City of Hood River
Engineering Standards

Adopted: March 29, 2005
Revision: September 2005 and 2006
By: David H. Bick, PE, City Engineer

Revision: August 15, 2016

By: Stoner Bell, PE, City Engineer

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ACKNOWLEDGEMENTS

Jody and Wade Seaborn, Seaborn Engineering P.C., working together with city staff members, prepared these Engineering Standards for the City of Hood River. In preparation of this document, Seaborn Engineering endeavored to be consistent with the following objectives:

- Provide for safe, adequate public facilities now and in the future,
- Provide for cost effective long-term operation and maintenance of public facilities,
- Minimize initial construction costs without compromising the preceding objectives, and
- Encourage creative solutions designed to enhance and expand upon the natural environment.

The following individuals are acknowledged for their significant contributions:

Dave Bick, P.E., City Engineer
Gary Lindemyer, Construction Inspector
Alexandra Sosnkowski, City Attorney
Mark Lago, Project Manager
Jennifer Donnelly, Senior Planner
Robin Harris, P.E., Anderson Perry & Associates

A special thank you is extended to members of the Technical Advisory Committee who volunteered their own time to review and provide comments on the draft stages of the document:

Don Wiley, P.E., Hood River County Engineer
Roger Kauble, P.E., RKA (and former Director of Public Works and Engineering)
Ron Schmidt, Crestline Construction
Linda Rouches, Mayor of the City of Hood River
John Everitt, JKE LLC
Darrin Eckman, P.E., Tenneson Engineering

COMMENT FORM

Recognizing that by their very nature these Engineering Standards will continually evolve, we encourage users of these Standards to provide us with comments so that we can continue to improve the content and usefulness of this document.

Please use this form to fax or mail your comments to:

Mark Lago, Public Works Director
PO Box 27
Hood River, OR 97031
(541) 386-2383

FAX: (541) 387-5222 No. of Pages (including cover) = _____

Or e-mail your comments to: lago @ci.hood-river.or.us

Comments: _____

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From (w/ contact info.): _____

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Revisions

August 2016

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1. Introduction

1.1 Purpose

The purpose of the City of Hood River Engineering Standards ("Engineering Standards" or "Standards") is to provide design standards for both public and private improvements, including grading and erosion control, under the jurisdiction of the City of Hood River ("City"). These Engineering Standards apply to proposed work within the City and Urban Growth Area ("UGA"), and to extensions of City-owned utilities outside the City limits and UGA.

These Standards are intended to provide technical guidance to those responsible for designing and reviewing engineered sites and facilities for public and private improvements. These Standards do not cover every possible situation. The user is assumed to have the necessary training and practical experience in the application of civil engineering principles to implement the methodologies described herein. Any exception to these Standards will be made at the sole discretion of the City Engineer.

1.2 Conflict

Except where these Engineering Standards provide otherwise, design, construction, materials, and testing shall conform to the appropriate standards of the most current edition of the following publications:

- Oregon Department of Transportation/APWA Oregon Standard Specifications for Construction
- American Water Works Association (AWWA) Standards
- Oregon Health Division Regulations
- Department of Environmental Quality Sewer Design Criteria, Oregon Administrative Rules
- AASHTO Policy on Geometric Design of Highways and Streets (AASHTO)
- U.S. Department of Transportation Federal Highway Administration Manual of Uniform Traffic Control Devices
- Oregon Department of Transportation Short Term Traffic Control Handbook

In case of conflicts between the text of these Engineering Standards, Standard Details, City's Transportation System Plan, Comprehensive Plan, or the Hood River Municipal Code (HRMC) Titles 16 and 17, the more stringent as determined by the City Engineer shall apply. Acceptable materials shall be as outlined in these Engineering Standards.

1.3 Definitions

Words not defined here shall have the meaning as defined in the Hood River Municipal Code.

Applicant – The person applying for a permit from the City's Public Works Department for a public or private improvement to which these Standards apply.

City – City of Hood River including all staff and departments as applicable.

City Engineer – Oregon licensed professional engineer on city staff or under contract by the City to perform engineering design reviews or his/her designated representative.

Contractor – Person listed on the construction site permit application as the party performing construction of the permitted work.

DEQ – Oregon Department of Environmental Quality

Design Engineer – Oregon licensed Professional Engineer responsible for preparation of the construction plans to be reviewed and approved by the City Engineer.

Detention Facility – A storm water facility that reduces the peak flow of storm water runoff (but not the total volume) to the downstream system in a controlled manner.

Final Acceptance – City Engineer's **written** acceptance of public facilities constructed by others.

Final Approved Plans – Complete set of construction plans approved and signed by the City Engineer.

ODOT – Oregon Department of Transportation

Private Utilities – Any utilities not owned by the City of Hood River.

Record Drawings – Complete set of plans incorporating all changes made to the Final Approved Plans during construction.

Resident Engineer – Oregon licensed Professional Engineer responsible for project oversight during construction.

Retention Facility – A storm water facility that reduces the volume of storm water runoff to the downstream system by means of evaporation, plant transpiration, or infiltration into the soil.

1.4 Clarification & Final Authority

Requests for clarification of these Standards shall be directed in writing to:

Dave Bick, P.E., City Engineer
City of Hood River Public Works
PO Box 27, 1200 18th Street
Hood River, OR 97031
(541) 386-2383
daveb@ci.hood-river.or.us

The City Engineer shall have final authority on all questions that may arise regarding the interpretation of these Standards.

1.5 Engineering Standards Revisions

Questions or suggestions should be addressed to the City Engineer (see form provided). It is anticipated that these Standards will be updated from time to time. The City will provide updates to those who have requested they receive revisions. However, it shall be the Applicant's responsibility to make sure they are using the most current version.

This document and revisions shall be available for download from the City's Public Works website: www.hoodriverpublicworks.com

1.6 Referenced Manuals

The engineering manuals referenced in these Standards will be located at the City Engineer's office for review by users of this manual.

1.7 Non-enforcement

Non-enforcement of any requirement in these Standards by the City shall not construe a waiver of that requirement, nor shall it affect the enforceability of that requirement or of the remainder of the Engineering Standards.

2. Development Process

2.1 General Process

2.1 A. Planning – Reviews by the City Planning Department, planning reviews, are generally required for all development projects under the jurisdiction of the City which involve the subdivision or partition of land, replats, plat vacations, lot line adjustments, construction or reconstruction of any building, change of use, or multi-family or group residential construction. Refer to the Hood River Municipal Code Title 16: Land Divisions and Title 17: Zoning Ordinances for a detailed description of the planning process. Most planning reviews include some level of engineering review.

2.1 B. Engineering – Engineering reviews by the City Engineer are generally required for all projects under the jurisdiction of the City that involve the:

1) construction of public facilities,
2) construction within the public right-of-way,
3) construction of private facilities discharging to public facilities,
4) construction of facilities, including grading, that may have an impact on storm water runoff or downstream water quality, or
5) dedication of public right-of-way.

