ENGINEERING AND DESIGN STANDARDS

Draft 2019 Engineering Standards Update

City of Helena
Public Works Department
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ACRONYMS

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 Engineers
LID - Low Impact Development
LOS - Level of Service
MDT - Montana Department of Transportation
MPWSS - Montana Public Works Standard Specifications
MS4 - Municipal Separate Storm Sewer Systems
MSE - Mechanically Stabilized Earth
MUTCD - Manual on Uniform Traffic Control Devices
NRCS - US Department of Agriculture Natural Resources Conservation Service
PVC - Polyvinyl Chloride Pipe
RCP - Reinforced Concrete Pipe
ROW - Right-of-Way
SC - Spill Control
SDF - System Development Fee
SWPPP - Stormwater Pollution Prevention Plan
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PART 1 GENERAL PROVISIONS

1.1 INFRASTRUCTURE ACCEPTANCE POLICY

Interim use of the underground public 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/owner 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. A financial guarantee will be required for the punch list items that have not been accepted by the City prior to filing 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 stormwater utilities will be completely installed, inspected, tested, and accessible to City personnel.
- All temporary and permanent 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 Engineering staff, the engineer of record, and the developer.
- The engineer of record will certify that all the utilities have been completed in substantial accordance with the plans and specifications. The 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.
- 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 a professional engineer of the underground public utilities to be accepted. The electronic file must be AutoCAD compatible and acceptable to the City Engineering Division.
- 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 rights-of-way 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 the interim water and sewer infrastructure must be provided to the City if required by the City Engineer.

• Roads must be completed to finished grade and accessible to emergency vehicles.

City Staff will respond in writing to a request for interim acceptance within 15 working days from the date that the written request and all the required information have been received by the Engineering Division.

1.1.2 FINAL ACCEPTANCE

Final acceptance of the water, sewer, stormwater, and street will occur upon completion and acceptance of all required infrastructure installation. Final acceptance will be granted by the City Engineer upon the completion of the following items:

• A comprehensive walk-through with City staff, the engineer of record 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 of record that the entire development has been completed in substantial accordance with the approved plans and specifications.

• Submission of final as-built drawings in an electronic AutoCAD format meeting the requirements of the City of Helena Computer Aided (CAD) Standards. As-built drawings must be stamped and signed by a professional engineer.

• Submission of the complete set of daily field inspection logs and photographs.

• A Bill of Sale for all the infrastructure provided to the City.

• Copies of the required tests supplied to the Engineering Division and 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 writing to a request for final acceptance within 15 working days from the date that the written request and all the required information have been received by the Engineering Division.
Final acceptance of a completed utility system component may 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 stormwater 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 Division 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 stormwater facilities must be constructed and operational prior to construction of any impervious area. As-built drawings and a professional engineer’s certification must be supplied to the Department of Public Works prior to acceptance or approval of the on-site stormwater facilities.

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

Any proposed deviation from these Engineering Design standards must be requested in writing to the Public Works Department and include the engineer of record’s stamp and signature on the deviation form and certifying statement along with the infrastructure submittal for the proposed project.

All deviation requests must contain information sufficient for reviewers to understand the deviation requested, the specific standard(s) to which the deviation applies, and to communicate the hardship or justification for the deviation requested. As a general rule, increased cost is not a valid justification for a deviation request.

Any deviation request will increase the City’s review time to allow for time for committee review and decision. Any deviation request that needs an action by the City Commission or a State Agency will increase the review time additionally as needed to accomplish these action(s).

All deviations submitted must contain, at a minimum the following information in the engineer of record’s stamped and signed deviation request:

1. **Formal Deviation Request** – A brief statement by the engineer of record outlining the proposed deviation, and summarizing the request and its effects on the proposed project and existing infrastructure.

2. **Deviation Form** – A completed City of Helena Deviation Form including engineer of record’s signed statement.

3. **Specific Standard(s)** – A list of the specific standards being deviated from and in what manner they will be deviated from.

4. **Specific Justification(s)** – A complete description of the hardships that would occur if the standard(s) were adhered to. Please provide detailed justification, including facts and figures as needed to show hardship for each standard deviated from in detail.

5. **Alternatives Considered** – Please indicate all alternatives, engineering or otherwise considered before the formal deviation request was made.

6. **Engineer of record’s Deviation Statement** – Stamped and signed deviation request package must be accompanied with the signed statement on the deviation request form.

**DEVIATION REVIEW PROCESS:**

All deviations will be reviewed by at least three (3) Engineering Division staff for a recommendation of approval or denial by simple majority, and forwarded to the City Engineer. The City Engineer will review the staff recommendations, consult with the Public Works Director, and then approve or deny the deviation based on the information provided, staff recommendations, and consultation with the Public Works Director.

1.8 CONSTRUCTION PLAN REQUIREMENTS
No public infrastructure construction shall begin until construction plans have been approved by the City of Helena.

Construction plans and specifications must be signed and stamped by a licensed professional engineer registered in the State of Montana.

Construction plans and specifications shall be prepared in accordance with City of Helena Engineering and Design Standards, City of Helena Computer Aided (CAD) Standards, and Montana Public Works Standard Specifications.

Any deviation from the approved standards shall be requested in accordance with the deviation process (see Section 1.7).

Electronic CAD drawings, PDF’s and paper copies of all construction plans and specifications must be submitted to the City of Helena for review.

**Minimum Requirements for ALL Civil Plan Sheets**

1. Title block – Across the bottom or along the right side:
   a. Owner
   b. Name of the project
   c. Engineering firm information and Engineer’s seal – Original signature shall be placed across the seal
   d. Sheet title
   e. Sheet number
   f. Revision(s) table

2. All plans shall be drawn to scale and tied to the City of Helena’s survey control for horizontal and vertical datum as provided by the City Engineer.

3. North arrow shall be shown on each plan view sheet. North arrow shall also point either up or to the right.

4. Scale shown on each plan, profile, section and detail.

5. Legend relevant to each sheet shown all special symbols, line types and hatch used.

6. Plan and profile must be shown on the same sheet, with profiles on the bottom half of the sheet.

7. Accepted sheet sizes are 24” by 36”, 22” by 34”, and 11” by 17”.

8. Rights-of-way labeled and dimensioned.

9. Lot & block numbers and/or ownership information shown for all lots.

10. Easement information with dimensions.

11. Caution notes shown when working next to any existing utilities (public and/or private).
12. Final Grades – shall be shown as a solid line and called out specifically.

13. Existing Grade – shall be shown as a dashed line and called out specifically.

14. Drawing Scales (Selected scale shall be legible and provide appropriate detail.):
   a. Plan View: \( 1" = 10', 20', 30', 40', 50', 60', 100' \) or 200'.
   b. Profile View – Horizontal: \( 1" = 10', 20', 50' \) or 100' (or match plan view scale)
   c. Profile View – Vertical: \( 1" = 1', 2', 5' \) or 10' (1:1, 2:1, 5:1 or 10:1 exaggeration)
   d. Stationing interval: 100 feet or 50 feet

Minimum Requirements for Individual Civil Plan, Section, and Detail Sheets

1. Cover Sheet:
   a. Project Location
   b. Vicinity map
   c. Client Name
   d. Sheet Index
   e. Statement identifying that the latest edition of MPWSS and City Standards will apply to the project

2. General Notes, Abbreviations and Legend Sheet(s):
   a. General and Construction Notes
   b. Abbreviations
   c. Legend

3. Horizontal Control Sheet:
   a. Existing Site Layout
   b. Horizontal and Vertical Datums
   c. Basis of Bearing
   d. All bench marks and control elevation points
   e. Property lines, and ownership (where applicable)

4. Typical Road Sections Sheet:
   a. Rights-of-way
   b. Typical sections, including pavement section and relative placement of utilities
   c. Compaction requirements
   d. Backslopes/Cross-slopes
   e. Sidewalks
   f. Curb & Gutter
   g. Non-motorized Facilities – where required
   h. Station limits

5. Erosion Control Plan Sheet(s):
SECTION PART 1 GENERAL PROVISIONS
1.8 CONSTRUCTION PLAN REQUIREMENTS

a. Existing and proposed contours shown/labeled
b. Existing and proposed storm lines and inlets shown
c. List the total disturbed acreage, including offsite, and delineate limits of construction
d. Appropriate BMP’s used and identified
e. Phasing of BMP’s with construction activities listed/described
f. BMP details provided shall be per City of Helena and Montana Department of Environmental Quality’s Storm Water Management During Construction Field Guide for Best Management Practices
g. Show areas to be sodded or seeded with specified annual and long-term perennial vegetation
h. Show areas of permanent erosion control (other than vegetation)

6. Post-Construction Storm Water and Water Quality Treatment Plan Sheet(s):
   a. Plan view showing horizontal locations of the pond, including existing and proposed contours, locations of low flow or trickle channels, outlet structure, emergency overflow spillway, pipe or channel inlets, etc. with appropriate horizontal control
   b. All streets, roadways, highways, property lines, ROW lines, existing and proposed easements and tracts
   c. Profile along from all the inlet to the outlet structure and pipe with all invert and outlet structure elevations and water surface elevations
   d. Grading details for all pipe and culvert inlets and outlets
   e. Water surface limits for the minor storm, major storm, and emergency overflow conditions
   f. Summary table on plan view with stage-storage-discharge characteristics
   g. Maintenance access improvements
   h. Utilities adjacent to or crossing the detention area
   i. Description of long-term operation and maintenance of BMPs
   j. Standard and additional details and notes, and as required

7. Grading Sheet(s):
   a. Both onsite and offsite existing/proposed contours
   b. Date and name of firm who prepared geotechnical report with corresponding note stating: “Work shall be done in accordance with the Geotechnical Report by ______, dated ______.” If required by the City Engineer.
   c. Drainage clarified by flow arrows, high points, low points, ridges, and valley gutters
   d. Show driveway locations for all lots adjacent to storm inlets
   e. Positive overflow provided at all low points, easements dedicated as needed
   f. Cross-sections and flow data for all swales and open channels provided
   g. Street Flow Computation Table provided for all public streets for minor and major events
   h. Inlet Interception Computation Table provided for all public inlets for minor and major events
   i. Pipe Hydraulics Computation Table provided for all public storm sewers for minor and major events
   j. Provide electronic copies of all hydraulic computations on CD or digital media

8. Roadway Sheet(s):
1.8 CONSTRUCTION PLAN REQUIREMENTS

**Plan View**

a. For streets, centerline stationing at a minimum of every 100’, bearings and curve data labeled (R, D, L, PC and PT stationing)

b. Proposed new construction including paving width and limits, curb and gutter, crossspans, sidewalks, and pedestrian ramps

c. Existing and Finished grades with finished grade slopes

d. Existing and proposed utilities

e. Intersection, driveway and island curb radii labeled

f. All sidewalks and barrier free ramps shown, labeled and dimensioned

g. Existing, proposed, future streets and drives shown and labeled

h. Rights-of-way and sight visibility easements provided if required

i. Storm inlets identified with paving stations and top of curb elevations at center of inlet.

j. Drainage clarified by flow arrows at crests, sags, ridges, intersections, and valley gutters

k. Show driveway locations for all lots adjacent to storm inlets and intersections

**Profile View**

a. Show and label existing and proposed centerline, left, right curb lines, if not the same

b. Any required utility adjustments

c. Top of curb/pavement elevations labeled at every 50 foot stations

d. Vertical curve stationing and elevations including PVC, PVI, PVT, high point/low point location, curve length, algebraic grade difference, and “K” values shown at a minimum

e. Street grades shown to the nearest hundredth of a percent. Maximum and minimum grades per engineering standards in Section 5.

9. Utility Improvement Plan Sheet(s):

**Plan View**

a. Show, label and dimension location of all mains, services, manholes (with rim elevations), inlets, meters, fire hydrants, valves, fittings, FDC locations, back-flow preventers, cleanouts, or other proposed infrastructure, and spacing from other utilities

b. Show, label and dimension location of all private utilities within public right-of-way

c. Dimension location of all mains from other utilities

d. Show and label water line leading to fire sprinkler systems as “fire line” where applicable

e. Show location for all utility services and stub-outs labeled with size, slope, and length

f. Show stationing along centerline of utility or roadway

g. Show and label all easements

h. Curve data and stationing provided as necessary

i. Label valves with paving station near barrier free ramps or ADA routes

10. Storm Sewer and Culverts Sheet(s):

**Plan View**
a. Show horizontal locations of all pipes, inlets, manholes, junction boxes, and outlet structures with appropriate horizontal control
b. All streets, roadways, highways, property lines, ROW lines, existing and proposed easements and tracts
c. Minor and major storm hydraulic grade lines
d. Pipe outlet protection on plan and profile views
e. Utilities adjacent to or crossing storm sewer or culvert alignment
f. Grading details for all pipe and culvert inlets and outlets
g. Maintenance access improvements
h. Standard and additional details and notes, and as required

Profile View
a. Profile all proposed utility mains
b. Existing and proposed ground line at centerline of pipe shown and labeled correctly
c. Laterals, or culverts with all inverts, rim elevations, sizes, lengths, slopes and type
d. Indicate length, type/class, slope and size of all lines
e. Indicate the type and diameter for all manholes
f. All utility crossings and parallel sewer/storm lines shown in profile
g. Indicate length, type and size of encasement, as needed

11. Open Channels, Swales, Channel Stabilization Sheet(s):

Plan View
a. Show horizontal locations of all channels and swales, including locations of grade control structures and stabilization measures, such as check structures, drop structures, toe protection, bank stabilization, low flow or trickle channels, with appropriate horizontal control
b. All streets, roadways, highways, property lines, ROW lines, existing and proposed easements and tracts
c. Profile along channel alignment with all invert elevation and top of channel bank elevations, and design flow rates
d. Water surface limits on plan view
e. Water surface profiles for the minor storm, major storm, and emergency conditions
f. Maintenance access improvements
g. Side tributary channels and pipe outlets
h. Utilities adjacent to or crossing channel alignment
i. Standard and additional details and notes, and as required.

12. Lighting Sheet(s):

a. Show all street light locations, consideration should be given to electrical layout from utility company
b. Show all stop signs and traffic related signage locations
c. Street lights located on opposite side of street from Stop Sign
d. Verification of fire hydrant placement relative to street lights and stop signs (3’ clear zone)
e. If symbols used in plan, include appropriate legend for clarification

13. Signing and Striping Sheet(s):
a. Sign installation schedule  
   1. Show and dimension all existing and proposed signing and striping  
   2. Label all proposed signs and striping with sizes and type  
b. Signing and Striping Notes  
c. Sign Details  

14. Traffic Signal Sheet(s) – if applicable:  
a. See Section 5.9  

15. Traffic Control Plan Sheet(s):  
a. Design site specific traffic control plan, i.e. MDT standard alone is inadequate  
b. Indicate posted speed limit or design speed  
c. Show all sign designation, sign graphic, and sign size  
d. Show channelization device type, locations, and spacing  
e. Show all traffic barricades and indicate type  
f. Show all detour routes and detour signage  
g. Show flagger locations where applicable  
h. Show message boards with text for two or more phases where applicable  
i. Show flashing arrow boards where applicable  
j. If symbols used in plan, include appropriate legend for clarification
PART 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 standards. The purpose of these standards is to establish the minimum requirements for the design and construction of municipal facilities and improvements.

2.2 DESIGN REPORT

All water main extensions will require the Engineer of Record to submit a written, stamped report to the City Engineer addressing the fire, irrigation and domestic flow requirements. The design report shall demonstrate compliance with these requirements, and provide an overview of the proposed project or development, proposed water system improvements, water service demands, system impact, feasibility and basic design requirements and shall include, at a minimum, the following information:

1. **Water Demands** – Include estimated water demands based on projected land use, occupancy and building type for the following conditions:
   a. Average Daily (gallons-per-minute)
   b. Maximum Hourly (gallons-per-minute)
   c. Fireflow (gallons-per-minute), and;
   d. Irrigation (gallons-per-minute)

2. **System Layout** – Describe and show the proposed distribution system layout, including locations for connections with the existing water distribution system.

3. **Conformance with Master Plan** – Describe how the proposed water utility improvements conform with the adopted Helena Water Facilities Plan.

4. **Network Analysis** – Include a distribution system analysis, performed through appropriate manual calculations or computer simulation, identifying any system impacts based on proposed demands and provide design solutions to ensure future water system growth, while maintaining appropriate system pressures and flow rates. Computer analyses, when required are to be submitted in both hard copy and electronic format. Hydrant test results used for network analysis shall be less than two years old at the time of submission.

5. **Main Sizing** – Indicate the required sizing of the proposed distribution mains based on water demands.

6. **Special Conditions** – Identify any special conditions, such as the presence of contaminated soils, conflicts with other utilities, unusual installation depths, or any requirements that require special provisions for construction.

Estimating water usage for residential developments shall be based on 150 gallons per day per capita per single residence using an average of 2.39 persons per residence.

Estimating irrigation water usage for residential developments shall be based on the application of 1 (one) inch of water per week on irrigated areas and shall be based on the proposed layout of
the development. If the exact layout of the development is unknown at the time of submittal, residential irrigation demand estimated shall be based on zoning district and residential lot coverage requirements of each district as follows:

<table>
<thead>
<tr>
<th>Residential Zoning</th>
<th>Maximum Lot Coverage</th>
<th>Estimated Weekly Irrigation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open Space Residential (OSR)</td>
<td>No Max</td>
<td>1” x 70% of lot area</td>
</tr>
<tr>
<td>Residential (R-1 &amp; R-2)</td>
<td>30% Max Coverage</td>
<td>1” x 70% of lot area</td>
</tr>
<tr>
<td>Residential (R-3)</td>
<td>40% Max Coverage</td>
<td>1” x 60% of lot area</td>
</tr>
<tr>
<td>Residential-Office (R-4/R-O)</td>
<td>60% Max Coverage</td>
<td>1” x 40% of lot area</td>
</tr>
</tbody>
</table>

Table 2-1. Irrigation Water Use For Residential Zoning Districts

Estimated water usage for non-residential developments shall be determined on a case by case basis by the design engineer based on the projected land use, occupancy and building type, using fixture counts/International Building Code methodology whenever possible. The design engineer shall provide all relevant references, assumptions and calculations for alternate methods of non-residential water demand estimation within the submitted report. If the design engineer is not able to estimate water usage using these methods, the engineer may use 160% of the approved wastewater generation estimate (112 gallons per day per capita) for the same development as per the City of Helena’s Wastewater Collection System Master Plan.

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 computer hydraulic modeling to demonstrate compliance with the Section 2.4. 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) and/or pressure reducing valve(s), the report will be required by the Public Works Department to include computer hydraulic modeling results and a working computer model that shows 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 without 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:

- Within the City limits or approved for annexation to the City of Helena
- 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; and
- 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 in writing. The minimum required fire flow shall be 1750 gallons per minute for two hours for residential housing or as determined by the City Fire Marshal at a minimum of twenty pounds per square inch residual pressure at the hydrant during flow.

**Diameter** – All water main piping shall be at least 8" diameter, unless otherwise authorized by the Director of Public Works in writing. 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 fire flow requirements, and/or overall system requirements outlined in the 2006 Helena Water Facilities Plan.

**As Constructed Drawings** – The professional engineer certifying the work shall submit two (2) copies of stamped, signed as-constructed drawings in hard copy and one electronic copy in AutoCAD .dwg format to the Engineering Division prior to final acceptance of the main(s).

2.4.2 MATERIALS

**Piping** – Acceptable water main pressure pipe shall be as follows.

Water main piping 12" in diameter or smaller shall be Class 52 wall thickness pipe material meeting AWWA C151, American National Standard for Ductile Iron Pipe. All water main piping larger than 12" in diameter shall be Class 51 thickness pipe material meeting AWWA C151 Standards.

Water main piping shall be DR-14 PVC pressure pipe and shall meet AWWA C-900 Standards. Acrylonitrile butadiene (NBR) gaskets will be required for water main installations in areas of known or suspected hydrocarbon contamination.

If specifically allowed in writing by the City of Helena Public Works Department, zinc coated ductile iron pipe meeting AWWA C150 and C151 and with zinc coating system conforming in every respect to ISO 8179-1 “Ductile iron pipes – External zinc-based coating – Part 1: Metallic zinc with finishing layer. Second edition 2004-06-01” can be used. Zinc coating shall be a
minimum of 200 g/m² surface area coverage. The use of zinc coated ductile Iron 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. Polyethylene wrap is not required on zinc coated ductile iron pipe installations however; cathodic protection shall still meet the requirements of Section 2.4.3. of these standards.

Requests to use alternate pipe materials shall be made in writing to the City Engineer, and shall include justification for doing so by the design engineer prior to submitting plans for review.

**Fittings** – All water main fittings, including valves, tees, crosses, caps, plugs, reducers and elbows equal to or greater than 11-1/4° shall use mechanical joint restraints. All mechanical joint restraints shall be “Megalug,” “Uniflange” or approved equal. Joint restraint use shall be in addition to meeting thrust block requirements in accordance with MPWSS.

### 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 Utility Maintenance Division (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 6½' unless otherwise approved in writing by the Director of Public Works or City Engineer.

**Encasement** – All water main piping, fittings, valves, etc. (excluding PVC and zinc coated ductile iron pipe) shall be encased in polyethylene wrap with a minimum thickness of 8 mils. All encasement shall be in accordance with AWWA C105 Standards.

**Electrical Thawing** – Conductive brass wedges shall be installed at all joints to provide for electrical thawing and continuity. Electrical continuity shall be provided at all flexible, dresser-type couplings. Bonded jumper wires can be used if needed to provide for electrical continuity.

**Tracer** – Tracer wire shall be installed along the top of all new water mains. Tracer wire for water lines is to be #10 AWG high-strength copper clad steel with a 30-mil HDPE insulation jacket (color blue) and have a 600-pound average tensile break load. Tracer wire may be manufactured by Copperhead Industries or an approved equal.

Tracer wire shall be grounded at all dead ends, except fire hydrant legs, using a 24-inch long minimum copper clad grounding rod. A grounding clamp approved for direct burial use shall be used to connect the tracer wire to the grounding rod. Direct burial grounding clamps shall be EK17 as manufactured by Erico or approved equal.

Tracer wire shall be securely affixed to the top exterior surface of the pipe using PVC pipe tape at 5-foot intervals. Tracer wire shall be looped around valves, saddles, curb stops, and other appurtenances in such a manner that there is no interference with the operation of the appurtenances. Tracer wire shall be continuous and without splices, breaks, or cuts except for spliced-in connections as approved by the Engineer. Where any approved spliced-in connections occur, 3M DBR watertight connectors, or approved equal, shall be used to provide electrical continuity. All spliced connections must be inspected by the Engineer before being buried.

Tracer wire shall be brought to the surface at all junctions and terminals, including at all valve boxes for water valves and fire hydrant legs. DryConn Waterproof Direct Bury Lugs as
manufactured by King Innovation, or approved equal, shall be used to splice into the main line tracer wire. The main line tracer wire shall not be broken or cut. Tracer wire shall be spiral-wrapped around the exterior of the valve box riser pipe and brought into the valve box top section. Provide 5 feet minimum of additional wire neatly coiled within each valve box.

