curbs or curb and gutter shall also be shown, where applicable.

Alternate surface treatments may only be used upon approval of the City Engineer. The applicant shall supply the City Engineer with specifications for materials and application rates as part of the approval process.

5.15.4. Transportation Construction Specifications

No construction shall begin until plans have been approved by the City of Helena.

Temporary and permanent barricades shall conform to the standards contained in the MUTCD.

Type I or Type II barricades may be used when traffic is maintained through the area being constructed/reconstructed.

Type III barricades may be used when roadways and/or proposed future roadways are closed to traffic. Type III barricades may extend completely across the roadway (such as a fence) or from curb to curb. Where provision must be made for access of equipment and authorized vehicles, the Type III barricades may be provided with movable sections that can be closed when work is not in progress, or with indirect openings that will discourage public entry. When job site access is provided through the Type I barricades, the developer/contractor shall assure proper closure at the end of each working day.

In the general case, Type III permanent barricades shall be installed to close arterials or other through streets hazardous to traffic. They shall also be used to close off lanes where tapers are not sufficiently delineated.

Type III barricades shall be used at the end of a local street abruptly without cul-de-sac bulb or on temporarily stubbed off streets. Each barricade shall be used together with an end-of-road marker.

Barricades on dead-end streets that may be extended in the future will have a sign placed upon them, as approved by the City Engineer.

Appendix A – Checklists/Applications

SEC #_____ *Date Received in Office _____*

Received by City Engineer _____

SEDIMENT & EROSION CONTROL PLAN

PLEASE PRINT OR TYPE

PROJECT DESCRIPTION

Contact:	**Owner Name:**
Location:	**Address:**
Legal Description:	
Purpose and types of Soil Disturbing Activities (be specific):	
Approximate acres to be disturbed:	
Sequence of Major Activities:	
1.	**6.**
2.	**7.**
3.	**8.**
4.	**9.**
5.	**10.**
Name of Receiving Waters: **(lakes, creeks, rivers, or wetlands the site will drain into)**	

Attach soils information which provides existing soils types, textures, and erodibility.

EROSION AND SEDIMENT CONTROLS

Provide detailed explanation of any temporary and/or permanent stabilization measures planned such as seeding, mulching, paving:
Provide detailed explanation of any structural practices planned such as dikes, sediment basins, and silt fences:
Provide detailed explanation of the stormwater management measures planned for the undeveloped areas as well as the developed areas:
Duration of Activity

_____ _____

Applicant Signature **Date**

CITY OF HELENA
PUBLIC WORKS DEPARTMENT

Instructions for Completing "Water/Wastewater Service Area Enlargement" within the Existing City Limits Only

Indicate the name and mailing address of applicant(s) under Items 1 and 2.

Fill in the **COMPLETE** legal description of the property involved in the appropriate space under Item 3. The description used must be complete and be the official legal description. Fill in present zoning and proposed zoning where applicable under Item #5.

If a subdivision, include lot number, block number, name of subdivision; and if applicable, the number of the filing of the subdivision, (**Example**: Lot, 4, Block 14, Bull Run #2, Second Filing).

If unplatted property, include section quarter (smaller portions as applicable) by section number, township and range. (**Example**: NE1/4 of the NE1/4, Section 33, Township 10 North, Range 3 West).

Indicate the name of the engineer and attorney for applicant(s) under Items 6 and 7.

Attach to the application a plat of the property to be considered in the application. In addition, note the following is to be supplied:

a) Type of development proposed.
b) Land use proposed;
c) Type of building construction proposed (condominiums, townhouse, apartments, single family dwellings, others);
d) Total number of persons to be ultimately served by the proposed development;
e) Estimated average and maximum day water consumption and/or estimated volume of sewage flow. These figures to be supplied on a per person basis and a total basis for proposed development.

Attach to the application a copy of a current Title Memorandum showing **ALL** owners of record for **ALL** property involved (Item #8).

Under Item 9, fill in the date of execution on second page of form and have the forms **SIGNED** and **NOTARIZED** by **ALL** of the proper parties in the spaces provided. The proper parties includes **ANY** and **ALL** person(s) having a lawful interest in the property.

In the case of a partnership or other group(s) of persons, one individual may sign for all others PROVIDED the person signing has a current and proper Power of Attorney authorizing such signature. A copy of the power of Attorney must be attached to the

executed forms. Otherwise ALL individual person(s) must sign. Please not special place on form applying to corporations.

If the property is being purchased under a Contract for Deed then **ALL** of the contract sellers must sign the document **IN ADDITION** to **ALL** contract buyers signing.

If there are any encumbrances against the property involved, a SUBORDINATION AGREEMENT must also be executed and is available from the City of Helena Public Works Department.

Record the executed documents with the County Clerk and Recorder. The documents are to be **RECORDED** with a book and page reference. They are **NOT** to be filed. Obtain a copy of the recorded documents to be returned to the Public Works Department.

AFTER all documents are recorded, a title report must be presented to the Public Works Department. Such title reports may be obtained by contacting a title insurance company. Obtain from your files a copy of the title insurance policy issued when you purchased the property and then request from the title company a "JUDGEMENT AND LIEN SEARCH SUBSEQUENT TO THE TITLE POLICY." Present both the copy of the title policy and the Judgment and Lien Search document to the Public Works Department. As a minimum, the title policy information presented must show **ALL** fee simple owners as well as **ALL** liens, claims and encumbrances against the property.

Return a **COPY** of the recorded documents, not the original documents, to the Public Works Department for review along with the title policy information requested above.

It is extremely important that all the above steps be followed explicitly. Failure to fully comply with all requirements will necessitate having to repeat the procedure in its entirety. The water or sewer service desired cannot be obtained until the necessary paperwork is submitted and approved.

Assistance with the forms may be obtained by contacting the City of Helena public Works Department.

THANK YOU FOR YOUR COOPERATION!

CITY OF HELENA
PUBLIC WORKS DEPARTMENT
APPLICATION FOR WATER/WASTEWATER SERVICE AREA
ENLARGEMENT WITHIN THE EXISTING CITY LIMITS

SUBMIT ORIGINALS IN DUPLICATE

1. Applicant's Name: _____

2. Mailing Address: _____

3. Legal description of area to be served: _____

_____

_____

_____

4. The total population to be served by the proposed development is _____ and the estimated average and maximum day consumption in gallons per capita required to serve said development is as follows:

   Water: Average Day _____ gpcd Maximum Day _____ gpcd

   Wastewater: Average Day _____ gpcd Maximum Day _____ gpcd

5. Present Zoning: _____ Proposed Zoning: _____

6. Engineer for Applicant: _____

8. The attached Title Memorandum indicates the "Owner of Record" for all of the property requesting inclusion in the Water Service Area.

9. The (DEDICATED) (PROPOSED) (APPROVED PRELIMINARY) or (RECORDED) attached plat or certificate of survey describes all the property for which this application is submitted, the type of development and land use proposed for the property in question, the type of construction of the buildings and streets to be lovated on the property in question, the total population to be served by the proposed development, and the estimated average and maximum day consumption in gallons per capita required to serve said development.

10. City of Helena

    Public Works Department

    316 North Park Avenue

    Helena, MT 59623

    Being desirous of obtaining water service from the City of Helena and as a necessary prerequisite thereto, we the owners of the property described in Section 3, above, petition the City Commission to grant and approve an enlargement of the City of Helena Water Service Area so as to include said property within said Water Service Area. It is clearly

understood that consideration of the application shall be governed by Title 6, Chapter 3, Municipal Code and Ordinance #2400.

It is understood to be the fundamental policy of the Public Works Department and the City Commission that the City shall not indefinitely reserve unused water service capacity to the detriment of the City and its existing and prospective customers.

If this application shall be approved, it is understood and agreed that construction of a water system extension to serve the subject property shall be commenced within two (2) years of the date of approval of this application; and said construction shall be prosecuted continuously to completion within a reasonable time. Notwithstanding any prior approval of the approved Water Service Area if construction of the water system extension is not commenced within two (2) years of the date of approval of this application; and if said construction is not prosecuted continuously to completion within a reasonable time, the subject property shall be excluded from the approved Water Service Area.

If the subject property is not within the corporate limits of Helena, Montana and is not required to be annexed into the corporate limits in conjunction with approval of this application, the owners for themselves, their successors, and assigns agree to petition the Lewis and Clark County Commissioners to create a Special Improvement Maintenance District in order to maintain the water main and fire hydrant facilities installed; and further agree that the maintenance district shall be legally constituted and created prior to commencement of water service.

The owners for themselves, their successors, and assigns agree to comply with all Rules, Regulations, Policies, Resolutions and Ordinances of the Helena Public Works Department, the Helena City Commission, the Lewis and Clark County Commissioners, and the Montana Public Service Commission which may govern the extension, use, operation, maintenance and rates, charges, and rentals of the water system of the City of Helena, Montana.

_____ _____

Record Owner's Signature Date

_____ _____

Record Owner's Signature Date

_____

Record Owner's Signature _____ Date

_____

Record Owner's Signature _____ Date

If a Corporate Owner, by _____

(It's Corporate Officer designed as representative for purpose of application)

DATE:_____

11. Submitted to City Commission: _____

Public Hearing Held: _____

Approved by City Commission: _____

Denied by city Commission: _____

12. SUBJECT TO ATTACHED LETTER.

13. By: _____

Public Works Director

CERTIFICATE (TAXES)

The undersigned desires to apply for water and/or sanitary sewer service for the following described property in Lewis and Clark County, Montana:

Insert or attach)

Legal description)

In order to initiate the application procedure, the undersigned does hereby CERTIFY as follows:

Definitions:

"Interested parties" are defined as lessor, lessee, sub-lessor, sub-lessee, contract buyer, principal, agent, optionee, owner, licensee and developer or assignee of any of the foregoing having any interest in the above described real property whether as an individual, partner (general, special or limited) and/or as a corporation and/or controlling person or persons in a corporation and/or as a trustee or beneficiary of a trust, as a cooperative, non-profit corporation, religious corporation sole or otherwise. (Mortgagees and other lien holders are exempted from this definition of interested parties).

1. That the undersigned and other interested parties in the above described property have paid and are currently not delinquent with respect to all taxes, special assessments and impositions against this property and any other property situated in Lewis and Clark County, Montana in which said parties are interested.

2. That the undersigned and other interested parties in the above described property have not protested the payment of any taxes, assessments and impositions with respect to this property and other property situated in Lewis and Clark County, Montana in which said parties are interested parties.

The undersigned further certifies that the following are all the "interested parties" as defined above who have any interest in the above described real property:

Name	Address	Nature of Interest

(Add additional sheets as needed)

The undersigned hereby certifies all the above information as being full and complete disclosures, UNDER PENALTY OF PERJURY.

DATED _____

_____
(WITNESS)

_____
(ADDRESS)

_____
(CITY, STATE, ZIP CODE)

TELEPHONE: _____

DATED _____

_____
(WITNESS)

_____
(ADDRESS)

_____
(CITY, STATE, ZIP CODE)

TELEPHONE: _____

CITY OF HELENA

COMPLETE STREET

PLAN & SPECIFICATION SUBMITTAL CHECKLIST

Project Name: _____

Engineering Firm: _____

Engineering Contact: _____

Telephone No.: _____

On December 20th, 2010 the City of Helena adopted the Complete Streets Resolution (Resolution #19799). The Resolution implements a Complete Streets policy to require the planning, design, and construction of streets to accommodate all modes of transportation and persons of all abilities, with the goal of optimizing safety, interconnectivity, compatibility, and convenience. In addition to the policy, City planning documents such as the Greater Helena Transportation Plan, Helena Transit Plan, and Non-motorized Plans, as well as these standards must be considered when designing a street.

The City of Helena's approach to complete streets is a modular approach where each feature has a set minimum width. The pavement and ROW widths are determined by which features are deemed necessary for each particular section. Not all features may be required for every street, but each must be considered. If a feature is not required, the ROW may or may not be reduced.

The following checklist that must be completed for each new street or street section is based on the complete street feature in Table 5-3 that establishes minimum widths for each feature. As stated before each feature must be considered and justification provided, if the feature is not included in the street section. If a feature is not required, the ROW may or may not be reduced based on future need of the particular feature. City Staff, and ultimately the City Commission, will determine if a feature is needed. Please note that some deviation from the complete streets standards may require commission approval, for instance exemption from installing a sidewalk or boulevard.

The attached plans and specifications for the above-mentioned project are in Compliance with City of Helena Complete Street Policy and City Street Standards:

SECTIONS 5.2.12 & 5.3 –COMPLETE STREETS AND RIGHT-OF WAY STANDARDS

A. Local Streets: ☐ N/A for this proposal

Name of Street/s:_____

Estimated ADT of Each Street:_____

1. **Are the travel lanes at least 10-feet**? **☐ Yes☐ No**

   Width of Lanes _____

   Deviation request:_____
   Justification:_____

2. **Is parallel parking (6-foot lanes) included both sides of the street?**

   ☐ Yes☐ No

   Deviation request:_____

   Justification:_____

3. **Are 5-foot sidewalks included on both sides? ☐ Yes ☐ No**

   Is a bike/ped path requested in place of one of the sidewalks: ☐ Yes☐ No
   Deviation request: ~~(All~~ Curbside sidewalk and variances to eliminate the sidewalk or Bike/Ped path must be approved by the Commission)_____
   Justification:_____

4. **Are 7-foot Boulevards included on both sides? ☐ Yes ☐ No**

   Deviation request: (All curbside sidewalk requests must be approved by the Commission)_____
   Justification:_____

5. **Does the Helena Transit Plan identify a Bus Stop in this area? ☐ Yes ☐ No**

6. **~~Is a~~ Are any transit stops proposed? ☐ Yes ☐ No**

7. **Is an additional 1-foot ROW strip included behind the sidewalk or bike/ped path included on both sides? ☐ Yes ☐ No**

   Deviation request:_____
   Justification:_____

8. **Does the Helena Transportation Plan or Non-Motorized Plan request or identify any bike lanes or off street paths in area? ☐ No ☐ Yes** Bike lanes are discouraged on Local Street unless identified in a Commission-approved plan

   Deviation request:_____
   Justification:_____

9. **Are there any other modes of transportation that need to be considered for this proposal (i.e. golf cart, horses, light rail, snowmobile, etc...) ☐ No ☐ Yes**

   A Brief Explanation which additional modes are included with this proposal:_____
   _____

B. Minor Collector Streets: ☐ N/A for this proposal

Name of Street/s:_____

Estimated ADT of Each Street:_____

1. **Are the travel lanes at least 11~~0~~-feet? ☐ Yes☐ No**

   Width of Lanes _____

   Deviation request:_____
   Justification:_____

2. **Is parallel parking (6-foot lanes) included both sides of the street?**

   ☐ Yes ☐ No

   Deviation~~Variance~~
   request:_____

   Justification:_____

3. **Are 5-foot sidewalks included on both sides? ☐ Yes ☐ No**

   Is a bike/ped path requested in place of one of the sidewalks: ☐ Yes☐ No

   Deviation request: (All sidewalk variances must be approved by the Commission)_____
   Justification:_____

4. **Are 7-foot Boulevards included on both sides? ☐ Yes ☐ No**

   Deviation request: (All curbside sidewalk requests must be approved by the
   Commission)_____
   Justification:_____

5. **Does the Helena Transit Plan identify a Bus Stop in this area? ☐ Yes ☐ No**

6. **~~Is a~~ Are any transit stops proposed? ☐ Yes ☐ No**

7. **Is an additional 1-foot ROW strip included behind the sidewalk or bike/ped path included on both sides? ☐ Yes ☐ No**

   Deviation request:_____
   Justification:_____

8. **Does the Helena Transportation Plan or Non-Motorized Plan request or identify any bike lanes or off street paths in area? ☐ No ☐ Yes**
   Bike lanes are discouraged on Minor Collector Street unless identified in a Commission-approved plan

Deviation request:_____
Justification:_____

9. **Are there any other modes of transportation that need to be considered for this proposal (i.e. golf cart, horses, light rail, snowmobile, etc...) ☐ No ☐ Yes**

   Explain which additional modes are included with this proposal:_____
   _____

C. **Major Collector Streets: ☐ N/A for this proposal**

Name of Street/s:_____

Estimated ADT of Each Street:_____

1. **Are the travel lanes at least 11~~0~~-feet? ☐ Yes☐ No**

   Width of Lanes _____

   Deviation request:_____
   Justification:_____

2. **Is a turn lane (11~~2~~-foot lane) proposed? ☐ Yes ☐ No**

   Deviation request:_____
   Justification:_____

3. **Is parallel parking (6-foot lanes) included on both sides of the street?**

   ☐ Yes ☐ No

   Deviation request:_____

   Justification:_____

4. **Are 5-foot sidewalks included on both sides? ☐ Yes ☐ No**

   Is a bike/ped path requested in place of one of the sidewalks: ☐ Yes ☐ No

   Deviation request: (All sidewalk variances must be approved by the Commission)_____
   Justification:_____

5. **Are 7-foot Boulevards included on both sides? ☐ Yes ☐ No**

   Deviation request: (All curbside sidewalk requests must be approved by the
   Commission)_____
   Justification:_____

6. **Does the Helena Transit Plan identify a Bus Stop in this area? ☐ Yes ☐ No**

7. **~~Is a~~ Are any transit stops proposed? ☐ Yes ☐ No**

8. **Is an additional 1-foot ROW strip included behind the sidewalk or bike/ped path included on both sides? ☐ Yes ☐ No**