A Construction Site Permit is required for all projects that require an engineering review. Depending on the complexity of the proposed facilities or improvements, either sketches or detailed plans are required for review.

See Exhibit 1 for a summary of the planning and engineering review process.

2.1 C. Design Exception Process

These Standards are not intended to limit the creativeness and ingenuity or substitute for the competent work of the Design Engineer. However, these Standards are intended to provide uniformity in the construction of safe public facilities in a manner allowing economical future maintenance. Therefore, any proposed exception to these standards is expected to provide a better or at least comparable result, in every way consistent with sound engineering practices as determined by the City Engineer.

Any proposed design exception should be discussed with the City Engineer prior to the plan submittal, followed by a written request explaining why the exception should be approved at the time of plan submittal. All approved design exceptions will be listed on the cover sheet of the Final Approved Plans. It will be the Applicant's responsibility to build the project consistent with these Engineering Standards unless specifically noted as a design exception on the cover sheet of the Final Approved Plans.

2.2 Construction Site Permit

2.2 A. A **Construction Site Permit** is required when one or more of the following apply:

1) Imported fill (borrow) or excavation will exceed 50 cubic yards.
2) Excavation or fill will result in elevation changes exceeding 2' on any portion of the site excluding landscaping on developed property, for which a permit is not otherwise required under these Engineering Standards.
3) 1 acre or more of land will be disturbed.
4) 5,000 square feet of new impervious surface will be added, or a combined total of 10,000 square feet or more of impervious surface will be added or reconstructed.
5) Infrastructure will be constructed and dedicated to the City.
6) Construction will occur within the public right-of-way (including temporary use of city owned property).
7) Site will be converted to a use that is a potentially significant source of water or air pollution (e.g. reconstruction of a neighborhood grocery into a gas station).

See Exhibit 2 for Construction Site Permit requirements.

2.2 B. Sketch Required: The Applicant shall submit a sketch (drawn to scale) to the City Engineer for approval for the following types of projects that require a Construction Site Permit:

1) Curb Cuts
2) Sidewalk Construction
3) Excavation for purpose of installing utility service lines only
4) Landscaping within the public right-of-way
5) Grading for construction of one single family dwelling that does not result in elevation changes exceeding 2' on any portion of the site

The sketch shall include:

- North arrow
- Scale
- Property Lines
- Easement(s) of Record
- Building Locations
- Structures, roads, and driveways within 50 feet of property lines
- Tax Lot Number or property description
- Depiction of proposed work
- All impacts to existing trees and/or vegetation within the public right-of-way.
- Estimated cost of the proposed work when cuts in existing city streets are involved.

- Any other requirements necessary to show that the proposed work is consistent with the requirements of these Engineering Standards as determined by the City Engineer.

2.2 C. Detailed Engineering Plan Review: For all projects not listed in 2.2b above that require a Construction Site Permit, a detailed engineering plan review is required. This includes the following:

1) Non-mandatory pre-submittal conference to discuss conceptual designs for roads, utilities, stormwater and erosion control management so that the City can assist in confirmation of the adequacy of public facilities to meet proposed and future development. If conceptual designs have already been prepared as part of the planning process, this step provides the Applicant an additional opportunity to get input from Public Works (ie. proposed design exceptions) prior to the preparation of detailed plans. **There is no fee assessed for the pre-submittal conference.**
2) Plan Submittal & Public Works Review – It is anticipated that a typical project will involve 1-2 reviews before final review depending on the completeness of the plan submittal. See Section 3 for submittal requirements. Upon receipt of the plan submittal, the City will have 30 calendar days to determine completeness and an additional 60 days to complete the review and provide comments (if any) to the Applicant.
3) Final Review – The City Engineer will issue final approval following receipt and review of the final (100%) plan submittal. The final plan submittal shall address all the City's review comments previously submitted.

2.2 D. Construction Site Permit Fees

Sketch Required(2.2b):

Fee will be a fixed fee set by resolution of City Council. See Appendix A.

Detailed Engineering Plan Review Required(2.2c):

Fee will be fixed percentage of total infrastructure costs as set by resolution of the City Council. See Appendix A.

2.2 E. Construction Site Permit Time Limits

Sketch Required(2.2b):

From permit issuance, construction shall start within 30 days and be completed within 6 months from start date or the permit will be void and a new permit will be required.

Detailed Engineering Plan Review Required (2.2c):

From permit issuance, construction shall start within 1 year or the permit will be void and a new permit will be required. (Note: Each phase of construction will require a separate Construction Site Permit.)

2.3 Other Agency Reviews/Permits

2.3 A. Work within County or State right-of-way requires a right-of-way permit from the applicable jurisdiction. The Applicant is responsible for obtaining the necessary permit(s) as required.

2.3 B. The following other types of permits/approvals may be required depending on the type of work and site conditions:

1) NPDES 1200-C Department of Environmental Quality, DEQ, permit for earth disturbance of more than one acre;
2) US Army Corps of Engineers and/or Oregon Division of State Lands permit for jurisdictional wetlands;
3) DEQ registration for Underground Injection Systems;
4) Railroad permit for work that crosses or is adjacent to a railroad right of way;
5) Oregon State Plumbing permit for work that involves private storm drains;
6) City building permit for work that involves retaining walls or fill on private property.
7) County or State approval for development that adds unanticipated traffic to county or state roads.

The above list may not address all permits required for a specific project. The City is not responsible for notifying the Applicant of permits that may be required. It is the Applicant's sole responsibility to determine which permits are required and obtain those necessary for the work as a condition of the City issuing the Construction Site Permit.

2.4 Pre-Construction Meeting

A pre-construction meeting is mandatory for every project that requires a detailed engineering plan review (2.2c). The Applicant is responsible for scheduling the meeting with the City Engineer, Prime Contractor (including job Foreman), Resident Engineer, Design Engineer (if different from Resident Engineer), Owner, and private utility representatives. If all permit requirements are met, the City Engineer will approve the Construction Site Permit following the Pre-Construction Meeting.

2.5 Contractor Pre-qualifications, Insurance, Bonding, and Warranty Requirements.

Prior to Construction Site Permit approval, the following requirements must be met. Pre-qualification and proof of insurance and bonding may be provided at the pre-construction meeting.

2.5 A. Contractor Pre-qualifications: All Contractors intending to construct or connect to City-owned infrastructure must be pre-qualified with the City. See forms in Appendix B. Experience on water line work shall be listed under "Other".

2.5 B. Insurance Requirements: Refer to the HRMC Title 13.36: Work in City Rights of Way for all work within the public right of way.

2.5 C. Bonding & Warranty Requirements: Refer to the HRMC Title 13.36: Work in City Rights of Way for all work within the public right of way and HRMC Title 16 for construction of all public facilities.

2.6 Construction Requirements

The following construction requirements apply to all projects that require a detailed engineering plan review (2.2c):

2.6 A. All public improvements shall be inspected by the Resident Engineer ("RE"), or a qualified individual under the supervision of the RE. The RE shall not have any pecuniary interest in the project or development, other than that as a professional service provider. The Applicant should have the RE designated prior to the pre-construction meeting where the RE's attendance is mandatory. All costs associated with the RE's work and testing shall be paid by the Applicant.