Prior to final acceptance, a continuity test shall be performed on tracer wire with the Certifying Engineer present to verify that the trace wire is continuous and allows for the proper tracing of the piping. If the Engineer identifies locations where the trace wire is not continuous, to include all connection points between new and existing water mains, the Contractor, at no additional cost to the City, shall make necessary repairs/corrections. Continuity testing shall be conducted prior to repaving roadways.

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** – The City of Helena cathodic protection policy for the protection of water mains is as follows:

A. Cathodic protection, polyethylene wrap and sacrificial anode design is required for all projects including fittings, valves, valve boxes or hydrants if no site specific soil data is presented in the design report submitted.

B. If soils testing is undertaken at the site for the sake of opting out of cathodic protection, the data will be included in the stamped and signed design report and applied to AWWA C105-10 Table A.1. If the "score" on Table A.1. is less than 10, and justified/documentated in the design report, then polyethylene wrap is required but sacrificial anode design is not. Polyethylene wrap is not required for zinc coated ductile iron pressure pipe.

C. If the soil test data indicates a score of 10 or above on AWWA C105-10 Table A.1., then polyethylene wrap and sacrificial anode design are both required.

A cathodic protection plan and accompanying design calculations stamped by a Certified NACE professional or licensed professional engineer in Montana is required with the design submittal. As-constructed drawings shall show the location, size and configuration of sacrificial anodes and testing stations.

If the engineer of record wishes to opt out of the sacrificial anode design and installation, a stamped and signed design report must be submitted including relevant soil testing data, as stated in the policy, above.

**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’ of mains and service lines 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.

**Chlorination** - All new water mains shall be chlorinated and tested as per the current edition of the Montana Public Works Standard Specifications Section 02660 – Water Distribution.
2.4.4 EXTENSION

Any extension of an existing City water main must be extended across the entire frontage 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 required to 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" 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" vertical separation may be allowed when a gravity sewer at the crossing is made from a single 20' 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".

No exception of the minimum 18" 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' horizontal separation is required when a water main and sanitary sewer are installed parallel, measured from edge to edge of the mains.

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) 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.

Taps of sizes of 1" on all mains require the contractor to provide a properly sized tapping saddle and corporation valve for mains of 6" and larger (currently up to 36"). Special provisions apply for 1" taps on 4" 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" and 2" services 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\" and larger (6\", 8\", 10\" and 12\") on all mains require a tapping saddle, tapping valve and a valve box to be purchased and supplied by the plumbing contractor. All taps 16\" or larger require contract tapping service or company. All taps 4\" 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 the plumbing contractor must provide and install the tapping saddle.

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

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

- Taps of 4\" and larger (up to 12\") on PVC and steel mains require a tapping saddle, tapping valve and a valve box to be purchased and supplied by the plumbing contractor. Taps 4\" to 12\" on steel mains 20\" and larger require a welded-on saddle for tapping. All taps 14\" 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 fewer than one valve every 600\'. Generally, there shall be two valves on each tee and three valves on each cross.

All Gate Valves shall conform to AWWA C515 Standards and shall open CLOCKWISE.

All Butterfly Valves shall conform to AWWA C504 Standards and shall open CLOCKWISE.

All Tapping Valves shall open COUNTER CLOCKWISE.

All valves, including hydrant valves shall be mechanically restrained. All mechanical joint restraints shall be “Megalug,” “Uniflange” or approved equal. Joint restraint use shall be in addition to meeting thrust/restraint block requirements in accordance with MPWSS. Joint restraints must be accessible after installation and shall not be buried in concrete.

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

All water valve boxes shall be aligned to allow a 4\" 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, fire hydrants shall be spaced no further apart than one standard City block, which is approximately 400\'. 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", 3-way, “Mueller Super Centurion 250”, “Kennedy K81A”, or approved equal, conforming to AWWA C502 Standards. All hydrants shall be painted OSHA yellow above the ground line.

All hydrants shall be equipped with a #4 pentagon (1¼") 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" to 3" above finished grade. Minimum bury depth of hydrant barrel shall be 7' with a maximum bury hydrant of 8.5’ as determined by the elevation of the safety flange. Hydrant barrel may be extended with the use of a single extension not to exceed two feet. Any other extensions will only be allowed with prior approval of the Public Works Department and when 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 mechanical joint water valve and asphalt 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 C858.

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

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

2.4.10 ABANDONMENT OF EXISTING WATER MAINS

Abandoning existing water mains is only to be done with written permission from the Director of Public Works. Water mains shall be abandoned by excavation and removal whenever possible. If permission is granted by the Director to abandon water mains in place, all valves and valve boxes are to be removed, the main is to be completely filled with flowable fill, non-shrink grout or another approved flowable material and the ends completely plugged with concrete to a watertight condition. All in place abandonments must be inspected and approved by an Engineering Division representative prior to backfilling.

2.5 WATER SERVICE LINES

2.5.1 MATERIALS

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

All water service lines 3.5" and smaller diameter shall consist of Type K copper pipe meeting ASTM B88-62 from the main to the curb box. Poly pipe or PVC pipe may be considered on a case-by-case basis in corrosive soil with written approval from the Public Works Department.
All water service lines 4" diameter and larger shall consist of ductile iron pipe meeting AWWA C151, American National Standard for Ductile Iron pipe or PVC pressure pipe meeting AWWA C900 Standard.

All water service lines from the curb valve to the use connection shall meet all current plumbing codes as used by the City of Helena Building Division.

Stainless steel inserts are required for all compression-type fittings if the use of poly pipe is approved.

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.

Flag lots must have a minimum of 10 horizontal feet of frontage at the public right-of-way. Water service lines installed for a flag lot shall only serve a single platted lot.

All individual condominiums or separate buildings must be served by individual service line from the main whenever possible. 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 than ten 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' of cover from the top of service pipe to final finished grade or be insulated with “blue board” type Styrofoam insulation.

No portion of any water service line shall be located within a property it does not service.

All water service lines shall be encased in 8 mil polyethylene wrap for a minimum distance of 3' 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" 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 lines or fire hydrant leads.
All service lines must have a tracer wire and it must be installed and tested for all service lines regardless of pipe types. Service line tracer wire shall conform to the requirements set forth in Section 2.4.3 for water mains, and be installed from the water main and terminate within the structure or vault. Water service lines shall also be installed with six-inch wide detectable tape marked “WATER” located two feet below finished grade along the alignment of the new service line.

### 2.5.3 ABANDONMENT OF EXISTING SERVICE LINES

Abandonment of existing water service lines shall be made at the point of connection with the public main by a method approved by the Director of Public Works in writing as per City of Helena City Code.

A street opening permit is required for disconnecting water service lines at the water main in the street right of way. A city building/plumbing inspector shall inspect and approve any water service being abandoned prior to backfilling. The service line shall be disconnected from the corporation stop and the corporation stop shall be in the off position. If the corporation stop or main is leaking, the inspector will advise the utility maintenance division so the leak can be repaired prior to backfilling the ditch.

### 2.5.4 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 or compression fitting on both connections.

**Curb Boxes** – All curb boxes shall be extension-type having a minimum box length, fully retracted, of 6’. All curb boxes shall consist of a Minneapolis or arch pattern (Buffalo) Style and shall be Mueller, Ford, curb box or equal as approved by the Director of Public Works in writing. All curb boxes shall have screw-on or other type lid, which can be attached to the top of the riser. Maximum depth of any curb box, measured from top of the operating nut to the face of the curb box lid shall be 8’. Minimum depth of any curb box, measured from the top of the operating nut to the face of the curb box lid shall be 6’ - 6”. Top of curb box shall be to grade and located 2” in back of curb line in boulevard at “W” stamp location. Bending or altering of curb box keys for operation is prohibited. Valve extension rods are not permitted.

All curb boxes shall be installed 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. Curb boxes shall be installed with a 4” PVC pipe around the cast iron curb box and the annulus filled with masonry sand and a cap or repair lid installed on top. 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.

### 2.5.5 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/plumber as approved by the City.

All water meters must have valves upstream and downstream of the meter in order to isolate the meter for servicing. Meter isolation valves are required within 24” of the center line of the meter.
on the upstream and downstream sides of the meter. All new and replacement residential water meters shall have a meter horn that contains a dual check backflow preventer included as supplied by the City of Helena Utility Maintenance Department. Meter horns shall be retrofitted on to all residential replacement water meters installed in the City of Helena.

All meters must be installed in a horizontal line at a minimum of 18” and a maximum of 4’ from the floor, and a minimum of 6” from any wall. The meter must also be located in close proximity to a floor drain to allow for draining/servicing.

All meters shall be located at least 5’ away from any electrical devices/equipment.

All meters larger than 2” 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.

All residential water meters shall be installed within 5’ of the crawl space entrance. The area leading to the water meter shall be free of obstructions and easily accessible.

All meters must be installed in a horizontal position at a minimum of 18” and a maximum of 4’ from the floor, and a minimum of 6” from any wall. The meter must also be located close to a floor drain to allow for draining/servicing.

Water meters shall be the same size/diameter as the service line serving the water meter.

Installer must provide a minimum of 4 times pipe diameter of straight run pipe (no fittings, bends etc.) upstream, and a minimum of 2 times pipe diameter of straight run pipe downstream of any commercial meter for proper operation.

Provide a minimum of 18 inches of clearance in all directions from the meter for maintenance purposes.

Isolation valves are required on the upstream and downstream side of the meter within 24” of the centerline of the meter.

All equipment shall be properly supported using anchored floor stands or mounted rigidly to the wall with Unistrut or approved equal.

Water Meters shall not be located within any property they do not service.

Meter size and type used shall be specified and shown on project plans (print).

Water service line size(s) shall be specified and shown on project plans (print).

All commercial properties are required to have reduced pressure backflow preventers on all service lines to protect the City distribution system from any backflow event.

Pressure reducing valve(s) shall be installed downstream of all water meters containing turbine components.

A Neptune strainer shall be provided by the City and are required for each meter containing a turbine component. The strainer is required to be mounted directly to the inlet of the water meter.

All commercial meters/accounts are required to have a bypass line that bypasses the main line backflow preventer, water meter and pressure reducing valve. The meter bypass line shall be the same size/diameter as the main service line. A locking isolation valve shall be provided on all meter bypass lines.
Meter bypass lines are required to have pressure reducing valves and backflow protection equal to the main line backflow preventers.

All backflow preventers shall be tested by a city approved and licensed backflow tester before final occupancy can be given.

All backflow preventer discharge lines shall be piped directly to a floor drain.

2.5.6 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.

2.5.7 FIRE SPRINKLER SYSTEMS

All fire sprinkler systems shall 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' and create the new Valley Pressure Zone to the maximum service elevation of 3819'. 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.
PART 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* and these standards. The purpose of these standards is to establish the minimum requirements for the design and construction of municipal facilities and improvements.

3.2 DESIGN REPORT

All sanitary sewer main extensions shall require the Design Engineer to submit a written, stamped report to the City Engineer which addresses the design requirements listed herein. The design report shall demonstrate compliance with these requirements, and provide an overview of the proposed project or development, proposed sanitary sewer system improvements, wastewater flow estimates, system impact, feasibility and basic design requirements and shall include, at a minimum, the following information.

1. **Wastewater Generation:** Include estimated wastewater generation estimates based on projected land use, occupancy and building type for the following conditions:
   a. Average-Day (gallons-per-minute),
   b. Peak Hourly (gallons-per-minute),
   c. Infiltration/Inflow (gallons-per-minute).

2. **System Layout:** Describe and show the proposed collection system layout, including locations for connections with the existing wastewater utility system.

3. **Service Area:** Describe the initial and ultimate area, measured in acres that could be served by the new wastewater facilities.

4. **Population:** Define the initial and ultimate population and population densities that could be served by the new wastewater facilities.

5. **Conformance with Master Plan** - Describe how the proposed wastewater utility improvements conform with the adopted Wastewater Collection System Master Plan.

6. **Industrial Wastes** - Define the estimated quantities and quality of any industrial wastes that could be discharged to the wastewater system.

7. **Collection System Analysis** - Include a collection system impacts analysis, identifying any system impacts based on proposed demands and providing design solutions to ensure perpetuation of future wastewater utility system growth and maintain system capacity and flow rates.

8. **Main Sizing** - Indicate the required sizing of proposed collection mains based on wastewater demands and a capacity analysis. 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.
9. **Wastewater Effluent Characteristics** – Indicate the makeup of the proposed wastewater discharges. If wastewater to be discharged into the City of Helena’s collection system is to be anything other than domestic wastes, the design Engineer shall include information concerning the characteristics of proposed wastewater effluent, including the following:

(a) Acidity-alkalinity,
(b) Phosphorus,
(c) pH,
(d) Sulfates and sulfides,
(e) Synthetic and organic compounds,
(f) Hazardous constituents,
(g) BOD5 (total and soluble fraction, carbonaceous and nitrogenous demand),
(h) COD (total and soluble),
(i) TSS,
(j) Nitrogen (TNK, NO3, NO4, NH4, organic), and
(k) Inorganic s (salts, metals)

10. **Special Conditions** - Identify any special conditions, such as conflicts with other utilities, unusual installation depths or oversizing requirements that require special provisions for improvements construction.

Estimating wastewater flows for residential developments shall be based on 112 gallons per day per capita for single residence using an average of 2.39 people per residence as shown in Table 3-1.

Estimating wastewater flows for non-residential developments shall be determined on a case by case basis by the design engineer based on the projected land use, occupancy and building type, using Circular MT DEQ-4, Tables 5-1 and 5-2 whenever possible. The design engineer shall provide all relevant references, assumptions and calculations for alternate methods of non-residential wastewater flow estimation used within the submitted report.

If the design engineer is not able to provide detailed wastewater estimation information for non-residential developments, the estimated wastewater flows shall be based on the proposed use of the property as shown in the following table:

<table>
<thead>
<tr>
<th>Table 3-1. Wastewater Load by Development Type</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Development Type</strong></td>
</tr>
<tr>
<td>Residential</td>
</tr>
<tr>
<td>Average Persons per Housing Unit</td>
</tr>
<tr>
<td>Non-Residential</td>
</tr>
<tr>
<td>Commercial Use</td>
</tr>
<tr>
<td>Industrial Use</td>
</tr>
<tr>
<td>Infiltration Allowance(^1)</td>
</tr>
</tbody>
</table>

\(^1\) Infiltration area based on total gross area of the development.
The allowance for inflow and infiltration shall be 150 gallons per acre of coverage area per day or otherwise approved by Public Works Department in writing. Peaking factors do not apply to the irrigation allowance.

The City may require, at its discretion, the capacity of the sewer to be increased.

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 of this standards document.

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

- Within the City limits or approved for annexation to the City of Helena
- 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; and
- 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 (fps) when depth of flow is at or below 0.3 of the sewer main inside diameter, based on Manning’s equation with an “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 (q), including allowance for infiltration, while flowing no more than half full (q/Q of 0.50) when no additional connections are possible and a quarter full (q/Q of 0.25) when future growth is anticipated. The development must upsize the existing mains if the capacity (Q) of the sewer main is calculated to be three quarters full (q/Q of 0.75). The allowance for groundwater 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". Increasing the diameter in order to meet the minimum pipe slope requirements will not be allowed.

Manholes- Shall be a minimum of 48” inside diameter for all manholes with a depth less than 13'. All manholes with depth equal to or greater than 13' shall be a minimum of 60” internal diameter. Manholes with a depth equal to or greater than 15’ shall have the design stamped by a professional engineer licensed in the state of Montana.
A drop type manhole must be provided for a sewer entering a manhole at an elevation of 24 inches or more above the manhole invert. Where the difference in elevation between the incoming sewer and the manhole invert is less than 24 inches the invert shall be filleted to prevent solids deposition. Drop manholes should be constructed using an inside drop connection whenever possible. Inside drop connections must be secured to the interior wall of the manhole using 316 stainless steel hardware and provide access for cleaning. All interior drop connections shall include a drop bowl and shall be manufactured by Reliner/Duran Inc. Drop holes with a force main connection shall include a drop bowl hood. All drop manholes shall be constructed using an inside drop connection whenever possible. Inside drop connections must be secured to the interior wall of the manhole using 316 stainless steel hardware and provide access for cleaning. All interior drop connections shall include a drop bowl and shall be manufactured by Reliner/Duran Inc. Drop holes with a force main connection shall include a drop bowl hood. All drop manholes shall conform to City of Helena Standard Drawing 3-12. Exterior drop manholes shall only be used with prior written approval of the Director of Public Works and shall conform to MT DEQ Circular 2.

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

Accessibility - Sewer mains shall be installed in public right-of-way wherever possible. Where mains cannot be installed in ROW a 20’ wide exclusive easement with a 14’ all weather surface road must be constructed in the easement. Complete easement information must be shown on the submitted plans.

3.4.2 MATERIALS

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

- PVC meeting ASTM D3034, SDR-26 (8" to 15")
- PVC meeting ASTM F679 PS115 (18" and larger)
- Concrete meeting ASTM C14, C76 or C655

Other sanitary sewer materials specifically approved by the City of Helena are given following.

Pressure Piping – Pressure sewer mains (force mains) shall consist of PVC Pressure Pipe, ASTM D2241, Class 200 SDR-21, or AWWA C900 Class 235 DR-18.

All pressure sewer mains (force mains) must have a tracer wire installed and tested for all lines regardless of pipe type. Pressure sewer mains tracer wire shall conform to the requirements set forth in Section 2.4.3 for water mains, and be installed from the lift station building and terminate at the receiving manhole ring and cover. Pressure sewer mains shall also be installed with six-inch wide detectable tape marked “SEWER” located two feet below finished grade along the alignment of the new pressure sewer main.

Manholes – All manholes shall be constructed using reinforced pre-cast concrete 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 or polyurea liner installed to protect against H2S gas.

Manhole Ring and Cover – Manhole cover shall have the City of Helena logo and shall be stamped “SANITARY SEWER” and shall be in compliance with City of Helena Standard Drawing 3-2. Final adjustment ring shall be made with Infra-Riser by East Jordan or approved equal.
3.4.3 INSTALLATION

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

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. If this is not possible the sewer main shall be installed in the center of the driving lane and manholes kept out of the vehicle wheel lines to prevent damage.

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 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. All drop manholes shall conform to City of Helena Standard Drawing 3-12.

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 as per Helena City Code 6-3-4 and these standards.

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" 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" vertical separation may be allowed when the gravity sewer at the crossing is made using a single 20' 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 Public Works Department in writing is required for a vertical separation of less than 18".

No exception of the minimum 18" 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 Public Works Department in writing, a minimum of 10' horizontal separation (measured edge to edge of mains) is required when a sanitary sewer main and water main are installed parallel.

3.4.6 ABANDONMENT OF EXISTING SANITARY SEWER MAINS

All sanitary sewer mains to be abandoned shall be excavated, removed and disposed of whenever possible. The abandonment of existing sanitary sewer mains and manholes in place shall only be
allowed with written permission from the Director of Public Works and shall be in accordance with these standards. All sanitary sewer mains and structures abandoned in place shall be inspected and approved by a City Engineering Division representative prior to backfilling. All sanitary sewer mains and structures abandoned in place shall be shown on the project’s submitted record drawings.

**Manholes** – Sanitary sewer manholes shall be abandoned in place by removing all castings and/or entry grates and salvaging them to the City of Helena Utility Maintenance Department. Manhole sections are to be excavated and cone and upper shaft sections removed and disposed of to a minimal depth of five (5) feet below the finished ground surface. The manhole base shall be broken up using jackhammer, concrete core drill or equipment mounted hydraulic or pneumatic hammer, and the remaining manhole sections completely filled with sand, gravel, flowable fill or other approved material. The excavation shall then be backfilled using approved materials and compacted to 95% minimum relative compaction up to finished grade.

**Mains** - All sewer mains abandoned in place shall be completely filled with flowable fill or non-shrink grout or other material approved in writing by the Director of Public Works. Concrete plugs shall be placed at both ends of the abandoned sanitary sewer main.

### 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 D3034, SDR-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' 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 D2241, 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.

Flag lots must have a minimum of 10 horizontal feet of frontage at the public right-of-way. Sewer service lines installed for a flag lot shall only serve a single platted lot.

All sewer service lines shall be installed in accordance with MPWSS with a minimum of 4' 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 an “S” in lettering at least 3” tall, for marking the sewer service location.
All service line crossings under existing curbs by tunneling are prohibited.

All sanitary sewer service lines must have a tracer wire installed and tested for all service lines regardless of pipe type. Service line tracer wire shall conform to the requirements set forth in Section 2.4.3 for water mains, and be installed from the sewer main and terminate within the structure or vault. Sanitary sewer service lines shall also be installed with six-inch wide detectable tape marked “SEWER” located two feet below finished grade along the alignment of the new sanitary sewer service line.

### 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 with a saddle wye fitting. See the following figure:

![Sanitary Sewer Main Tapping Figure](image)

### 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.

### 3.5.5 SOLIDS HANDLING/GRINDER PUMP/COMMUNITOR SERVICES

If a proposed sewer service is to handle bulk solids or garbage with discharged materials greater than one half inch (1/2”), or organic materials greater than one quarter inch (1/4”) a grinder pump or communitor must be installed such that all wastewater discharges are capable of passing through a quarter inch screen (1/4”) as per Title 6 of City Code. A communitor or grinder pump service may be required at the discretion of the Director of Public Works based on proposed use of the property.
3.5.6 **ABANDONMENT OF EXISTING SANITARY SEWER SERVICES**

Abandonment of existing sanitary sewer service lines shall be made at the point of connection with the public sanitary sewer main by a method approved by the Director of Public Works in writing as per City of Helena City Code.

A street opening permit is required for permanently disconnecting sanitary sewer service lines at the sanitary sewer main in the street right of way. A city building/plumbing inspector shall inspect and approve any sanitary sewer service being abandoned prior to backfilling. The service line shall be disconnected, truncated and sealed within four (4) feet of the sanitary sewer main.

3.6 **LIFT STATIONS**

3.6.1 **CAPACITY**

The design capacity for a lift station shall be designed on a case by case basis by the design engineer to a reasonable capacity based on established wastewater flow estimation methodology or as outlined in Section 3.2 of these standards. 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 than the original design capacity of the lot. If the capacity for the building is greater, additional capacity may be 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 curb cut 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 with an irrigation system for the landscape screening.

3.6.2.2 **FENCING**

All lift stations must be fenced with an 8' 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° for allowing maintenance vehicles and equipment to access the site.

3.6.3 **WET WELL**

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

3.6.4 **PIPING**

All piping must be stainless steel within the wet well and ductile 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 must be located out from under the lift station slab or located within a grated trench. All fittings must be accessible without damaging the building.
3.6.5 VALVING
All check valves must have external levers.
A three-way Dezurik 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 lb. 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 required 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 equal as approved in writing 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 than 2000' that 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 be fitted with a carbon filters.