Deviation request:_____
Justification:_____

9. **Does the Helena Transportation Plan or Non-Motorized Plan request or identify any bike lanes or off street paths in area? ☐ No ☐ Yes**

   Deviation request:_____
   Justification:_____

10. **Are 5-foot Bike Lanes included on both sides of the street?**

    ☐ Yes ☐ No (Bike Lanes are required unless specifically excluded by the Greater Helena Transportation Plan or other Commission Approved Non-motorized Plan)

    Deviation request:_____
    Justification:_____

11. **Are there any other modes of transportation that need to be considered for this proposal (i.e. golf cart, horses, light rail, snowmobile, etc...) ☐ No ☐ Yes**

    Explain which additional modes are included with this proposal:_____
    _____

D. **Minor Arterial Streets: ☐ N/A for this proposal**

Name of Street/s:_____

Estimated ADT of Each Street:_____

1. **Are the travel lanes at least 12~~0~~-feet? ☐ Yes☐ No**

   Width of Lanes _____

   Deviation request:_____
   Justification:_____

2. **Is a turn lane (12-foot lane) proposed? ☐ Yes ☐ No**

   Deviation request:_____
   Justification:_____

3. **Is parallel parking (6-foot lanes) included on both sides of the street? ☐ Yes ☐ No**

   Deviation request:_____

   Justification:_____

4. **Are 5-foot sidewalks included on both sides? ☐ Yes ☐ No**

   Is a bike/ped path requested in place of one of the sidewalks: ☐ Yes ☐ No
   Deviation request: (All sidewalk variances must be approved by the Commission)_____
   Justification:_____

5. **Are 7-foot Boulevards included on both sides? ☐ Yes ☐ No**

   Deviation request: (All curbside sidewalk requests must be approved by the

Commission)_____
Justification:_____

6. **Does the Helena Transit Plan identify a Bus Stop in this area? ☐ Yes ☐ No**
7. **~~Is a~~Are any transit stops proposed? ☐ Yes ☐ No**
8. **Is an additional 1-foot ROW strip included behind the sidewalk or bike/ped path included on both sides? ☐ Yes ☐ No**

   Deviation request:_____
   Justification:_____
9. **Does the Helena Transportation Plan or Non-Motorized Plan request or identify any bike lanes or off street paths in area? ☐ No ☐ Yes**

   Deviation request:_____
   Justification:_____
10. **Are 5-foot Bike Lanes included on both sides of the street? ☐ Yes**

    ☐ No (Bike Lanes are required unless specifically excluded by the Greater Helena Transportation Plan or other Commission Approved Non-motorized Plan)

    Deviation request:_____
    Justification:_____
11. **Are all Medians at least 4-feet? ☐ Yes ☐ No ☐ N/A**

    Deviation request:_____
    Justification:_____
12. **Are there any other modes of transportation that need to be considered for this proposal (i.e. golf cart, horses, light rail, snowmobile, etc...) ☐ No ☐ Yes**

    Explain which additional modes are included with this proposal:_____
    _____

E. **Major Arterial Streets: ☐ N/A for this proposal**

Name of Street/s:_____

Estimated ADT of Each Street:_____

1. **Are the travel lanes at least 12-feet? ☐ Yes # of lanes_____☐ No**

   Width of Lanes _____

   Deviation request:_____
   Justification:_____
2. **Is a turn lane (12-foot lane) proposed? ☐ Yes ☐ No**

   Deviation request:_____
   Justification:_____

3. **Is parallel parking (6-foot lanes) included on both sides of the street? ☐ Yes ☐ No**

   Deviation request:_____

   Justification:_____

4. **Are 5-foot sidewalks included on both sides? ☐ Yes ☐ No**

   Is a bike/ped path requested in place of one of the sidewalks: ☐ Yes☐ No

   Deviation request: (All sidewalk variances must be approved by the Commission)_____
   Justification:_____

5. **Are 7-foot Boulevards included on both sides? ☐ Yes ☐ No**

   Deviation request: (All curbside sidewalk requests must be approved by the
   Commission)_____
   Justification:_____

6. **Does the Helena Transit Plan identify a Bus Stop in this area? ☐ Yes ☐ No**

7. **Does the Helena Transit Plan identify a Bus Lane in this area? ☐ No ☐ Yes**

   Is a bus lanes included at part of the typical section? ☐ Yes☐ No

   Justification:_____

8. **~~Is a~~ Are any transit stops proposed? ☐ Yes ☐ No**

9. **Is an additional 1-foot ROW strip included behind the sidewalk or bike/ped path included on both sides? ☐ Yes ☐ No**

   Deviation request:_____
   Justification:_____

10. **Does the Helena Transportation Plan or Non-Motorized Plan request or identify any bike lanes or off street paths in area? ☐ No ☐ Yes**

    Deviation request:_____
    Justification:_____

11. **Are 5-foot Bike Lanes included on both sides of the street? ☐ Yes**

    ☐ No (Bike Lanes are required unless specifically excluded by the Greater Helena Transportation Plan or other Commission Approved Non-motorized Plan)

    Deviation request:_____
    Justification:_____

12. **Are all Medians at least 4-feet? ☐ Yes ☐ No ☐ N/A**

    Deviation request:_____
    Justification:_____

13. **Are there any other modes of transportation that need to be considered for this proposal (i.e. golf cart, horses, light rail, snowmobile, etc...) ☐ No ☐ Yes**

    Explain which additional modes are included with this proposal:_____
    _____

F. <u>Traffic Calming/Storm Water Treatment</u>

1. **Is any traffic calming proposed? ☐ No ☐ Yes**

   Location of traffic calming:_____

   Type of Traffic Calming Measure Proposed at each location: (Reference Traffic Calming Table in the Transportation Section of Appendix B)
   _____

   Is addition ROW required? ☐ Yes ☐ No

2. **Are any Storm water treatment elements included within the ROW?**

   ☐ No ☐ Yes

   Location of storm water elements:_____

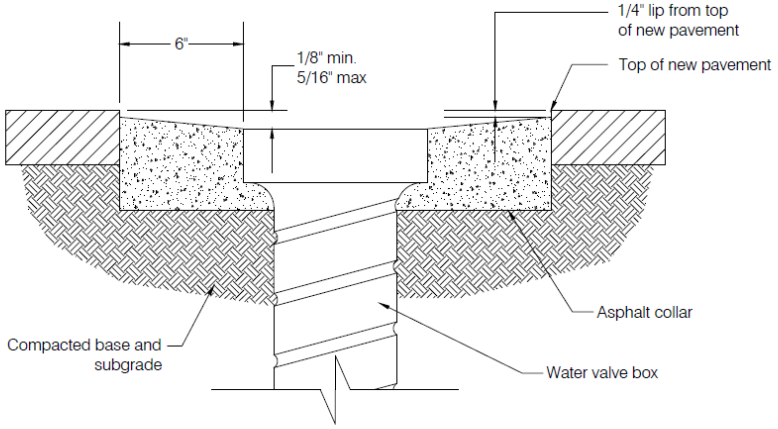
   Type of treatment at each location:_____

   Is addition ROW required? ☐ Yes ☐ No

Certified by: _____ (Stamp)

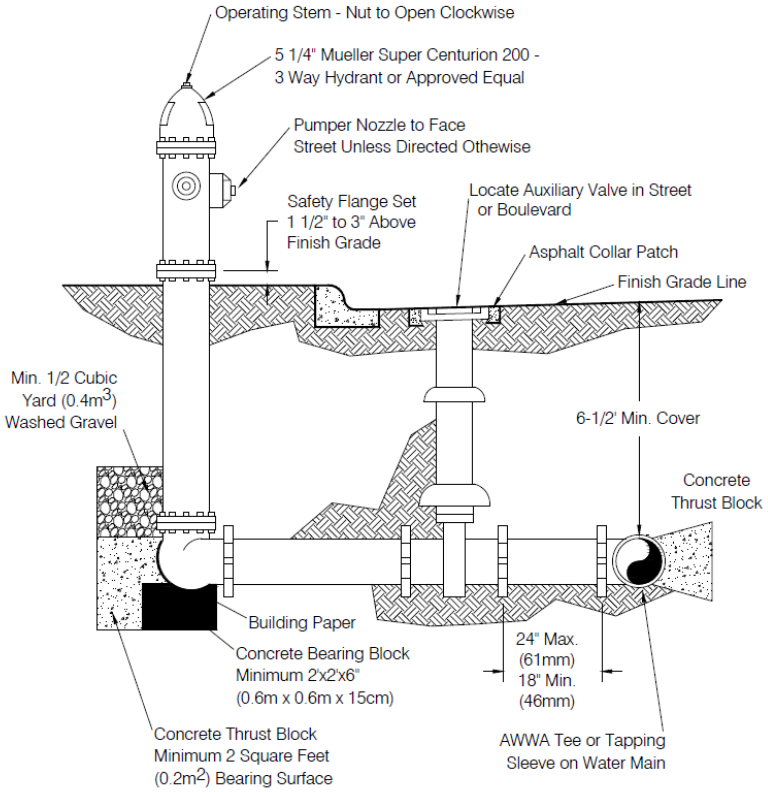
Appendix B - Standard Details

Water Standard Details



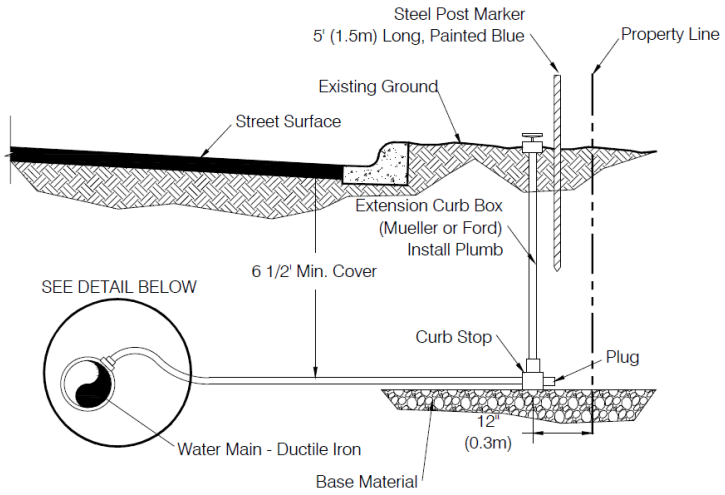
Notes:
1. Adjust water valve boxes upward or downward as required.
2. Final adjustment shall be made after paving.
3. Valve cover shall not be located in curb or gutter.

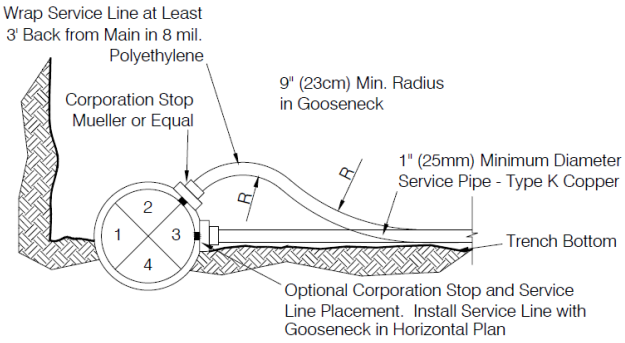
CITY OF HELENA ENGINEERING STANDARDS		**Water Valve Cover Adjustment**	***STANDARD DRAWING:*** **2-1**
REVISED: 2/12/13	***SCALE:*** NONE		



Notes:
1. Thrust blocking to be in conformance with MPW standard drawing 02660-1.
2. For bolted fittings, blocking shall not obstruct bolts.
3. Hydrant weep holes to remain unobstructed.
4. Thrust block shall bear horizontally against undisturbed soil.

CITY OF HELENA ENGINEERING STANDARDS		**Fire Hydrant Setting**	**STANDARD DRAWING:** **2-2**
REVISED: 2/12/13	***SCALE:*** NONE		





DETAIL OF A PROPERLY INSTALLED CORPORATION STOP. SHOWING GOOSENECK IN SERVICE PIPE

Notes:

1. Minimum cover for service lines shall be measured from existing ground line when ground is level or falling away from street, and measured from top of street curb when ground is rising from street.
2. Water service lines shall be installed where shown on the drawings or as specified.
3. Bedding shall be 1 inch (25mm) diameter maximum within 6" (15cm) of service pipe.

CITY OF HELENA ENGINEERING STANDARDS		**Water Service Line**	***STANDARD DRAWING:*** **2-3**
REVISED: 2/12/13	***SCALE:*** NONE		

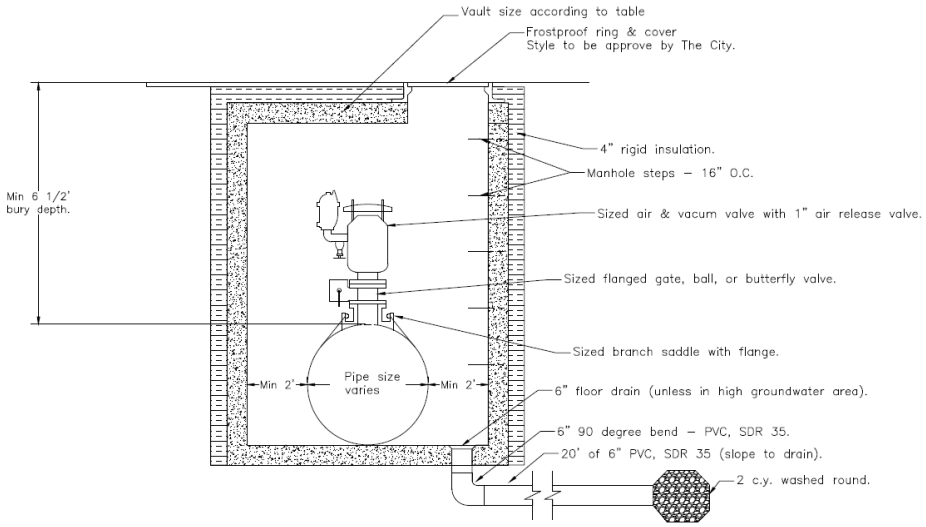
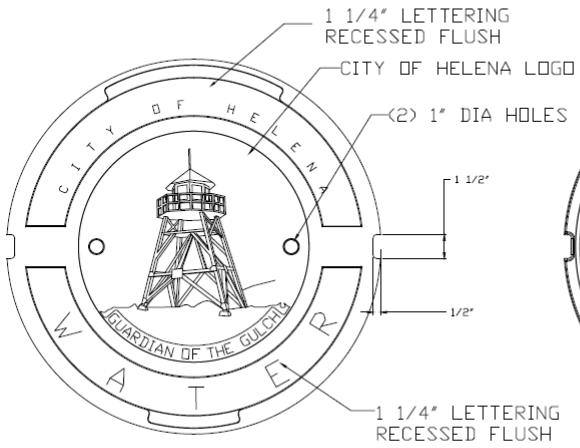


TABLE OF VAULT SIZE		
PIPE SIZE	INSIDE ID	ACCESS OPENING
8", 12", & 16"	VAULT=72"	24"
16" TO 24"	VAULT=84"	30"
30" TO 36"	VAULT=96"	36"

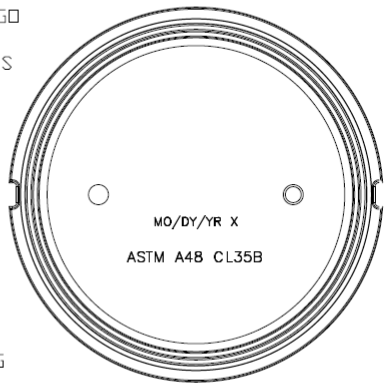
Notes:

1. Minimum inside working height of 6 1/2 feet.
2. Minimum 2' of work space on either side of pipe.
3. Minimum access of 24", offset over pipe.
4. Minimum bury depth to top of pipe = 6 1/2 feet + pipe diameter + floor.