2.6 B. The following minimum activities and responsibilities are required of the RE:

1) The RE shall maintain a project log book which contains at least the following information:
   a) Job number and name of engineer and designers;
   b) Date and time of site visits;
   c) Weather conditions, including temperature;
   d) Description of construction activities with photographs of work in progress;
   e) Statements of directions to change plans, specifications, stop work, reject materials or other work quality actions;
   f) Public Agency contacts which result in plan changes or other significant actions;
   g) Perceived problems and actions taken;

h) General remarks;
i) Final Inspections;
j) Record of all testing.

2) The RE shall have a copy of the Final Approved Plans and Specifications on-site at all times.

3) The RE shall obtain written approval from the City Engineer for all proposed changes to the Construction Site Permit, plans or specifications prior to implementing any change. All changes during construction shall be documented on the Final Approved Plans by use of a revision block with changes outlined in a cloud. The RE shall provide copies of all changes to the City, Contractor and Applicant.

4) The RE shall review all materials prior to installation for conformance with the Standards or specific design exceptions as shown in the Final Approved Plans.

5) The RE shall observe construction activities for compliance with the Final Approved Plans and specifications. Prior to Final Acceptance, the RE shall provide the City Engineer a letter, certification letter, stating that the project was constructed in conformance with the Final Approved Plans and specifications, based on what he/she has observed.

6) The RE shall observe all required testing and shall provide copies of all results to the City Engineer in a format readily useable by the City. See attached checklists in Appendix C.

7) The RE shall confirm pre-paving approval is issued prior to paving operations.

8) The RE shall have the project log book available for review by the City Engineer upon request at all times throughout construction.

9) Prior to Final Acceptance, the RE shall stamp the project log book, or an exact copy, and file with the City Engineer

2.6 C. The City's activities and responsibilities are limited to the following:

1) General monitoring of work progress.
2) Observation of performance testing as determined at the pre-construction meeting.
3) Issuance of pre-paving approval.
4) Observation and testing of underground utilities, including tracer wiring testing. Pre-paving approval will not be issued until underground utilities have been observed and tested to the City Engineer's satisfaction.
5) Approval of any plan changes during construction.
6) Issuance of stop work orders. The City will promptly notify the RE of any stop word order.

7) Participation in final inspection for acceptance of improvements.

The City's construction observation is **not** an inspection or validation of the contractual obligations between the Contractor and the Applicant, nor does it constitute Final Acceptance of any work.

2.6 D. The following minimum activities and responsibilities are required of the Contractor:

1) The Contractor listed on the Construction Site Permit shall perform or oversee all permitted work. Substitutions of Contractors following issuance of the permit will not be allowed without prior pre-qualification and written approval by the City Engineer.

2) The Contractor shall have a copy of the Final Approved Plans, specifications and Construction Site Permit on the job site at all times.

2.7 Construction Testing Requirements

For all projects requiring a detailed engineering review (2.2c), the Applicant shall be responsible for conducting and passing to the City Engineer's satisfaction the following tests.

2.7 A. Streets
- Curb Staking and/or String line Inspection;
- Subgrade compaction testing or proof rolls;
- Base rock compaction testing;
- AC Pavement Placement observation and testing;

2.7 B. Sanitary Sewers
- Backfill compaction testing;
- Mandrel testing of mainlines;
- Air testing of mainlines;
- Video inspection of mainlines;
- Hydrostatic or vacuum testing of manholes following paving;
- City observation and tracer wire testing prior to paving;

2.7 C. Storm Sewers
- Backfill compaction testing;
- Mandrel testing of mainlines;
- Video inspection of mainlines;
- City observation and tracer wire testing prior to paving;

2.7 D. Water Distribution System
- Backfill compaction testing;
- Pressure Test;
- Disinfection;
- City observation and tracer wire testing prior to paving;

The City Engineer will provide a list of the tests that the City will observe to the Contractor at the pre-construction meeting. The Contractor shall notify the City Engineer a minimum of 48 business hours (2 business days) prior to these tests.

Testing documentation shall be prepared and retained by the RE for all tests. Copies of the testing documentation will be required to be submitted to the City Engineer prior to Final Acceptance.

2.8 Final Acceptance & Record Drawing Requirements

The following requirements apply to all projects requiring a detailed engineering review (2.2c).

2.8 A. Following completion of construction, the RE shall notify the City Engineer that the improvements are complete and ready for final inspection and acceptance.

2.8 B. Following notification, the RE shall schedule the final walk-through of the construction site with the Contractor, Design Engineer, and City Engineer. If the work is not acceptable to the City Engineer, the RE shall document the unacceptable items in writing and provide a copy to the Contractor, Applicant, Design Engineer, and City Engineer.

2.8 C. When all final walk-through items have been addressed to the City Engineer's satisfaction, the RE shall prepare Record Drawings incorporating the changes made during construction, the final walk-through, if any, and submit these drawings to the City Engineer. The documents shall be provided in hard copy and electronic format. The electronic format shall conform to the requirements of Appendix E.

2.8 D. The City Engineer will not give Final Acceptance until all final walk-through items have been addressed to his/her satisfaction and the City Engineer has received the Record Drawings, certification letter, project log book, and testing documentation.

3. Detailed Engineering Plan Review Submittal Requirements

3.1 Survey: All designs shall be based on a complete topographic survey including surface and subsurface features, existing utilities, and all property line information on the City's coordinate system (see Appendix D). Record information on existing utilities and street improvements is available from the City. Although this information can be used to assist in determining capacity constraints during conceptual design, all record information must be field verified through design surveys. Surveys must extend beyond the site boundary an adequate distance to determine grading and any other potential impacts to surrounding properties with an absolute minimum of 50 feet.

3.2 Construction Site Permit Submittal Requirements

3.2 A. Construction Site Permit Application and Review Fees

3.2 B. Stormwater Management Calculations stamped by an Oregon Professional Engineer including:

1) Stormwater Management Plan (see Section 4.5 B)
2) Drainage area maps (to scale) showing entire contributory area(s) and clearly delineating all calculated sub-areas and time of concentration routes,
3) Documentation of all assumptions,
4) Adequate detail to allow confirmation that calculations meet design criteria in these Engineering Standards.

3.2 C. Design Engineer's estimated project cost (in unit prices) for all proposed infrastructure. (Note: This is not for final plat approval; please refer to HRMC Title 16 for final plat approval requirements.)

3.2 D. List of all changes made to the drawings since the last City Engineer's review, if applicable.

3.2 E. Two (2) sets of construction drawings, 22" x 34" or 24" x 36" bound sets. If the drawings are reproduced on 24" x 36" paper, the drawing border shall be appropriate for a 22" x 34" sheet so that the plans can be half-sized to 11" x 17". The drawing submittal shall address all design criteria in Section 4 and shall include the following drawings as applicable.