3.6.11 ON SITE GENERATOR
All lift stations must be supplied with an on-site generator. Generator sizing must be based on appropriate load testing and/or manufacturers' requirements. 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 for all lift station installations.
PART 4 STORM DRAINAGE SYSTEMS

4.1 INTRODUCTION AND STORM DRAINAGE POLICY

Storm drainage shall comply with Helena City Code: Title 6 - Public Works, Chapter 6 - Storm Water Control, and Title 3 - Building Regulations, Chapter 14 - Floodplain Regulations.

Storm drainage design criteria shall be the following in order of priority: City Engineering and Design Standards, Montana Public Works Standard Specifications, and then the most stringent criteria found in the technical references cited in these standards.

The most current City of Helena Storm Drainage Master Plan must be evaluated in the context of any site development such that the hydrologic and hydraulic conditions are accounted for and any impacts from or to a development are mitigated.

All State and Federal requirements shall be applied to all storm drainage systems. Where applicable, Railroad, Montana Department of Transportation, and Airport design specific requirements shall apply.

The following technical publications were utilized to develop these standards and may be referenced for all storm drainage design except as modified by these standards. A full bibliography is provided in Section 4.8.

1. Open Channel Hydraulics by Ven Te Chow
3. Hydraulic Design of Highway Culverts, Hydraulic Design Series No. 5, FHWA
7. Montana Department of Transportation Drainage Manual – Adoption of AASHTO Drainage Manual Chapter 7, MDT
10. Urban Storm Drainage Criteria Manual, Volumes 1 to 3 by Urban Drainage and Flood Control District

All site development with an impervious area of greater than 5,000 square feet must be routed to an on-site storm water pond or an off-site regional storm water pond which will contain water quality capacity and storm water runoff capacity with flow controls to reduce discharges of the 5 year and 100 year 24 hour storm events to the pre-developed (historic) rates. The volume of water requiring water quality treatment is referred to as the Runoff Reduction Volume (RRV) in these standards.
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.

Discharge from any developed site shall not exceed the pre-developed (historic) conditions and shall discharge at the same flow rate and location as the pre-developed (historic) conditions or as approved by the City Engineer.

All impacts to wetlands must comply with State and Federal regulations. Additionally, wetlands within the City are a limited and valuable resource and must be maintained or otherwise compensated for if they are negatively impacted by a development regardless of their State or Federal standing. If it is determined by the City Engineer that wetlands potentially exist on the site and will be impacted by the development, the owner/developer must hire a professional ecologist to determine the existence and extent of the wetlands.

A professional engineer certification is required for the design and completed construction of all storm water facilities.

Storm water runoff into the sanitary sewer system is prohibited.

Storm drainage systems serving more than one lot shall be public systems, except where storm drainage systems serving lots zoned R-1 and R-2 convey runoff from three or fewer R-1 and R-2 zoned lots. Storm drainage systems serving only one lot shall be private systems. Storm drainage systems conveying runoff from three or fewer R-1 and R-2 zoned lots shall be private systems.

Public systems will be maintained by the City and private systems will be maintained by the property owner.

Maintenance access from City right-of-way must be provided for all components of public drainage systems. Maintenance access from City right-of-way is required for all storm water runoff control ponds and all water quality treatment facilities whether publicly or privately owned. Maintenance access from City right-of-way must be included in a drainage easement or tract. All public storm water runoff control ponds and water quality treatment facilities must be included in a drainage easement or tract.

The property owner(s) shall be responsible for the maintenance of all private drainage system including inlets, pipes, culverts, channels, ditches, hydraulic structures, and detention basins located on their land.

Should the property owner(s) fail to adequately maintain their private drainage system, the City shall have the right to enter the private land for the purposes of operation and maintenance. All such maintenance costs will be assessed to the property owner. If the property owner has a valid written agreement with the City defining maintenance responsibilities of a private drainage system to the City, the City shall maintain the drainage system.

4.2 DRAINAGE REPORT AND PLAN SUBMITTAL REQUIREMENTS

A Drainage Report and Plan is required for any development which creates more 5,000 square feet of impervious area or when a public storm sewer system is required.

The purpose of the Drainage Report is to identify and provide solutions to the problems that may occur on-site and off-site because of the development. All reports shall be prepared on 8 ½” by
11" paper and bound as a stand-alone document (Plans, maps, figures and tables may be on 11”x17” sheets folded to 8 ½” by 11”).

The drawings, figures and tables shall be bound with the report or included in a pocket attached to the report. The report shall be stamped by a professional engineer licensed in Montana.

**Report Contents:** The Drainage Report generally consists of a narrative portion and appendices with supporting calculations and other pertinent information. The narrative portion shall provide detailed discussion regarding the general location and description of the site, off-site and on-site drainage basins and sub-basins, drainage design criteria, storm water management facility design, and conclusions. Discussion of methodology, assumptions, input, and a summary of results shall be provided in the narrative for all hydrologic or hydraulic modeling efforts. Peak flow rates, storage volumes (RRV, detention), critical water surface elevations, and storm water management facility sizes shall be included in the report narrative.

The appendices must provide the appropriate backup information and calculations, but the reader should not have to review information contained in the appendices to have a clear and thorough understanding of the project and the storm water management analysis and facility designs.

The following is an outline of the minimum Drainage Report and Plan requirements:

**4.2.1.1 COVER SHEET**
- Name of Project
- Address
- Owner
- Developer
- Engineer
- Submittal date and revision dates as applicable

**4.2.1.2 GENERAL LOCATION AND DESCRIPTION**

**Site Location**
- Site Vicinity Map
- Township, Range, and Section
- Existing and proposed streets, roadways, and highways adjacent to and within the proposed development, or within the area served by the proposed drainage improvements
- Names of surrounding or adjacent developments, including land use or zoning information

**Description of Property**
- Area in Acres
- Ground Cover, vegetation, site topography and slopes
- NRCS Soils Classification Map and discussion
- Natural Drainageways and Wetlands
- Floodplains delineated on FEMA FIRM Maps
- Existing irrigation canals or ditches
- Significant geologic features
4.2.1.3 DRAINAGE DESIGN REGULATIONS AND CRITERIA

Regulations
- Discussion of applicable Local, State and Federal regulations.

FEMA Flood Insurance Rate Maps
- Identify the FEMA FIRM the project is located on
- Identify any FEMA flood hazards
- Discuss proposed floodplain modifications
- Floodplain modifications must be designed in compliance with the City of Helena Floodplain Ordinance and all State and Federal regulations, standards, and guidance.

Additional Permitting Requirements
- Compliance with Section 404 of the Clean Water Act
- Compliance with the Endangered Species Act
- Compliance with other local, State, or Federal Permitting requirements

Existing Drainage Studies
- Discuss previous drainage studies for the project that influence the stormwater facility design
- Discuss drainage studies for adjacent developments and how those developments affect the stormwater facility design

4.2.1.4 EXISTING SITE CONDITIONS

Physical Constraints
- Discuss impacts to stormwater design, caused by site constraints, such as streets, utilities, existing structures, etc.

Groundwater
- Discuss groundwater investigations and results
- Identify potential groundwater issues
- Discuss methods to manage groundwater impacts

Waterways and Wetlands
- Discuss any waterway and wetlands investigations and results
- Identify any waterways and potential wetlands adjacent to or on the site
- Discuss methods to protect, preserve and mitigate impacts to waterways and wetlands

4.2.1.5 HYDROLOGIC AND HYDRAULIC DESIGN METHODS

Hydrology
4.2 DRAINAGE REPORT AND PLAN SUBMITTAL REQUIREMENTS

4.2.1.6 Drainage Basins

- Runoff calculations method(s)
- Design storm recurrence intervals and depths
- Detention storage calculation method(s)
- Detention storage release rate calculation method

**Hydraulics**
- Methods used to determine channel and storm sewer capacities
- Hydraulic and energy grade line calculation method and discussion of energy loss coefficients
- Methods used for design of hydraulic structures, outlet protection and erosion control
- Methods used for designing storm water pond outlet structures

**4.2.1.6 DRAINAGE BASINS**

- On-site and off-site drainage basin characteristics and flow patterns and paths under historic and developed conditions.
- Existing and proposed land uses within the basins
- Discussion of the impacts of the off-site flow patterns and paths under fully developed conditions
- Discussion of irrigation facilities that will influence or be impacted by the site drainage

**4.2.1.7 EXISTING STORM WATER CONVEYANCE OR STORAGE PONDS**

**Existing Storm Water Conveyance Facilities**
- Discussion of how existing conveyance facilities will be incorporated or modified

**Existing Storm Water Storage Ponds**
- Discussion of how existing Storage Ponds will be incorporated or modified

**4.2.1.8 PROPOSED STORM WATER CONVEYANCE OR STORAGE PONDS**

**Storm Water Conveyance Facilities**
- Discuss general conveyance concepts
- Discuss proposed drainage paths and patterns
- Discuss allowable street capacities
- Discuss storm sewer design, including inlet and pipe locations and sizes, tributary basins and areas, peak flow rates at design points, hydraulic grade lines, groundwater impacts, etc.
- Discuss storm sewer outfall locations and design, including method of energy dissipation
- Discuss how runoff is conveyed from all outfalls to the nearest public storm water system
- Discuss open channel and swale designs, including dimensions, alignments, tributary basins, peak flow rates, stabilization, water surface elevations, groundwater impacts, etc.
• Discuss easements and tracts
• Discuss facilities proposed offsite for the conveyance to a public storm drainage system

Storm Water Ponds
• Discuss storm water pond designs, including tributary area, release rates, storage volumes, and water surface elevations, emergency overflow conditions, outlet structure design, groundwater impacts, etc.
• Discuss the design of all water quality treatment BMPs, including tributary areas, sizing, treatment volumes (RRV), design features, etc.
• Discuss pond outfall locations and design, including method of energy dissipation
• Discuss how runoff is conveyed from all pond outfalls to the public storm drainage system
• Discuss easements and tracts

4.2.1.9 EROSION AND SEDIMENT CONTROL
• Discuss overall erosion and sediment control plan
• Discuss BMPs used on the site
• Discuss soil type, site topography and potential for erosion
• Discuss use, size and location of sediment basin and sediment trap

4.2.1.10 CONCLUSIONS

Compliance with Standards
• City of Helena Engineering Design Standards
• Applicable Local, State and Federal Regulations

Engineer Deviations
• Identify provisions by section number for which a deviation will be requested
• Provide justification for each deviation requested

4.2.1.11 REFERENCES
• Reference all criteria, reports, or other technical information used in development of the drainage report and plan

4.2.1.12 APPENDICES

Hydrologic Computations
• Determination of runoff coefficients, times of concentration, and runoff calculation
• Land use assumptions for off-site areas
• Peak flow rate calculations for the minor and major storms
• Rainfall Information
• Hydrograph data, if applicable
• Connectivity diagram showing relationship/connectivity of basins, conveyance facilities, detention ponds, and design points
- Floodplain hydrology

**Hydraulic Computations**
- Culvert Capacities
- Storm sewer capacities and hydraulic grade lines, including the loss coefficients
- Street capacities
- Inlet capacities
- Open channel or swale capacities
- Stabilization and grade control improvements
- Water surface profiles
- Emergency spillway sizing calculations
- Downstream capacity to and of the receiving public drainage system
- Energy dissipation at pipe outfalls
- Floodplain modeling

**Storm Water Ponds**
- Infiltration investigation and capacity
- Groundwater investigation
- Retention Pond sizing and drain-down
- Detention Pond stage-storage-discharge determination
- Water Quality Treatment sizing and discharge

**4.2.1.13 DRAINAGE PLANS**

**Overall Drainage Plan**
- Appropriate size and scale for legibility
- Title block and legend
- Show boundaries of entire development or project
- Existing or proposed streets, roadways, or highways
- Topography
- Show limits of all major basins, including off-site basins
- General drainage patterns and flow paths, including those entering and leaving the site
- Location and outline of detention/retention and water quality facilities
- Significant existing and proposed infrastructure including: storm water ponds, waterways, wetlands, channels, storm sewers, above and below ground utilities, gas transmission lines, railroads, etc.
- Floodplain boundaries

**4.2.1.14 DETAILED DRAINAGE PLANS**
- Title block and legend
- Basin designations, design points, flow rates, volumes, release rates identified
- Scale 1"= 20' to 1"= 100', or as required to show sufficient detail
Existing (dashed or screened) and proposed (solid) contours with a two (2) foot maximum contour intervals. In terrain where the slope exceeds 15%, the maximum interval is five (5) feet. Contour must extend a minimum of 100 feet beyond property lines.

- Existing utilities and structures
- All property lines and easements with type of easements noted
- Adjacent developments or ownerships
- Streets and roadways with ROW and paved widths, type of curb and gutter or roadside swale, slope, flow directions, and cross-slopes
- Drainage basin and sub-basin limits
- Existing and proposed stormwater management facilities, including irrigation ditches, roadside swales, open channels and drainageways, storm sewers, culverts, detention ponds, water quality enhancement structures or features, etc. Information must be included regarding materials, sizes, shapes, and slopes
- Proposed outfall points and existing or proposed facilities to convey runoff to the nearest public drainage system with capacity for discharge rates from the site
- Location and elevation of all existing and proposed FEMA 100 year floodplain boundaries
- Summary Runoff Table, includes Basin ID, contributing area, runoff coefficient, % imperviousness, runoff value, design point and the routed flows.

4.2.1.15 EROSION AND SEDIMENT CONTROL PLANS

- See Section 4.7.2. for erosion and sediment control plan sheet requirements.

4.3 HYDROLOGIC ANALYSIS AND DESIGN

4.3.1 DESIGN STORM EVENTS

- Water Quality – 0.5 Inches of Precipitation
- 5 year, 24 hour storm (Runoff Control and Street conveyance)
- 25 year, 24 hour storm (Channels and Storm Sewers Conveyance)
- 100 year, 24 hour storm (Combined Conveyance and Runoff Control)

4.3.2 RAINFALL

The rainfall depths provided in the following table are for use with hydrograph analyses to estimate peak rates of runoff and runoff volumes. These values were obtained from Chapter 7 Appendix B of the Montana Department of Transportation Drainage Manual, 2017.

<table>
<thead>
<tr>
<th>Design Storm</th>
<th>Precipitation, inches</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water Quality</td>
<td>0.50</td>
</tr>
<tr>
<td>5 year, 24 hour</td>
<td>1.57</td>
</tr>
<tr>
<td>25 year, 24 hour</td>
<td>2.05</td>
</tr>
<tr>
<td>100 year, 24 hour</td>
<td>2.44</td>
</tr>
</tbody>
</table>
Rainfall intensity-duration-values provided in the following table are for use with the Rational Method for determining peak rates of runoff. These values were obtained from Chapter 7 Appendix B of the Montana Department of Transportation Drainage Manual, 2017.
4.3 HYDROLOGIC ANALYSIS AND DESIGN

### Table 4-2. Precipitation Intensity Values, Inches/Hour

<table>
<thead>
<tr>
<th>Duration</th>
<th>Return Period</th>
<th>5 year</th>
<th>25 year</th>
<th>100 year</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 minutes</td>
<td></td>
<td>4.26</td>
<td>6.38</td>
<td>8.31</td>
</tr>
<tr>
<td>10 minutes</td>
<td></td>
<td>2.82</td>
<td>4.21</td>
<td>5.45</td>
</tr>
<tr>
<td>15 minutes</td>
<td></td>
<td>2.15</td>
<td>3.21</td>
<td>4.14</td>
</tr>
<tr>
<td>30 minutes</td>
<td></td>
<td>1.31</td>
<td>1.95</td>
<td>2.51</td>
</tr>
<tr>
<td>60 minutes</td>
<td></td>
<td>0.74</td>
<td>1.09</td>
<td>1.39</td>
</tr>
</tbody>
</table>

4.3.3 HYDROLOGIC MODELS

There are two methods for allowed estimating storm runoff peak flows: SCS Runoff Curve Number Method and the Rational Method. Technical guidance for the SCS curve number method can be found in TR-55. Technical guidance for the Rational Method can be found in the Urban Drainage Design Manual, Hydraulic Engineering Circular No. 22; and the National Engineering Handbook, Part 630 Hydrology. Standard forms SF-1 and SF-2 shall be used for rational method calculations.

There are two methods allowed for estimating storm runoff volumes: SCS hydrograph procedure and Simplified Volume. The SCS hydrograph procedure can found in TR-55 and for routing hydrographs in TR-20. The Simplified Volume method is only allowed for sizing retention storm water ponds and detention ponds with less than 10 acres of tributary area. The Simplified Volume method is described in Section 4.5.5 Retention Pond.

The SCS methods may be used for estimating runoff peak flows and total runoff volumes. A SCS hydrograph procedure shall be used for all tributary areas greater than 160 acres and for routing runoff flows through detention ponds with tributary areas greater than 10 acres. The SCS methods shall be performed with 24 hour storm events, Type II rainfall distributions, and resolved to 5 minute time intervals.

The rational method may be used for determining peak runoff flows from tributary basins up to 160 acres.

**Offsite Drainage Evaluation:** Drainage analysis must include an evaluation of all off-site drainage basins impacting the proposed site. Offsite drainage evaluation must include the results of the hydrologic and hydraulic analysis contained in the most current City of Helena Storm Water Master Plan.

Any site discharging developed flows must evaluate the route and downstream capacity of the drainage system and provide adequate capacity from the site to the point where flows are reduced to the pre-developed rates and discharge conditions.

Offsite drainage areas exceeding 25% of the site area or 25 acres, whichever is smaller, must be routed around, to discharge below, the site or regional storm water pond.

Offsite drainage areas routed to a storm water pond shall be included in the pond rate, volume, and water quality controls for its existing developed condition or its future developed condition based on zoning, whichever has more impervious area.
4.4 CONVEYANCE DESIGN

4.4.1 OPEN CHANNELS

**Natural Channels:** In general, natural channels are limited in within the Helena, and as such, these standards do not provide guidance in this regard. Any impacts to a natural waterway will be evaluated with City Engineering on a case by case basis.

**Man-made Channels:** Only vegetated man-made channels are allowed in the City. No hard lined, rock or concrete, channels are allowed. Man-made channels must be evaluated for stability during the post-construction (pre-vegetation) and ultimate (vegetated) condition. Design criteria for man-made channels is provided in the following table.

<table>
<thead>
<tr>
<th>Design Item</th>
<th>Minor Channel</th>
<th>Major Channel</th>
</tr>
</thead>
<tbody>
<tr>
<td>100-year Flow Capacity</td>
<td>Less than 50 cfs</td>
<td>More than 50 cfs</td>
</tr>
<tr>
<td>Maximum 100-year Velocity</td>
<td>7 feet per second</td>
<td>5 feet per second</td>
</tr>
<tr>
<td>Manning $n$</td>
<td>0.035</td>
<td>0.035</td>
</tr>
<tr>
<td>Maximum Froude Number</td>
<td>0.8</td>
<td>0.5</td>
</tr>
<tr>
<td>Maximum Depth</td>
<td>2 feet</td>
<td>5 feet</td>
</tr>
<tr>
<td>Maximum Slope</td>
<td>2.5%</td>
<td>0.6%</td>
</tr>
<tr>
<td>Maximum Side Slope</td>
<td>3:1</td>
<td>4:1</td>
</tr>
<tr>
<td>Maximum Centerline Bend Radius</td>
<td>2 times top width</td>
<td>2 times top width</td>
</tr>
<tr>
<td>Minimum Freeboard</td>
<td>0.5 feet</td>
<td>1.0 feet</td>
</tr>
<tr>
<td>Minimum Freeboard &gt;2 to 5 feet</td>
<td>1.0 feet</td>
<td>1.0 feet</td>
</tr>
</tbody>
</table>

Temporary erosion control linings are necessary prior to establishment of vegetation. Temporary erosion control lining must be biodegradable and designed to be stable during the 5 year storm event.

Grade control structures may be required to meet the maximum longitudinal channel slopes in Table 4-3. Design Criteria for Man-Made, Grass-Lined Channels. Grade control structures shall be designed in accordance with Federal Highway Administration, Hydraulic Design of Energy Dissipaters for Culverts and Channels, Hydraulic Engineering Circular No. 14.

Any use of riprap shall be mixed with soil at a rate of 1/3 soil to 2/3 riprap and covered with 6 inches of topsoil.

Technical design guidance for Open-channels can be found in Open-Channel Hydraulics by Ven Te Chow.

Major channels must be excavated and not have any embankments.
4.4.2 STORM SEWERS

**Materials:** Concrete pipe shall be steel reinforced and rubber gasket joints. The minimum diameter pipe size for public storm sewer systems shall be 12 inches. High Density Polyethylene and Metal pipe are not allowed.

All open ends of storm sewers have a concrete flared end section and galvanized steel safety rack. All safety racks shall be constructed from smooth steel pipe with a minimum outside diameter of one (1) inch at four (4) inches on-center. The safety racks ends and bracing should be constructed with steel angle sections.

Riprap inlet and outlet protection is required at all open ends of storm sewers.

Any use of riprap shall be mixed with soil at a rate of 1/3 soil to 2/3 riprap and covered with six (6) inches of topsoil.

All storm sewers must be designed for a minimum of H-20 loading, unless other circumstances require higher structural loading requirements.

**Hydraulic Design:** Storm Sewers shall have non-pressurized (non-surcharged) flow during the 25 year storm event. Storm Sewers shall not have the hydraulic grade line greater than one (1) foot above the ground surface at any point during the 100 year storm event.

Hydraulic and energy grade line shall be calculated by accounting for all pipe friction losses and structure losses. Hydraulic and energy grade lines shall be shown on all storm sewer plan a profile sheets for public storm sewer systems.

Backwater effects of outfalls into channels and storm water ponds must be accounted for in the design of storm sewers.

Maximum internal velocity shall be 25 feet-per-second (fps) during the 25 year storm event, and the minimum velocity shall be 2.5 fps at 10% of full flow capacity. The maximum outlet velocity into a waterway, open channel, or storm water pond shall not exceed 15 fps.

Inlet and outlet protection shall be designed in accordance with Federal Highway Administration, Hydraulic Design of Energy Dissipators for Culverts and Channels, Hydraulic Engineering Circular No. 14.

**Vertical Alignment:** The minimum clearance between storm sewer and water main, either above or below, shall be 18 inches, or as otherwise restricted. Concrete encasement of the water line will be required for clearance of 18 inches or less. Minimum vertical clearance to other buried utilities are provided in the following table.
Table 4-4. Vertical Clear Distances from Storm Sewers

<table>
<thead>
<tr>
<th>Utility Type</th>
<th>Clear Distance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cable TV</td>
<td>Per Utility Owner, 12 inches minimum</td>
</tr>
<tr>
<td>Gas</td>
<td>Per Utility Owner, 12 inches minimum</td>
</tr>
<tr>
<td>Power</td>
<td>Per Utility Owner, 12 inches minimum</td>
</tr>
<tr>
<td>Sewer main</td>
<td>12 inches</td>
</tr>
<tr>
<td>Telephone, Fiber Optics</td>
<td>Per Utility Owner, 12 inches minimum</td>
</tr>
<tr>
<td>Water main*</td>
<td>18 inches or DEQ Circular 1, whichever is greater</td>
</tr>
</tbody>
</table>

* All storm sewer crossings of water mains less than three (3) feet clear distances shall have two (2) inches of rigid insulation placed between the pipes for a width two (2) feet wider than the storm sewer and for four (4) feet on either side of the water main.