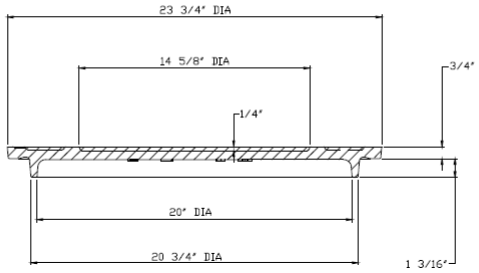
CITY OF HELENA ENGINEERING STANDARDS		**Combination Air and Vacuum Valve and Manhole Vault**	***STANDARD DRAWING:*** **2-4**
REVISED: 2/12/13	***SCALE:*** NONE		



PLAN VIEW

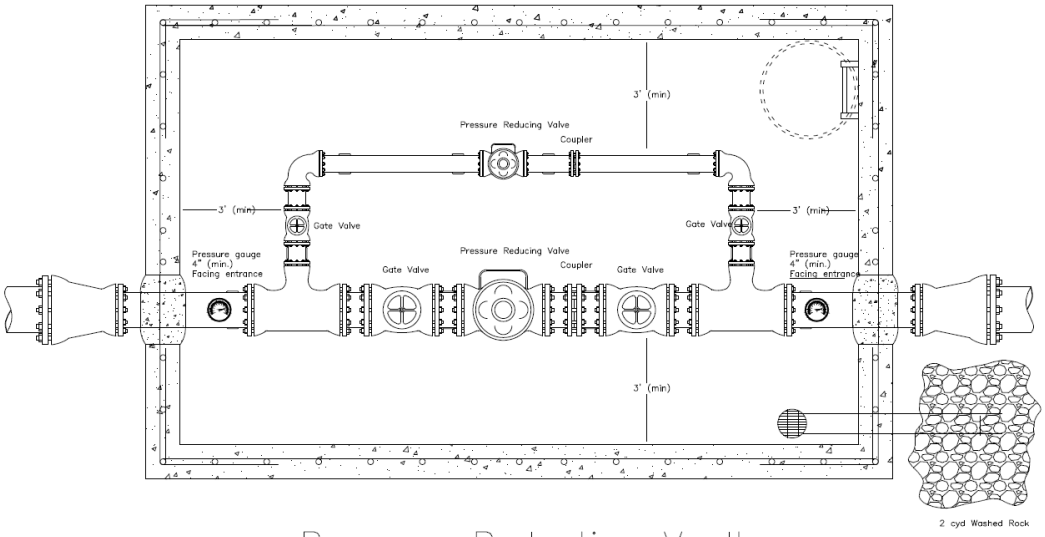


BOTTOM VIEW



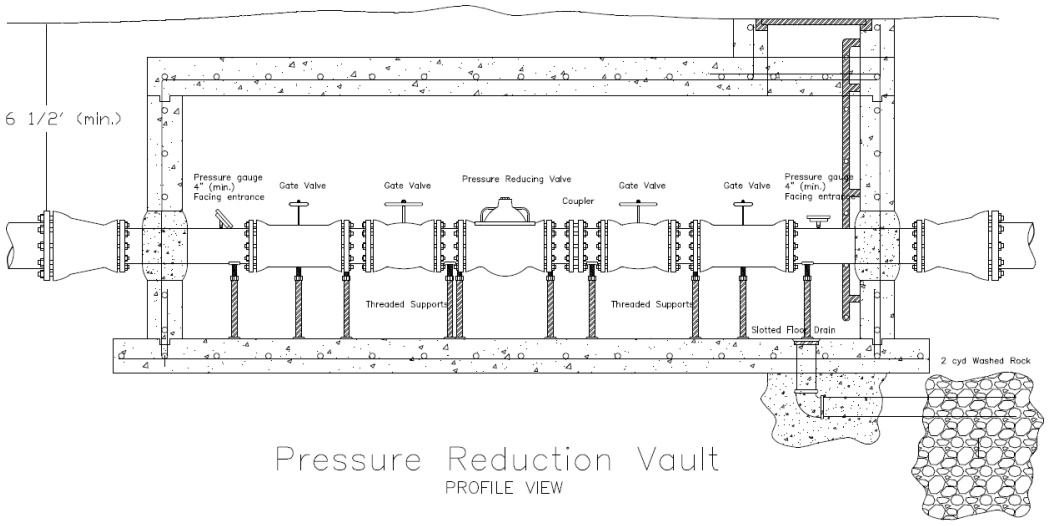
SECTION

CITY OF HELENA ENGINEERING STANDARDS		**Approved City Logo Manhole Lid "Water" Lettering**	*STANDARD DRAWING:* **2-5**
REVISED: 2/12/13	*SCALE:* NONE		



Pressure Reduction Vault

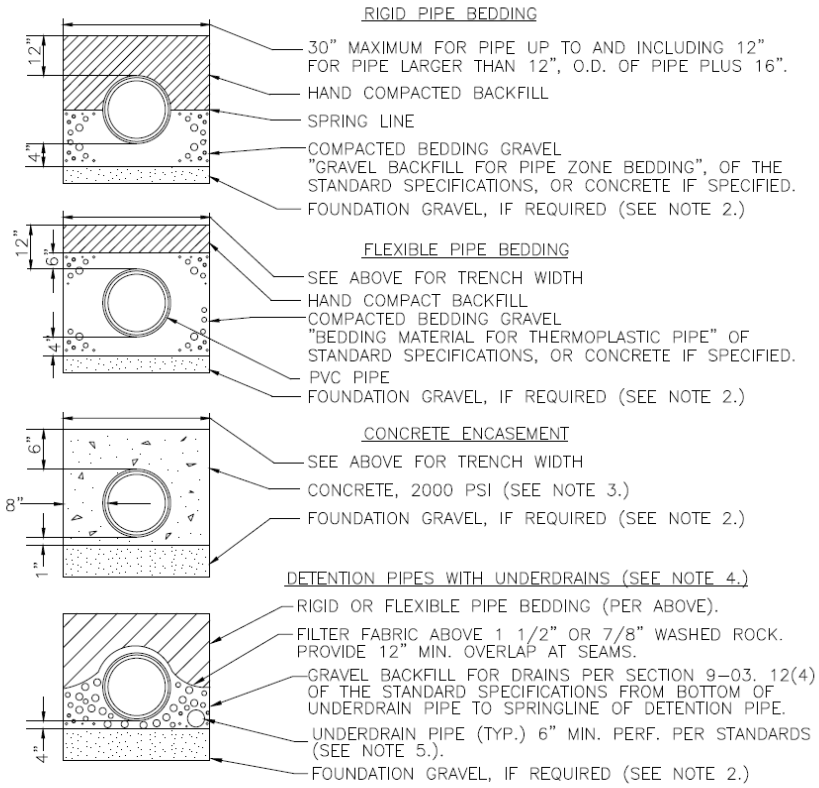
PLAN VIEW



Pressure Reduction Vault

PROFILE VIEW

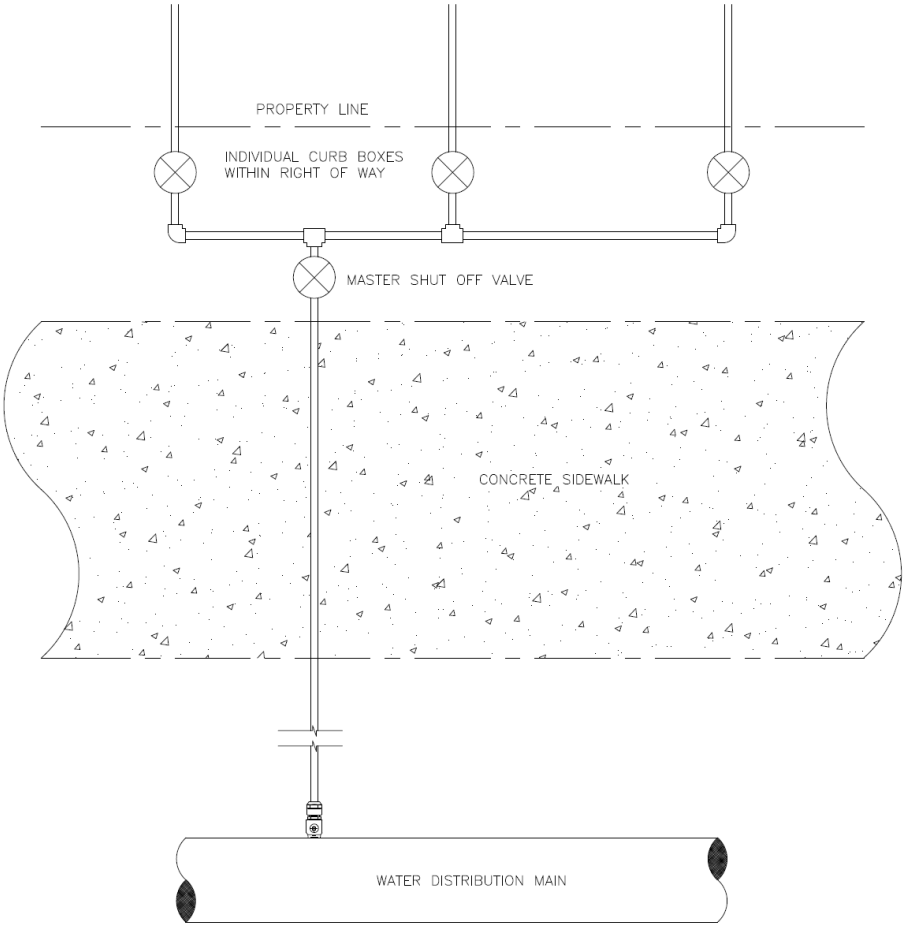
CITY OF HELENA ENGINEERING STANDARDS		**Pressure Reducing Vault**	***STANDARD DRAWING:*** **2-6**
REVISED: 2/12/13	***SCALE:*** NONE		



NOTES:

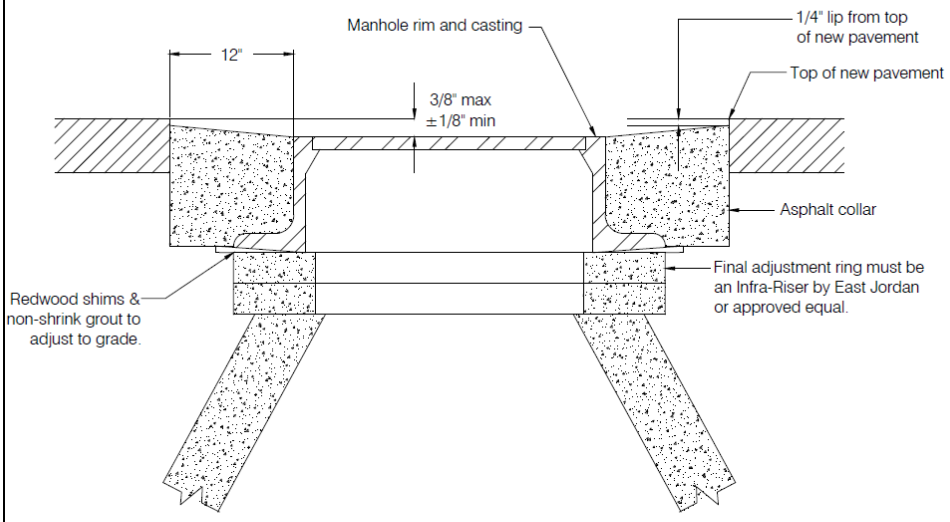
1. COMPACTED CRUSHED SURFACING TOP COURSE, CRUSHED SURFACING, CAN ALSO BE USED AS BEDDING GRAVEL.
2. EXCAVATE UNSTABLE MATERIAL DOWN TO FIRM SOIL AND REPLACE WITH FOUNDATION GRAVEL BALLAST.
3. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ANCHORING PIPE TO PREVENT FLOTATION DURING CONCRETE PLACEMENT.
4. WHEN THE DESIGN OF TANKS OR PIPES DOES NOT TAKE INTO ACCOUNT BOUYANCY, UNDERDRAINS SHALL BE PROVIDED.
5. PROVIDE CLEANOUTS ON UNDERDRAIN PIPE, EVERY 100 FEET, AND AT BENDS OR JUNCTIONS.

CITY OF HELENA ENGINEERING STANDARDS		**Pipe Bedding**	***STANDARD DRAWING:*** **2-7**
REVISED: 2/12/13	***SCALE:*** NONE		



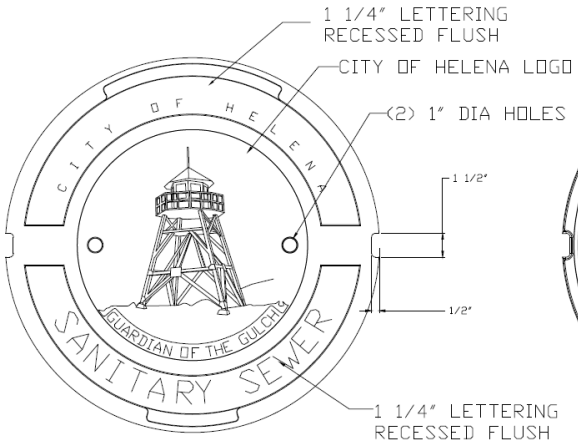
CITY OF HELENA ENGINEERING STANDARDS		**Water Service Condominium Manifold For Street Less Than 10 Years Old**	STANDARD DRAWING: 2-8
REVISED: 2/12/13	SCALE: NONE		

Sewer and Storm Water Standard Details

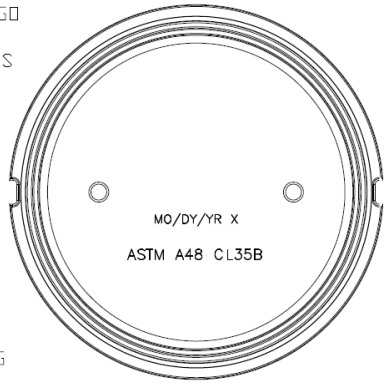


Notes:
1. Adjust manholes upward with adjusting rings under frame.
2. Adjust manhole downward by removing cone and barrel sections as necessary and replacing with sections of length required to match grade.
3. Slope manhole frame as required to match slope of street.
4. Final manhole adjustment shall be made after paving.

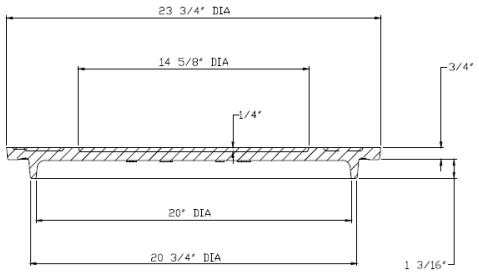
CITY OF HELENA ENGINEERING STANDARDS		**Manhole Casting Adjustment**	STANDARD DRAWING: 3-1
REVISED: 2/12/13	SCALE: NONE		



PLAN VIEW

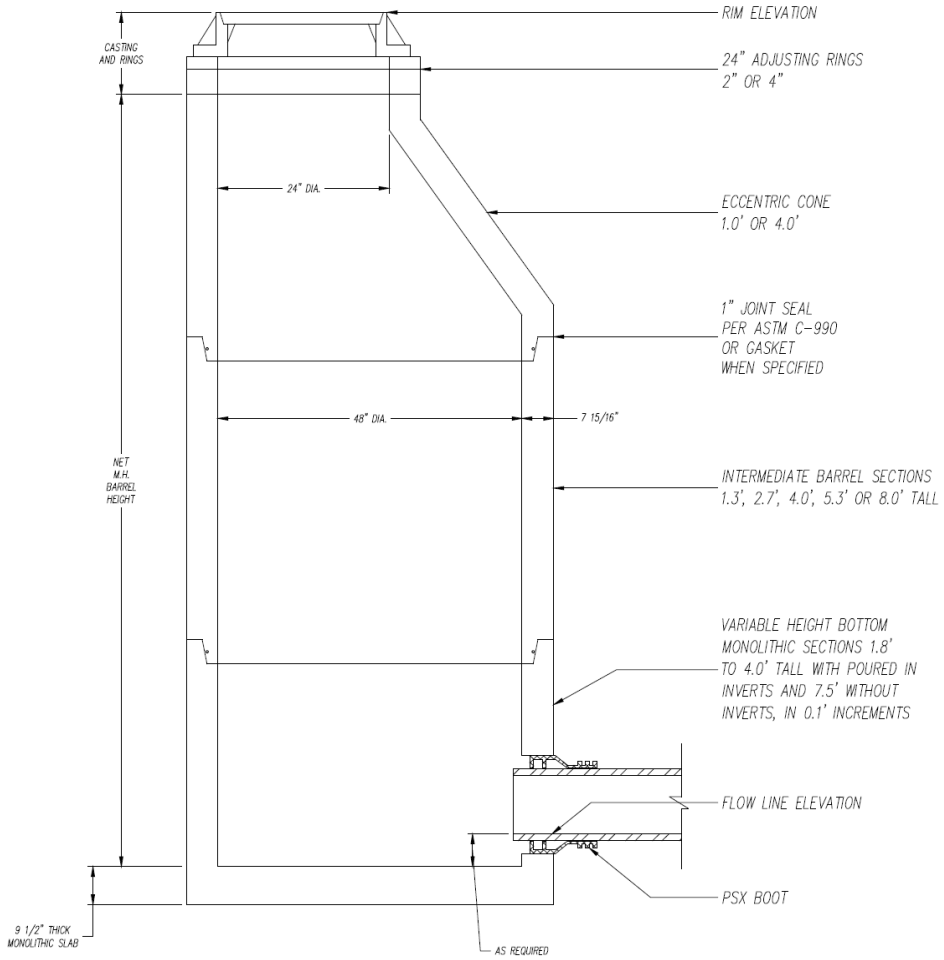


BOTTOM VIEW



SECTION

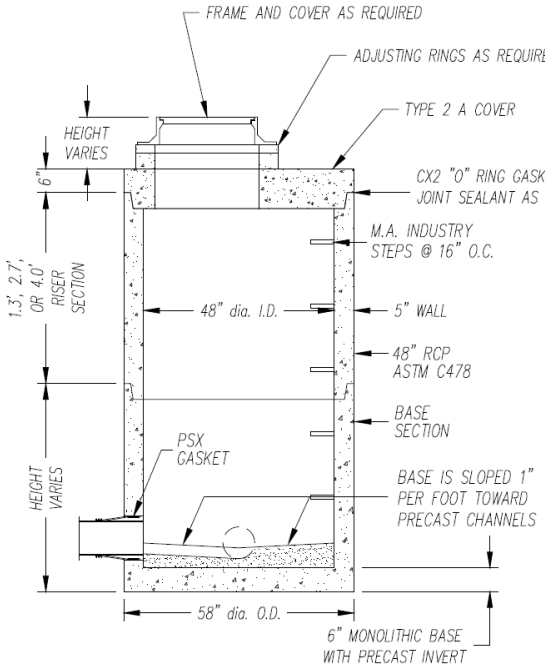
CITY OF HELENA ENGINEERING STANDARDS		**Approved City Logo Manhole Lid "Sanitary Sewer" Lettering**	***STANDARD DRAWING:*** **3-2**
REVISED: 2/12/13	***SCALE:*** NONE		



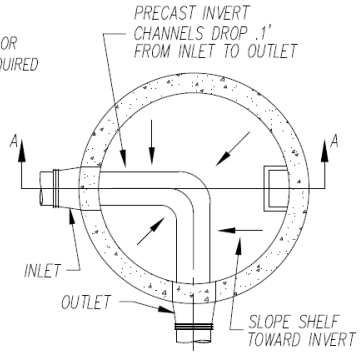
SECTION

1. All components are manufactured per ASTM C478.
2. Steps provided and located as required.
3. Poured-in inverts available as required.