- Cover Sheet
  Project name, Owner, Developer & Design Engineer with contact information for each, Vicinity Map, Legend, Specific notes as listed in Section 3.6, Sheet Index, Utility Owner and City Engineer Signature Blocks

- Roadway Typical Section(s) and General Notes

- Site Plan – Streets, Utilities, Storm Drainage

  Survey control, right-of-way and property lines, and easements (existing and proposed); existing and proposed streets, curbs, walks, ramps, driveways, utilities and appurtenances; and natural features including wetlands, floodways and floodplains.

- Grading & Erosion Control Plan

  Existing and proposed contours, drainage systems, building elevations where appropriate, protection of all existing trees and/or vegetation, and all erosion control measures (temporary and permanent).

- Plan & Profile Sheets for Streets, Stormwater Systems, Sanitary Sewers, and Water Systems

  These sheets shall contain **all information** necessary for staking and construction of these items including:

  Streets & Stormwater Plan & Profiles:
  - ◊ all tie-ins to existing streets and stormwater facilities,
  - ◊ super-elevations and cross-slope transitions,
  - ◊ curb return profiles,
  - ◊ driveway locations,
  - ◊ limits of overlay work if any,
  - ◊ location of all low points of street grades and curb returns,
  - ◊ grading limits,
  - ◊ all existing and proposed stormwater structures including upstream and downstream systems as required to show conditions affecting the design,
  - ◊ numbering system for all proposed stormwater structures consistent with the Capitol Facilites Plan,
  - ◊ all existing and proposed utility crossings shall be shown in profile (note: if a private utility has not been located vertically, the horizontal location of the crossing shall be shown on the profile at minimum.),
  - ◊ all special ditch profiles,
  - ◊ all sanitary and water lines in "background" linestyle on plan and profiles so that conflicts can be clearly seen.

  Sanitary Sewer & Water Plan & Profiles:
  - ◊ all existing and proposed structures and appurtenances including upstream and downstream systems as required to show conditions affecting the design,
  - ◊ numbering system for all proposed sanitary structures consistent with the Capitol Facilites Plan,
  - ◊ tie-ins to existing sanitary and water systems,

- ◊ all existing and proposed utility crossings shall be shown in profile (note: if a private utility has not been located vertically, the horizontal location of the crossing shall be shown on the profile at minimum),
- ◊ all stormwater lines in "background" linestyle on plan and profiles so that conflicts can be clearly seen

- Private Utility Plan
  Location of all proposed power, phone, gas, cable, etc… not owned by the City including a cross section showing these facilities in relation to the street.

- Signing, Pavement Marking, and Lighting Plan
  Location of all proposed street signs, pavement marking, street lights, and traffic signals including conduit and other related items.

- Details
  Project specific and applicable standard details.

3.3 Clarity of Drawings: It is the Design Engineer's responsibility to prepare Construction Drawings that are clear and concise and easily followed by both City reviewers and the Contractor. To this end, the following minimum requirements shall be met:

3.3 A. North arrows shall be included for all plan views.

3.3 B. Drawing scales as appropriate to show the work clearly. It is recommended that scales do not exceed 1" = 20' for City street and utility plan/profiles unless a larger scale is more appropriate for the specific conditions and is approved by the City Engineer. Vertical scale on profiles shall be 1/10 the horizontal scale typically, ie. 1"= 20' horizontal with 1"= 2' vertical.

3.3 C. Linetypes will be appropriately selected so that the intent of each sheet is easy to follow, ie. on Storm Drain Profile sheets, sanitary and water lines are shown but in the background so that the Storm Drain linework and text is easy to follow.

3.3 D. Letter size shall not be smaller than .08" high, preferably .1".

3.4 Private Utility Coordination: All potential conflicts with private utilities must be addressed prior to submission of the final (100%) plan submittal. Final plan submittal shall include completed signature blocks for all private utilities. The Design Engineer or Applicant shall be responsible to coordinate with all non-city-owned utilities to resolve conflicts and obtain signatures.

3.5 Electronic Drawing Submittal Requirements (Record Drawings only)

See Appendix E for requirements.

3.6 Cover Sheet Notes

The following notes shall be included on the Cover Sheet of all projects:

3.6 A. All materials and workmanship shall be in accordance with the City of Hood River Engineering Standards, the ODOT/APWA Oregon Standard Specifications for Construction, and the AWWA Standard Specifications. In case of conflicts, the City's Engineering Standards shall apply unless specifically listed as a Design Exception on this Drawing.

3.6 B. All late-season AC paving (placed after October 15th and before April 1st), shall be held to the same performance criteria as all other paving. If for any reason there is aggregate separation, a rough finished surface, or other non-acceptable final product and the City Engineer determines that it is not in the best interest of the City to reject the work and have it removed and reconstructed, the City Engineer may require an asphalt seal coat or other remediation on the entire surface or portions thereof.

3.6 C. Design Exceptions

4. Design Criteria

4.1 General

4.1 A. General Design Guidelines

All public improvements shall be designed as a logical part of the development of the surrounding area. Conveyance and distribution pipes (storm drains, sanitary sewers, and water mains) and street improvements shall be designed and constructed to provide adequate capacity of public facilities, which means, at a minimum, being able to accommodate the entire area the facilities will ultimately serve. The Capital Facility Plans shall be used as a guideline in determining the extent of the service areas. Additional studies may be required by the City Engineer. All utilities and street improvements shall be extended to the boundaries of the site to provide for future extensions to the adjoining properties.

The City has a number of tools that may be available to the owner/developer pursuant to which they may be able to obtain reimbursement or credit for public improvements that benefit others or that are constructed with excess capacity. These include system development charge credits, reimbursement districts, or developer agreements with the City.

4.1 B. City Utility Easements

1) All city utilities shall be placed within the public right of way. A design exception is required for all city utilities on private property.

2) All city utilities on private property shall be located in easements. The easement shall be a minimum of 15-feet-wide and there shall be a minimum of 5' from center of utility to edge of easement.

3) An all-weather access road shall be constructed for all city utilities constructed outside of the right-of-way. The all-weather access road shall be a minimum of 15-feet-wide with a minimum of 4" of aggregate base or such depth as required to support a 50,000-pound vehicle. The access road shall be shaped to promote drainage and shall not cause ponding of storm water.

4.2 *Work within City Right-of-Way*

4.2 A. General

1) All work within right-of-way shall conform to the requirements of Section 4.3: Grading and Erosion Control.
2) All existing survey monuments within the limits of work shall be protected during construction. If monuments must be relocated and/or replaced to complete the work, the monument(s) shall be relocated and/or replaced by an Oregon licensed Land Surveyor.
3) All existing utilities shall be located using the Oregon One-Call (1-800-332-2344) prior to the commencement of any work.
4) Care shall be taken during construction to protect all existing utilities from damage. If relocation of utilities is required, the Applicant shall be responsible for all coordination with the Utility Owner and any costs not borne by the Utility Owner. The plans shall clearly show protection and/or relocation of any facilities within or adjacent to the public right-of-way.
5) Upon completion of all work within the right-of-way, all areas affected by construction shall be restored to the same or better condition as they were prior to the start of work.
6) No surplus or excavated materials will be stored or allowed to remain within the right-of-way at the end of each work day unless specifically approved by the City Engineer in writing.