The minimum slope shall be 0.5% for pipes 24 inches and greater and 1% for pipes smaller than 24 inches.

All storm sewers shall be buried a minimum of one (1) foot below the pavement section and 1.5 feet below finished grade in landscaped areas. Storm sewer pipe shall not be buried greater than 15 feet deep.

Open pipe outfalls must discharge a minimum of one (1) foot above a channel invert or storm water pond.

Manhole or inlet access is required at all vertical bends.

**Horizontal Alignment**: Storm sewers shall not be placed under any structure, retaining wall greater than three (3) feet tall, or building. Storm sewers shall be a minimum of 10 feet from any permanent above-ground structure, retaining wall greater than three (3) feet tall, or building, or the same distance as the buried depth of the storm sewer, whichever is greater. Storm sewers shall not be placed under the landscaped boulevards or medians except to make crossings or when buried greater than three (3) feet from the top of the pipe to finished grade.

Utility crossing shall occur between 45 degrees and 90 degrees. 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. Minimum horizontal clearance to other buried utilities are provided in the following table.

Table 4-5. Horizontal Clear Distances from Storm Sewers

<table>
<thead>
<tr>
<th>Utility Type</th>
<th>Clear Distance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cable TV</td>
<td>Per Utility Owner, 5 feet minimum</td>
</tr>
<tr>
<td>Gas</td>
<td>Per Utility Owner, 5 feet minimum</td>
</tr>
<tr>
<td>Power</td>
<td>Per Utility Owner, 5 feet minimum</td>
</tr>
<tr>
<td>Sewer main</td>
<td>5 feet</td>
</tr>
<tr>
<td>Telephone, Fiber Optics</td>
<td>Per Utility Owner, 5 feet minimum</td>
</tr>
<tr>
<td>Water main</td>
<td>10 feet or DEQ Circular 1, whichever is greater</td>
</tr>
</tbody>
</table>

Manhole or inlet access is required at all changes in horizontal alignment.
Storm Sewer System Connections: Connections to a public storm sewer system must occur at an accessible structure such as a manhole or inlet, or by an open pipe outfall to channel or storm water pond. Connections must be made by saw cutting or through an existing knockout and sealed to a watertight connection with non-shrink grout.

Angle between the inflow pipe and outflow pipe shall be 90 degrees or greater.

Private storm sewer systems must be accessible on the private property through a straight run of pipe, no greater than 400 feet in length and through a manhole, inlet or end of an open pipe.

No roof drains or underdrains are allowed to be connected to the public storm sewer system.

Abandoning Storm Sewer Pipes and Structures: The Contractor shall either remove or completely fill the pipeline to be abandoned with flowable fill.

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 the top 24 inches of the structure must be completely removed and the structure filled with flowable fill, compacted pipe bedding, or trench backfill material.

No storm sewer pipes or structure may be abandoned in place if they conflict with existing and future public works infrastructure installation or maintenance.

4.4.3 MANHOLES

Materials:
- All manholes must be concrete.
- All manhole covers must be ductile or cast iron.

Manhole Design/Construction Requirements: The minimum undisturbed wall between openings is 12 inches.

All manhole covers shall have City of Helena logo and stamped “STORM SEWER” in block letters at least one and a quarter inch (1 ¼”) inches high, recessed to be flush with the surface (Standard Drawing 4-9).

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.

No steps are permitted in a manhole. All manholes shall have a one (1) foot sump below the lowest invert.

All manholes must be designed for a minimum of H-20 loading, unless other circumstances require higher structural loading requirements.

Location: Manhole lids shall not be placed in the wheel travel path. Manholes shall be located a maximum distance of 400 feet for pipe diameters up to 36 inches and 600 feet for pipe diameters greater than 36 inches.

Hydraulics: Headlosses shall be accounted for at all manholes.
4.4.4 INLETS

**Materials:**
- All inlets must be concrete.
- All grates shall be cast or ductile iron.

**Inlet Design/Construction Requirements:** All grates shall have “No Dumping, Drains to Stream” stamped in block letters at least two (2) inches high and recessed so as to be flush with the surface. On-grade inlets shall be vaned. Inlet grates shall be bike and pedestrian safe.

No steps are permitted in an inlet. All inlets shall have a one (1) foot sump below the lowest invert.

All inlets must be designed for a minimum of H-20 loading, unless other circumstances require higher structural loading requirements.

**Location:** Inlets shall be located in the curb line. Where roads are super-elevated, an inlet shall be placed where the standard cross-slope of the road begins to diminish (1% cross-slope) to prevent flow across travel lanes. Inlets shall be placed on the upstream side of all pedestrian crossings.

**Hydraulics:** For sub-basins less than one (1) acre, inlets with a curb opening are required at all low points. For drainage sub-basins greater than one (1) acre, double inlets with a curb opening are required at all low points.

Area drains in low points shall be sized assuming 50% of the inlet grate capacity is clogged and ineffective. Inlet capacities and by-pass flow shall be calculated. By-pass flow leaving the site shall be reduced to the historic rate.

Headlosses shall be accounted for at all inlets.

4.4.5 CULVERTS

The requirements under storm sewers apply to culverts. The minimum culvert diameter is 18 inches.

Hydraulic design of culverts shall be performed in accordance with Federal Highways Administration, Hydraulic Design of Highway Culverts, Hydraulic Design Series No. 5.

Inlet and outlet protection shall be designed in accordance with Federal Highway Administration, Hydraulic Design of Energy Dissipators for Culverts and Channels, Hydraulic Engineering Circular No. 14.

The maximum headwater during the 100 year storm event shall be 1.5 times the culvert diameter or culvert rise.

4.4.6 STREETS

All drainage design involving the use of streets for drainage shall meet the standards in the following tables for evaluating allowable encroachments within public streets for conveying runoff.
Table 4-6. Allowable Drainage Encroachment within Public Streets by Street Classification.

<table>
<thead>
<tr>
<th>Street Classification</th>
<th>Maximum Encroachment for Calculating Theoretical Conveyance Capacity</th>
<th>5-year Storm Event</th>
<th>100-year Storm Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local</td>
<td>For six (6) inch curb, no curb overtopping and flow may spread to crown of street, whichever is lower depth.</td>
<td>Residential dwellings, public, commercial, and industrial buildings shall not be inundated at the lowest adjacent grade. The depth of water at the gutter flowline shall not exceed 12 inches or the water surface shall not extend past the street right-of-way (or adjacent drainage easement), whichever is more restrictive.</td>
<td></td>
</tr>
<tr>
<td>Collector</td>
<td>For six (6) inch curb, flow may spread to back of walk and to crown of street, whichever is lower depth. Flow spread must leave at least one 10 foot lane free of water.</td>
<td>Residential dwellings, public, commercial, and industrial buildings shall not be inundated at the lowest adjacent grade. To allow for emergency vehicle access, the depth of water shall not exceed six (6) inches at the street crown, 12 inches at the gutter flowline, or the water surface shall not extend past the street right-of-way (or adjacent drainage easement), whichever is more restrictive.</td>
<td></td>
</tr>
<tr>
<td>Arterial</td>
<td>For six (6) inch curb, flow may spread to back of walk and to crown of street, whichever is lower depth. Flow spread must leave at least 10-feet free of water for each travel direction.</td>
<td>Residential dwellings, public, commercial, and industrial buildings shall not be inundated at the lowest adjacent grade. To allow for emergency vehicle access, the depth of water shall not exceed six (6) inches at the street crown, 12 inches at the gutter flowline, or the water surface shall not extend past the street right-of-way (or adjacent drainage easement), whichever is more restrictive.</td>
<td></td>
</tr>
</tbody>
</table>

Cross-street flow is not allowed for collector and arterial roads.

4.4.7 FLOODPLAINS

All work within the Federal Emergency Management Agency (FEMA) flood hazard area shall comply with FEMA regulations, standards, and guidance, Helena City Code: Title 3 Building Regulations, Chapter 14 Floodplain Regulations, and as required by the City Engineer.

4.5 STORM WATER RUNOFF CONTROL & WATER QUALITY TREATMENT

All site development with an impervious area of greater than 5,000 square feet must be routed to an on-site or regional off-site storm water pond which will include water quality treatment and storm water runoff capacity with flow controls.

Low Impact Development (LID) techniques may be used in lieu of water quality treatment. LID design guidance is available using the Montana Post-Construction Storm Water BMP Design Guidance Manual (MTDEQ, 2017) or the Urban Storm Drainage Criteria Manual (UDFCD, 2010). LID techniques shall be designed in coordination with the City Engineering.

All portions of above-ground storm water ponds must be vegetated. The minimum pond size for any site shall be 1,000 cubic feet or 2,000 cubic feet per acre, whichever is greater. Specific standards for types of runoff control and water quality treatment ponds are provided in these standards. For additional pond design guidance review of the Montana Post-Construction Storm Water BMP Design Guidance Manual (MTDEQ, 2017) or the Urban Storm Drainage Criteria Manual (UDFCD, 2010) is recommended. See Post-Construction Storm Water Management...
4.5 STORM WATER RUNOFF CONTROL & WATER QUALITY TREATMENT

Plan Review Checklist in Appendix A.

4.5.1 REGIONAL PONDS

Any site proposing to use a regional pond (storm water pond serving more than one lot) must be designed to provide capacity for the fully developed tributary drainage basin.

If an existing regional pond is proposed to be used for storm water runoff control and water quality treatment, that pond must be modified to meet the current standards for its entire tributary area. A schematic design standard for an above ground extended detention basin that could adapted for use as a regional facility is provided in Standard Drawing 4-10.

4.5.2 ABOVE-GROUND DETENTION PONDS

**Design Frequency, Volume, and Release Rates:** Above-ground detention ponds must store excess runoff from the developed condition and release it at the historic (pre-developed) rates to the public storm water system or an existing drainageway for the 5-year and 100-year, 24-hour storm events. Inflow and outflow hydrographs must be generated to estimate the pre-developed and developed runoff volumes and rates.

**Configuration Requirements:** The following design requirements for above-ground detention ponds must be incorporated into the pond design:

- The maximum capacity is 10 acre-feet
- The maximum water depth is five (5) feet
- The top of any cut slope and the toe of any fill slope shall be 3 horizontal feet or greater from the property boundary
- The length to width ratio shall be 2:1 or greater
- A minimum of one (1) foot of freeboard shall be provided
- Side slopes shall be 4H:1V or flatter
- Inlet and outlet shall be arranged at opposite ends of the pond
- The base shall have a minimum slope of 0.5% from the inlet to the outlet
- A schematic design standard for an extended detention basin meeting the above configuration requirements is provided in Standard Drawing 4-10.
- Retaining walls are not allowed to exceed three (3) feet inside or outside of the pond.
- If groundwater is encountered or expected to be within three (3) feet of the bottom of the storm water pond, then the storm water pond shall be designed in coordination with, and as required by the City Engineer, as a wet bottom pond.
- Outlets shall be design in accordance with Section 4.5.7 Outlet Structures.

4.5.3 PARKING LOT DETENTION PONDS
Only detention ponds are allowed in a private parking lot. Parking lot retention ponds are not allowed.

**Design Frequency, Volume, and Release Rates:** Parking lot detention ponds must store excess runoff from the developed condition and release it at the historic (pre-developed) condition rates to the public storm water system or an existing drainageway for both the 5 year, 24-hour storm event and 100-year, 24-hour storm event.

Parking lot detention ponds may not be used to store either the water quality or the 5-year storm event volume.

Inflow and outflow hydrographs must be generated to estimate the pre-developed and developed runoff volumes and rates.

**Configuration Requirements:** In addition to the configuration requirements under Section 4.5.2 Above-Ground Detention Ponds, the following shall apply to parking lot detention ponds:

- Parking lot detention may not exceed 12 inches in depth
- Parking lot detention ponds must be located in the outer portion of the parking lot, a minimum of 40 feet from the building
- Parking lot detention ponds shall not inundate handicap parking spaces

### 4.5.4 UNDERGROUND DETENTION POND

Only private underground detention ponds are allowed. Underground retention ponds are not allowed. Prior to discharge to an underground detention pond, storm water must pass through an above-ground water quality treatment pond. The requirements under Section 4.4 CONVEYANCE DESIGN for storm sewers and manholes shall apply to underground detention ponds.

**Design Frequency, Volume, and Release Rates:** The same requirements as in Section 4.5.2 Above-Ground Detention Ponds apply.

**Configuration Requirements:** Sites smaller than one acre must drain to a single underground detention pond unless there is a physical impracticability as determined by City Engineering. Sites larger than one (1) acre must drain to a maximum of one (1) pond per acre such that any pond has a minimum tributary area of one (1) acre unless there is a physical impracticability as determined by the City Engineer.

- Underground detention ponds must be located under a parking lot or landscaped area
- The minimum width and height of any underground detention vault shall be 36 inches
- The void or pore space in buried gravel or rock is not allowed for use a storage capacity.
- Multiple underground chambers must be connected by a head pipe at the upstream end and a tail pipe at the downstream end. The head and tail pipes must be of similar size as the chambers
• Inlet pipes must be connected to the head pipe
• Only one outlet is allowed which must be connected to the tail pipe
• Access manholes, meeting the requirements under Section 4.4.3 Manholes, are required at the inlet pipe(s), outlet pipe and at 400 foot spacing along each chamber
• Underground detention ponds are not allowed where groundwater is present within five (5) feet of the base of the pond

4.5.5 RETENTION PONDS

Design Frequency, Volume, and Release Rates: Retention ponds shall be designed to capture the 100-year, 24-hour storm event and infiltrate that volume in 48 hours. Inflow outflow hydrographs may be used for retention pond sizing or the Simplified Volume Method outlined below may be used. Infiltration rates shall be based on soil classification or percolation testing as described in Section 4.5.6 Water Quality Treatment Ponds.

Simplified Volume Method

The minimum pond volume shall be the runoff volume less the infiltration volume. The runoff and infiltration volumes must be calculated as indicated below:

\[
RV = \frac{C \times P_{100yr, 24hr} \times A}{12}
\]

Where:
RV = Runoff Volume (cubic feet)
C = Composite runoff coefficient
\(P_{100yr, 24hr}\) = 100 year 24 hour precipitation Depth (inches)
A = Area (square feet)

\[
IV = \frac{I \times T \times (A_b + 0.5A_s)}{12}
\]

Where:
IV = Infiltration Volume (cubic feet)
I = Infiltration rate (inches/hour)
T = 24 (hours)
\(A_b\) = Area of pond base (square feet)
\(A_s\) = Area of pond side slope (square feet)
Configuration Requirements:

- The maximum capacity is 10 acre-feet
- The maximum water depth is five (5) feet
- The top of any cut slope and the toe of any fill slope shall be 10 feet or greater from the property boundary
- The length to width ratio shall be 2:1 or greater
- A minimum of one (1) foot of freeboard shall be provided
- Side slopes shall be 4H:1V or flatter
- Retaining walls are not allowed to exceed three (3) feet inside or outside of the pond.

If groundwater is encountered or expected to be within three (3) feet of the bottom of the storm water pond, then the storm water pond shall be designed in coordination with, and as required by the City Engineer as a Wet Bottom Pond.

4.5.6 WATER QUALITY TREATMENT PONDS

All site development with an impervious area of greater than 5,000 square feet must be routed to an on-site or regional off-site water quality treatment pond. Water quality ponds for development and redevelopment greater than one (1) acre must be designed in accordance with Infiltration Basins in the Montana Post-Construction Storm Water BMP Design Guidance Manual.

Low Impact Development (LID) techniques may be used in lieu of water quality treatment. LID design guidance is available using the Montana Post-Construction Storm Water BMP Design Guidance Manual (MTDEQ, 2017) or the Urban Storm Drainage Criteria Manual (UDFCD, 2010). LID techniques shall be designed in coordination with the City Engineering.

All motorized (recreational, small engine, passenger, truck and construction) vehicle and equipment fueling stations, and service/repair facilities shall route all parking lot storm water to an appropriately sized oil/sand and water separator or separate water quality treatment pond.

All dumpster areas shall drain to a separate and adjacent Water Quality Treatment Pond or be connected to the sanitary sewer system. No additional storm water outside the dumpster area is permitted to drain to the sanitary sewer system.

**Design Frequency, Volume, and Release Rates:** Water Quality Treatment Ponds shall be designed to capture and infiltrate, evaporate and/or evapotranspirate runoff volume from 0.5 inches of precipitation from a 24-hour storm over the tributary area. This volume is referred to as the Runoff Reduction Volume (RRV).

- The RRV shall be calculated as shown in the Montana Post-Construction Storm Water BMP Design Guidance Manual. An additional 10% must be included with the RRV for sediment storage. Imperviousness of roofs, pavement and concrete shall be 100%
• The RRV shall be in addition to the capture volume for detention ponds. No additional volume is required for retention ponds

• Water quality treatment ponds shall be designed to infiltrate the RRV in less than 48 hours

• If infiltration within 48 hours is not possible based on geotechnical percolation tests, then the RRV may be released over 48 hours. The maximum tributary area to the water quality treatment pond is 300 acres or when a base flow exceeds 50% of the release rate

**Water Quality Pond Configuration for greater than 5000 sf of imperviousness and less than a 1 acre development or redevelopment:**

• The minimum RRV shall be 250 cubic feet.

• The surface area of the RRV shall encompass no more that ½ of the area of the base of the storm water pond

• RRV shall be located at the outlet and below the lowest outlet invert of the storm water pond

• The maximum water depth is three (3) feet

• Side slopes shall be 2H:1V to 4H:1V

**Infiltration Rates:** Infiltration rates for sizing water quality treatment and retention ponds shall be based on the percolation rate and USDA soil texture as required below.

Soil types shall be determined based on grain size distribution by sieve analysis (ASTM D6913) and hydrometer analysis (ASTM D422) for major subdivisions, commercial sites and sites serving more than one (1) acre of imperviousness.

Percolation rates shall be determined by ASTM D 3385 for major subdivisions, commercial sites and sites serving more than one acre of imperviousness. The percolation rate and soil type shall be measured and obtained at a depth equal to the proposed bottom grade of the facility. The location of the soil sample and percolation test shall be shown on a map.

The maximum percolation rates for soil types shall be:

**Table 4-7. Maximum Percolation Rates for Soil Types**

<table>
<thead>
<tr>
<th>Soil Texture Class (U.S.D.A.)</th>
<th>Infiltration Rates (Inches per Hour)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coarse sands, cobbles</td>
<td>20.0</td>
</tr>
<tr>
<td>Medium sand</td>
<td>8.0</td>
</tr>
<tr>
<td>Fine sand, loamy sand</td>
<td>2.4</td>
</tr>
<tr>
<td>Sandy loam</td>
<td>1.0</td>
</tr>
<tr>
<td>Loam</td>
<td>0.5</td>
</tr>
</tbody>
</table>
The actual or maximum percolation rates, whichever is less, shall be reduced by one-half for use as the infiltration rate to determine the drain-down time of the RRV. This reduction is to account for sedimentation and silting in of the natural soil profile and subsequent reduced infiltration rate over time.

4.5.7 OUTLET STRUCTURES

Outlet structures shall be designed in accordance with Urban Drainage and Flood Control District, Urban Storm Drainage Criterial Manual, Volume 3, Chapter 4: Treatment BMPs, Treatment Fact Sheet T-12 Outlet Structures. A simplified outlet structure meeting these standards is provided in Standard Drawings 4-11 and 4-12.

4.5.8 EMERGENCY SPILLWAY

All storm water ponds must have an emergency spillway with a capacity equal to peak flow from the undetained 100-year storm event.

The emergency spillway must have non-erosive velocities or include erosion protection.

No structures or surface features (e.g. fences, barriers, landscaping) that would divert the overflow are allowed within the flow path of runoff discharged from the emergency spillway flow path.

4.5.9 MAINTENANCE ACCESS AND RESTRICTIONS

A vehicle access ramp shall be provided from a parking lot or road to the base of all storm water ponds with a minimum width of 12 feet, a maximum slope of 15% and must be surfaced with six (6) inches of road base course.

When required by the City Engineer or when safety is a concern, a gate, removable bollards and fencing must be included to restrict access to the pond.

4.5.10 EMBANKMENTS

All embankments greater than three (3) feet in height or impounding more than one (1) acre-foot of water shall be compacted to ASTM D1557, have minimum crest width of eight (8) feet, and shall have a permeability of less that $1 \times 10^{-5}$ cm/sec.

The maximum embankment height is six (6) feet. The embankment height is measured from the downslope toe to the crest of the embankment.

Anti-seep collars shall be installed on all conveyance pipes within the embankment.

4.5.11 VEGETATION AND LANDSCAPING

All storm water ponds, except parking lot and under-ground ponds, and channels shall be covered with six (6)-inches of topsoil and be vegetated with seed mixes for native areas in Open Space Areas as shown below or sod if the area is irrigated. Wetland areas must be seeded with a wetland seed mix approved by the City of Helena Open Lands Manager.

Native Areas in City of Open Space shall be seeded with the following seed mixes:
### Table 4-8. Native Area Seeding Mixes by Site Characteristics

<table>
<thead>
<tr>
<th>Droughty Site (south aspects)</th>
<th>Moderately cool sites (north aspects)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Common Name</strong></td>
<td><strong>Pounds per Acre</strong></td>
</tr>
<tr>
<td>Slender wheatgrass</td>
<td>4</td>
</tr>
<tr>
<td>Mountain Brome</td>
<td>4</td>
</tr>
<tr>
<td>Idaho Fescue</td>
<td>3</td>
</tr>
<tr>
<td>Bluebunch wheatgrass</td>
<td>4</td>
</tr>
<tr>
<td>Prairie Junegrass</td>
<td>2</td>
</tr>
<tr>
<td>Richardson’s needlegrass</td>
<td>3</td>
</tr>
</tbody>
</table>

All slopes steeper than 5% and longer than 50 feet, or steeper 10% and longer than 20 feet shall be cover with a biodegradable erosion control mat.

All other slopes shall be covered with straw mulch with a tackifier or crimped. Straw mulch shall be placed to a uniform depth of one (1) inch and crimped by impressing into the soil 1-½ inches at eight (8) inches on-center.

### 4.6 DRAINAGE EASEMENTS AND TRACTS

In general, easements are required for channels, storm sewers, and storm water ponds and any conveyance which routes runoff from adjacent properties. Structures unrelated to the stormwater drainage system are not allowed in drainage easements or tracts. No landscaping, fences or other surface features which may impede, divert or otherwise alter the flow of runoff or obstruct maintenance are allowed in drainage easements or tracts.