CITY OF HELENA ENGINEERING STANDARDS		**Standard 48" Diameter Sanitary Manhole with Monolithic Base**	**STANDARD DRAWING:** **3-3**
REVISED: 2/12/13	**SCALE:** NONE		



SECTION VIEW

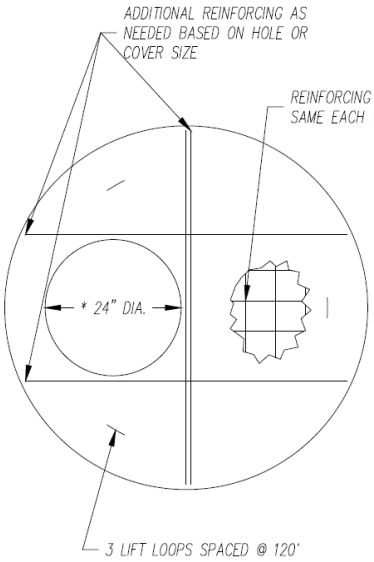


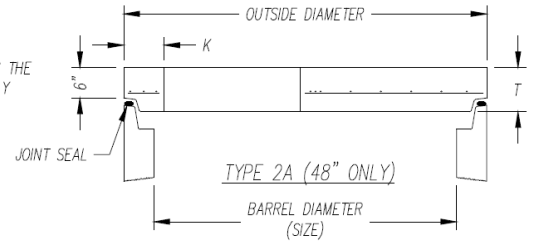
PLAN VIEW

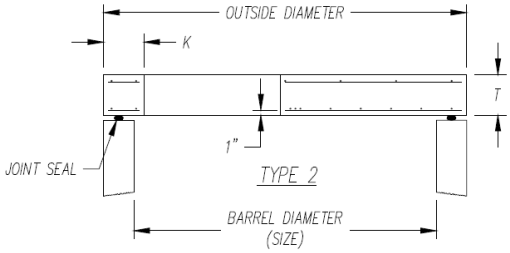
NOTE:
SANITARY SEWER MANHOLE WITH PRECAST PAN INVERT SYSTEM IS ONLY AVAILABLE WITH 8" CHANNELS AND FOR USE WITH 48" MANHOLES.

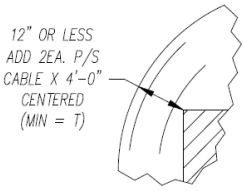
ALL COMPONENTS ARE MANUFACTURED PER ASTM C 478 & C 443. STRUCTURE CAN BE FURNISHED WITH OR WITHOUT STANDARD PLASTIC COATED STEEL STEPS THAT MEET ASTM C 478.

CITY OF HELENA ENGINEERING STANDARDS		**48" Diameter Straight Manhole with Cover**	**STANDARD DRAWING:** **3-4**
REVISED: 2/12/13	**SCALE:** NONE		









DETAIL FOR COVERS WITH RECTANGULAR OPENINGS

0.60 PS CABLE MAY BE SUBSTITUTED FOR #4 REBAR @ SAME SPACING

TYPE 2A (48" ONLY)

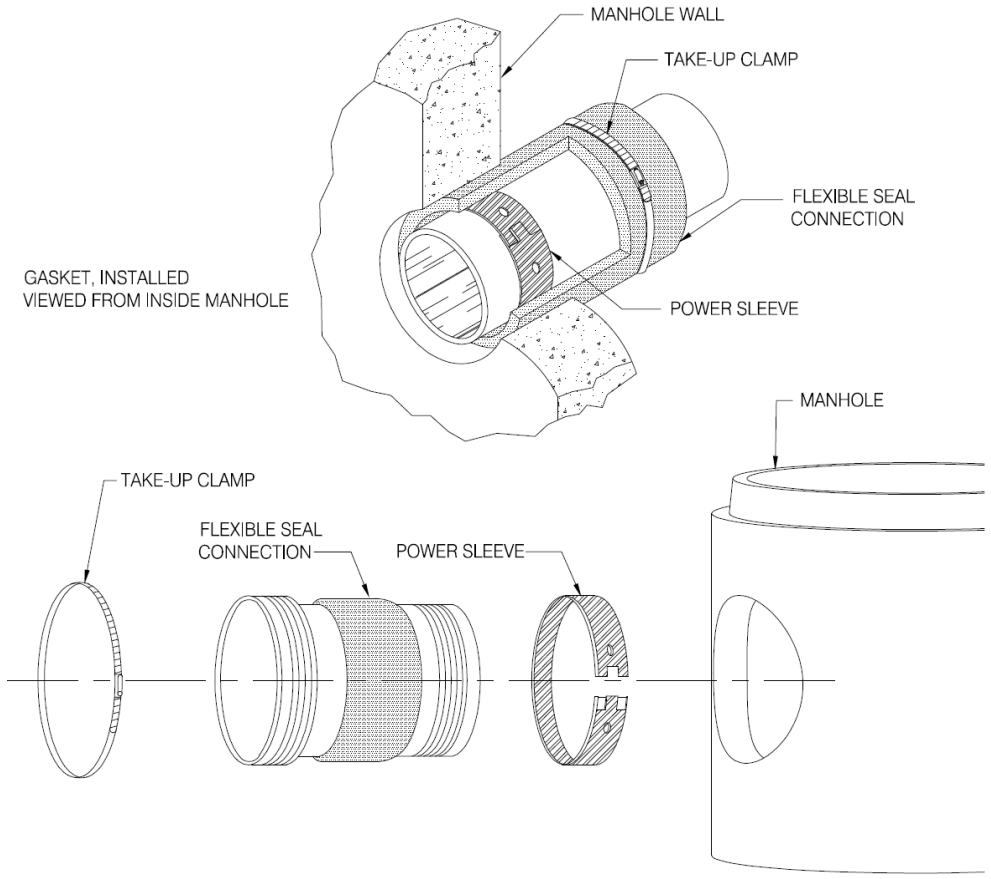
SIZE	DIMENSIONS OD x T	WEIGHT	K	BOTTOM BARS	TOP BARS
in	in	lbs	in	in	in
48	58 X 8	1,450	6	#4 @ 6	– –

TYPE 2

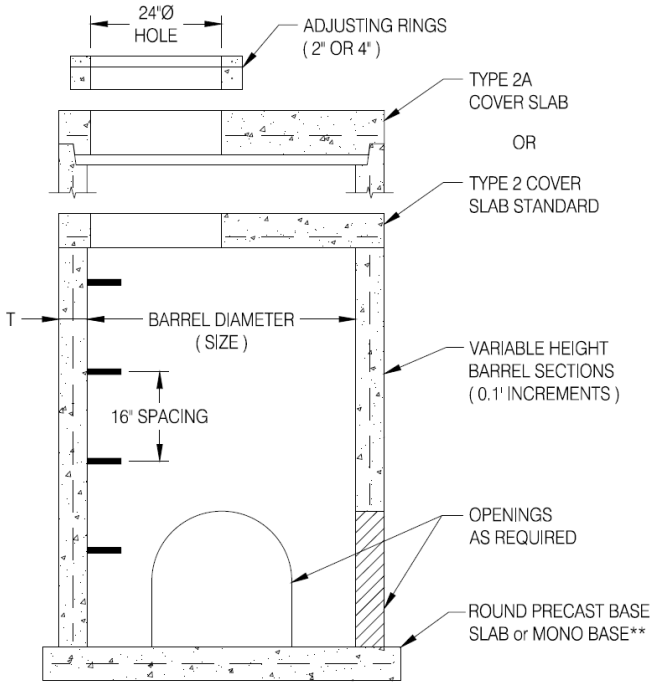
SIZE	DIMENSIONS OD x T	WEIGHT	K	BOTTOM BARS	TOP BARS
in	in	lbs	in	in	in
36	44 X 6	520	6	#4 @ 6	– –
42	51 X 6	800	6	#4 @ 6	– –
48	58 X 6	1,110	6	#4 @ 6	– –
60	72 X 8	2,470	7	#4 @ 6	#4 @ 11
72	86 X 8	3,680	8	#4 @ 6	#4 @ 11
84	100 X 8	5,100	9	#4 @ 4	#4 @ 7
90	107 X 8	6,250	9	#4 @ 4	#4 @ 7
96	114 X 8	6,730	9	#4 @ 4	#4 @ 7
120	142 X 12	16,500	12	#4 @ 4	#4 @ 7

1. Slabs are manufactured per ASTM C478.
* 2. Various sizes of round or rectangular openings are available. Cover designed for HS20 Load regardless of opening size.
3. Various sizes of round or rectangular castings can be embedded.
4. Special sizes are available upon request.

CITY OF HELENA ENGINEERING STANDARDS	**Standard Type 2 & Type 2A Cover Slabs**	STANDARD DRAWING: 3-5
REVISED: 2/12/13 / SCALE: NONE		



CITY OF HELENA ENGINEERING STANDARDS		**Watertight Pipe To Manhole Connection**	***STANDARD DRAWING:*** **3-6**
REVISED: 2/12/13	***SCALE:*** NONE		

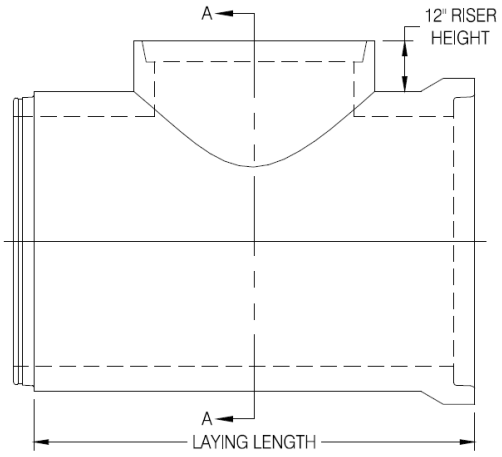


SIZE (IN)	WEIGHT (LBS. / VF)	T (IN.)	BASE (IN.)
36	540	4	50 x 6
42	700	4.5	58 x 6
* 48	880	5	64 x 6
60	1320	6	78 x 6
72	1840	7	92 x 8
84	2450	8	106 x 8
96	3160	9	120 x 10
108	3950	10	134 x 10
120	4800	11	148 x 12

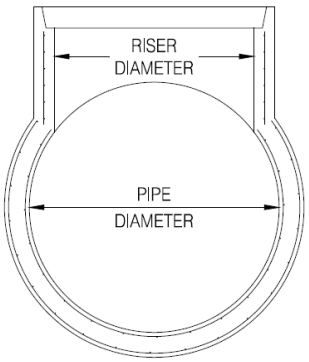
* TYPE 2A COVER SLAB AVAILABLE
** MONO BASE AVAILABLE IN 48",60" or 72"

ALL COMPONENTS MUST BE MANUFACTURED PER ASTM C 478.

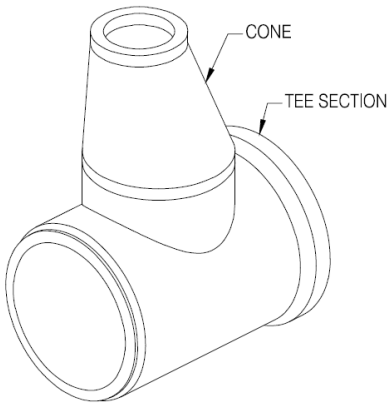
CITY OF HELENA ENGINEERING STANDARDS		**Standard Straight Manhole**	***STANDARD DRAWING:*** **3-7**
REVISED: 2/12/13	***SCALE:*** NONE		



ELEVATION VIEW



SECTION A-A

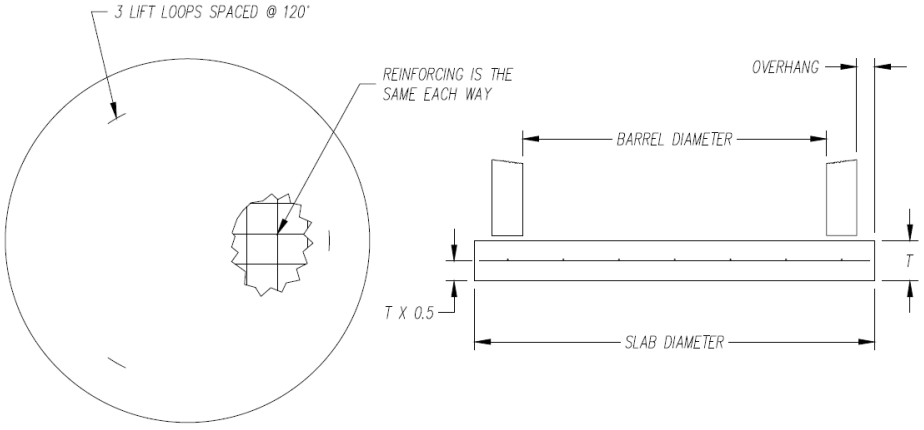


PERSPECTIVE VIEW

DIAMETER OF RISER INCHES	DIAMETER OF BARREL INCHES
42	42
42	48
42	60
48	42
48	48
48	54
48	60
48	66
48	72
48	78
48	84

ALL COMPONENTS MUST BE MANUFACTURED PER ASTM C 478.

CITY OF HELENA ENGINEERING STANDARDS		**RCP Manhole Tee**	***STANDARD DRAWING:*** **3-8**
REVISED: 2/12/13	***SCALE:*** NONE		



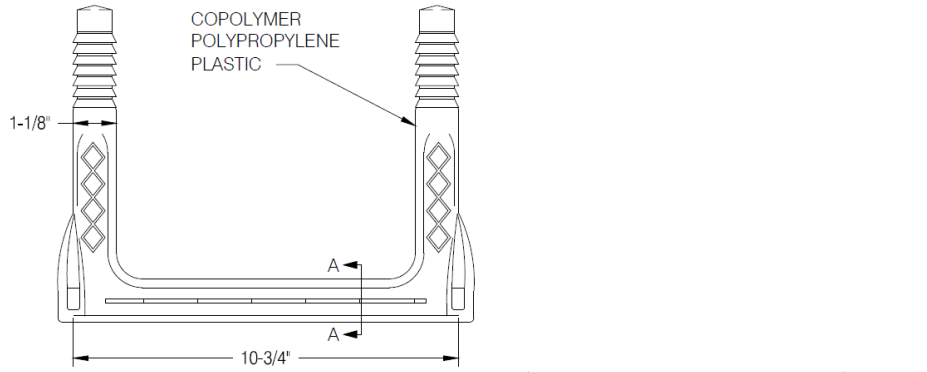
STANDARD BASE SLABS				
SIZE	DIMENSIONS OD x T	WEIGHT	OVERHANG	REINFORCING BARS
in	in	lbs	in	in
30	44 X 6	790	3.5	#4 @ 11
36	51 X 6	1,065	3.5	#4 @ 11
42	58 X 6	1,380	3.5	#4 @ 11
48	64 X 6	1,680	3.0	#4 @ 11
60	79 X 8	3,400	3.5	#4 @ 11
72	93 X 8	4,720	3.5	#4 @ 11
84	107 X 8	6,250	3.5	#4 @ 11
96	121 X 8	7,990	3.5	#4 @ 11
120	146 X 12	17,450	2.0	#4 @ 6

NON-STANDARD BASE SLABS				
SIZE	DIMENSIONS OD x T	WEIGHT	OVERHANG	REINFORCING BARS
in	in	lbs	in	in
48	72 X 8	2,830	7.0	#4 @ 11
60	86 X 8	4,030	7.0	#4 @ 11
72	100 X 8	5,460	7.0	#4 @ 11
84	114 X 8	7,090	7.0	#4 @ 11

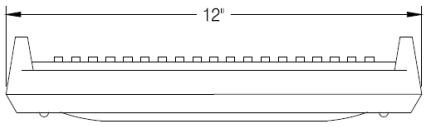
1. Slabs are manufactured per ASTM C478.
2. Various sizes of drain holes can be provided.
3. Special sizes are available upon request.
4. Base slabs can be cast as monolithic with barrel section for an additional charge.