4.2 B. Maintenance of Traffic During Construction

1) Access to private driveways shall be maintained during construction. Any temporary closures required for phasing of construction shall be coordinated directly with the affected property owners.
2) Access to fire hydrants shall be provided at all times.
3) Temporary traffic control measures and devices (barricades, lights, warning signs, flaggers, etc…) shall be in accordance with the Oregon Department of Transportation's Short Term Traffic Control Handbook.
4) A traffic control plan is required for all work in or on all public rights-of-way. A copy of the traffic control plan to be implemented during construction shall be submitted to the City Engineer for approval no less than 5 working days prior to start of work.

4.2 C. Street Openings and Excavations

1) All excavation will be by open cut from the surface, tunneling or other means will be permitted by design exception only.
2) All excavations shall conform to Occupational Safety and Health Association, OSHA, regulations.
3) No excavation shall be left open and unattended at any time including the end of a work day.

4) No opening or excavation in any street shall extend beyond the centerline before being backfilled and the surface restored or temporarily surfaced.
5) No more than 150 feet of trench, measured longitudinally, shall be opened at any one time, except by written approval of the City Engineer.
6) Rock excavation, where drilling and blasting is required, shall comply with Chapter 33 of the International Fire Code as adopted by the Oregon State Fire Marshall's Office. The Applicant will be required to obtain blasting permits from the Fire Marshall.
7) All pavement cuts, backfilling, and resurfacing shall be in conformance with the City's most recent Standard Details.

4.2 D. Required Notices & City Observation

1) The Contractor shall provide a minimum 48-hour advance notice to the City Engineer prior to the start of any work and also before excavation, backfilling, and surface restoration work. Notice may be by phone or fax. The City Engineer will observe each of these operations. The City Engineer will not approve any work that is not observed.
2) If the work will affect the use of properties abutting or adjoining the project, the Applicant shall notify the affected property owners and/or tenants upon issuance of the Construction Site Permit. The Contractor shall notify these same owners a minimum of 48-hours in advance of the work.
3) If the work to be done will affect other subsurface utilities, the Applicant shall notify the utility owners prior to start of work.
4) The Applicant shall notify all public transportation facilities (including Fire, Police, and School District) of all street openings which might affect, interrupt or restrict traffic flow.

4.2 E. Additional Requirements

The City Engineer may have additional requirements depending on the size, nature, and location of the work. Such requirements may include but shall not be limited to:

1) Limitations on the time of the year in which the work may be performed.
2) Designation of routes upon which the materials may be transported.
3) More extensive public notice requirements when construction may impact the traveling public.
4) Regulations as to the use of streets in the course of the work.
5) Restrictions as to the size and type of equipment used.
6) Noise restrictions.

4.3 *Grading and Erosion Control*

4.3 A. Establishing Site Grades and Elevations

1) Elevations and grade are based on site conditions existing prior to any site work being done and are determined from aerial topographical information on file with the City Engineering Department.

4.3 B. Site Grading Plan

1) A plan depicting the proposed grading shall be required for all projects requiring a detailed engineering plan review (2.2c).

2) The plan shall include:
   - Existing contours at a minimum of 2' intervals (1' for sites with an average land slope less than 5%) extending a minimum of 25 feet beyond the boundaries of the site
   - Proposed contours will be required when the cuts or fills have the potential to impact surrounding properties and/or the grading plan is an integral part of the stormwater drainage design for the site
   - Grading limits
   - Location of all existing and proposed structures including buildings and retaining walls
   - Finished Floor elevations for buildings when appropriate
   - All natural features including wetlands, floodways, floodplains, large trees (>6" in diameter at breast height, dbh), and dense vegetation
   - All existing and proposed drainage systems and erosion control measures including swales & channels
   - At a minimum, drainage arrows depicting the proposed direction of flow for all individual lots including those lots not graded as part of the initial construction.

4.3 C. Grading Policies and Criteria

1) No cut or fill work may be undertaken on a site without first obtaining a Construction Site Permit as required by these Standards (see Section 2.2). A person who undertakes cut or fill work without a permit will be required to restore the site to the condition, including elevations and grade, existing prior to the unauthorized work.
2) Cut and/or fill slopes shall not exceed a 2-foot horizontal to 1-foot vertical slope (2:1) without a site specific soils engineering or engineering geology (or both) study. The study, signed and sealed by the appropriate registered professional, must state that the site soils have been investigated and that a steeper slope will be stable. All recommendations of the report must be adhered to in the site design

and construction in order for the City Engineer to consider allowing the design exception.

3) All fills shall be placed in 6"-12" lifts and compacted to accepted engineering standards sufficient to support the structure(s) intended.
4) Any proposed fills on an existing slope shall be constructed by benching the existing slope and placing the fill from the bottom to the top of slope. Consult with a qualified geotechnical engineer to determine the specific details required for the site conditions.
5) The limits of construction shown shall allow for sufficient room for the Contractor to construct the cuts and fills along the perimeter of the site while not encroaching on adjacent properties or a temporary construction agreement shall be obtained from the adjacent property owner.

4.3 D. Erosion Control Measures

Refer to the Oregon Department of Transportation Hydraulics Manual Volume 2: Erosion and Sediment Control for a detailed description of Best Management Practices (BMP's) for selection and implementation of the appropriate measures for erosion and sediment control.

1) All projects shall maximize utilization of the following erosion **prevention** measures in the order shown so that the need for runoff and sediment control measures are minimized:
   a) Phasing and timing of construction to minimize the potential for erosion.
   b) Preserve natural vegetation
   c) Maintain existing and create new natural buffers
   d) Installation of permanent seeding as soon as practical
   e) Mulching
   f) Sod
   g) Matting
   h) Dust Control
   i) Plastic Sheeting

2) As a minimum, all plans shall address the following items:
   a) All clearing limits (limits of construction) shall be flagged prior to initial clearing.
   b) Construction timing and phasing such that it minimizes the potential for erosion.
   c) Stabilized construction entrance(s) which will be the sole means of ingress and egress from the site will be constructed prior to initiating construction.
   d) All stockpiles and staging areas shall be stabilized such that no material erodes into the adjoining street or property.

e) Slope stabilization measures (for all slopes 3:1 and steeper) shall be initiated within 7 calendar days after earthmoving activities have temporarily or permanently ceased in that portion of the site.

f) Sediment Control measures (silt fence, wattles, erosion control matting, inlet protection, sediment traps & basins etc…) for both temporary and permanent conditions as required for the individual site are clearly shown and are consistent with the guidelines in the ODOT Hydraulics Manual Volume 2.

- Inlet protection measures will be consistent with ODOT Table 3-8 for the specific site conditions.
- Calculations for sizing of structural controls such as sediment traps and basins will be required and included in the Drainage Report.
- Verification that other measures such as erosion control matting are being used appropriately may also be required.

g) Establishment of all permanent cover through hydro-seeding or other appropriate means shall be clearly shown.

h) It shall be the responsibility of the Contractor (and ultimately the Applicant) to ensure that all sediment controls are being maintained throughout construction.