Drainage easements are required on any site which conveys off-site storm water though the site, except where a lot zoned R-1 or R-2 conveys runoff from three (3) or fewer R-1 or R-2 zoned lots. Drainage easements are required from any site which routes storm water to an off-site storm water pond.

Drainage easements for access shall be a minimum of 15 feet wide, unobstructed and have a maximum slope of 15%.

Drainage easements and tracts shall be shown on the Drainage Plan, Preliminary and Final Plats, or shall be dedicated and recorded prior to final approval of any project.

The Grantor shall pay all title policy and recording fees necessary to transfer rights to the City. Drainage easements shall state that the City has the right of access on the easements for inspection and maintenance purposes.

### 4.6.1 STORM SEWERS AND CULVERTS
Minimum easement width for storm sewers up to 36 inches wide is 20 feet. Minimum easement width for storm sewer 36 inches wide or greater shall be the width of the storm sewer plus 20 feet.

Storm sewers shall be located in the center 1/3 of the easement. No trees shall be planted in a storm sewer easement.

### 4.6.2 STORM WATER PONDS

Private storm water ponds and outlet works are required by these criteria for proper functioning of the overall public drainage system, and therefore are required to be placed within drainage easements or tracts.

Drainage tracts are required for any storm water pond which serves more than one parcel and must abut City right-of-way or provide an access easement from City right-of-way.

Easements or tracts for storm water ponds shall be as required to contain the design volume, freeboard, embankments, spillway and maintenance access.

### 4.6.3 OPEN CHANNELS AND NATURAL WATERWAYS

Easements for open channels and natural waterways shall be a minimum of 15 feet wide or equal to the width of the 100 year water surface elevation plus freeboard, whichever is greater.

Maintenance access to the open-channel or natural waterway easement shall be provided at a minimum every 500 feet.

### 4.7 CONSTRUCTION EROSION AND SEDIMENT CONTROL

#### 4.7.1 GENERAL CONSTRUCTION SITE REQUIREMENTS

Any construction project which disturbs the earth and exposes soil shall implement and maintain effective soil erosion and control measures, also referred to as Construction Best Management Practices (BMPs), which will protect surface water quality and not discharge soil or other pollutants from the project site.

No construction project shall discharge any pollutant off site.

Storm water runoff from undisturbed tributary areas shall be routed around the areas of disturbance or accounted for in the sizing of erosion and sediment control measures.

Any construction project which pours concrete shall use an excavated concrete washout area or water-tight basin of sufficient size to contain all excess concrete and wash water.

#### 4.7.2 EROSION AND SEDIMENT CONTROL PLAN SHEET(S)

A separate Erosion and Sediment Control Plan sheet(s) is required for all commercial projects and for any residential project with a site disturbance greater than one (1) acre. At a minimum the Erosion and Sediment Control Plan sheet(s) shall include:

- Sediment basin for drainage basins greater than 10 acres located at the low point of the project
- Sediment trap for drainage basins less than 10 acres, located at the low point of the project
• A secondary sediment trap is required for any part of a disturbed site that exceeds one (1) acre where runoff cannot be routed to the primary sediment basin or sediment trap

• A sediment basin or trap shall have a minimum volume of 1,000 cubic feet per acre of disturbed tributary area

• Perimeter diversion swales or diversion dikes to route flow to the sediment basin or sediment trap

• Silt fence or straw waddles must be installed for areas less than one (1) acre that cannot be routed to a sediment trap or basin

• Vehicle tracking control

• Construction staging area with debris disposal

• Temporary sanitation facilities

• Chemical storage and fueling area

• Concrete washout area


4.7.3  SWPPP REVIEW AND APPROVAL

Whenever site disturbance exceeds one (1) acre, coverage under the Montana Department of Environmental Quality, General Permit for Storm Water Discharges Associated with Construction Activity is required. Coverage under this permit requires preparation submittal of a Notice of Intent (NOI) and Storm Water Pollution Prevention Plan (SWPPP) submitted to Montana Department of Environmental Quality prior to ground disturbance.

Infrastructure and Building Plans and Design Documentation (including the Drainage Report and Plan discussed in these standards) shall be submitted to the City of Helena Engineering and Building Divisions for review and approval. When the City determines that the design documentation and plans meet City standards, the City will issue written approval of the project design.

Prior to beginning earth disturbing activities, the property owner, or the property owner’s construction agent must submit copies of the following documents:

• Stormwater Pollution Prevention Plan

• Notice of Intent

• Montana Department of Environmental Quality confirmation of SWPPP and NOI submission
A Building Permit will not be issued until the City of Helena has received, reviewed, and approved the SWPPP, NOI, and DEQ confirmation of submission.

Final stabilization, and release under the Montana Department of Environmental Quality, General Permit for Storm Water Discharges Associated with Construction Activity, shall only occur when soil-disturbing activities at a site have been completed and a vegetative cover has been established with a density of at least 70% of the pre-disturbance levels, or equivalent permanent physical erosion reduction methods have been employed.

4.8 REFERENCES

1. Chow, Ven Te, Open Channel Hydraulics, 1959


3. Federal Highway Administration, Hydraulic Design of Highway Culverts, Hydraulic Design Series No. 5, April 2012


10. Urban Drainage and Flood Control District (UDFCD), Urban Storm Drainage Criteria Manual, Volumes 1 to 3, November 2010
PART 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, hereafter 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 promote the implementation of Helena’s Growth Policy and to minimize total costs over the life of the transportation system.

Implementing these standards requires balancing of several policy concerns, including but not limited to:

- Providing a safe and efficient multi-modal transportation system;
- Implementing the complete streets policy;
- Discouraging excessive speed; and
- Requiring no more right-of-way than necessary

5.1.2 DEFINITIONS

Words 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 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. Due to the different characteristics regarding land use, network density, and travel patterns, 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 classifications 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:

Principal Arterial: The principal arterial is a basic element of the City’s road system. All other functional classifications supplement the principal arterial network. Access to a principal arterial is ideally limited to intersections with other principal arterials or to the interstate system. Direct access is minimal and controlled. See Sec. 5.2.4 for Driveway Standards. The primary purpose of a major arterial is to promote mobility, serve the major centers of activity, the highest traffic volume corridors, and the longest trip distances in an urbanized area. This classification of road 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:** The minor arterial interconnects with and augments the principal 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 principal arterial road system. They serve through traffic, while at the same time provide direct access for commercial, industrial, office and multi-family 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 principal 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:** The 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 and 5,000 vehicles per day.

**Minor Collector:** The minor collector provides for land access and traffic circulation within and between residential neighborhoods, and commercial and industrial areas. 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:** Local roads comprise all facilities not included in the higher systems. Their 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 are designed for less than 1,500 vehicles per day.

### 5.2 TRANSPORTATION DESIGN STANDARDS

It shall be the policy of the City of Helena to review and approve all projects for access management and control measures during the review phase of a project. The City reserves the right to mandate or limit certain access control feature implementation should it be in the best interest of the traveling public or the City’s concerns.

#### 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 these City of Helena Engineering and Design Standards, 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 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” thick across driveways and 4” thick elsewhere with 8” and 6” of base course respectively.

All sidewalks shall be a minimum width of 5’. All multi-use paths shall be a minimum of 10’ wide.

Integral curb and gutter shall be used on all roadways with maximum of 5% cross-slope from the lip of the gutter to the flow line of the gutter. For hot plant mix pavements, the pavement must be installed between 1/8" to ¼" above the gutter lip. Roll or drop curbs shall be installed with the initial curb and gutter construction. Alterations to the original curb cuts shall be submitted for approval by the City Engineer.

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 ADA ramps must have a detailed design on the plans showing that all ADA requirements are met.

All sidewalks, sidewalk crossings, pedestrian ramps or other pedestrian facilities in the rights-of-way shall be constructed in accordance with the Americans with Disabilities Act (ADA) and the best practices as identified in the current edition of Public Rights-of-Way Accessibility Guidelines (PROWAG).

Guardrail may be required in certain situations adjacent to sidewalk. Guardrail shall be designed and constructed in accordance with the current American Association of State Highway and Transportation Officials (AASHTO) Roadside Design Guide 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 facilities, and multi-use paths, trails, and routes shall conform to the most recent update of the Greater Helena Area Transportation Plan. All new construction shall conform to the standards for bicycle facilities detailed herein and the AASHTO Guide for the Development of Bicycle Facilities. All new construction of pedestrian facilities shall conform to the AASHTO Guide for Planning, Design, and Operation of Pedestrian Facilities and all applicable ADA standards. Bike lanes are required on all major collector or higher classified street, unless specifically excluded in the Greater Helena Area Transportation Plan or other commission approved non-motorized plan. For minor collector or lesser classified street, bike lanes will be discouraged unless identified by the Greater Helena Area Transportation Plan.

On-Street Bike Lanes (Without On-Street Parking): Bicycle lanes on streets without on-street parking shall be at least 5’ 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 5’ 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 5’ wide, exclusive of the parking lane.

Multi-Use Paths or Trails: Multi-use paths or trails shall be at least 10’ wide with an inside edge radius of at least 15’. The minimum asphalt pavement thickness shall be 3” with a minimum of 6” of high quality untreated aggregate base. Intersections with typical sidewalks or roadways shall have the appropriate signing and sight distance.
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 75°.

**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.

<table>
<thead>
<tr>
<th>Street Classification</th>
<th>Local (ft)</th>
<th>Collector (ft)</th>
<th>Minor Arterial (ft)</th>
<th>Principal Arterial (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local</td>
<td>15</td>
<td>15</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td>Collector</td>
<td>15</td>
<td>25</td>
<td>25</td>
<td>25</td>
</tr>
<tr>
<td>Minor Arterial</td>
<td>15</td>
<td>25</td>
<td>**</td>
<td>**</td>
</tr>
<tr>
<td>Major Arterial</td>
<td>15</td>
<td>25</td>
<td>**</td>
<td>**</td>
</tr>
</tbody>
</table>

* Measured from top back of curb

** Per AASHTO standards

**Design Speed:** Design speed shall be as shown in Table 5-2. The design speed is typically higher than or equal to the posted speed limit. The design speed determines various geometric design features of roadways. In an urban area with a grided transportation system the design speed is not a major factor, because of the closely spaced intersections and mainly determines sight distance and turning radiiuses.

**Horizontal Curves:** The minimum centerline radius for horizontal curves shall be as shown in Table 5-2. Deviations from the requirements of Table 5-2 for local streets only may be considered on a case-by-case basis.

**Intersections:** Two streets meeting a third street from opposite sides shall meet at the same point, or their centerlines shall be off-set at least 125°.

**Superelevation:** Superelevation may be required for arterial roadways and selected collector roadways. Horizontal curve radius and superelevation shall be in accordance with the recommendations of AASHTO. Superelevation 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.

### Table 5-2. Alignment Controls

<table>
<thead>
<tr>
<th>Street Type</th>
<th>Arterial</th>
<th>Collector</th>
<th>Local</th>
<th>Alley/Emergency Access Road</th>
</tr>
</thead>
<tbody>
<tr>
<td>Terrain*</td>
<td>Principal</td>
<td>Minor</td>
<td>Ordinary</td>
<td>Ordinary</td>
</tr>
<tr>
<td>Horizontal centerline radius on curves (Min.)</td>
<td>**</td>
<td>**</td>
<td>300'</td>
<td>150'</td>
</tr>
<tr>
<td>Tangent length between reverse curves</td>
<td>**</td>
<td>**</td>
<td>100'</td>
<td>50'</td>
</tr>
<tr>
<td>Stopping sight distance</td>
<td>**</td>
<td>**</td>
<td>360'</td>
<td>155'</td>
</tr>
<tr>
<td>Angle at intersection centerline</td>
<td>**</td>
<td>**</td>
<td>&gt;75°</td>
<td>&gt;75°</td>
</tr>
<tr>
<td>Length of tangent at intersection</td>
<td>**</td>
<td>**</td>
<td>150'</td>
<td>100'</td>
</tr>
<tr>
<td>Max. cul-de-sac length</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>600'</td>
</tr>
<tr>
<td>Cul-de-sac right-of-way radius</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>96'</td>
</tr>
<tr>
<td>Max. vertical alignment grade</td>
<td>10%</td>
<td>10%</td>
<td>10%</td>
<td>10%</td>
</tr>
<tr>
<td>Min. vertical alignment grade</td>
<td>**</td>
<td>**</td>
<td>0.5%</td>
<td>0.5%</td>
</tr>
<tr>
<td>Max. vertical alignment grade within 75’ of intersection centerline</td>
<td>**</td>
<td>**</td>
<td>4%</td>
<td>4%</td>
</tr>
<tr>
<td>Design speed (mph)</td>
<td>50</td>
<td>45</td>
<td>45</td>
<td>25</td>
</tr>
<tr>
<td>Min. Vertical Curve K Factor</td>
<td>**</td>
<td>**</td>
<td>**</td>
<td>**</td>
</tr>
<tr>
<td>Crest</td>
<td>**</td>
<td>**</td>
<td>**</td>
<td>**</td>
</tr>
<tr>
<td>Sag</td>
<td>**</td>
<td>**</td>
<td>**</td>
<td>**</td>
</tr>
<tr>
<td>Min. Vertical Curve Length</td>
<td>**</td>
<td>**</td>
<td>90'</td>
<td>50'</td>
</tr>
<tr>
<td>Crest</td>
<td>**</td>
<td>**</td>
<td>70'</td>
<td>50'</td>
</tr>
<tr>
<td>Sag</td>
<td>**</td>
<td>**</td>
<td>70'</td>
<td>50'</td>
</tr>
</tbody>
</table>

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

*** Must meet turnaround requirements or exits onto public right-of-way

5.2.6 VERTICAL ALIGNMENT

**Permissible Roadway Grades:** The minimum allowable vertical alignment grade for any roadway (or alley) is 0.5%. The maximum allowable grade for any roadway is 10% 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,” is not desirable, but may be considered in areas with flat topography in order to improve the drainage performance of a street. Any exception to this requirement will require written approval of the City Engineer. The use of grade breaks in lieu of vertical curves is not desirable, especially at higher design speeds. The table below sets the allowable difference in grade (A) for a given design speed, above which a vertical curve is required.

<table>
<thead>
<tr>
<th>Design Speed (mph)</th>
<th>Maximum grade change, % (A)</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>1.85</td>
</tr>
<tr>
<td>30</td>
<td>1.30</td>
</tr>
<tr>
<td>35</td>
<td>0.95</td>
</tr>
<tr>
<td>40</td>
<td>0.75</td>
</tr>
<tr>
<td>45</td>
<td>0.55</td>
</tr>
<tr>
<td>50</td>
<td>0.45</td>
</tr>
<tr>
<td>55</td>
<td>0.40</td>
</tr>
</tbody>
</table>

**Vertical Curves:** All vertical curves shall be symmetrical. Design criteria for vertical curves are found in Table 5-2. The minimum desirable grade within a sag (sump) vertical curve is 0.5%. However, in areas with flat topography, this may be difficult to achieve, and in that scenario the length of the flattest portion of the vertical curve should be minimized to prevent ponding of surface water runoff. Any exception to this requirement will require written approval of the City Engineer. 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. Carrying the crown of the side street into the intersecting through street is not permitted.

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.

At an arterial-arterial intersection, a more detailed review on the entire intersection’s driveability shall be performed by the designer and submitted for review and approval.
Curb Returns: The minimum fall around curb returns, when turning water, shall be 0.3' for a 15' radius; 0.4' for a 20' radius; and 0.5' for a 25' radius. For all other curb return radii, use a flowline grade of 1.25% within the return to establish minimum fall when turning water. The maximum flowline slope around a curb return is 4%, subject to meeting ADA requirements at curb ramps. Show and label high point location, elevation and intersection of flowline 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 1%. 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 500' or to its intersection with an arterial roadway. This limit shall be extended to 1000' when arterial roadways are being designed, or as necessary based on sound engineering judgment for the offsite terrain. 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 4' 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:

\[
L = \begin{cases} 
\frac{WS^2}{60} & \text{Speed Limit} \\
W \times S & \text{45 MPH or Greater}
\end{cases}
\]

where:

- \(L\) = length of transition in feet
- \(W\) = width of offset in feet
- \(S\) = speed limit or 85th percentile speed (whichever is greater)

The Engineering Division should be consulted for any unusual transition conditions. Grade breaks greater than 1% 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 8’ wide should be capped with M-4000 concrete a minimum of 3” thick. Wider medians should be topsoiled and seeded with an approved seed mix. The minimum median width is 4’. 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.

Crossspans: Crossspans (valley gutters) shall be constructed in accordance with MPWSS. Crossspans are not allowed across collector or arterial roadways. Crossspans may be used parallel with collector or arterial roadways to convey storm runoff across residential roadways. Crossspans are required for stormwater control at intersections where a stormwater 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 superelevation (see Section 4.4.4). 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 superelevation is required, it is desirable for roadways to be level from top of curb to top of curb and shall have a 3% crown for all streets with a grade less than or equal to 6%. Any deviation to this requirement will require written approval of the City Engineer. For example, this may not be achievable for streets built on sideslopes, especially where existing development presents constraints in terms of driveway slopes.

On streets where the grade exceeds 6%, a 2% 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 5% 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 75' horizontally for local streets, 100' horizontally for collector streets, and 150' horizontally for arterial streets. Quarter crowning 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: Stormwater runoff 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 20-year performance period traffic volume; however, the minimum design lane 18,000-lb Equivalent Single Axle Load (ESAL) used in the pavement design shall not be less than 50,000-lb ESAL. The minimum asphalt pavement thickness for any new local road roadway shall be 3". The minimum asphalt pavement thickness for any new collector or arterial roadway shall be 4". A minimum of 6" 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 but are not limited to water and sewer services, cut through asphalt newer than 10 years old shall be saw cut the entire width of the street or to centerline of the roadway depending on location of excavation. Excavation limits will be proposed and approved by the City Engineer. All excavations shall be backfilled 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 Division. 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 backfilled 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 Division.

Prior to any street opening, an application with a traffic and/or pedestrian control plan shall be submitted to the City Engineering Division for review and approval. All street openings shall be for a maximum of 24 hours, unless there is written approval from the City Engineering Division. On collector or 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 backfilled each night, so the street can be open to traffic after 4:30 PM and not closed again until 8:30 AM. Any traffic control exceeding one day shall have a traffic control maintainer on call at all times to restore any traffic control devices to the approved plan location as submitted to the Engineering Division.

All utility work patches upon final paving shall be overcut by a minimum of 12” and sawcut lines are to be neat and squared off. If the overcut sawcut lies within a striped lane or other
longitudinal marking then pavement restoration shall extend to the pavement markings. The City Engineer can approve or deny a request for reducing pavement restoration width.

All patches shall be a minimum of 6” of compacted road mix capped a minimum of 3” of compacted ¾” hot mix asphalt patch or the existing pavement structure depths whichever is greater.

For temporary patches, when hot mix asphalt is not available, place 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 on a case-by-case basis as approved by the City Engineering Division. 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 backfill must be removed from the job site by the date of 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 is allowed under sidewalks, or curb and gutter. However, directional boring will be allowed upon approval of the City Engineer. 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 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.

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 may 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 compliance with City of Helena Resolution No. 19799.

5.3 RIGHT-OF-WAY (ROW) STANDARDS

The typical roadway sections shown in “Appendix C” identify the minimum amount of right-of-way that may be necessary to accommodate full build-out of each type of facility. The appropriate classification for new streets will be determined by the multi-modal study for the development along with all the relevant planning documents for the City of Helena including but
not limited to Helena Zoning Map, 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 local streets maybe considered with one checklist as one as long as all features included in the typical section including on-street parking are the same.

5.3.1 TYPICAL ROADWAY SECTIONS

The typical roadway section shall be as shown on the typical exhibit sections included in “Appendix C”. 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.

5.3.2 EXISTING ROW HIERARCHY

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 (ROW) widths on all new roadway and development projects. For existing ROW, the street shall be designed for a complete street. However, if the ROW (for existing streets only) is narrower than what is required, and additional ROW cannot be obtained, the following list will set the hierarchy of which complete street features may be exempt from installation or the minimum set width:

1. The Boulevard can be narrowed to not less than 4' for a Local Street and 5' for every other classification. In special cases, the boulevard can be completely eliminated. However, Commission approval is required for this situation.
2. On-street parking on one or both sides of the street can be eliminated.
3. For collector and arterial streets the lane can be narrowed to 10' which includes the center turning lanes.
4. For collector and arterial streets the bike lane can be eliminated.
5. Sidewalk on one side of the street can be eliminated. Commission approval required
6. 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)

<table>
<thead>
<tr>
<th>Street Features</th>
<th>Local</th>
<th>Minor Collector</th>
<th>Major Collector</th>
<th>Minor Arterial</th>
<th>Major Arterial</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Driving Lanes</strong></td>
<td>18' (2 lanes min.) (9' each lane)</td>
<td>20' (2 lanes min.) (10' each lane)</td>
<td>20' (2 lanes min.) (10' each lane)</td>
<td>22' (2 lanes min.) (11’ each lane)</td>
<td>48' (4 lanes min.) (12’ each lane)</td>
</tr>
<tr>
<td><strong>Sidewalk</strong></td>
<td>10' (5' Each Side)</td>
<td>10' (5' Each Side)</td>
<td>10' (5' Each Side)</td>
<td>10' (5' Each Side)</td>
<td>10' (5' Each Side)</td>
</tr>
<tr>
<td><strong>Bike/Ped Path</strong> (can replace sidewalks on one side) if required by the Greater Helena Trans Plan or proposed in the subdivision master plan</td>
<td>10' (5' additional each side of the street that the path replaces the sidewalk)</td>
<td>10' (5' additional each side of the street that the path replaces the sidewalk)</td>
<td>10' (5' additional each side of the street that the path replaces the sidewalk)</td>
<td>10' (5' additional each side of the street that the path replaces the sidewalk)</td>
<td>10' (5' additional each side of the street that the path replaces the sidewalk)</td>
</tr>
<tr>
<td><strong>Curb and Gutter</strong></td>
<td>4' (2' each side)</td>
<td>4' (2' each side)</td>
<td>4' (2' each side)</td>
<td>4' (2' each side)</td>
<td>4' (2' each side)</td>
</tr>
<tr>
<td><strong>Buffer Strip</strong></td>
<td>2' (1' each side behind sidewalk)</td>
<td>2' (1' each side behind sidewalk)</td>
<td>2' (1' each side behind sidewalk)</td>
<td>2' (1' each side behind sidewalk)</td>
<td>2' (1' each side behind sidewalk)</td>
</tr>
<tr>
<td><strong>Parking Lane</strong></td>
<td>12' (6' each side)</td>
<td>12' (6' each side)</td>
<td>12' (6' each side)</td>
<td>12' (6' each side)</td>
<td>12' (6' each side)</td>
</tr>
<tr>
<td><strong>Bike lane</strong></td>
<td>10' (5' each side)</td>
<td>10' (5' each side)</td>
<td>10' (5' each side)</td>
<td>10' (5' each side)</td>
<td>10' (5' each side)</td>
</tr>
<tr>
<td><strong>Boulevard</strong></td>
<td>14' (7' each side)</td>
<td>14' (7' each side)</td>
<td>14' (7' each side)</td>
<td>14' (7' each side)</td>
<td>20' (10' each side)</td>
</tr>
<tr>
<td><strong>Utility Corridor - for electric, phone, and cable- if not placed under sidewalk or street</strong></td>
<td>4'</td>
<td>4'</td>
<td>4'</td>
<td>4'</td>
<td>4'</td>
</tr>
<tr>
<td><strong>Bus Lanes</strong></td>
<td></td>
<td>12'</td>
<td>12'</td>
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<td></td>
</tr>
<tr>
<td><strong>Bus Stops</strong></td>
<td>8'</td>
<td>8'</td>
<td>8'</td>
<td>8'</td>
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<tr>
<td><strong>Center Medians</strong></td>
<td></td>
<td>4' min.</td>
<td>4' min.</td>
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</tr>
<tr>
<td><strong>Center Turn Lanes</strong></td>
<td></td>
<td>10'</td>
<td>11'</td>
<td>12'</td>
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</tr>
<tr>
<td><strong>Stormwater Elements</strong></td>
<td>Varies - if proposed by developer</td>
<td>Varies - if proposed by developer</td>
<td>Varies - if proposed by developer</td>
<td>Varies - if proposed by developer</td>
<td>Varies - if proposed by developer</td>
</tr>
<tr>
<td><strong>Traffic Calming</strong></td>
<td>Additional ROW maybe needed</td>
<td>Additional ROW maybe</td>
<td>Additional ROW maybe</td>
<td>Additional ROW maybe</td>
<td>Additional ROW maybe needed</td>
</tr>
</tbody>
</table>
SECTION PART 5 TRANSPORTATION STANDARDS

5.4 TRAFFIC CALMING

<table>
<thead>
<tr>
<th>Street Features</th>
<th>Local</th>
<th>Minor Collector</th>
<th>Major Collector</th>
<th>Minor Arterial</th>
<th>Major Arterial</th>
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<tbody>
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<td>needed</td>
<td>needed</td>
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</table>

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

* Deviations from the required components may be allowed with sufficient justification. By way of example, a deviation from a requirement for on-street parking components on one or both sides of the street may be allowed with sufficient justification, which could include (but not be limited to) a showing that the street involved is a local side street with no fronting buildings, a showing that such deviation is warranted by applicable zoning, or a showing that adjoining uses would provide sufficient off-street parking.