0.60 PS CABLE MAY BE SUBSTITUTED FOR #4 REBAR @ SAME SPACING

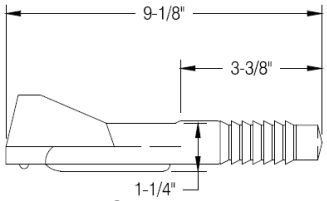
CITY OF HELENA ENGINEERING STANDARDS		**Separate Base Slabs**	**STANDARD DRAWING:** **3-9**
REVISED: 2/12/13	**SCALE:** NONE		



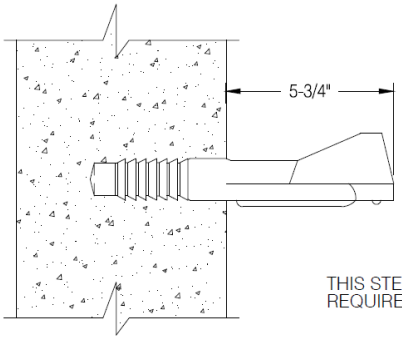
PLAN VIEW



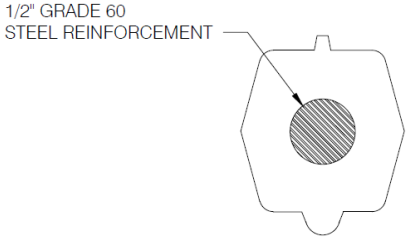
FRONT VIEW



SIDE VIEW



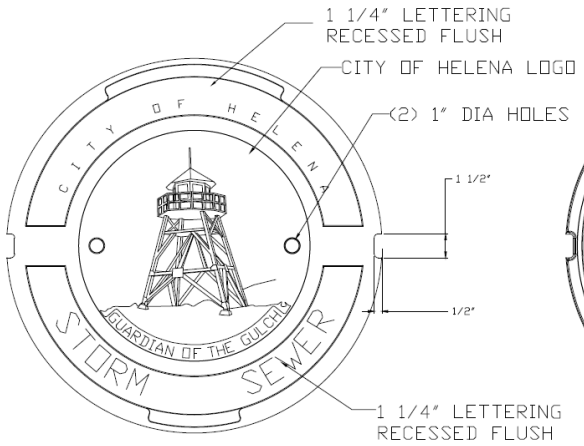
TYPICAL INSTALLATION



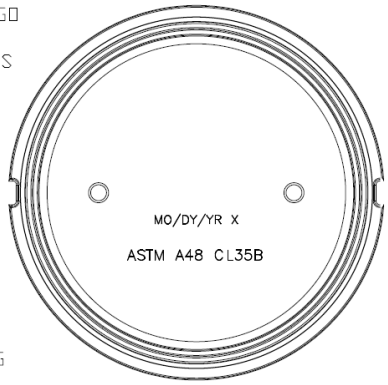
SECTION A-A

THIS STEP MUST MEET THE REQUIREMENTS OF ASTM C 478

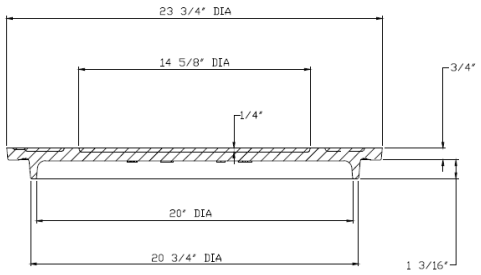
CITY OF HELENA ENGINEERING STANDARDS		**Manhole Step**	*STANDARD DRAWING:* **3-10**
REVISED: 2/12/13	*SCALE:* NONE		



PLAN VIEW



BOTTOM VIEW



SECTION

CITY OF HELENA ENGINEERING STANDARDS		**Approved City Logo Manhole Lid "Storm Sewer" Lettering**	***STANDARD DRAWING:*** **4-9**
REVISED: 2/12/13	***SCALE:*** NONE		

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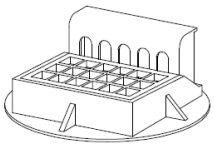
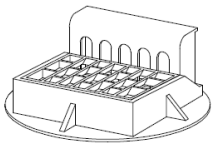
Storm Water Specific Standard Details



TYPE II

APPROVED GRATE
AND CURB BOX
30"Ø CURB INLET

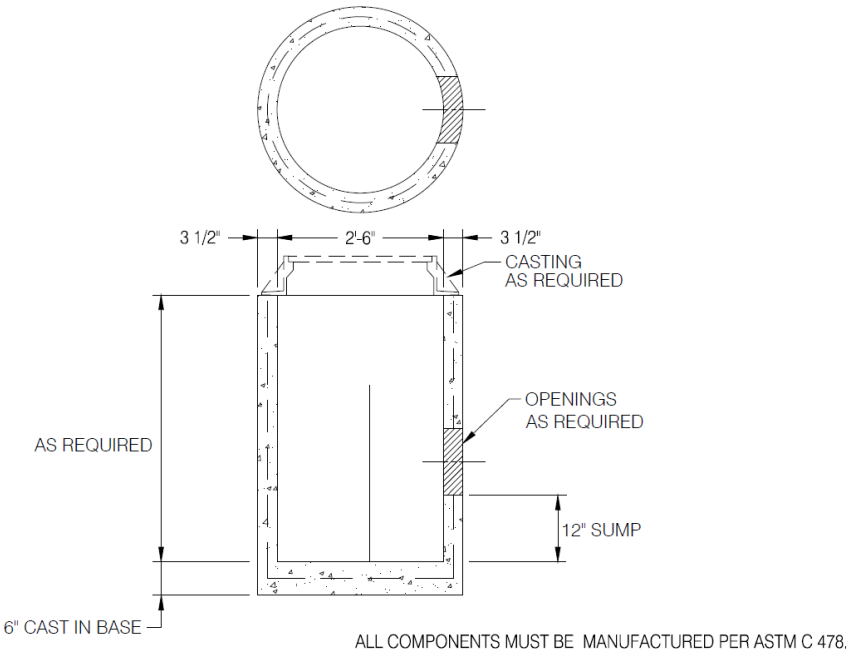


TYPE III

APPROVED GRATE
AND CURB BOX
30"Ø CURB INLET

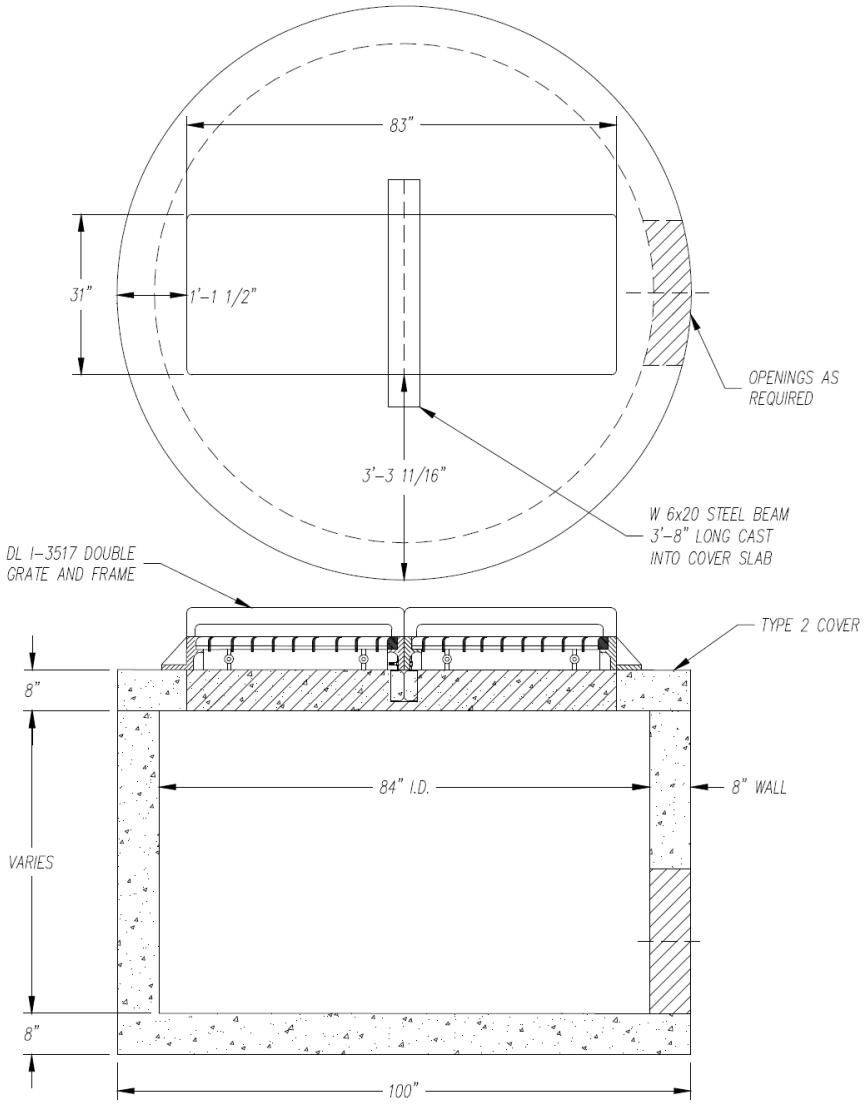
TYPE IV

APPROVED GRATE
30"Ø AREA DRAIN



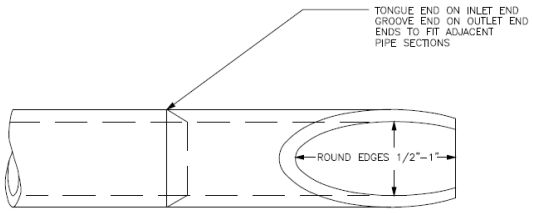
ALL COMPONENTS MUST BE MANUFACTURED PER ASTM C 478.

CITY OF HELENA ENGINEERING STANDARDS		**Standard Specification Inlets**	***STANDARD DRAWING:*** **4-1**
REVISED: 2/12/13	***SCALE:*** NONE		

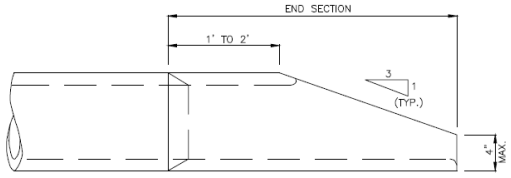


ALL COMPONENTS MUST BE MANUFACTURED PER ASTM C 478.

CITY OF HELENA ENGINEERING STANDARDS		**Combo Manhole Double Curb Inlet**	***STANDARD DRAWING:*** **4-2**
REVISED: 2/12/13	***SCALE:*** NONE		

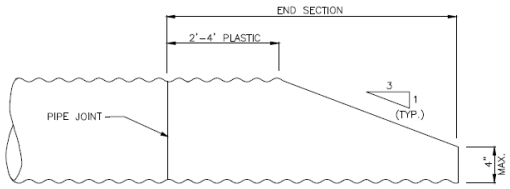


PLAN



ELEVATION

CONCRETE PIPE

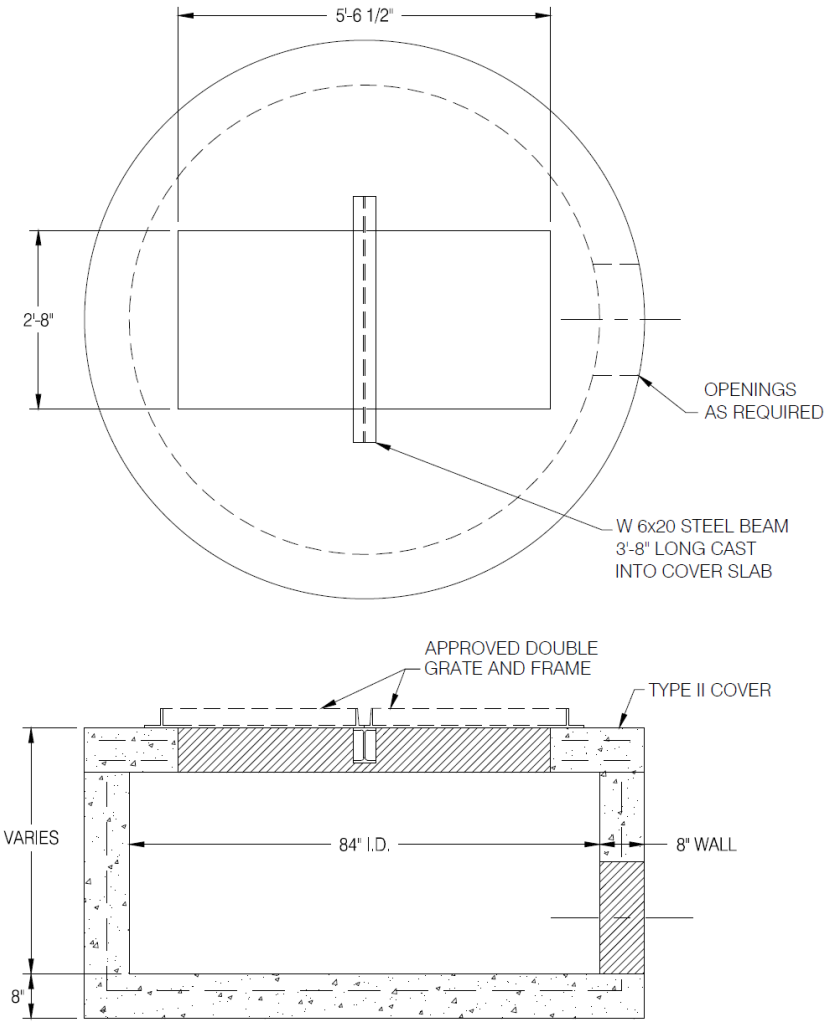


THERMO–PLASTIC PIPE

NOTE:

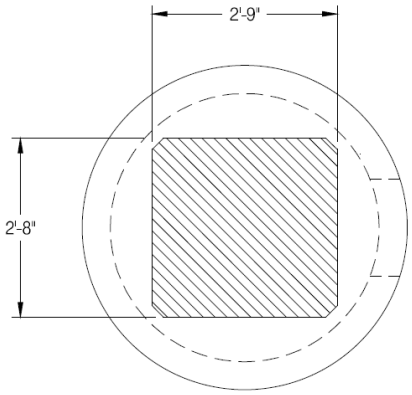
SIDE SLOPE SHALL BE WARPED TO MATCH THE BEVELED PIPE END. WHEN CULVERT IS ON SKEW, BEVELED END SHALL BE ROTATED TO CONFORM TO SLOPE. IF SLOPE DIFFERS FROM 3:1, PIPE SHALL BE BEVELED TO MATCH SLOPE.

CITY OF HELENA ENGINEERING STANDARDS		**Beveled End Pipe Section**	***STANDARD DRAWING:*** **4-3**
REVISED: 2/12/13	***SCALE:*** NONE		

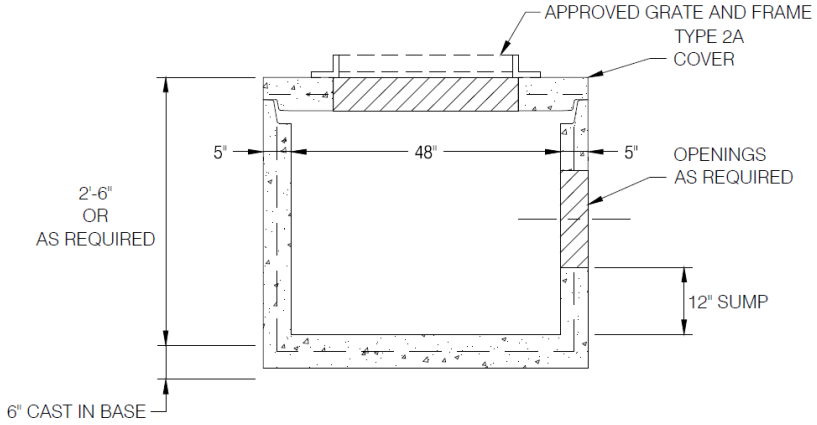


ALL COMPONENTS MUST BE MANUFACTURED PER ASTM C 478.

CITY OF HELENA ENGINEERING STANDARDS		**Type 2 Double Drop Inlet**	***STANDARD DRAWING:*** **4-4**
REVISED: 2/12/13	***SCALE:*** NONE		

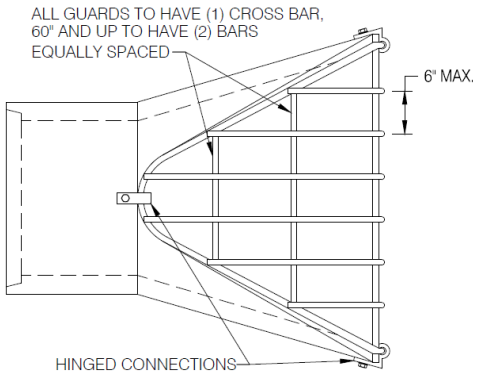


48" TYPE 2A INLET COVER

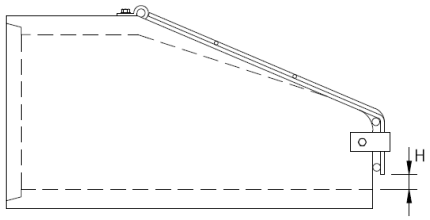


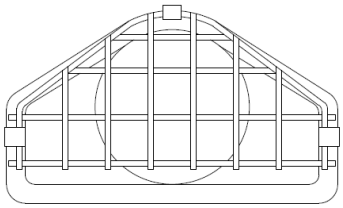
ALL COMPONENTS MUST BE MANUFACTURED PER ASTM C 478.