3) The following standards shall apply to all erosion control measures. The following general notes shall be included on all plans submitted for a <u>detailed engineering review (2.2c)</u>:

a) The erosion control measures shown on the plan should be used as a guideline only, erosion control measures may need to be added or altered depending on construction methods, staging, site conditions, weather, and scheduling.

b) The Contractor is responsible for control of sediment transport within project limits during construction and until the site is permanently stabilized. If an installed erosion control system does not adequately contain sediment on site, then the erosion control measures must be field adjusted by the Contractor as necessary for expected storm events to ensure that sediment laden water does not leave the site.

c) The implementation of these Erosion and Sediment Control, ESC, plans and the construction, maintenance, replacement and upgrading of these ESC facilities is the responsibility of the Contractor until all construction is complete and approved, and vegetation is established.

d) The ESC facilities shall be inspected by the Contractor and maintained as necessary to ensure their continued functioning.

e) The Contractor shall seed and mulch all cut and fill slopes, and all disturbed ground areas. The Contractor shall be responsible for the seeded areas until

vegetation upon them is established. Any additional seeding necessary to establish vegetation shall be done by the Contractor.

f) The Contractor is solely responsible for protection of all adjacent properties and downstream facilities from erosion and siltation during the course of the work. Any damage resulting from such erosion and siltation shall be corrected at the sole expense of the Contractor.

g) Stabilized construction entrances shall be installed at the beginning of construction and maintained for the duration of the project. Additional measures may be required to insure that all paved areas are kept clean for the duration of the project.

h) In areas subject to surface and air movement of dust, one or more of the following preventative measures shall be taken for dust control:
   i. minimize the period of soil exposure through the use of temporary ground cover and other temporary stabilization practices.
   ii. sprinkle the site with water until the surface is wet, repeat as needed.
   iii. spray exposed soils with an approved dust palliative. note: used oil is prohibited as a palliative.

i) Prior to any site excavation, all existing and newly constructed storm drainage inlets shall be protected as shown in the details to prevent sediment from entering the storm drainage system prior to permanent stabilization of all disturbed areas. Clean the filter as necessary to maintain drainage. Provide approved traffic control devices as necessary. Remove filter and clean catch basins following completion of all sitework.

j) At no time shall more than 12" of sediment be allowed to accumulate within a trapped catch basin. All catch basins and conveyance lines shall be cleaned prior to paving. The cleaning operation shall not flush sediment laden water into the downstream system.

k) Install silt fences at the toe of all fill slopes before construction starts. Remove all silt when it becomes greater than 12" at the silt fence. Remove all silt and silt fences after completion of the project and after vegetation has been permanently established.

4.3 E. Temporary Rock Crushing

1) Temporary rock crushing for on-site construction is permitted with an approved Construction Site Permit. The following standards must be met:

a) The subject property must have received site plan, tentative plat, or final plat approval for the construction activity, or is an approved public facility project.
b) The rock crushing equipment must have a valid Oregon Department of Environmental Quality air containment discharge permit.
c) The crushing equipment must be capable of processing material meeting Oregon Department Of Transportation "three quarter (3/4) minus" specifications.
d) No off-site material shall be brought on-site for crushing.
e) The rock crushing equipment must be removed from the site within fifteen (15) days of completing the crushing activity.
f) The rock crushing equipment must be set up as far as practicable from any property line or existing residence, but in no case shall the setback be less than one hundred fifty (150) feet.
g) The duration of the temporary rock crushing activity shall be for no more than sixty (60) consecutive days from the issuance of the permit unless the applicant obtains an extension of time from the City Engineer.
h) Rock crushing shall occur Monday through Friday between 8:00 AM and 5:00 PM, and not on legal holidays.
i) Water must be available to provide dust control.

2) An application for temporary on-site rock crushing activities shall contain the following information:

a) A detailed explanation of the proposed construction and rock crushing activities including:
   - An approved grading/clearing plan.
   - An estimate of the amount of material to be processed.
   - The amount of material to be used on site and the amount to be removed, if any.
   - The duration and operating characteristics of the rock crushing activity.
   - An explanation for how the proposal will reduce truck trips or otherwise benefit the community.
   - A list containing the names, phone numbers, and addresses of all property owners adjacent to the site property.

b) A map drawn to scale showing:
   - The location of the property boundaries.
   - The location and ownership of adjacent properties.
   - The truck travel routes for vehicles accessing the site and rock material being removed from the site.
   - The destination site for material being removed.

- Setbacks to the rock crushing activity.
- Any topographic features in the immediate vicinity of the rock crusher.

c) Any additional information which will assist in the evaluation of the proposed temporary rock crushing.

d) The application shall be processed pursuant to the City Engineering Standards for a Construction Site Permit.

4.4 *Roadways*

4.4 A. Road and Bike Lane, Sidewalk, and Planting Strip Requirements

1) See HRMC Title 16: Land Divisions for the street typical sections by street classification. These are the minimum lane widths and right-of-way requirements, additional right-of-way and traffic lane width and number of lanes may be required to accommodate turning movements at intersections and as identified through traffic studies for proposed projects. The street classifications are listed in the Transportation System Plan, TSP.

2) Structural Section: The minimum street section shall conform to the section as shown in the Standard Details. Site-specific pavement designs may be required by the City Engineer for proposed roadways under conditions such as the following:

   a) Unusually high traffic volumes or percentage of trucks are anticipated
   b) Oversized or overloaded trucks are expected on a regular basis
   c) Site soils are unusually poor for the area
   d) Construction is staged such that the roadway will receive traffic prior to placing the final lift of asphalt pavement.
   e) Requirements imposed by other governing jurisdictions (ie. Hood River County, ODOT,…)

3) Public Street Improvements:

Depending on the level of development, half-street or full-street improvements along the property frontage or beyond may be required.

The City has a number of tools that may be available to the owner/developer pursuant to which they may be able to obtain reimbursement or credit for public improvements that benefit others or that are constructed with excess capacity. These include system development charge credits, reimbursement districts, or developer agreements with the City.

4) Traffic Studies – See HRMC Title 16 for traffic study requirements.

4.4 B. Horizontal and Vertical Geometrics

Reference HRMC Title 16.12.060 B: Transportation Standards for requirements for street alignment and connection, intersection layout, cul-de-sacs, driveways, and other relevant criteria not included here.

1) Horizontal Curves – Centerline radii shall not be less than the following:

Arterials	700 feet
Collectors	500 feet
Local Roads	100 feet

There shall be a minimum 100-foot tangent section between reverse horizontal curves on arterial and collector streets.

2) Intersection Layout

a) Street intersections shall be as near to right angles (90°) as possible except where site constraints require a lesser angle, but in no case shall the acute angle be less than 75°. The right-of-way line along the acute angle shall have a minimum corner radius of twenty (20) feet.

b) There shall be a minimum 50 foot of tangent from the centerline of the intersection to the beginning of a horizontal curve.

c) A minimum landing length of 20 feet from the intersecting edge of pavement at a maximum grade of 5% shall be provided at all new intersection approaches.

d) Right-of-way lines at intersections with arterial streets shall have a minimum corner radius of twenty (20) feet.