### 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 bicyclists.

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. Appropriate traffic calming measures must be used to discourage excess speeds on all local and collector streets.

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 areas of improvements that have been identified.

### 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 and approval.

5.6 **UTILITY CORRIDORS WITHIN NEW SUBDIVISIONS OR UNDEVELOPED ANNEXATIONS**
All new utility installations within the public ROW requires written approval from the City Engineer 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 underground utilities installed parallel to City owned utilities within the public street right-of-way shall be located horizontally at least 5' away from the city owned utilities. If 5' cannot be maintained the utility must apply to the City Engineering Division for a deviation.

Utilities shall not be installed in street boulevards except above ground features such as light poles, residential transformers, and secondary pedestals, etc., 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 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' in depth are encouraged to be installed in protective conduit whenever possible. The protective conduit will allow for the maintenance and replacement of the utility without damaging any boulevard trees.
All utilities shall be installed at the required depth, as determined by the utility, 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.

For new subdivision or location where the streets are less than 10 years old and television, telephone, power, or natural gas has not been installed, provisions shall be made for installation without the cutting of paved roadways.

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 MULTI-MODAL STUDIES

Private or public developments which increases the peak hour trips per day to the City Street System shall have a Traffic Impact Study completed by an Engineer with adequate experience and expertise in transportation engineering.

The Multi-modal 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 Multi-modal Studies shall be signed and stamped by a licensed professional engineer registered in the State of Montana.

Multi-modal Studies have been divided into three levels depending on the impact the City roadway system. Each level has certain requirements to be met. An outline of the three different levels can be found in Appendix B.

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 Chapter 12 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 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, 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. An engineering study/review shall be performed before installation of any new stop signs. In general, stop signs shall be installed on local streets when they intersect with any collector or arterial streets, but shall not be installed arbitrarily.

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). Temporary or
final striping shall be installed within 5 business days of the completion of hot plant mix paving operations. For concrete pavement, a minimum of 28 days cure time is required prior to the placement of the final striping.

All signs and pavement markings shall be approved by the City of Helena Engineering and Traffic and Pavement Markings Divisions.

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 AND PEDESTRIAN CONTROL

A Traffic and Pedestrian 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 and pedestrian control devices must be shown on the Traffic and Pedestrian Control Plan. The plan must be approved by the Public Works Department prior to beginning construction. If the required traffic and pedestrian control devices are not in place, the Contractor will not be allowed to begin work on the project.

All traffic and pedestrian 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 and pedestrian control device observed to be in inferior condition. A traffic and pedestrian control device maintainer shall be on call 24 hours a day to restore the control devices per the approved plan. All traffic control devices intended to be used from sunset to sunrise shall meet the MUTCD’s reflectivity requirements. Emergency access to the work area shall be maintained and given priority 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 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 TEMPORARY AND PERMANENT BARRICADES

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.

### 5.15 TRANSPORTATION DESIGN SPECIFICATIONS

The standards for the design of City of Helena roads and bridges shall consist of the latest edition 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;
- Manual on Uniform Traffic Control Devices;
- 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;
- 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.
Appendix A – Checklists/Applications
CITY OF HELENA
PUBLIC WORKS DEPARTMENT

Instructions for Completing
Water/Wastewater Service Area Enlargement Application
Within the Existing City Limits

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 include **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 note 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 a model agreement is available from the 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 Public Works Department.

**THANK YOU FOR YOUR COOPERATION!**
CITY OF HELENA
PUBLIC WORKS
CONSTRUCTION STORMWATER MANAGEMENT PLAN REVIEW CHECKLIST

<table>
<thead>
<tr>
<th>NAME OF PROJECT</th>
<th>PROJECT FILE NO.</th>
<th>ADDRESS</th>
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<th>TOTAL PROJECT ACRES</th>
<th>TOTAL DISTURBED ACRES</th>
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<th>Latitude:</th>
<th>Longitude:</th>
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GPS LOCATION OF CONSTRUCTION SITE

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<th>PHONE NUMBER</th>
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<tr>
<th>OWNER (If different from Applicant)</th>
<th>ADDRESS</th>
<th>PHONE NUMBER</th>
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Review History

First Review

Plan Received on: __________________________ Approved/Denied: __________________________
Review Completed on: __________________________ Comments: __________________________
Reviewed by: __________________________

Second Review

Plan Received on: __________________________ Approved/Denied: __________________________
Review Completed on: __________________________ Comments: __________________________
Reviewed by: __________________________

Third Review

Plan Received on: __________________________ Approved/Denied: __________________________
Review Completed on: __________________________ Comments: __________________________
Reviewed by: __________________________

REPORT OF TECHNICAL REVIEW

The Construction Stormwater Management Plan for the above named project or activity **includes** the necessary components identified within the attached checklist.

The Construction Stormwater Management Plan for the above named project or activity **does not include** the necessary components identified within the attached checklist through failure to include the following:

<table>
<thead>
<tr>
<th>Review by:</th>
<th>Signature:</th>
<th>Date:</th>
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### General Information

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<th>Incomplete</th>
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<tbody>
<tr>
<td>1.</td>
<td>Describe the project location (address, parcel number, etc…)</td>
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<td></td>
<td>a. Description of project activity</td>
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<td>2.</td>
<td>Areas (ac)</td>
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<td>a. Total disturbed area</td>
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<td></td>
<td>b. Existing impervious area</td>
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<td>3.</td>
<td>Construction schedule/sequence</td>
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<td>4.</td>
<td>Identify site features</td>
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<td>a. Limits of improvements relative to neighbors or a Vicinity Map</td>
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<td>b. Limits of clearing and grading</td>
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<td></td>
<td>c. Existing vegetation delineated</td>
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<td>d. Existing and proposed site topography</td>
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<td>e. Existing and proposed runoff direction</td>
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<td>f. Surface waters and storm conveyance systems within 200’ of project</td>
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<td></td>
<td>g. Description of outfall and receiving surface waters</td>
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<td></td>
<td>h. Protection of waterways, receiving surface waters and natural resources</td>
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<tr>
<td></td>
<td>i. Construction Stormwater Management Plan is phased with construction</td>
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<td></td>
<td>j. Stockpile locations, staging areas and access points defined</td>
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<td>k. Show all areas of construction, including but not limited to: structures, retaining walls, roads, drives, utilities, trenches, scaffolds, catch basins, etc.</td>
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<td></td>
<td>l. Description of site soil</td>
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<td>m. Description of watershed tributary to site</td>
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### Maintenance Plan for Control Facilities

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### Erosion and Sediment Controls

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<tbody>
<tr>
<td>1.</td>
<td>Design considerations and erosion control BMPs are specified to:</td>
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<tr>
<td></td>
<td>a. Control stormwater volume and velocity within the site to minimize soil erosion through use of controls such as check dams, fiber rolls, etc.</td>
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<td></td>
<td>b. Control stormwater discharges, including both peak flowrates and total stormwater volume, to minimize erosion at outlets and to minimize downstream channel and streambank erosion through use of controls such as stilling basins, fiber rolls, etc.</td>
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<td></td>
<td>c. Minimize the amount of soil exposed during construction activity</td>
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<td></td>
<td>d. Minimize the disturbance of steep slopes</td>
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<tr>
<td><strong>Erosion and Sediment Controls (cont.)</strong></td>
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<td>-----------------------------------------</td>
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<td>e. Minimize sediment discharges from the site through use of perimeter controls such as silt fence, fiber rolls, diversion berms, etc.</td>
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<td>f. Provide and maintain natural buffers around surface waters, direct stormwater to vegetated areas to increase sediment removal and maximize stormwater infiltration, unless infeasible</td>
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</tr>
<tr>
<td>g. Minimize soil compaction and, unless infeasible, preserve topsoil</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Soil Stabilization</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The following soil stabilization requirements are clearly communicated:</td>
</tr>
<tr>
<td>a. Stabilization of disturbed areas must be initiated immediately whenever any clearing, grading, excavating or other earth disturbing activities have permanently ceased on any portion of the site, or temporarily ceased on any portion of the site and will not resume for a period exceeding 14 calendar days</td>
</tr>
<tr>
<td>b. If initiating vegetative stabilization measures immediately is infeasible, alternative stabilization measures must be specified</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Dewatering</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. If applicable, discharges from dewatering activities are managed by appropriate controls such as sedimentation basins, sediment traps, etc.</td>
</tr>
<tr>
<td><em>Note: This does not preclude the contractor from the requirement to obtain a dewatering permit from MT DEQ.</em></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Pollution Prevention Measures</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Pollution prevention measures are specified to:</td>
</tr>
<tr>
<td>a. Specify treatment of wash waters in a sediment basin or alternative control that provides equivalent or better treatment prior to discharge</td>
</tr>
<tr>
<td>b. Minimize the exposure of building materials, building products, construction wastes, trash, landscape materials, fertilizers, pesticides, herbicides, detergents, sanitary waste and other materials present on the site to precipitation and to storm water</td>
</tr>
<tr>
<td>c. Minimize the discharge of pollutants from spills and leaks and implement chemical spill and leak prevention and response procedures</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Prohibited Discharges</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Wastewater from washout of concrete is prohibited or managed by appropriate controls</td>
</tr>
<tr>
<td>2. A statement (or statements) which prohibit discharges of the following:</td>
</tr>
<tr>
<td>a. Wastewater from washout and cleanout of stucco, paint, from release oils, curing compounds and other construction materials</td>
</tr>
<tr>
<td>b. Fuels, oils, or other pollutants used in vehicle and equipment operation and maintenance</td>
</tr>
<tr>
<td>c. Soaps or solvents used in vehicle and equipment washing</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Surface Outlets</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. When discharging from basins and impoundments, outlet structures that withdraw water from the surface are used (unless infeasible)</td>
</tr>
</tbody>
</table>
CITY OF HELENA
PUBLIC WORKS
POST-CONSTRUCTION STORMWATER MANAGEMENT
PLAN REVIEW CHECKLIST

NAME OF PROJECT

PROJECT FILE NO.

ADDRESS

TOTAL PROJECT ACRES

TOTAL DISTURBED ACRES

Latitude: ____________________________ Longitude: ____________________________

GPS LOCATION OF CONSTRUCTION SITE

APPLICANT

ADDRESS

PHONE NUMBER

OWNER (If different from Applicant)

ADDRESS

PHONE NUMBER

Review History

First Review
Plan Received on: ____________________________ Approved/Denied: ____________________________
Review Completed on: ____________________________ Comments: ____________________________
Reviewed by: ____________________________

Second Review
Plan Received on: ____________________________ Approved/Denied: ____________________________
Review Completed on: ____________________________ Comments: ____________________________
Reviewed by: ____________________________

Third Review
Plan Received on: ____________________________ Approved/Denied: ____________________________
Review Completed on: ____________________________ Comments: ____________________________
Reviewed by: ____________________________

REPORT OF TECHNICAL REVIEW

The Stormwater Management Plan for the above named project or activity includes the necessary post-construction controls in order to comply with the State and local post-construction stormwater requirements (as identified within the attached checklist).

The Stormwater Management Plan for the above named project or activity does not include the necessary post-construction controls in order to comply with the State and local post-construction stormwater requirements (as identified within the attached checklist) through failure to include the following:

________________________________________

Review by: ____________________________
Signature: ____________________________ Date: ____________________________
## General Information

1. **Location**
   - Address, subdivision name, legal description, etc…

2. **Type of development** (residential, commercial, etc…)

3. **Areas** (ac)
   - Total disturbed area
   - Existing impervious area
   - Post-development impervious area

4. Drainage basin maps are provided which clearly label the following:
   - Existing basin boundaries
   - Existing time of concentration flowpaths for each basin
   - Post-development basin boundaries
   - Post-development time of concentration flowpaths for each basin
   - Discharge location(s)
   - Receiving waters within 200 feet of project are identified

5. Montana Licensed Engineer Stamp

## Drainage Plan Content

1. **Topographic map of existing and finished grade contours at 2-foot max intervals**

2. **Location of each permanent stormwater control**

3. **Plan and profile of each permanent stormwater control**

4. **Invert elevations, slopes, and lengths of storm drain facilities**

5. **Size, types, invert elevations and lengths of all culverts and pipe systems**

6. **Discharge points clearly labeled**

7. **Receiving surface waters identified**

8. **Existing on-site natural resources identified and protected**

9. **FEMA floodplains identified**

## Calculations and Design Documentation

1. **Hydrology calculations**
   - State runoff method used (rational, SCS, etc…)
   - State modeling constants and assumptions
   - Description of design storms (frequency, depth, duration)
   - Existing and post-development land uses
### Calculations and Design Documentation (Continued)

<table>
<thead>
<tr>
<th></th>
<th>Complete</th>
<th>Incomplete</th>
<th>N/A</th>
</tr>
</thead>
<tbody>
<tr>
<td>e.</td>
<td>Existing and post-development peak runoff rate for each design storm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>f.</td>
<td>Existing and post-development runoff volume for each design storm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Post-construction BMP sizing calculations</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>a. State design requirements (0.5-inch requirement, TSS removal, or other)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>b. Required permanent controls capacities, flow rates, and operating levels</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>c. Sizing calculations with results</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>d. A statement documenting compliance with design requirements</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>e. If 0.5-inch or TSS removal requirements are not met, provide documentation showing the impracticability of infiltration, evapotranspiration, capture for reuse, and treatment.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Culvert and pipe system capacities and outlet velocities</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Ditch capacities and velocities</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Additional Information

1. Permits, easements, setbacks, and discharge agreements
2. Floodplain maps
3. Operations and Maintenance Manual for each permanent stormwater control
   a. Identify the owner
   b. Identify the party responsible for long-term O&M
   c. A schedule of inspection and maintenance for routine and non-routine maintenance tasks to be conducted
   d. System failure and replacement criteria to define the structure’s performance requirements
4. Geotechnical Report
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: ____________________________

7. The attached Title Memorandum indicates the "Owner of Record" for all of the property requesting inclusion in the Water Service Area.

8. 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 located 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.

9. 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

(Its Corporate Officer designed as representative for purpose of application)

DATE:
10. Submitted to City Commission: ________________________________

Public Hearing Held: ________________________________

Approved by City Commission: ________________________________

Denied by City Commission: ________________________________

11. SUBJECT TO ATTACHED LETTER.

12. 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-lesser, 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.

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:

<table>
<thead>
<tr>
<th>Name</th>
<th>Address</th>
<th>Nature of Interest</th>
</tr>
</thead>
<tbody>
<tr>
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</table>

(Add additional sheets as needed)
The undersigned hereby certifies all the above information as being full and complete disclosures, UNDER PENALTY OF PERJURY.

___________________________________  DATED __________________________

___________________________________  DATED __________________________

___________________________________ (WITNESS) ________________________

___________________________________ (WITNESS) ________________________

___________________________________ (ADDRESS) ________________________

___________________________________ (ADDRESS) ________________________

___________________________________ (CITY, STATE, ZIP CODE) __________

___________________________________ (CITY, STATE, ZIP CODE) __________

TELEPHONE: ________________________ TELEPHONE: ________________________
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:**

<table>
<thead>
<tr>
<th>Question</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Are the travel lanes at least 9’?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Width of Lanes:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Deviation request:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Justification:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Is parallel parking (6’ lanes) included both sides of the street?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>☐ Yes ☐ No</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Deviation request:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Justification:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Are 5’ sidewalks included on both sides?</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Is a bike/ped path requested in place of one of the sidewalks?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Deviation request:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Justification:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Are 7’ Boulevards included on both sides?</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Deviation request:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Justification:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Does the Helena Transit Plan identify a Bus Stop in this area?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Are any transit stops proposed?</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Will the stop have a shelter?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Will the stop service HAT or other transit operations?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Will the stop be near a lobby or other shelter that will generally be available to the public or employees?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Can the stop accommodate bike, pedestrians, and ADA users?</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>☐ Yes ☐ No</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Is an additional 1’ ROW strip included behind the sidewalk or bike/ped path included on both sides?</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Deviation request:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Justification:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Does the Helena Transportation Plan or Non-Motorized Plan request or identify any bike lanes or off street paths in area?</td>
<td>No</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Bike lanes are discouraged on Local Street unless identified in a Commission-approved plan.
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 10”? □ Yes □ No

Width of Lanes ________

Deviation request: ______________________________________________________

Justification: __________________________________________________________

2. Is parallel parking (6’ lanes) included both sides of the street?

□ Yes □ No

Deviation request: ______________________________________________________

Justification: __________________________________________________________

3. Are 5’ 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’ 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. Are any transit stops proposed? □ Yes □ No

Will the stop have a shelter? □ Yes □ No

Will the stop service HAT or other transit operations? □ Yes □ No

Will the stop be near a lobby or other shelter that will generally be available to the public or employees? □ Yes □ No

Can the stop accommodate bike, pedestrians, and ADA users?

□ Yes □ No

7. Is an additional 1’ ROW strip included behind the sidewalk or bike/ped path included on both sides? □ Yes □ No

Deviation request: ____________________________________________________
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 10’? □ Yes □ No

   Width of Lanes __________

   Deviation request: ______________________________________________

   Justification: ___________________________________________________

2. Is a turn lane (10’ lane) proposed? □ Yes □ No

   Deviation request: ______________________________________________

   Justification: ___________________________________________________

3. Is parallel parking (6’ lanes) included on both sides of the street?

   □ Yes □ No

   Deviation request: ______________________________________________

   Justification: ___________________________________________________

4. Are 5’ 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’ 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. Are any transit stops proposed? □ Yes □ No

   Will the stop have a shelter? □ Yes □ No

   Will the stop service HAT or other transit operations? □ Yes □ No
Will the stop be near a lobby or other shelter that will generally be available to the public or employees? □ Yes □ No

Can the stop accommodate bike, pedestrians, and ADA users? □ Yes □ No

8. Is an additional 1’ 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’ 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 11”? □ Yes □ No

Width of Lanes _________

Deviation request: ______________________________________
Justification: ____________________________________________

2. Is a turn lane (12’ lane) proposed? □ Yes □ No

Deviation request: ______________________________________
Justification: ____________________________________________

3. Is parallel parking (6’ lanes) included on both sides of the street? □ Yes □ No

Deviation request: ______________________________________
Justification: ____________________________________________

4. Are 5’ 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
5. Are 7’ 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. Are any transit stops proposed?  □ Yes □ No
   Will the stop have a shelter?  □ Yes □ No
   Will the stop service HAT or other transit operations?  □ Yes □ No
   Will the stop be near a lobby or other shelter that will generally be available to the public or employees?  □ Yes □ No
   Can the stop accommodate bike, pedestrians, and ADA users?
   □ Yes □ No

8. Is an additional 1’ 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’ 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’?  □ 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’?  □ Yes # of lanes______ □ No
Width of Lanes __________
Deviation request:
Justification:____________________________________________________

2. Is a turn lane (12’ lane) proposed? ☐ Yes ☐ No
Deviation request:
Justification:____________________________________________________

3. Is parallel parking (6’ lanes) included on both sides of the street? ☐ Yes ☐ No
Deviation request:
Justification:____________________________________________________

4. Are 5’ 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’ 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 as part of the typical section? ☐ Yes ☐ No
Justification:____________________________________________________

8. Are any transit stops proposed? ☐ Yes ☐ No
Will the stop have a shelter? ☐ Yes ☐ No
Will the stop service HAT or other transit operations? ☐ Yes ☐ No
Will the stop be near a lobby or other shelter that will generally be available to the public or employees? ☐ Yes ☐ No
Can the stop accommodate bike, pedestrians, and ADA users?
☐ Yes ☐ No

9. Is an additional 1’ 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’ 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’? □ 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. Traffic Calming/Stormwater Treatment

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 C)
_____________________________________________________________________

Is addition ROW required? □ Yes  □ No

2. Are any Stormwater treatment elements included within the ROW?

□ No  □ Yes

Location of stormwater elements: _______________________________________

Type of treatment at each location: _______________________________________

_____________________________________________________________________

Is addition ROW required? □ Yes  □ No

Certified by: ___________________________________  (Stamp)
Appendix B – Multi-Modal Study
PURPOSE

The City of Helena requires traffic impact studies (TIS) to assess transportation impacts associated with public or private development projects and provide consistency with City of Helena Growth Policy (HGP), Lewis and Clark County Growth Policy (LCGP), Helena Area Transit Development Plan (HATDP) and Greater Helena Area Long Range Transportation Plan – 2014 Update (GHALRTP) criteria. The data collection required for these studies shall be the responsibility of the owner/developer/consultant.