CITY OF HELENA ENGINEERING STANDARDS		**Type 1 Drop Inlet**	***STANDARD DRAWING:*** **4-5**
REVISED: 2/12/13	***SCALE:*** NONE		



ROUND	
PIPE SIZE	H
12"	2 1/2"
15"	3"
18"-24"	4"
27"-36"	5"
42"-54"	6"
60"-72"	7"
78"-90"	8"

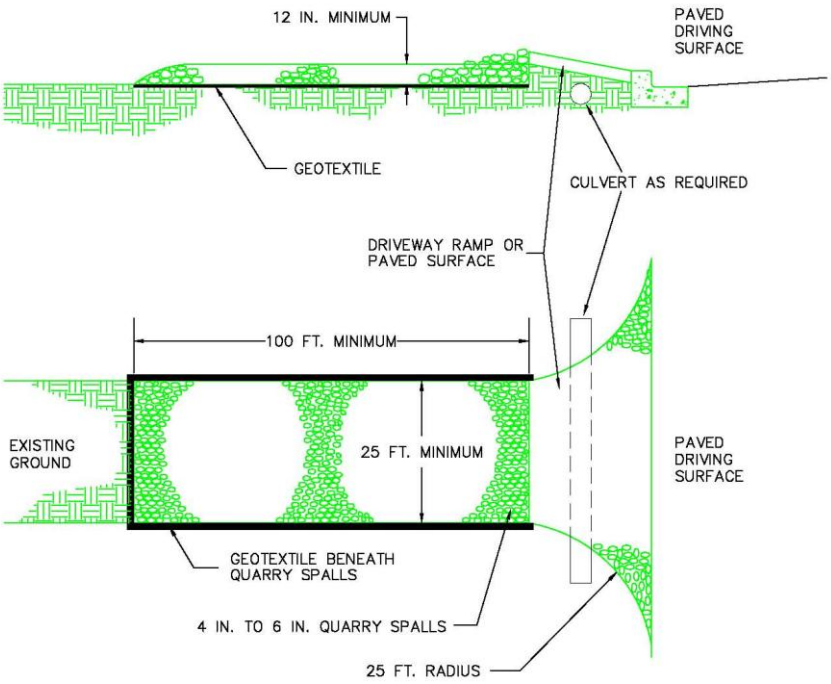




BAR SIZES							
STANDARD DESIGN				HEAVY DESIGN			
PIPE SIZE	HOLE DIA. REQ'D	BOLT DIA.	BAR SIZE	PIPE SIZE	HOLE DIA. REQ'D	BOLT DIA.	BAR SIZE
12"-24"	3/4"	5/8"	5/8"	12"-18"	3/4"	5/8"	3/4"
27"-48"	7/8"	3/4"	3/4"	21"-42"	7/8"	3/4"	1"
54"-90"	1 1/8"	1"	1"	48"-90"	1 1/8"	1"	1 1/4"
BOLT LENGTH = PIPE WALL THICKNESS + 2 1/2"							

Note:
Hot dip galvanized per ASTM A153.

CITY OF HELENA ENGINEERING STANDARDS		**Trash Guard For Flared End Sections**	***STANDARD DRAWING:*** **4-6**
REVISED: 2/12/13	***SCALE:*** NONE		

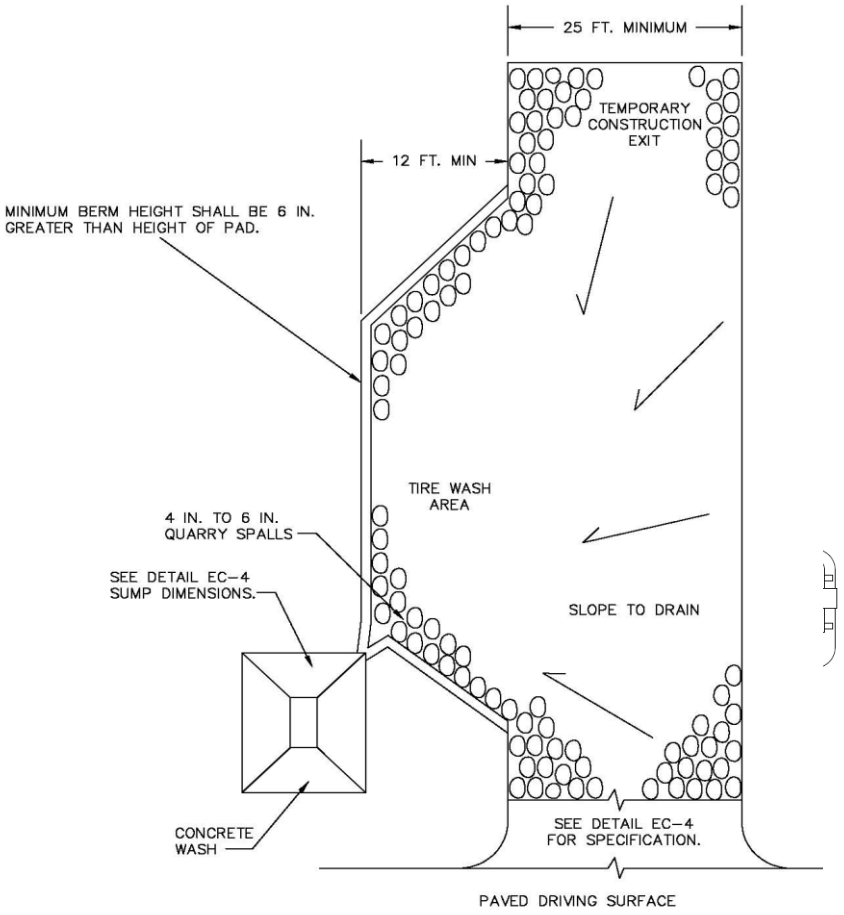


PLAN

NOTES:

1. PAD SHALL BE REMOVED AND REPLACED WHEN SOIL IS EVIDENT ON THE SURFACE OF THE PAD OR AS DIRECTED BY THE CITY CLEARING AND GRADING INSPECTOR.
2. PAD SHALL BE INSTALLED IN PLANTING STRIP AS APPROPRIATE.
3. PAD THICKNESS SHALL BE INCREASED IF SOIL CONDITIONS DICTATE OR PER THE DIRECTION OF THE CITY CLEARING AND GRADING INSPECTOR.
4. MINIMUM DIMENSIONS MAY BE MODIFIED AS REQUIRED BY SITE CONDITIONS UPON APPROVAL OF THE CITY CLEARING AND GRADING INSPECTOR.

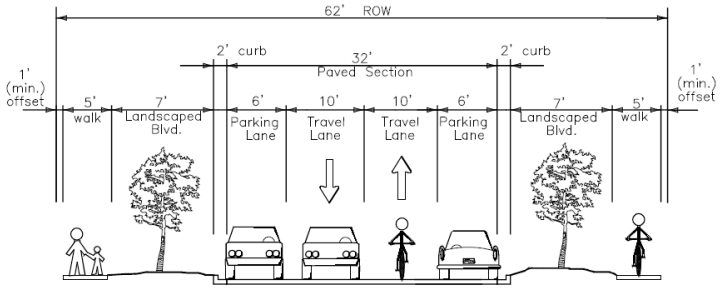
CITY OF HELENA ENGINEERING STANDARDS		**Temporary Construction Exist - Commercial**	***STANDARD DRAWING:*** **4-7**
REVISED: 2/12/13	***SCALE:*** NONE		



NOTE:
TIRE WASH AREA MUST BE INSTALLED DOWNGRADIENT OF TEMPORARY CONSTRUCTION EXIT.

CITY OF HELENA ENGINEERING STANDARDS		**Tire and Concrete Wash Basin**	*STANDARD DRAWING:* **4-8**
REVISED: 2/12/13	*SCALE:* NONE		

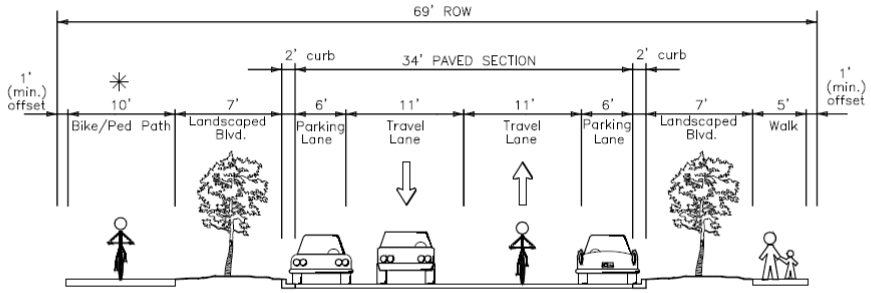
Transportation Standard Details



LOCAL ROAD (w/On-Street Parking)

(NON–MOTORIZED VEHICLES SHARE THE ROAD)

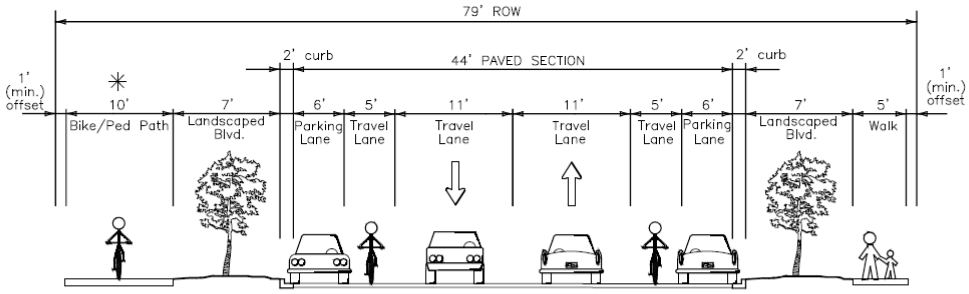
CITY OF HELENA ENGINEERING STANDARDS		**LOCAL ROAD**	***STANDARD DRAWING:*** **5-1**
REVISED: 2/12/13	***SCALE:*** NONE		



MINOR COLLECTOR ROAD ON BIKE ROUTES
(w/On-Street Parking)

PARKING MAY BE OPTIONAL ON ONE (1) OR BOTH SIDES

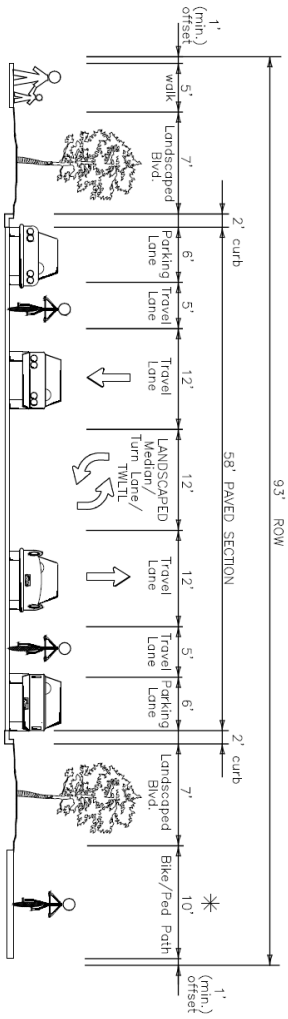
✳ 10' BIKE/PED PATH ON BIKE ROUTES OR 5' SIDEWALK



MAJOR COLLECTOR ROAD ON BIKE ROUTES
(w/ On-Street Parking)

✳ 10' BIKE/PED PATH ON BIKE ROUTES OR 5' SIDEWALK

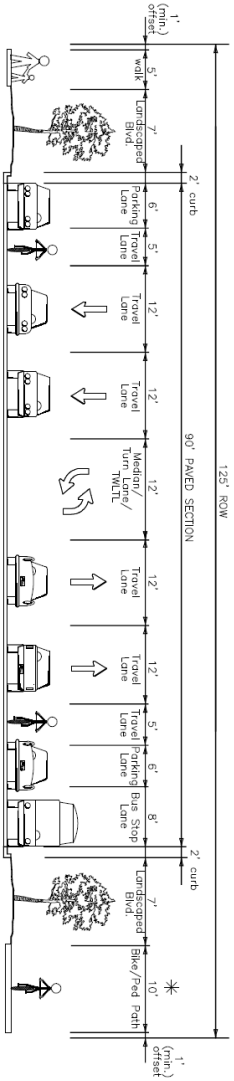
CITY OF HELENA ENGINEERING STANDARDS		***MINOR AND MAJOR COLLECTOR***	***STANDARD DRAWING:*** **5-2**
REVISED: 2/12/13	***SCALE:*** NONE		



MINOR ARTERIAL (w/On-Street Parking)

✳ 10' BIKE/PED PATH ON BIKE ROUTES

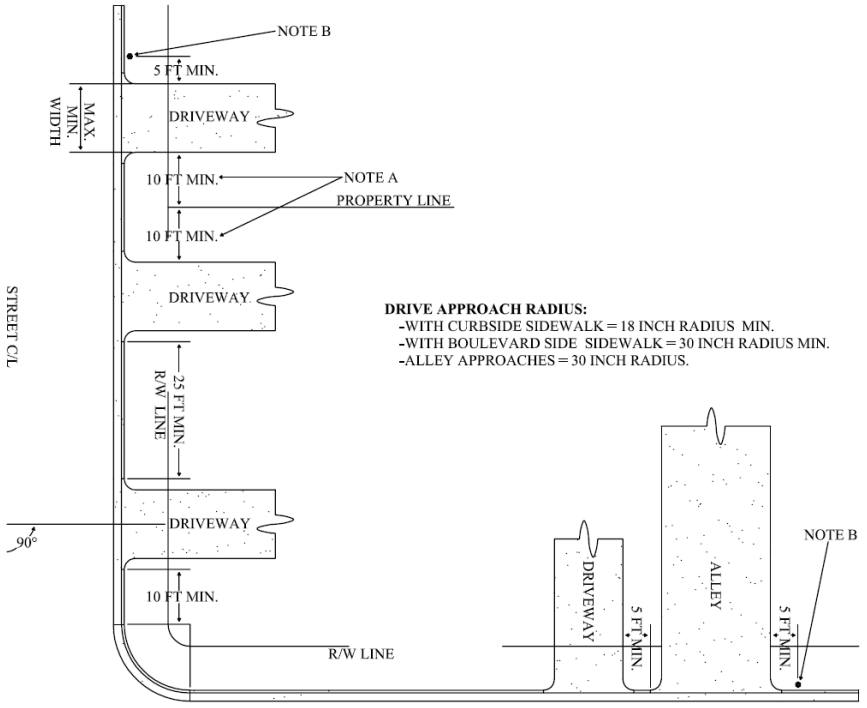
CITY OF HELENA ENGINEERING STANDARDS		MINOR ARTERIAL	STANDARD DRAWING: 5-3
REVISED: 2/12/13	SCALE: NONE		



MAJOR ARTERIAL (w/On-Street Parking)

✳ 10' BIKE/PED PATH ON BIKE ROUTES

CITY OF HELENA ENGINEERING STANDARDS		**MAJOR ARTERIAL**	***STANDARD DRAWING:*** **5-4**
REVISED: 2/12/13	***SCALE:*** NONE		



DRIVE APPROACH RADIUS:
- -WITH CURBSIDE SIDEWALK = 18 INCH RADIUS MIN.
- -WITH BOULEVARD SIDE SIDEWALK = 30 INCH RADIUS MIN.
- -ALLEY APPROACHES = 30 INCH RADIUS.

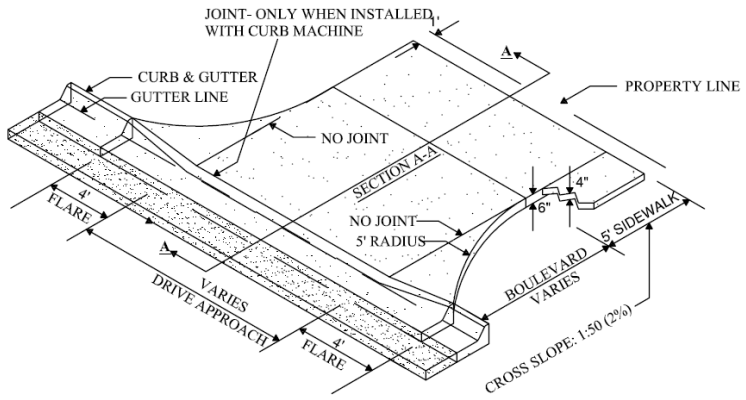
DRIVE APPROACH WIDTHS:
- -SINGLE FAMILY RESIDENTIAL DISTRICTS (R-1, R-2) = 12 FOOT MIN. TO 24 FEET MAX.
- -MULTIPLE FAMILY RESIDENTIAL ZONES (R-3) = 12 FOOT MIN. TO 30 FOOT MAX.
- -RESIDENTIAL OFFICE, COMMERCIAL AND INDUSTRIAL DISTRICTS = 12 FOOT MIN. TO 40 FOOT MAX.
- -TWO ADJOINING PROPERTIES OF 60 FEET OR LESS MAY SHARING A COMMON DRIVE = 12 FOOT MIN. TO 30 FOOT MAX.
- -PROPERTIES MAY HAVE MORE THAN ONE CURB CUT FOR THE SAME PROPERTY IF SEPARATED BY 25 FEET OR MORE OF FULL HEIGHT CURB.

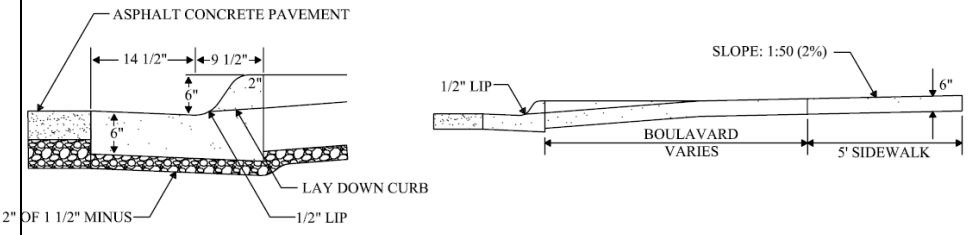
NOTE A:
-NO CURB CUT SHALL BE CONSTRUCTED CLOSER THAN 10 FEET FROM THE SIDE PROPERTY LINE EXCEPT IN RESIDENTIAL ZONES OR AS MAY BE REGULATED BY CITY SPECIFICATIONS IN EFFECT AT THE TIME OF SUCH WORK.

NOTE B:
-ANY UTILITY FACILITIES, LIGHT, STANDARDS, FIRE HYDRANT, STREET SIGNS, SIGNALS OR OTHER PUBLIC IMPROVEMENT OR INSTALLATION.

-ALL DRIVE APPROACHES SHALL COMPLY WITH CURRENT ADA STANDARDS.

CITY OF HELENA ENGINEERING STANDARDS		***DRIVE APPROACH SPACING & WIDTHS***	***STANDARD DRAWING:***
REVISED: 2/12/13	***SCALE:*** NONE		***5-5***





-CLASS 5 (1 1/2" MINUS AGGREGATE) CONCRETE SHALL BE USED.