3) Grades

a) All grades exceeding 8% shall require a design exception. In no case shall grades exceed the following:

Arterials	10 %
All other roads	12%*

*Local roads and residential access roads may have segments with grades up to 15% for distances of no more than 250 feet.

b) Minimum slope for drainage control at the gutter line for all streets is 0.5%, with 1% preferred. In all cases where less than 1% is used, a Design Exception shall be required.

4) Vertical Curves – The minimum vertical curve length for sag and crest curves shall be as determined by the AASHTO formulas in *The Policy on Geometric Design of Highways and Streets* for the design speed and condition.

5) Tapers & Flared Roadways

a) For travel lane shifts, the taper lengths shall conform to the following per the MUTCD manual:

Speeds under 45 mph $L = WS^2/60$

Speeds over 45 mph $L = WS$

where L = length of taper (feet)
W = width of taper (feet)
S = design speed (mph)

b) For addition of a right turn lane and/or left turn lane, a 15:1 approach taper shall be used, L = 15W, unless a site specific constraint requires a shorter taper for storage reasons. Appropriate reverse curves per AASHTO recommendations may be allowed as an alternative.

6) Cross-slopes and Superelevation

a) All streets shall be crowned with 2% cross-slopes.
b) All cross-slope transitions (ie. intersection approaches) shall be clearly shown on the roadway profile and shall be designed in accordance with AASHTO recommendations per the design speed. The plans shall specifically address any stormwater drainage issues created by the transitions.

7) Curb Returns

a) For the intersection of two local streets, the minimum allowable curb radius shall be 20 feet, measured from the radius point to face of curb. For the intersection of a local street with any collector or arterial, the minimum radius shall be 25 feet. On all other intersections, the minimum allowable radius shall be 30 feet.

Radii of 40 feet or more shall be provided where large truck combinations and buses turn frequently. Radii of 40 feet or more shall be designed to fit the paths of appropriate design vehicles.

b) All curb return geometrics, both horizontal and vertical, shall be shown on the plans. Elevations given in a table at ¼ points may be sufficient to show the grades.

8) Sight Distance –

In accordance with AASHTO *Policy on Geometric Design of Highways and Streets*:

- All streets shall meet adequate stopping sight distance.
- All collectors and arterials shall meet adequate intersection sight distance.

4.4 C. Sidewalks – When sidewalks will be constructed with the individual buildings or homes, the Applicant shall be required to install all handicap ramps as part of the infrastructure construction.

4.4 D. Narrow Street Sections – For all proposed streets less than 30-feet wide, it is recommended that the location of all utilities (both public and private) shall be shown in concept during the planning stages for conceptual agreement by the City Engineer prior to development of construction drawings.

4.4 E. Asphalt Concrete Pavement (AC Paving)

1) All AC paving, regardless of the time of year the paving is placed, shall be held to the same performance criteria. If for any reason there is aggregate separation, a rough finished surface, or other non-acceptable final product and the City Engineer determines that it is not in the best interest of the City to reject the work and have it removed and reconstructed, the City Engineer may require an asphalt seal coat or other remediation on the entire surface or portions thereof.
2) In no case shall the ratio of asphalt lift thickness to maximum aggregate size be greater than 5 or less than 3.
3) The maximum aggregate size in the final lift of AC paving **shall be less than ¾".**
4) Compaction of both asphalt and base rock shall conform to the Standard Drawing, "Street Detail".

4.5 *Stormwater Management*

4.5 A. General

1) Applicability: This criteria is applicable when one or more of the following criteria apply:

   a) Excavation and/or imported fill (borrow) exceeds 250 cubic yards.
   b) 3,000 square feet or more of new impervious surface will be added to the site (i.e. new 3,000 square foot parking lot replaces existing pervious surface).
   c) A combination of 6,000 square feet or more of impervious area will be added and/or reconstructed (ie. 4,000 square foot of existing building reconstructed with expansion of a new 2,000 square foot parking lot).
   d) Storm water infrastructure will be constructed and dedicated to the City.
   e) Private storm water infrastructure will be constructed.
   f) The site will be converted to a facility that will potentially affect downstream water quality (ie. fueling station).

   This criteria does not apply to single family homes or duplexes within existing sub-divisions that have approved stormwater plans which mitigate the stormwater runoff created from lot development, unless the approved stormwater plan included individual lot on-site stormwater management such as detention, retention, or other best management practices (BMP)s . This criteria is applicable for private storm water infrastructure as it pertains to the quantity and quality of stormwater runoff leaving the site.

2) Other Agency Reviews: Other agencies may require drainage review. The policies in this manual shall not relieve the Owner from complying with the requirements of any federal, state, or local authority with jurisdiction over a development (e.g. ODOT, Oregon DEQ, Oregon DSL, Army Corps of Engineers, Oregon Department of Fish and Wildlife, U.S. Fish and Wildlife, and Hood River County)

3) Recognizing that the field of storm water management, both regulatory and design, is continually evolving in an effort to provide more effective long-term solutions to managing storm water, the following standards are intended to set the minimum criteria which must be met but are in no way intended to limit the ingenuity and creativity of either the Applicant or Design Engineer for a specific site.

4.5 B. Storm Water Management Plan

1) As part of the Pre-submittal process it is required that the Applicant or their Design Engineer prepare a planning-level concept for the development's storm drainage system and best management practices (BMP's).

2) A Storm Water Management Plan is required and shall include:
   a) **Project Overview** briefly describing the nature and goals of the project with a vicinity map showing the location of the project site.
   b) **Existing Conditions Summary** including a topographic map and narrative describing existing drainage patterns of the site and surrounding areas. The map shall cover all areas presently draining to the site as well as adjoining and downstream areas that may be impacted by the development. The map shall indicate total site acreage, existing land use, drainage courses, flow direction, drainage basins, any existing development and/or drainage facilities, and information regarding areas such as wetlands that may require additional permits.
   c) **Proposed Improvements Summary** shall include a map and narrative showing proposed improvements as relevant to the storm water management plan. Include drawings as needed to show proposed topography (drainage arrows may be sufficient), structures and impervious areas, existing and proposed drainage infrastructure and other BMP's.
   d) **Operation and Maintenance Plan, O&M Plan,** shall describe the maintenance requirements and who will be responsible for operation and maintenance of all proposed storm water facilities. If the City will not provide maintenance, the O&M Plan shall describe the method of providing a financial guarantee to the City for the operation and maintenance of the facility. Public ingress/egress easements shall be provided for all stormwater facilities (both public and private) which require maintenance. The easement shall be a minimum of 15-feet-wide and shall have an all-weather access road as described in Section 4.1B.