GENERAL REQUIREMENTS AND THRESHOLDS FOR TRAFFIC STUDIES

Level I Study - Less than 10 total PM peak hour trips to an intersection or access
Level II Study - 11 to 30 total PM peak hour trips to an intersection or access
Level III Study - Greater than 30 PM total peak hour trips to an intersection or access

<table>
<thead>
<tr>
<th>Topic</th>
<th>Level I</th>
<th>Level II</th>
<th>Level III</th>
</tr>
</thead>
<tbody>
<tr>
<td>I. Introduction</td>
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<td>II. Executive Summary</td>
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<td>III. Proposed Development</td>
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<td>IV. Existing Conditions</td>
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<td>V. Traffic Forecasts</td>
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<td>VI. Traffic Analysis</td>
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<td>VII. Other Items to Address</td>
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<td>VIII. Mitigation Alternatives</td>
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<tr>
<td>IX. Recommendations and Conclusions</td>
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<td></td>
</tr>
<tr>
<td>X. Appendices</td>
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<td></td>
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</tr>
</tbody>
</table>

Specific safety or capacity issues associated with a site, staff may request those be addressed, regardless of the number of site trips generated.

An outline of City of Helena requirements for a traffic study is provided on the following page. A proposal establishing the scope of the traffic study shall be submitted for review to the City Engineer based on guidelines in this document. Prior to or concurrent with the scope proposal, the applicant shall submit a preliminary trip generation and trip distribution analysis.

OUTSIDE AGENCIES AND JURISDICTIONS

There are streets within or adjacent to the City limits that are under the jurisdiction of MDT and/or Lewis and Clark County. Where development will impact their facilities, MDT and/or Lewis and Clark County may have additional requirements for a traffic study. Prior to approval of a final traffic study scope, a meeting with all impacted agencies is required to verify that the proposed scope addresses each agency’s concerns.
GENERAL OUTLINE FOR TRAFFIC IMPACT STUDIES

I. Introduction
   A. Cover page (All Levels)
   B. General project description (All Levels)
   C. Assumptions (Level II and III studies)

II. Executive summary (Level II and III studies)

III. Proposed development (All levels)
   A. Trip Generation and Distribution
   B. Development Phasing/Schedule
   C. Access locations, configuration and sight distance
   D. Site Circulation and Parking
   E. Study Area

IV. Existing conditions (All Levels)
   A. Existing street network and street classifications
   B. Existing traffic volumes and turn movements
   C. Existing LOS and V/C
   D. Pedestrian and Bicycle facilities (safety/compliance/connectivity/etc.)
   E. Existing transit routes and facilities
   F. Accident History

V. Traffic forecasts (Level III studies)
   A. Study scenarios
   Non-site traffic
   B. Site generated traffic

VI. Traffic analysis (All Levels)
   A. Site Access
   B. Site Circulation and Parking
   C. Intersections (LOS and V/C)
   Capacity Analysis of Roadway Segment
   D. Warrants, Turn Lanes, Traffic Signals
   E. Queuing and Storage
   F. Sight Distance
   Traffic Calming
   G. Safety analysis/Accident History analysis (may be combined with Section IV F)

VII. Other items to address (Level III studies)
   A. Applicable MDT Criteria
   B. GHALRTP identified improvements within the study area
   C. Any known improvement projects within the study area (City, County, State)

VIII. Mitigation alternatives (Level III studies)

IX. Recommendations and conclusions (Level II and III studies)

X. Appendices (Level II and III studies)
I. INTRODUCTION

A. Cover page shall include project name, address or location and study consultant. Level II and Level III studies shall be stamped by a professional engineer registered in the state of Montana.

B. The general description should include any existing and proposed site uses including square footage/acreage; current/proposed zoning and/or any proposed zoning changes. Project phasing, proposed or future, shall be identified. The description of uses shall reflect the uses allowed by City of Helena zoning regulations. In addition to the general site description, the surrounding land uses and zoning need to be documented. A map showing the site and surrounding area is required.

C. Any assumptions used shall be documented completely with the appropriate justification also documented. Examples of assumptions include but are not limited to trip generation rates, independent variables, study area, trip distribution, any modal splits, worst case scenario, etc.

II. EXECUTIVE SUMMARY

The executive summary provides a clear and concise one or two page summary which shall include but is not limited to existing deficiencies, major section findings, mitigation alternatives to address existing deficiencies and those issues resulting from development and preferred alternatives.

III. PROPOSED DEVELOPMENT

A. ITE trip rates are typically used by the City to project traffic. Trip rates and code(s) for the development need to be provided based on the latest version of the ITE Trip Generation Manual and reflect uses identified in the City of Helena zoning regulations. The City of Helena Community Development Department has made available local generation rates that can be used to project traffic. The gross daily trips, in addition to any adjustments for internal site, pass-by, or diverted link trips, shall be documented. Upon approval from the City Engineer, trip generation studies from a similar site may be used instead of the ITE manual. If the development does not fit within an ITE category, alternative trip generation methodology may be required including a separate trip generation study of similar sites. Daily AM and PM peak trip generation shall be provided.

B. Trip distribution for the proposed development shall be addressed both in a narrative and as a diagram in the study. Assumptions for the trip distribution shall be included and based on existing count information or a logical explanation of expected origins and destinations based on the proposed uses. In some instances it may be appropriate to use origin and destination information upon City Engineer’s approval.
C. Timelines for completion of phases is required including years for any subsequent phases. The year of opening should be based on a realistic schedule of when all public improvements and building construction will be complete and ready to occupy. The applicant may provide trip generation and distribution information for each phase and for build-out of the project. Mitigation for impacts shall be done consistent with an approved phasing plan if mitigation based on phasing is clearly identified in the TIS.

D. Specific access locations shall be identified in the study. The location of access points shall consider the classification and design standards of the adjacent street, applicable access control requirements, sight distance, number of lanes, vehicle storage and queuing, signage and striping, on-site circulation needs and pedestrian and bicycle facilities. Analysis of access points needs to include existing and proposed driveway locations.

E. On-site circulation and parking facilities shall be explained in adequate detail to document any impacts to adjacent public streets and development sites and compliance with applicable City code and development standards. Particular attention should be provided for applicable delivery, loading and drive-thru facilities.

F. The study shall cover the entire area of influence from the proposed development including any intersections or accesses receiving 20 or more trips per day, access points within 150-feet of any major street and any other item that needs to be considered such as nearby school zones or transportation projects. A map and description/justification of the study area shall be provided.

IV. EXISTING CONDITIONS

A. A description and map of existing conditions in the study area shall include but is not limited to: street classifications, speed limits, ROW and pavement widths, bike lanes, median strips, sidewalks, lane configurations, intersections, traffic control, bicycle and pedestrian facilities, schools and transit routes. Also identify any known capacity or functional deficiencies (review the GHALRTP and any relevant area or corridor studies).

B. Traffic counts shall be taken Tuesday, Wednesday or Thursday when Helena School District and Helena College is in regular session. Developments with unusual peak hours, an analysis of the peak hour of the traffic generator is also required. For example, schools require analysis of the peak hour during the commencement and let-out for the school day. Depending on the school type there may be significant student or parent traffic. Counts taken during vacations, or any
other time when school is not in session will not be accepted. Another area in Helena that requires special consideration is the State Capital area or routes leading to the Capital. Traffic counts shall be adjusted to levels consistent to that of what is observed during a Legislative session. Banquet or church facilities may also need special consideration. Recent counts (within one year) from a governmental agency such as the City or MDT may be used with prior approval. Counts shall accurately reflect the existing intersection or access conditions, including turning movements and bicycle and pedestrian counts and movements. Classification of counts shall be required to identify truck traffic. Cite reference sources and document the date, time of day and location of counts. Please notify the appropriate jurisdiction or utility prior to mounting traffic counting devices on infrastructure. Identify and justify the methods used to quantify non-site generated trips.

C. Existing Level of Service (LOS) based on delay and volume to capacity ratio (V/C) shall be provided for each intersection identified for analysis in the traffic study scope. Intersections which are impacted with at least 20 trips from the proposed site during the AM or PM peak hours, or have trip volumes increase by at least 10% and are within expected routes of travel are typically reviewed. Where there are other facilities, such as a school, in the vicinity that have a peak hour outside the typical AM or PM peak, those shall be studied. The City Engineer will make the final determination of the study area. Highway Capacity Manual methodology shall be used for the analysis, which needs to include performance measures for average intersection, worst case and critical movements. Location maps shall be used to identify the locations of the intersection and LOS. More information is provided in Section VI Traffic Analysis.

D. A summary of existing pedestrian and bicycle facilities shall be provided to document how the development will be served and any connectivity deficiencies to existing facilities. Missing or deficient sections of sidewalks or curb ramps (including ADA best practices requirements) within or adjacent to the site shall be identified.

E. Transit routes serving the site and/or the distance to the closest transit stop or shelter should be documented.

F. Accident history shall be analyzed to document any existing safety conditions that may be aggravated or impacted by the development or development mitigation. The minimum history is typically latest five years.
V. TRAFFIC FORECASTS

Any modal split should be addressed for Sections B and C including documentation and justification. Documentation shall include reference to any standards or prior studies. Any modal split shall be approved prior to initiation of the traffic study.

A. The study scenarios for traffic forecasts and analysis should include the following:
   - Existing conditions
   - Existing plus proposed development (each applicable phase and build out)
   - 20-year horizon (typical) plus development (Mitigation design life 20-years).

Since improvements are designed for a minimum life of 20-years, analysis of any mitigation for a 20-year horizon is prudent. Variations to the planning horizon may be allowed on a case by case basis, depending on the size of the development and the potential need for mitigation. The planning horizon noted in the GHALRTP is 20-years. Growth rates used in the GHALRTP are approximately 0.94% per year (p. 52). Past AADT’s maybe used for growth rates.

For land use actions such as a zone change, conditional use permit, annexation or subdivision, the traffic forecasts and analysis shall include the reasonable worst case scenario of the area subject to the land use action, i.e. the total acres and max density. A proposed development plan, typically, doesn’t provide the worst case scenario. Per development regulations, a full range of development potential (min. to max.) under current vs. proposed land use designations shall be addressed in the analysis. Reasonable worst case analysis must have justification and should be based on maximum viable development.

B. Non-site traffic includes existing traffic plus proposed or approved development in the area not accounted for in existing traffic counts. If other traffic studies for surrounding developments are used to estimate non-site traffic, those sources must be adequately documented. Trips need to be adjusted for each scenario based on the approved growth factor. Any assumptions for trip generation must be documented.

C. ITE trip generation rates are generally used as noted in Section III A above and adjusted by approved growth rates. Explanation of trip distribution and assignment should include any assumptions. Provide a diagram noting percentages and trip numbers from both the proposed development and non-site trips. Directional distribution for both the AM and PM peak hours should be included. Trip distributions under different scenarios should be adjusted based on any anticipated improvements or new street connections associated with the development or identified within the planning horizon in the GHALRTP or
Comprehensive Capital Improvement Program (CCIP). For example, new streets in a phased subdivision may impact the distribution, or, a planned CCIP project that occurs five years out could change the distribution between the build out and 20-year scenarios.

VI. TRAFFIC ANALYSIS

A. Traffic analysis including vision clearance/sight distance, proximity to intersections, turn lanes, queuing, existing access spacing and conflicts with pedestrians or bicycles shall be provided for all proposed site accesses. Criteria for minimum access spacing and the number of access points are outlined in the Engineering and Design Standards, development regulations and City Code. Interior site circulation, emergency vehicle and truck traffic shall also be considered in the analysis of access locations.

B. Impacts to site circulation from queuing such as drive through facilities, geometric considerations for emergency vehicular access and trucks needs to be addressed. Any change from the City’s Engineering and Design Standards or City Code must be identified.

C. Intersection analysis, including LOS and V/C, shall be provided for any intersection significantly impacted by the proposal. An intersection is considered significantly impacted as described in Section IV.C, or if the intersection is suspected of operating at LOS D or lower in the build year with build year background traffic. An analysis is required for each study scenario, including each cumulative sequence of phasing through the build-out condition. The analysis needs to clearly show the LOS and V/C of the intersection with and without the development.

Intersection analysis needs to balance signal timing based on the traffic demand. Assumed and proposed signal timing needs to be documented and suggested timing improvements identified. The intersection average LOS, V/C, critical movements and worst movements should be identified. Evaluation of the intersections needs to document the expected queue lengths and available vehicle storage. Deficiencies in existing storage and lane configuration need to be identified. This would include but not limited to lane widths and curb radii where truck traffic is expected.

D. Applicable warrants for turn lanes and traffic signals should be identified. Where it is expected that a signal may be needed based on a failing level of service, applicable warrants shall be evaluated to justify the need for a signal.
E. Queuing analysis should include both the average queue length and the 95th percentile queue length. The 95th percentile shall be used for design and for determining the required storage. Conflicts with queued vehicles should be addressed, such as, street or driveway accesses, adjacent vehicle lanes, RR tracks, etc.

F. Sight Distance for new intersections, streets and access points needs to meet the requirements of the City’s Sight Distance Triangle (City Code 7-3-7). Deficiencies in site distance with the proposed development plan shall be identified and discussed. This should also address sight distance to crosswalks and traffic control devices such as proposed signals, stop signs and road signs. The tree planting plan must be reviewed for conflicts with proposed traffic control devices/signs.

G. Analysis should be consistent with City of Helena Engineering and Design Standards – Traffic Calming Section 5.4. There may or may not be a need for traffic calming with the development. The minimum thresholds of vehicle counts and speeds should be identified to determine if traffic calming is consistent with City policy and would provide a significant benefit. Potential locations and types of traffic calming should be evaluated.

H. This Section may be combined with Section IV F. Current accident data for the past five years, and any other safety issues, should be identified and evaluated within the study area for potential impacts to the study scenarios. Accident history shall be analyzed to document if there are any existing safety conditions that may be impacted or aggravated by the development or development mitigation.

Graphics including tables, lane configurations and turning movements should be included to supplement and summarize the traffic analysis.

In summary, the traffic analysis should encompass the evaluation of intersection and access LOS, queuing, traffic signals, additional travel lanes, turn lanes, intersection functional areas, access control, bicycle movements, pedestrian movements, signal coordination, transit facilities, acceleration and deceleration lanes, merge lanes, weaving sections, future extension of transportation facilities through surrounding properties, etc.

VII. OTHER ITEMS TO ADDRESS

Other items that should be addressed include: nearby school zones, pending improvements from either nearby developments or nearby State, County, and City identified improvement projects or project identified in the GHALRTP or CCIP.
VIII. MITIGATION ALTERNATIVES

Possible mitigation identified in the above analysis sections should be discussed here. If the traffic study identifies safety concerns as a whole or per movement of a LOS of “D” or less, improvements and funding strategies shall be considered concurrent with a development proposal. Mitigation should be addressed for each phase of a development. Any ROW required for mitigation also needs to be identified.

Adequate capacity should be provided and maintained on arterial and collector streets to accommodate intersection LOS standards and to avoid traffic diversion to local streets. The LOS standards shall be:

- V/C less than 0.85
- LOS D or better during morning (7:00-9:00 am) and evening (4:00-6:00pm) peak hours of operation for all intersections with arterial or collector streets
- LOS C for all other times of the day

An example of mitigation to be addressed include, but is not limited to:
- Site access lane configuration, access restrictions / right in, right out
- Center turn lanes / dedicated turn lanes
- Additional vehicular lanes / left turn lanes / revised lane configurations
- Queuing lengths and storage capacity
- Geometric changes such as vertical or horizontal curves
- Speed limit investigations
- Bike lanes, ADA facilities, sidewalks and multi-use paths
- Traffic control devices and signage
- Traffic signals, signal timing, phasing and coordination
- Traffic calming
- Transit facilities

IX. RECOMMENDATIONS AND CONCLUSIONS

This should be a list of recommendations by the Engineer and include key findings of the study. Any required improvements must be identified. When a phasing plan is proposed, improvements should be clearly identified by phase and the expected year for completion of mitigation and non-construction years. Additionally, any improvements that are not required of the development, but
recommended to mitigate traffic issues in the study area, should be identified for City consideration and transportation planning purposes.

X. APPENDICES

Appendices to the traffic study should include but are limited to:

- Definitions, applicable references and standards
- Traffic count data (including other traffic studies cited or used)
- Maps
- Warrant worksheets
- Signal progression worksheets, where applicable
- Analysis software printouts

Software analysis printouts, shall be clearly labeled with consistent background/phasing nomenclature and applicable time period. Printout lane numbers, geometries and vehicular volumes shall all be consistent with other sections of the TIS and the land use application.
Appendix C – 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.
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.


**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.
**Table of Vault Size**

<table>
<thead>
<tr>
<th>Pipe Size</th>
<th>Inside ID</th>
<th>Access Opening</th>
</tr>
</thead>
<tbody>
<tr>
<td>8&quot;, 12&quot;, &amp; 16&quot;</td>
<td>VAULT=72&quot;</td>
<td>24&quot;</td>
</tr>
<tr>
<td>16&quot; to 24&quot;</td>
<td>VAULT=94&quot;</td>
<td>30&quot;</td>
</tr>
<tr>
<td>30&quot; to 36&quot;</td>
<td>VAULT=106&quot;</td>
<td>36&quot;</td>
</tr>
</tbody>
</table>

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.

---

**Combination Air and Vacuum Valve and Manhole Vault**

- Vault size according to table
- Frostproof ring & cover
- Style to be approved by City
- 4" rigid insulation
- Manhole steps – 16" O.C.
- Sized air & vacuum valve with 1" air release valve
- Sized flanged gate, ball, or butterfly valve
- Sized branch saddle with flange
- 6" floor drain (unless in high groundwater area)
- 8" 90 degree bend – PVC, SDR 35
- 20' of 6" PVC, SDR 35 (slope to drain)
- 2 c.y. washed round

---

**City of Helena Engineering Standards**

**Revised:** 2/12/13  
**Scale:** None  

**Standard Drawing:**  2-4
Approved City Logo
Manhole Lid
"Water" Lettering
Pipe Bedding

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 PIPE DOES NOT TAKE INTO ACCOUNT BOUNCINESS, UNDERDRAINS SHALL BE PROVIDED.

5. PROVIDE CLEANOUTS ON UNDERDRAIN PIPE, EVERY 100 FEET, AND AT BENDS OR JUNCTIONS.
Water Service Condominium Manifold For Street Less Than 10 Years Old
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.

Manhole rim and casting

1/4" lip from top of new pavement

Top of new pavement

Asphalt collar

Final adjustment ring must be an Infra-Riser by East Jordan or approved equal.

Redwood shims & non-shrink grout to adjust to grade.
Approved City Logo
Manhole Lid
"Sanitary Sewer" Lettering
1. All components are manufactured per ASTM C478.
2. Steps provided and located as required.
3. Poured-in inverts available as required.
FRAME AND COVER AS REQUIRED

ADJUSTING RINGS AS REQUIRED

TYPE 2 A COVER

CX2 "O" RING GASKET OR J oint SEALANT AS REQUIRED

M.A. INDUSTRY STEPS @ 16" O.C.

5" WALL

48" RCP ASTM C478

BASE SECTION

BASE IS SLOPED 1" PER FOOT TOWARD PRECAST CHANNELS

SECTION VIEW

HEMGHT V ARES

48" dia. I.D.

58" dia. O.D.

6" MONOLITHIC BASE WITH PRECAST INVERT

PLAN VIEW

PRECAST INVERT CHANNELS DROP 1" FROM INLET TO OUTLET

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.
1. Slabs are manufactured per ASTM C478.
2. Various sizes of round or rectangular openings are available.
   Cover designed for H520 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

REVISIONS:
2/12/13

SCALE:
NONE

Standard Type 2 & Type 2A
Cover Slabs

STANDARD DRAWING:
3-5
GASKET, INSTALLED VIEWED FROM INSIDE MANHOLE

FLEXIBLE SEAL CONNECTION

POWER SLEEVE

MANHOLE WALL

TAKE-UP CLAMP

POWER SLEEVE

TAKE-UP CLAMP

MANHOLE
**Standard Straight Manhole**

All components must be manufactured per ASTM C 478.
ELEVATION VIEW

SECTION A-A

PERSPECTIVE VIEW

ALL COMPONENTS MUST BE MANUFACTURED PER ASTM C 478.

<table>
<thead>
<tr>
<th>DIAMETER OF RISER</th>
<th>DIAMETER OF BARREL</th>
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<tbody>
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</table>

CITY OF HELENA
ENGINEERING STANDARDS

RCP Manhole Tee

STANDARD DRAWING:

3-8

REVISED: 2/12/13
SCALE: NONE
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
1/2" GRADE 60 STEEL REINFORCEMENT

THIS STEP MUST MEET THE REQUIREMENTS OF ASTM C 478

COPOLYMER
POLYPROPYLENE
PLASTIC

1-1/8"

10-3/4"

PLAN VIEW

12"

SIDE VIEW

9-1/8"

3-3/8"

1-1/4"

1/2" GRADE 60 STEEL REINFORCEMENT

5-3/4"

THIS STEP MUST MEET THE REQUIREMENTS OF ASTM C 478

TYPICAL INSTALLATION

SECTION A-A

Manhole Step

CITY OF HELENA ENGINEERING STANDARDS

REVISED: 2/12/13
SCALE: NONE

STANDARD DRAWING: 3-10
Approved City Logo
Manhole Lid
"Storm Sewer" Lettering
**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.
ALL COMPONENTS MUST BE MANUFACTURED PER ASTM C 478.

Combo Manhole
Double Curb Inlet
TONGUE END ON INLET END
PROOVE END ON OUTLET END
ENDS TO FIT ADJACENT PIPE SECTIONS

ROUND EDGES 1/2" - 1"

PLAN

END SECTION

1' TO 2'

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.

Beveled End Pipe Section
W 6x20 STEEL BEAM 3'-8" LONG CAST INTO COVER SLAB

OPENINGS AS REQUIRED

APPROVED DOUBLE GRATE AND FRAME

TYPE II COVER

ALL COMPONENTS MUST BE MANUFACTURED PER ASTM C 478.
48" TYPE 2A INLET COVER

APPROVED GRATE AND FRAME TYPE 2A COVER

OPENINGS AS REQUIRED

6" CAST IN BASE

5' OR AS REQUIRED

12" SUMP

ALL COMPONENTS MUST BE MANUFACTURED PER ASTM C 478.

Type 1 Drop Inlet
ALL GUARDS TO HAVE (1) CROSS BAR, 60" AND UP TO HAVE (2) BARS EQUALLY SPACED.