-COMMERCIAL DRIVE APPROACHES SHALL USE REINFORCED CONCRETE.

-BASE SHALL BE 2" OF 1 1/2" MINUS MATERIAL COMPACTED TO 95% AND SHALL COMPLY WITH AASHTO T99 OR ASTM D698.

-DRIVE APPROACH TO BE INSTALLED BEFORE ASPHALT CONCRETE PAVEMENT.

-APPROACH WILL BE PLACED MONOLITHICALLY EXCEPT WHEN CURB MACHINE IS ALLOWED BY THE ENGINEER WITH DOWELING 2ft. ON CENTER, #4 REBAR 2ft. (60cm) IN LENGTH.

-JOINTS SHALL BE 1/2"MASTIC OR AS DIRECTED BY THE ENGINEER.

-PROVIDE RECTANGULAR JOINT PATTERN DEPENDENT ON WIDTH OF SLABS (NOT TO EXCEED 100 S.F. (9 sq.m.) SURFACE.

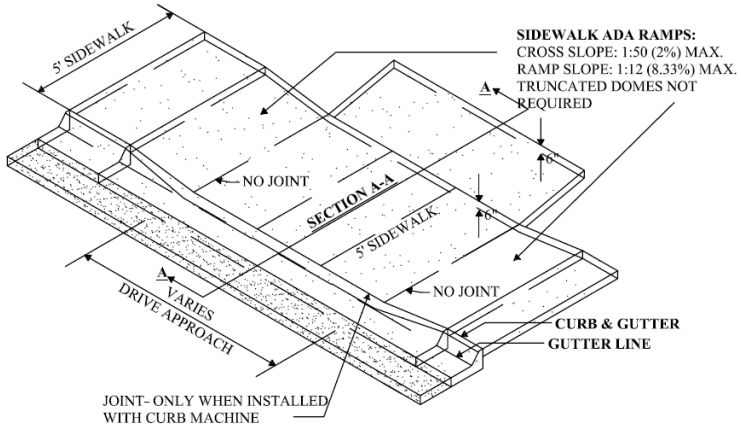
-WHERE DRIVEWAYS EXCEED 16' IN WIDTH, A 1/2" MASTIC JOINT SHALL BE PLACED LONGITUDINALLY ALONG THE CENTER LINE.

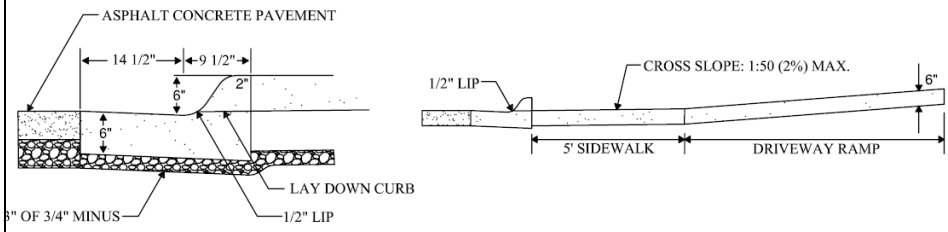
-DRIVE APPROACHES WHERE THE BOULAVARD EXCEEDS 12' (3.7m) IN DEPTH REQUIRE A TRANVERSE JOINT AT THE TOP OF THE FLARE.

-FLARES SHALL BE 4' (1.2m) IN WIDTH. STANDARD DRIVEWAY WIDTH DOES NOT CHANGE.

-ALL DRIVE APPROACHES SHALL COMPLY WITH CURRENT ADA STANDARDS.

CITY OF HELENA ENGINEERING STANDARDS		***BOULAVARD DRIVEWAY APPROACH DETAIL (WITH FLAIR SECTIONS)***	***STANDARD DRAWING:*** **5-6**
REVISED: 2/12/13	***SCALE:*** NONE		





-CLASS 5 (3/4" MINUS AGGREGATE) CONCRETE SHALL BE USED.

-COMMERCIAL DRIVE APPROACHES SHALL USE REINFORCED CONCRETE.

-BASE SHALL BE 3" OF 3/4" MINUS MATERIAL COMPACTED TO 95% AND SHALL COMPLY WITH AASHTO T99 OR ASTM D698.

-DRIVE APPROACH TO BE INSTALLED BEFORE ASPHALT CONCRETE PAVEMENT.

-APPROACH WILL BE PLACED MONOLITHICALLY EXCEPT WHEN CURB MACHINE IS ALLOWED BY THE ENGINEER WITH DOWELING 2ft. ON CENTER, #4 REBAR 2ft. (60cm) IN LENGTH.

-JOINTS SHALL BE 1/2"MASTIC OR AS DIRECTED BY THE ENGINEER.

-PROVIDE RECTANGULAR JOINT PATTERN DEPENDENT ON WIDTH OF SLABS (NOT TO EXCEED 100 S.F. (9 sq.m.) SURFACE.

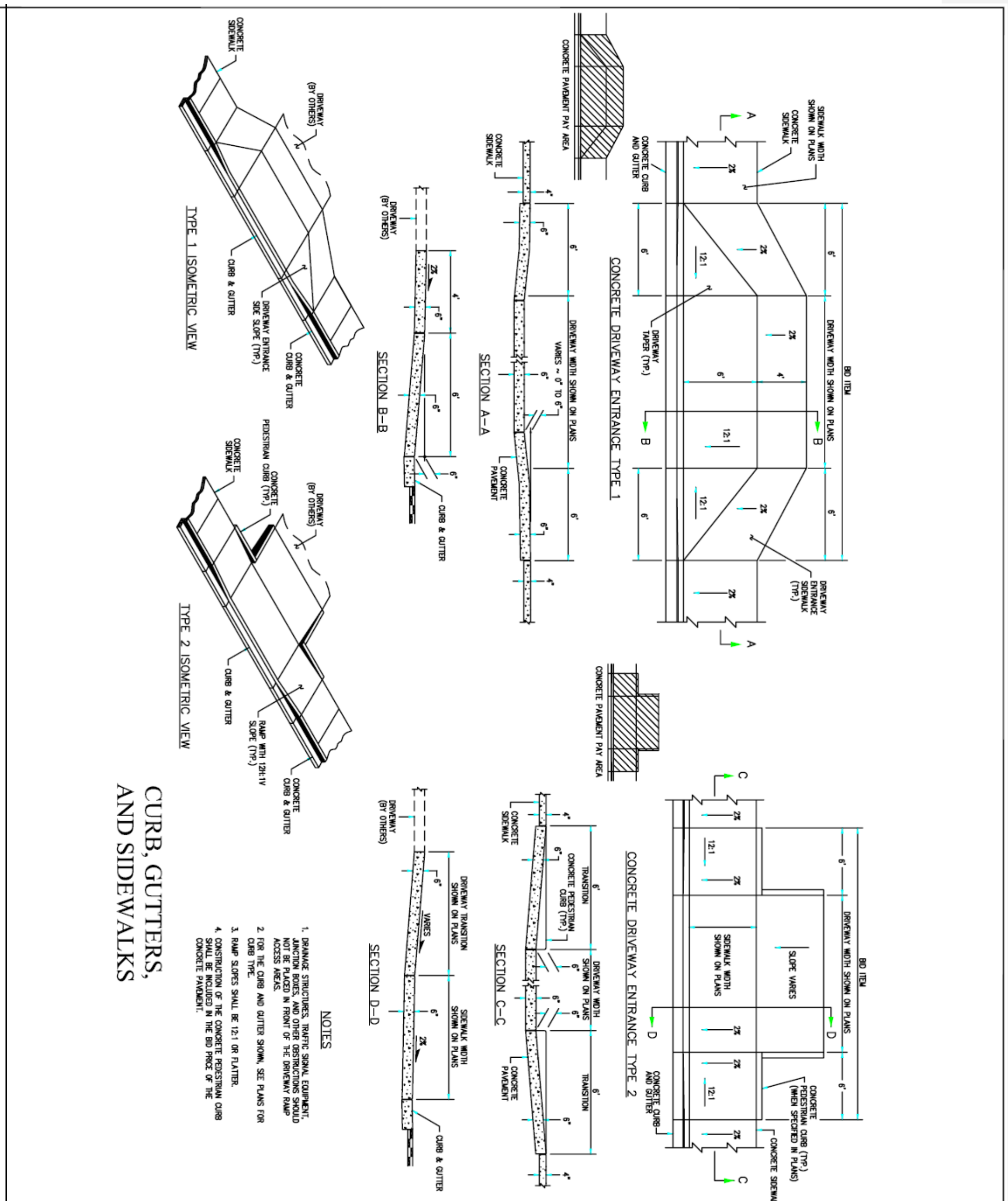
-WHERE DRIVEWAYS EXCEED 16' IN WIDTH, A 1/2" MASTIC JOINT SHALL BE PLACED LONGITUDINALLY ALONG THE CENTER LINE.

-DRIVE APPROACHES WHERE THE BOULAVARD EXCEEDS 12' (3.7m) IN DEPTH REQUIRE A TRANVERSE JOINT AT THE TOP OF THE FLARE.

-FLARES SHALL BE 4' (1.2m) IN WIDTH. STANDARD DRIVEWAY WIDTH DOES NOT CHANGE.

-ALL DRIVE APPROACHES SHALL COMPLY WITH CURRENT ADA STANDARDS.

CITY OF HELENA ENGINEERING STANDARDS		***CURBSIDE SIDEWALK DRIVEWAY APPROACH DETAIL (WITH FLAIR SECTIONS)***	***STANDARD DRAWING:*** **5-7**
REVISED: 2/12/13	***SCALE:*** NONE		



CITY OF HELENA ENGINEERING STANDARDS		*CURBSIDE SIDEWALK DRIVEWAY APPROACH DETAIL (ALTERNATE)*	***STANDARD DRAWING:*** ***5-8***
REVISED: 2/12/13	***SCALE:*** NONE		

TWO DIRECTIONAL STREET CROSSING

NEW CONSTRUCTION:

NOTE:

- ALL ADA RAMPS MUST BE CUNSTRUCTED TO CURRENT ADA STANDARDS.

- SINGLE DIAGONAL CURB RAMPS SERVING TWO STREET CROSSING DIRECTIONS ARE NOT PERMITTED IN NEW CONSTRUCTION.

1. THE DESIREABLE WIDTH OF THE CURB RAMP (DIMENSION "W" BELOW) IS 4'. THE MINIMUM WIDTH IS 3'.

2. THE CURB RAMP SLOPE IS 1:12 (8.33%) OR FLATTER.

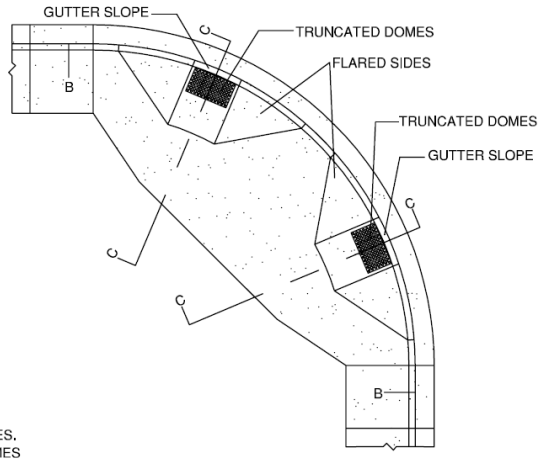
3. THE MINIMUM LANDING LENGTH IS 4'.

4. THE MAXIMUM FLARED SIDE SLOPE IS 1:12 (8.33%).

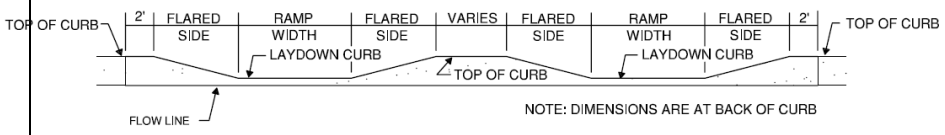
5. THE MAXIMUM CROSS SLOPE OF THE RAMP AND ADJOINING SIDEWALK IS 1:50 (2%).

6. THE DETECTABLE SURFACE OF THE SIDEWALK RAMP IS TO CONTRAST VISUALLY WITH THE ADJOINING SIDEWALK SURFACES. THIS WILL BE OBTAINED BY USE OF COLORED TRUNCATED DOMES (RED) FLUSH TO THE BACK OF THE LAYDOWN CURB.

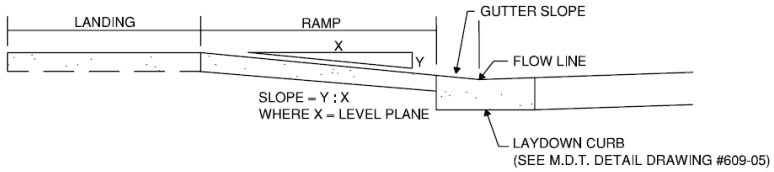
7. THE MAXIMUM GUTTER SLOPE MAY IS 1:20 (5%).



SECTION B-B



SECTION C-C



CITY OF HELENA ENGINEERING STANDARDS		ADA SIDEWALK CURB RAMP	STANDARD DRAWING: 5-9
REVISED: 2/12/13	SCALE: NONE		

NEW CONSTRUCTION:

NOTE:

- ALL ADA RAMPS MUST BE CUNSTRUCTED TO CURRENT ADA STANDARDS.

- SINGLE DIAGONAL CURB RAMPS SERVING TWO STREET CROSSING DIRECTIONS ARE NOT PERMITTED IN NEW CONSTRUCTION.

1. THE DESIREABLE WIDTH OF THE CURB RAMP (DIMENSION "W" BELOW) IS 4'. THE MINIMUM WIDTH IS 3'.

2. THE CURB RAMP SLOPE IS 1:12 (8.33%) OR FLATTER.

3. THE MINIMUM LANDING LENGTH IS 4'.

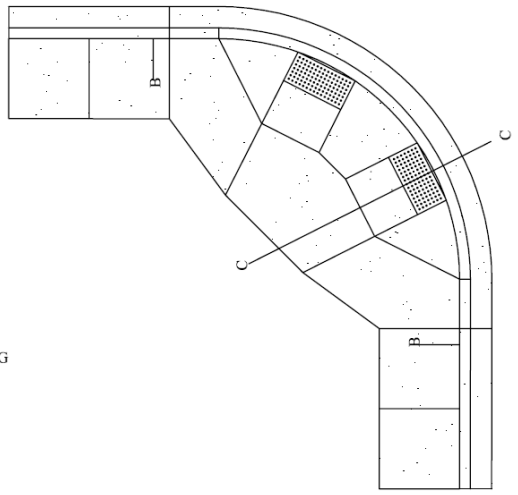
4. THE MAXIMUM FLARED SIDE SLOPE IS 1:12 (8.33%).

5. THE MAXIMUM CROSS SLOPE OF THE RAMP AND ADJOINING SIDEWALK IS 1:50 (2%).

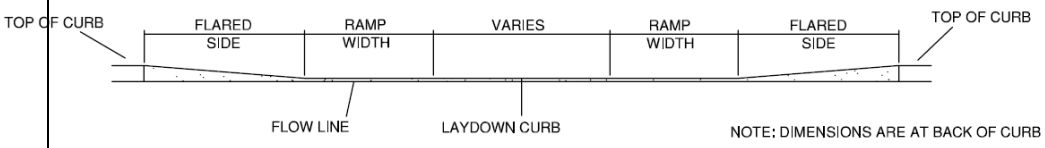
6. THE DETECTABLE SURFACE OF THE SIDEWALK RAMP IS TO CONTRAST VISUALLY WITH THE ADJOINING SIDEWALK SURFACES. THIS WILL BE OBTAINED BY USE OF COLORED TRUNCATED DOMES (RED) FLUSH TO THE BACK OF THE LAYDOWN CURB.

7. THE MAXIMUM GUTTER SLOPE MAY IS 1:20 (5%).

TWO DIRECTIONAL STREET CROSSING

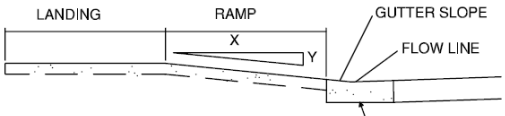


SECTION B-B



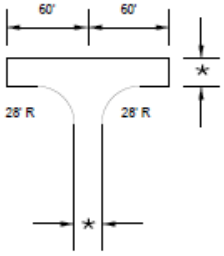
NOTE: DIMENSIONS ARE AT BACK OF CURB

SECTION C-C

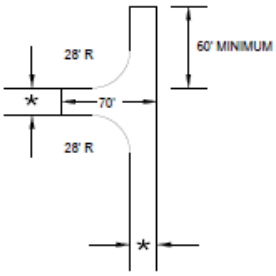


SLOPE = Y : X
WHERE X = LEVEL PLANE

CITY OF HELENA ENGINEERING STANDARDS	***ADA SIDEWALK CURB RAMP (15' Radius)***	***STANDARD DRAWING:*** **5-10**
REVISED: 2/12/13 / ***SCALE:*** NONE		

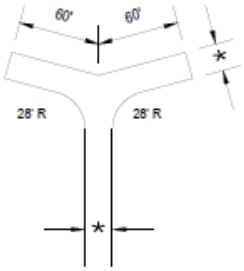


120' HAMMERHEAD

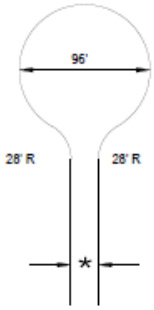


ACCEPTABLE ALTERNATIVE
TO 120' HAMMERHEAD

ALL STREET DIMENSIONS ARE BASED ON CITY
STREET STANDARDS AND ARE FROM FACE OF CURB.



ACCEPTABLE ALTERNATIVE
TO 120' HAMMERHEAD



96' CUL-DE-SAC

TURNAROUNDS ARE BASED ON THE INTERNATIONAL
FIRE CODE INSTITUTE APPLICATION MANUAL (1995 ED.)

APPROVED BY:

CITY ENGINEER

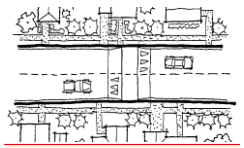
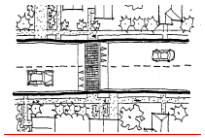
FIRE MARSHAL

FIRE CHIEF

CITY OF HELENA ENGINEERING STANDARDS		ACCECPTABLE TURNAROUNDS	STANDARD DRAWING: 5-11
REVISED: 2/12/13	SCALE: NONE		

TYPES OF TRAFFIC CALMING MEASURES

Vertical Deflection

Measure	Definition/Application	Advantages	Disadvantages	Special Considerations
 Speed Hump	Paved hump in the street that causes discomfort at high speeds. • Speed reduction • Possible traffic reduction	• Effective if used in series at 300 to 500 foot spacing. • Self-enforcing. • Relatively inexpensive.	• If not properly designed, drivers may skirt around to reduce impact. • Drivers may speed up between humps. • May increase volumes on other streets. • Difficult to properly construct.	• Emergency vehicles • Drainage • Signage • Snow removal Estimated Cost Range = $1,000 to $2,000
 Raised Crosswalk	Speed hump designed as a pedestrian crossing. • Speed reduction at crossing • Possible traffic reduction	• Highlights crosswalk. • Excellent pedestrian safe treatment. • Aesthetically pleasing if designed. • Relatively inexpensive.	• Drivers may speed up between humps. • May increase volumes on other streets. • Difficult to properly construct.	• Emergency vehicles • Drainage • Signage • Snow removal Estimated Cost Range = $1,000 to $2,000
	Patterned sections of rough pavement.	• Relatively inexpensive to	• High maintenance.	• Emergency vehicles

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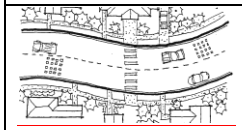
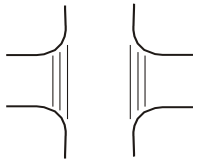
Vertical Deflection

Measure	Definition/Application	Advantages	Disadvantages	Special Considerations
 Rumble Strips	• Possible speed reduction	install. • Create driver awareness.	• May adversely impact bicyclists. • Noisy by design, and not recommended for all areas.	Estimated Cost Range = $1,000 to $2,000
 Surface Valley Gutters	Dips in the street that can be used to carry run-off as well as cause discomfort to drivers at high speeds. • Speed reduction • Possible traffic reduction	• Effective if used in series at 300 to 500 foot spacing. • Self-enforcing. • Relatively inexpensive during initial construction.	• Drivers may speed up between dips. • May increase volumes on other streets. • Not usually appropriate for existing streets with established drainage patterns.	• Emergency vehicles • Drainage • Signage Estimated Cost Range = $1,000 to $2,000
	Raised plateau where streets intersect.	• Slows vehicles in the most critical area, reducing	• Increases difficulty of	• Emergency vehicles

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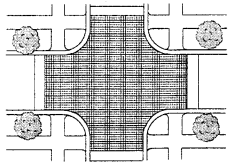
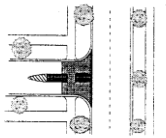
Vertical Deflection

Measure	Definition/Application	Advantages	Disadvantages	Special Considerations
 Raised Intersection	• Speed reduction • Possible traffic reduction	conflict. • Highlights intersection. • Excellent pedestrian safety treatment. • Aesthetically pleasing if well designed. • Better for emergency vehicles than speed humps.	making a turn. • Increased maintenance. • Requires adequate signage and driver education.	• Drainage • Signage • Snow removal Estimated Cost Range = $4,000 to $6,000

Horizontal Deflection

Measure	Definition/Application	Advantages	Disadvantages	Special Considerations
 Gateway Treatment	Entry treatment that communicates a sense of neighborhood identity and a change in traffic conditions. • Speed reduction at entry • Traffic reduction	• Positive indication of a change in environment from arterial road to residential street. • Reduces pedestrian crossing distances. • On wide streets, provides space for landscaping in the median.	• Low speed of turning vehicles may restrict flow on adjacent arterial.	• Emergency vehicle access • Lighting • Irrigation and maintenance of landscaping Estimated Cost Range = $5,000 to $25,000

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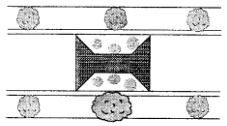
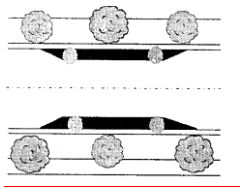
Horizontal Deflection

Measure	Definition/Application	Advantages	Disadvantages	Special Considerations
Single-Lane Slow Point/  Lane Narrowing	Mid-block expansion of landscaped areas and/or on-street parking in order to physically narrow the street to a single traffic lane. • Speed Reduction • Traffic Reduction	• Minor inconvenience to drivers. • Minimal inconvenience to local traffic. • Shorter crossing distance for pedestrians. • Provides space for landscaping. • Effective when used in series.	• Unfriendly to bicyclists unless designed to accommodate them. • Conflict between opposing drivers arriving simultaneously could create problems. • Contrary to driver expectation of unobstructed flow.	• Emergency vehicle access • Lighting • Signage • Irrigation and maintenance of landscaping Estimated Cost Range = $8,000 to $20,000
 Two-Lane Slow Point	Mid-block expansion of landscaped areas and/or on-street parking in order to physically narrow the street. • Speed reduction • Possible traffic reduction	• Minor inconvenience to drivers. • Regulates parking if bulb-outs are placed in no parking zones. • Protects parked vehicles. • Reduces pedestrian crossing distance. • Provides space for landscaping.	• Less effective in reducing speed and diverting traffic than the single-lane application. • Unfriendly to bicyclists unless designed to accommodate them.	• Lighting • Signage • Irrigation and maintenance of landscaping Estimated Cost Range = $8,000 to $20,000
	Offset curb extensions used to narrow the street to a single lane and create angled deviations in the path of travel.	• Minor inconvenience to drivers. • Minimal inconvenience to	• Unfriendly to bicyclists unless designed to accommodate them. • Conflict between opposing	• Emergency vehicle access • Lighting • Signage

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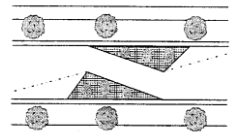
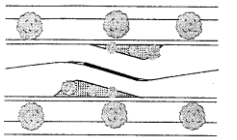
Horizontal Deflection

Measure	Definition/Application	Advantages	Disadvantages	Special Considerations
 Single-Lane Angled Slow Point	• Speed reduction • Traffic reduction	local traffic. • Shorter crossing distance for pedestrians. • Provides space for landscaping. • Effective when used in series.	drivers arriving simultaneously could create problems. • Contrary to driver expectation of unobstructed flow.	• Irrigation and maintenance of landscaping Estimated Cost Range = $8,000 to $20,000
 Two-Lane Angled Slow Point	Offset curb extensions used to narrow the street and create angled deviations in the path of travel. • Speed reduction • Possible traffic reduction	• Same as Single-Lane Angled Slow Point, except pedestrian safety is reduced.	• Same as Single-Lane Angled Slow Point, except less effective in controlling speeds because drivers can create a straighter through movement by driving over centerline.	• Lighting • Signage • Irrigation and maintenance of landscaping Estimated Cost Range = $8,000 to $20,000

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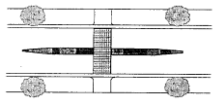
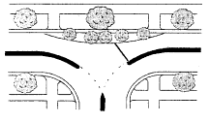
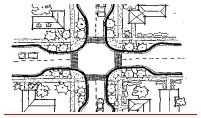
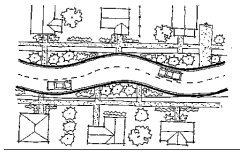
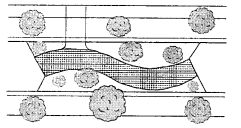
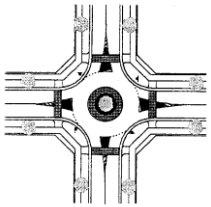
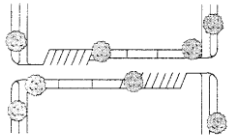
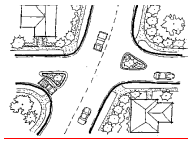
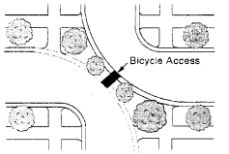
Horizontal Deflection

Measure	Definition/Application	Advantages	Disadvantages	Special Considerations
 Mid-Block Median	Island or barrier in the center of a street that narrows lanes and segregates traffic. • Possible speed reduction • Possible traffic reduction	• Provides a refuge for pedestrians and bicyclists. • Can improve the streetscape if landscaped.	• Limited reduction in vehicle speeds.	• Lighting • Signage • Irrigation and maintenance of landscaping Estimated Cost Range = $5,000 to $10,000
 Modified "T" Intersection	Modification of "T" intersection layout which gives priority to turning traffic. • Speed reduction • Possible traffic reduction	• Reduces through traffic along the top of the "T". • May provide space for landscaping.	• Can cause confusion regarding priority movements, which may lead to accidents.	• Lighting • Signage • Irrigation and maintenance of landscaping Estimated Cost Range = $5,000 to $10,000
 Neckdown/Curb Bulbs	Physical curb reduction of road width at an intersection. • Speed reduction	• Reduces pedestrian crossing distance. • Can be used in multiple applications or on a single segment of roadway. • Aesthetically pleasing if landscaped.	• Unfriendly to bicyclists unless designed to accommodate them. • Landscaping may cause sight line problems.	• Lighting • Signage • Irrigation and maintenance of landscaping Estimated Cost Range = $20,000 to $30,000
	Offset curb extensions that cause deviation in the path of travel.	• Imposes minimal inconvenience on local	• May create opportunities for head-on conflicts on	• Lighting

Measure	Definition/Application	Advantages	Disadvantages	Special Considerations
 Deviation/Chicanes **Horizontal Deflection**	• Speed reduction • Possible traffic reduction	traffic. • Reduces pedestrian crossing distance. • Provides large area for landscaping. • Reduces speed without significantly increasing emergency response time. • Aesthetically pleasing.	narrow streets. • Cost is greater than many other devices. • Unfriendly to bicyclists unless designed to accommodate them.	• Signage • Irrigation and maintenance of landscaping Estimated Cost Range = $20,000 to $30,000
 Driveway Link	Narrow winding driveway section placed between two standard street segments. • Speed reduction • Traffic reduction	• Changes the initial impression of the street. Appears to be a road closure yet allows through movements for local traffic. • Provides a large area for landscaping.	• High cost can be prohibitive. Best installed in conjunction with street reconstruction or initial construction. • Unfriendly to bicyclists unless designed to accommodate them.	• Emergency vehicle access • Lighting • Signage • Irrigation and maintenance of landscaping Estimated Cost Range = $20,000 to $50,000
	Raised circular area placed in the center of an intersection. Drivers travel in a counter-clockwise direction and are required to yield upon entry.	• Reduces accidents by 50% to 90% over stop control. • Provides space for landscaping.	• May be restrictive for larger vehicles if designed to a low speed. (This can be minimized by the use of a mountable apron.)	• Lighting • Signage • Irrigation and maintenance of landscaping

Measure	Definition/Application	Advantages	Disadvantages	Special Considerations
 Traffic Circle/Roundabout	• Speed reduction at intersection • Possible traffic reduction	• Cheaper to maintain than signals. • Effective at multi-leg intersections. • Provides equal access to intersections for all drivers. • Provides a good environment for bicyclists.	• Right of way may need to be purchased to accommodate left turns by large vehicles. • Initial safety issues as drivers adjust. • May increase volumes on adjacent streets.	Estimated Cost Range = $10,000 to $50,000
 Shared Zone	A block with narrow entry points and high-density parking which functions similarly to a parking lot. • Speed reduction • Traffic reduction	• Provides a low speed shared environment that is safe for all users. • Improves amenity without restricting access. • Provides flexibility for on-street parking.	• High cost unless part of original design. • May result in an increased number of low speed accidents.	• Emergency vehicle access • Signage Estimated Cost Range = $15,000 to $25,000

Obstruction

Measure	Definition/Application	Advantages	Disadvantages	Special Considerations
 Forced Turn Barriers/ Diverters	Small traffic islands installed at intersections to restrict and channelize turning movements. • Traffic reduction • Possible speed reduction	• Changes driving patterns • May reduce cut through traffic. • May be attractive if landscaped.	• May increase trip length for some drivers. • May increase response times for emergency vehicles.	• Lighting • Signage • Irrigation and maintenance of landscaping Estimated Cost Range = $4,000 to $8,000
 Diagonal Road Closure	Barrier placed diagonally across a four-legged intersection, interrupting traffic flow across the intersection. • Traffic reduction • Speed reduction	• Eliminates through traffic • Provides area for landscaping. • Reduces traffic conflict points. • Increases pedestrian safety • Can include bicycle path connection.	• May inconvenience residents gaining access to their properties. • May inhibit access by emergency vehicles. • May divert through traffic to other local streets. • Altered traffic patterns may increase trip length.	• Lighting • Signage • Irrigation and maintenance of landscaping Estimated Cost Range = $10,000 to $20,000

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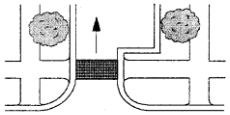
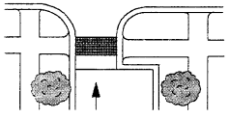
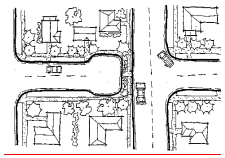
Obstruction

Measure	Definition/Application	Advantages	Disadvantages	Special Considerations
  Partial Street Closure	Blockage of one direction of traffic on a two-way street. The open lane of traffic is signed one-way, and traffic from the blocked lane is not allowed to drive around the barrier in the open lane. • Traffic reduction • Speed reduction	• Reduces through traffic in one direction. • Allows two-way traffic on the remainder of the street. • Shorter crossing distance for pedestrians. • Provides space for landscaping. • Two-way bicycle access can be maintained. • Emergency vehicles can drive around partial closure with care.	• Reduces access for residents. • Compliance with semi-diverters is not 100%. • May increase trip length.	• Lighting • Signage • Irrigation and maintenance of landscaping Estimated Cost Range = $10,000 to $20,000 each side of intersection
 Cul-De-Sac/Street Closure	Street closed to motor vehicles at the end of a block using planters, bollards, barriers, etc. • Traffic reduction • Speed reduction	• Eliminates through traffic. • Improves safety for all street users. • Pedestrian and bicycle access maintained.	• Reduces emergency vehicle access. • Reduces access to properties for residents. • May increase trip lengths. • May increase volumes on other streets. • Reduces connectivity	• Emergency vehicle access • Lighting • Signage • Irrigation and maintenance of landscaping Estimated Cost Range = $15,000 to $25,000
	Street closed to motor vehicles mid-block using planters, bollards, barriers, etc.	• Eliminates through traffic. • Improves safety for all	• Reduces emergency vehicle access. • Reduces access to	• Emergency vehicle access • Lighting

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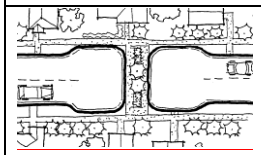
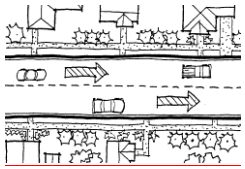
Obstruction

Measure	Definition/Application	Advantages	Disadvantages	Special Considerations
 Mid-Block Street Closure	• Traffic reduction • Speed reduction	street users. • Pedestrian and bicycle access maintained.	properties for residents. • May increase trip lengths. • May increase volumes on other streets. • Reduces connectivity	• Signage • Irrigation and maintenance of landscaping Estimated Cost Range = $15,000 to $25,000
 One-Way Street	Street upon which motor vehicles may operate in just one direction. • Possible traffic reduction	• Increased safety due to lack of opposing traffic. • Can be used to open up more resident parking. • Maintains reasonable access for emergency vehicles. • Can discourage through traffic.	• Can lead to increased vehicle speeds. • May increase trip lengths. • May increase volumes on other streets. • Initial safety concerns as drivers adjust. • Alternative route must exist. • Reduces connectivity	• Signage • Emergency vehicle access Estimated Cost Range = $2,000 to $3,000
	Intersection at which opposing legs carry one-way traffic in different directions.	• Increased safety due to lack of opposing traffic. • Maintains reasonable access for emergency	• May increase trip lengths. • May increase volumes on other streets.	• Signage • Emergency vehicle access

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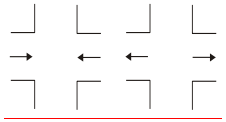
Obstruction

Measure	Definition/Application	Advantages	Disadvantages	Special Considerations
 Imploding/Exploding One-Way Street Intersections	• Traffic reduction	vehicles. • Interrupts the flow of through traffic.	• Initial safety concerns as drivers adjust. • Alternative route must exist.	Estimated Cost Range = $3,000 to $5,000

* Narrow streets, boulevards, and street trees also provide traffic calming

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