TABLE:

<table>
<thead>
<tr>
<th>PIPE SIZE</th>
<th>H</th>
</tr>
</thead>
<tbody>
<tr>
<td>12&quot;-24&quot;</td>
<td>2 1/2&quot;</td>
</tr>
<tr>
<td>15&quot;-18&quot;</td>
<td>3&quot;</td>
</tr>
<tr>
<td>18&quot;-24&quot;</td>
<td>4&quot;</td>
</tr>
<tr>
<td>27&quot;-36&quot;</td>
<td>5&quot;</td>
</tr>
<tr>
<td>42&quot;-54&quot;</td>
<td>6&quot;</td>
</tr>
<tr>
<td>60&quot;-72&quot;</td>
<td>7&quot;</td>
</tr>
<tr>
<td>78&quot;-90&quot;</td>
<td>8&quot;</td>
</tr>
</tbody>
</table>

BAR SIZES

<table>
<thead>
<tr>
<th>PIPE SIZE</th>
<th>HOLE DIA. REQ'D</th>
<th>BOLT DIA.</th>
<th>BAR SIZE</th>
<th>HOLE DIA. REQ'D</th>
<th>BOLT DIA.</th>
<th>BAR SIZE</th>
</tr>
</thead>
<tbody>
<tr>
<td>12&quot;-24&quot;</td>
<td>3/4&quot;</td>
<td>5/8&quot;</td>
<td>5/8&quot;</td>
<td>12&quot;-18&quot;</td>
<td>3/4&quot;</td>
<td>5/8&quot;</td>
</tr>
<tr>
<td>27&quot;-48&quot;</td>
<td>7/8&quot;</td>
<td>3/4&quot;</td>
<td>3/4&quot;</td>
<td>21&quot;-42&quot;</td>
<td>7/8&quot;</td>
<td>3/4&quot;</td>
</tr>
<tr>
<td>54&quot;-90&quot;</td>
<td>1 1/8&quot;</td>
<td>1&quot;</td>
<td>1&quot;</td>
<td>48&quot;-90&quot;</td>
<td>1 1/8&quot;</td>
<td>1&quot;</td>
</tr>
</tbody>
</table>

BOLT LENGTH = PIPE WALL THICKNESS + 2 1/2"

Note:
Hot dip galvanized per ASTM A153.
Approved City Logo
Manhole Lid
"Storm Sewer" Lettering
Extended Detention Basin

FLOW LENGTH ≥ 2W

ACCESSIBLE OUTLET WITH SAFETY GRATE

4:1 SIDESLOPES WITH NO AREAS GREATER THAN 3:1. FOR AESTHETIC DESIGN, VARY SLOPES AND DESIGN ONE SIDE MILDER THAN THE OTHER.

FOREBAY WITH CONCRETE OR RIPRAP FLOOR. PROVIDE ENERGY DISSIPATION FOR CONCENTRATED INFLOW.

IN THE BOTTOM OF THE BASIN PROVIDE A 3% MIN. SLOPE TO THE TRICKLE CHANNEL OR MICROPOOL.

SOIL RIPRAP (WHEN DOWNSTREAM GRADE IS LOWER THAN TOP OF BERM)

3:1 MAX. (BERM) OR VERTICAL CONC. WALL

TRICKLE CHANNEL: FOR CONCRETE, SLOPE BETWEEN 0.4 AND 1.0%

3:1 MAX. (BERM) OR VERTICAL CONC. WALL

PROVIDE ENERGY DISSIPATION FOR CONCENTRATED INFLOW

CONCRETE WALL w/ NOTCHED OUTLET RECOMMENDED FOR DRAINAGES TOO SMALL FOR BERM/ PIPE CONFIGURATION.

1 SOFT BOTTOM WHERE BASE FLOWS OR GROUNDWATER IS ANTICIPATED

2 INCREASE WHERE BASE FLOWS ARE ANTICIPATED

3 SIZE FOREBAY OUTLET TO PASS 2% OF UNDETAINED 100-YEAR 24 HOUR PEAK FLOW. CONCRETE WALL w/ NOTCHED OUTLET RECOMMENDED FOR DRAINAGES TOO SMALL FOR BERM/ PIPE CONFIGURATION.

CONCRETE OR RIPRAP FOREBAY

8" MIN. PIPE WITH BERM, USE NOTCH FOR WALL

INVERT OF TRICKLE CHANNEL

MICROPOOL DEPTH 2.5' MIN.

INFLOW

OUTFLOW

CONCRETE TRICKLE CHANNEL RUNDOWN

CONCRETE OR SOFT BOTTOM MICROPOOL

OUTLET WORK (SEE ADDITIONAL DETAILS IN STD. DWGS. 4-9 AND 4-10)

SEEPAGE CUTOFF COLLAR (IF NECESSARY)
NOTES:
ALL SAFETY GRATES SHOULD BE SIZED PER FIGURE OS-1 (USDCM CHP. 4, T-12)

4" MIN. INITIAL SURCHARGE VOLUME (EDB ONLY)

1'-0" FREEBOARD

OVERFLOW OUTLET w/ SAFETY GRATE

100-YR WSE

RTV WSE

3 OR 4

1'-0"

PERMANENT WSE

SAFETY GRATE

STAINLESS STEEL ORIFICE PLATE (SEE SECTION A-A)

100-YR FLOW RESTRICTOR (STAINLESS STEEL)

STD DWG 4-12

OUTLET PIPE

(120% OF 100-YR CAPACITY)

ALTERNATE MICROPOLL WITHIN STRUCTURE WHEN NEEDED FOR SPACE OR WILDLIFE CONCERNS

OVERFLOW OUTLET

W/ SAFETY GRATE

FINISHED GRADE

EMERGENCY SPILLWAY

OVERTOPPING PROTECTION (DESIGNED FOR 100-YR DISCHARGE OR GREATER)

EMERGENCY SPILLWAY

4" MIN. INITIAL SURCHARGE VOLUME (EDB ONLY)

OVERFLOW OUTLET

w/ SAFETY GRATE

100-YR WSE

RTV WSE

3 OR 4

1'-0"

PERMANENT WSE

SAFETY GRATE

STAINLESS STEEL ORIFICE PLATE (SEE SECTION A-A)

100-YR FLOW RESTRICTOR (STAINLESS STEEL)

OUTLET PIPE

(120% OF 100-YR CAPACITY)

STAINLESS STEEL BOLTS OR INTERMITTENT WELDS, SEE STANDARD DRAWING 4-10, SECTION C

STRUCTURAL STEEL CHANNEL FORMED INTO CONCRETE

STAINLESS STEEL ORIFICE PLATE

W OPENING

H/3

H/3

H/3

H (VARIES)

1'-0" TO 8'-0"

2'-6" MIN.

SECTION A-A

NTS

NOTE:
RTV ELEVATION H (VARIES, TYPICALLY THE RTV DEPTH). THREE ORIFICES ARE RECOMMENDED TO MAXIMIZE THE DIAMETER. INCREASE THE TOP ORIFICE AS NEEDED TO MATCH THE DESIRED DRAIN TIMES.

ORIFICE PLATE NOTES:
1. PROVIDE CONTINUOUS NEOPRENE GASKET MATERIAL BETWEEN THE ORIFICE PLATE AND CONCRETE.
2. BOLT PLATE TO CONCRETE 12" MAX. ON CENTER. SEE TABLE OS-2 (USDCM CHP. 4, T-12) FOR PLATE THICKNESS.

SAFETY GRATES:
1. ALL SAFETY GRATES SHALL BE MOUNTED USING STAINLESS STEEL HARDWARE AND PROVIDED WITH HINGED AND LOCKABLE OR BOLTABLE ACCESS PANELS.
2. SAFETY GRATES SHALL BE STAINLESS STEEL, ALUMINUM, OR STEEL. STEEL GRATES SHALL BE HOT DIP GALVANIZED AND MAY BE HOT POWDER COATED AFTER GALVANIZING.
3. SAFETY GRATES SHALL BE DESIGNED SUCH THAT THE DIAGONAL DIMENSION OF EACH OPENING IS SMALLER THAN THE DIAMETER OF THE OUTLET PIPE.
4. STRUCTURAL DESIGN OF SAFETY GRATES SHALL BE BASED ON FULL HYDROSTATIC HEAD WITH ZERO HEAD DOWNSTREAM OF THE RACK.
5. SAFETY GRATES SHALL BE 6-INCHES WIDER THAN THE OPEN SPAN BETWEEN WING WALLS.
STANDARD DRAWING: Typical Pond Outlet Structure Details

SAFETY GRATE WITH 5' MAX. CLEAR BETWEEN BARS

ALTERNATE MICROPOOL, ALLOW 1" GAP UNDER SAFETY GRATE

ALTERNATE INTERNAL MICRPOOL OUTLET STRUCTURE

ALTERNATE TRICKLE CHANNEL INVERT

C8x18.75 AMERICAN STANDARD STRUCTURAL STEEL CHANNEL FORMED INTO CONCRETE BOTTOM AND SIDES OF W OPENING

MICROPOOL WSE

100-YR WSE

BOLT OR LOCK

RTV WSE

100-YR FLOW RESTRICTOR (STAINLESS STEEL)

STAINLESS STEEL ORIFICE PLATE

OUTLET PIPE (PREFERRED LOCATION)

OUTLET PIPE (OPTIONAL LOCATION)

STAINLESS STEEL ORIFICE PLATE

RACK SWIVEL HINGE

FINISHED GRADE

1'-0" MIN FREEBOARD

EMERGENCY SPILLWAY

SHAPED INVERT 2.5% MIN. SLOPE

PROVIDE CONTINUOUS NEOPRENE GASKET BETWEEN ORIFICE PLATE AND STRUCTURE

SECTION B-B

NTS

STEEL PLATE THICKNESS (IN INCHES) BASED ON DESIGN HEAD AND SPAN OF PLATE

<table>
<thead>
<tr>
<th>SPAN (FEET)</th>
<th>3</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.1875</td>
<td>0.1875</td>
<td>0.1875</td>
<td>0.1875</td>
<td>0.1875</td>
</tr>
<tr>
<td>2</td>
<td>0.1875</td>
<td>0.2500</td>
<td>0.2500</td>
<td>0.2500</td>
<td>0.2500</td>
</tr>
<tr>
<td>3</td>
<td>0.2500</td>
<td>0.2500</td>
<td>0.3750</td>
<td>0.3750</td>
<td>0.3750</td>
</tr>
<tr>
<td>4</td>
<td>0.2500</td>
<td>0.3750</td>
<td>0.3750</td>
<td>0.3750</td>
<td>0.3750</td>
</tr>
</tbody>
</table>

1 12" MIN. INCREASE AS NEEDED TO ACCOMMODATE ORIFICE DESIGN DIAMETER

SECTION C-C

NTS

CITY OF HELENA ENGINEERING STANDARDS

REVISED: 5/11/2019

SCALE: NONE

STANDARD DRAWING: 4-10
LOCAL ROAD (w/On-Street Parking)

(NON-MOTORIZED VEHICLES SHARE THE ROAD)
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
MINOR ARTERIAL (w/On-Street Parking)

* 10' BIKE/PED PATH ON BIKE ROUTES
MAJOR ARTERIAL (w/On-Street Parking)

* 10' BIKE/PED PATH ON BIKE ROUTES
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.
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 2 ft. ON CENTER, #4 REBAR 2 ft. (60 cm) 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 BOULEVARD EXCEEDS 12' (3.7 m) IN DEPTH REQUIRE A TRANVERSE JOINT AT THE TOP OF THE FLARE.

FLARES SHALL BE 4' (1.2 m) IN WIDTH. STANDARD DRIVEWAY WIDTH DOES NOT CHANGE.

ALL DRIVE APPROACHES SHALL COMPLY WITH CURRENT ADA STANDARDS.
- 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 2 ft. ON CENTER, #4 REBAR 2 ft. (60 cm) IN LENGTH.

- JOINTS SHALL BE 1/2" LASTIC 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" LASTIC JOINT SHALL BE PLACED LONGITUDINALLY ALONG THE CENTER LINE.

- DRIVE APPROACHES WHERE THE BOULAVARD EXCEEDS 12' (3.7 m) IN DEPTH REQUIRE A TRAVERSE JOINT AT THE TOP OF THE FLARE.

- FLARES SHALL BE 4' (1.2 m) IN WIDTH. STANDARD DRIVEWAY WIDTH DOES NOT CHANGE.

- ALL DRIVE APPROACHES SHALL COMPLY WITH CURRENT ADA STANDARDS.
NEW CONSTRUCTION:

NOTE:
- ALL ADA RAMPS MUST BE CONSTRUCTED TO CURRENT ADA STANDARDS.
- SINGLE DIAGONAL CURB RAMPS SERVING TWO STREET CROSSING DIRECTIONS ARE NOT PERMITTED IN NEW CONSTRUCTION.

1. THE DESIRABLE 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

FLOW LINE

NOTE: DIMENSIONS ARE AT BACK OF CURB

CITY OF HELENA ENGINEERING STANDARDS

REVISED: 2/12/13
SCALE: NONE

ADA SIDEWALK CURB RAMP

STANDARD DRAWING: 5-9
NEW CONSTRUCTION:

NOTE:
- ALL ADA Ramps must be constructed to current ADA standards.
- Single diagonal curb ramps serving two street crossing directions are not permitted in new construction.

1. The desirable 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 be 1:20 (5%).
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
## Types of Traffic Calming Measures

<table>
<thead>
<tr>
<th>Measure</th>
<th>Definition/Application</th>
<th>Advantages</th>
<th>Disadvantages</th>
<th>Special Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Speed Hump</td>
<td>Paved hump in the street that causes discomfort at high speeds.</td>
<td>• Speed reduction</td>
<td>• If not properly designed, drivers may skirt around to reduce impact.</td>
<td>• Emergency vehicles • Drainage • Snow removal</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Possible traffic reduction</td>
<td>• Drivers may speed up between humps.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Effective if used in series at 300 to 500 foot spacing.</td>
<td>• May increase volumes on other streets.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Self-enforcing.</td>
<td>• Difficult to properly construct.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Relatively inexpensive.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Estimated Cost Range = $2,000 to $4,000</td>
<td></td>
</tr>
<tr>
<td>Raised Crosswalk</td>
<td>Speed hump designed as a pedestrian crossing.</td>
<td>• Highlights crosswalk.</td>
<td>• Drivers may speed up between humps.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Excellent pedestrian safe treatment.</td>
<td>• May increase volumes on other streets.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Aesthetically pleasing if designed.</td>
<td>• Difficult to properly construct.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Relatively inexpensive.</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Estimated Cost Range = $2,000 to $4,000</td>
<td></td>
</tr>
<tr>
<td>Rumble Strips</td>
<td>Patterned sections of rough pavement.</td>
<td>• Relatively inexpensive to install.</td>
<td>• High maintenance.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Create driver awareness.</td>
<td>• May adversely impact bicyclists.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Noisy by design, and not recommended for all areas.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Estimated Cost Range = $2,000 to $4,000</td>
<td></td>
</tr>
<tr>
<td>Surface Valley Gutters</td>
<td>Dips in the street that can be used to carry run-off as well as cause discomfort for drivers at high speeds.</td>
<td>• Speed reduction</td>
<td>• Emergency vehicles</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Possible traffic reduction</td>
<td>• Drainage</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Effective if used in series at 300 to 500 foot spacing.</td>
<td>• Signage</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Self-enforcing.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Relatively inexpensive during initial construction.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Estimated Cost Range = $2,000 to $4,000</td>
<td></td>
</tr>
</tbody>
</table>
### Vertical Deflection

**Raised Intersection**

- Raised plateau where streets intersect.
  - Speed reduction
  - Possible traffic reduction

- Slows vehicles in the most critical area, reducing conflict.
- Highlights intersection.
- Excellent pedestrian safety treatment.
- Aesthetically pleasing if well designed.
- Better for emergency vehicles than speed humps.

- Increases difficulty of making a turn.
- Increased maintenance.
- Requires adequate signage and driver education.

- Emergency vehicles
- Drainage
- Signage
- Snow removal

Estimated Cost Range = $6,000 to $10,000

### Horizontal Deflection

<table>
<thead>
<tr>
<th>Measure</th>
<th>Definition/Application</th>
<th>Advantages</th>
<th>Disadvantages</th>
<th>Special Considerations</th>
</tr>
</thead>
</table>
| **Gateway Treatment**        | Entry treatment that communicates a sense of neighborhood identity and a change in traffic conditions. | • Positive indication of a change in environment from arterial road to residential street. | • Low speed of turning vehicles may restrict flow on adjacent arterial.         | • Emergency vehicle access
• Lighting
• Irrigation and maintenance of landscaping                                                |
|                              |                                                                                        | • Speed reduction at entry  
• Traffic reduction                                             |                                                                                 | Estimated Cost Range = $5,000 to $25,000                                               |
| **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. | • 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                                               |
## Horizontal Deflection

<table>
<thead>
<tr>
<th>Measure</th>
<th>Definition/Application</th>
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</tr>
</thead>
</table>
| 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 | • 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 |
| Single-Lane Angled Slow Point | Offset curb extensions used to narrow the street to a single lane and create angled deviations in the path of travel. | • Speed reduction  
• Traffic reduction | • 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 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 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 |
<table>
<thead>
<tr>
<th>Measure</th>
<th>Definition/Application</th>
<th>Advantages</th>
<th>Disadvantages</th>
<th>Special Considerations</th>
</tr>
</thead>
</table>
| Mid-Block Median    | Island or barrier in the center of a street that narrows lanes and segregates traffic. | Provides a refuge for pedestrians and bicyclists.  
• Possible speed reduction  
• Possible traffic reduction | 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.                        | Reduces through traffic along the top of the “T”.  
• Speed reduction  
• Possible traffic reduction | 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.                              | Reduces pedestrian crossing distance.  
• Speed reduction  
• 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 |
| Deviation/Chicanes   | Offset curb extensions that cause deviation in the path of travel.                     | Imposes minimal inconvenience on local traffic.  
• Speed reduction  
• Possible traffic reduction | May create opportunities for head-on conflicts on narrow streets.  
• Cost is greater than many other devices.  
• Unfriendly to bicyclists unless designed to accommodate them. | Lighting  
• Signage  
• Irrigation and maintenance of landscaping  
Estimated Cost Range = $20,000 to $30,000 |
<table>
<thead>
<tr>
<th><strong>Horizontal Deflection</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Driveway Link</strong></td>
</tr>
<tr>
<td>Narrow winding driveway section placed between two standard street segments.</td>
</tr>
<tr>
<td>• Changes the initial impression of the street. Appears to be a road closure yet allows through movements for local traffic.</td>
</tr>
<tr>
<td>• Provides a large area for landscaping.</td>
</tr>
<tr>
<td>• High cost can be prohibitive. Best installed in conjunction with street reconstruction or initial construction.</td>
</tr>
<tr>
<td>• Unfriendly to bicyclists unless designed to accommodate them.</td>
</tr>
<tr>
<td>• Emergency vehicle access</td>
</tr>
<tr>
<td>• Lighting</td>
</tr>
<tr>
<td>• Signage</td>
</tr>
<tr>
<td>• Irrigation and maintenance of landscaping</td>
</tr>
<tr>
<td>Estimated Cost Range = $20,000 to $50,000</td>
</tr>
<tr>
<td><strong>Traffic Circle</strong> (Does not include Modern Roundabouts)</td>
</tr>
<tr>
<td>Raised circular area placed in the center of an intersection. Drivers travel in a counter-clockwise direction and are required to yield upon entry.</td>
</tr>
<tr>
<td>• Speed reduction at intersection</td>
</tr>
<tr>
<td>• Possible traffic reduction</td>
</tr>
<tr>
<td>• Reduces accidents by 50% to 90% over stop control.</td>
</tr>
<tr>
<td>• Provides space for landscaping.</td>
</tr>
<tr>
<td>• Cheaper to maintain than signals.</td>
</tr>
<tr>
<td>• Effective at multi-leg intersections.</td>
</tr>
<tr>
<td>• Provides equal access to intersections for all drivers.</td>
</tr>
<tr>
<td>• Provides a good environment for bicyclists.</td>
</tr>
<tr>
<td>• May be restrictive for larger vehicles if designed to a low speed. (This can be minimized by the use of a mountable apron.)</td>
</tr>
<tr>
<td>• Right of way may need to be purchased to accommodate left turns by large vehicles.</td>
</tr>
<tr>
<td>• Initial safety issues as drivers adjust.</td>
</tr>
<tr>
<td>• May increase volumes on adjacent streets.</td>
</tr>
<tr>
<td>• Lighting</td>
</tr>
<tr>
<td>• Signage</td>
</tr>
<tr>
<td>• Irrigation and maintenance of landscaping</td>
</tr>
<tr>
<td>• Emergency vehicle Access</td>
</tr>
<tr>
<td>Estimated Cost Range = $10,000 to $50,000</td>
</tr>
<tr>
<td><strong>Shared Zone</strong></td>
</tr>
<tr>
<td>A block with narrow entry points and high-density parking which functions similarly to a parking lot.</td>
</tr>
<tr>
<td>• Speed reduction</td>
</tr>
<tr>
<td>• Traffic reduction</td>
</tr>
<tr>
<td>• Provides a low speed shared environment that is safe for all users.</td>
</tr>
<tr>
<td>• Improves amenity without restricting access.</td>
</tr>
<tr>
<td>• Provides flexibility for on-street parking.</td>
</tr>
<tr>
<td>• High cost unless part of original design.</td>
</tr>
<tr>
<td>• May result in an increased number of low speed accidents.</td>
</tr>
<tr>
<td>• Emergency vehicle access</td>
</tr>
<tr>
<td>• Signage</td>
</tr>
<tr>
<td>Estimated Cost Range = $15,000 to $25,000</td>
</tr>
</tbody>
</table>
### Obstruction

<table>
<thead>
<tr>
<th>Measure</th>
<th>Definition/Application</th>
<th>Advantages</th>
<th>Disadvantages</th>
<th>Special Considerations</th>
</tr>
</thead>
</table>
| Forced Turn Barriers/ Diverters | Small traffic islands installed at intersections to restrict and channelize turning movements. | • 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. | • 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                                    |                                                      |
| 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. | • 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 |
<p>|                                 |                                                                                        |                                                                          | Estimated Cost Range = $10,000 to $20,000 each side of intersection          |                                                      |</p>
<table>
<thead>
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<th>Disadvantages</th>
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</tr>
</thead>
</table>
| Cul-De-Sac/Street Closure                  | Street closed to motor vehicles at the end of a block using planters, bollards, barriers, etc. | • 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 |
| Mid-Block Street Closure                   | Street closed to motor vehicles mid-block using planters, bollards, barriers, etc.     | • 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 |
| One-Way Street                             | Street upon which motor vehicles may operate in just one direction.                     | • 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 |
| Imploding/Exploding One-Way Street Intersections | 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 vehicles.  
• Interrupts the flow of through traffic. | • May increase trip lengths.  
• May increase volumes on other streets.  
• Initial safety concerns as drivers adjust.  
• Alternative route must exist. | • Signage  
• Emergency vehicle access  
Estimated Cost Range = $5,000 to $10,000 |

* Narrow streets, boulevards, and street trees also provide traffic calming