3) The detail of the Storm Water Management Plan will vary greatly depending on the complexity of the site. The information shall be presented in a clear and concise format commensurate to the complexity of the site and sufficient to convey to the reviewer that the proposed design concept is feasible and will meet City standards if designed and constructed appropriately. It is in the discretion of the City Engineer or his/her designee to determine whether the proposed stormwater management design adequately addresses the following questions or if criteria additional to that in this section is required to provide safe and effective mitigation measures for the concentration of natural rainwater resulting from the proposed development. The following types of questions shall be addressed:

   - Where will the flows discharge? Are additional permits required?
   - Are all off-site flows addressed?
   - Is detention required? How will this be addressed?
   - How will the proposed plan protect water quality?
   - Is erosion control a significant concern? If so, how will this be addressed?
   - Will any of the proposed facilities be maintenance intensive? If so, how will this be addressed?

4.5 C. Determination of Design Flows and Volumes (Hydrologic Analysis Methods)

1. Acceptable Methods
   a) Rational Method for sizing of conveyance systems only where attenuation effects of existing storage are ignored.
   b) Hydrograph Technique such as the Soil Conservation Service Unit Hydrograph (SCS) or similar method for volume and/or time-dependent analysis such as detention and water quality flows and volumes.

2) Rainfall
   a) Rational Method - use the ODOT Zone 5 IDF curves in the ODOT Hydraulics Manual
   b) SCS Method – Type 1A storm using the NOAA Atlas 2 Isopluvials for the 2, 5, 10, 25, 50, and 100-year 24 hour storm as follows:

Storm	P (inches)
2	1.8
5	2.3
10	2.8
25	3.3
50	3.8
100	4.3

   c) Water quality design storm - .6" in 24 hours

3) Soils Information

Hydrologic soil groups shall be determined from the SCS Soil Survey of Hood River County or as determined by a soils report prepared by a qualified professional engineer, geologist, or soils scientist.

4) Runoff Coefficients and Curve Numbers
   a) Rational Method runoff coefficients shall be determined from the table in the *ODOT Hydraulics Manual*
   b) USDA NRCS *Urban Hydrology for Small Watersheds Technical Release 55* (TR55) shall be used for developing Runoff Curve "C" numbers, but C values listed in TR55 for various residential lot sizes shall not be used. Designers must supply the anticipated maximum impervious areas that will be developed for each lot/parcel. Runoff from impervious areas such as streets, sidewalks, and roofs shall be calculated independently of pervious areas. The separate impervious and pervious hydrographs shall be combined to calculate the runoff at a particular location and to size stormwater management facilities.

In no case shall curve numbers with a difference of more than 10 be area averages together.

5) Time of Concentration

a) Time of concentration, the time it takes for runoff to travel from the hydraulically most distant point in the watershed to the point of reference downstream, shall be calculated according to the methods in the *ODOT Hydraulics Manual* or the *TR-55: Urban Hydrology for Small Watersheds* with a minimum time of 5 minutes.

b) Travel times for sheet flow, shallow concentrated flow, open channel flow, and pipe flow shall be included as applicable.

4.5 D. Sizing of System Components (Hydraulic Analysis Methods)

1) General

a) Where a site presently receives flow from upstream properties, the site shall be designed to provide for conveyance of these same flows through the site in a manner consistent with these Engineering Standards while preserving existing streams and channels in their existing condition wherever possible.

b) The design shall minimize existing site disturbances, maintain areas of existing sheet flow discharge, minimize the creation of new impervious surfaces, and lengthen the post-development time of concentration wherever feasible.

c) In general existing sheet flow shall not be concentrated and discharged onto adjacent property, If flows are concentrated they must be redistributed over the downstream area to emulate the existing down gradient runoff hydrograph.

d) Sizing of all conveyance systems within ODOT jurisdiction (ie. City arterials and culverts under Interstate 84) shall conform to ODOT criteria.

e) All portions of the storm water system intended to meet quantity and quality controls shall be constructed separately from the City's conveyance system. (e.g. Utilizing the City's conveyance pipes for detention is not acceptable.)

2) Outlets

a) Appropriate Discharge Location – All surface and storm water runoff from a site must discharge directly into the City storm drainage system or other approved discharge location. The Applicant must document that adequate downstream conveyance facilities exist to safely transport the concentrated discharge without causing erosion, sedimentation, flooding, or other harm. If the downstream system does not have sufficient capacity to handle the flows or increased volume from the site or is a documented problem area (see Capital Facilities Plan), the Applicant will not be allowed to connect to the system without the necessary improvements to relieve the documented

problems or proof that the proposed improvements will not worsen the existing conditions (note: increasing volume to downstream systems will likely result in increased duration of flooding even if peak flows are not increased). Storm water runoff may not be diverted from one drainage basin to another. If this is proposed for any reason, the Applicant must document the ability of the downstream system to safely convey the additional flows without causing erosion, sedimentation, flooding, or other harm.

b) Outlet Protection – The receiving channel at the outlet shall be protected from erosion. A rock lining, as specified in the following table, is generally acceptable:

Design Flow Discharge Velocity (fps)	**Required Protection (Minimum Dimensions)**				
	Type (ODOT/ APWA Specs)	**Thickness (feet)**	**Width (feet)**	**Length (feet)**	**Height (feet)**
0-5	Riprap Class 50	1	Diameter + 6 ft.	8 ft. or 4X Diameter, whichever greater	See Note A
>5-10	Riprap Class 100	2	Diameter + 6 ft. or 3X Diameter, whichever greater	12 ft. or 3X Diameter, whichever greater	See Note A
>10	Site specific design by qualified engineer and approved by the City Engineer.				

Notes:

A. Crown + 1 foot.
B. Filter blanket or geotextile shall be placed under all riprap.
C. Engineered energy dissipaters including stilling basins, drop pools, etc… are required for design flow velocities exceeding 20 fps.
D. Design reference shall be included on the plan submittal for all design flow velocities exceeding 10 fps.

3) Sizing of Conveyance Systems

a) Inlets shall be designed for the 10-year storm and shall be spaced such that:
   - The maximum encroachment of runoff on the roadway pavement shall not exceed one half of the traveled lane during the design storm.
   - Bypass flow shall be limited to a maximum of 30 percent.
   - Runoff greater than 0.5 cfs does not flow across intersections (ie. catch basins placed just before the beginning of the curb radius)
   - Maximum inlet spacing of 350 feet where the inlets are used as junction structures for the conveyance pipes (acceptable for 18" diameter or smaller pipes).
   - Design is in accordance with methodology described in the *ODOT Hydraulics Manual*

b) Pipes
   - Local collector pipes shall be designed to convey the 10-year storm event by gravity flow. Additionally, pipes receiving flows from sumps (low points) on collectors shall be design to convey the 25-year storm event by gravity flow. Arterial pipes shall be designed to convey the 25-year storm event by gravity flow. More stringent criteria may be required by other agencies with jurisdiction on a given project.
   - A backwater and/or hydraulic grade line analysis may be required for a proposed or existing pipe system if tailwater conditions could potentially affect the ability of the system to carry the design flows. In the case of a system where private service lines are connected to the storm pipe network, calculations must show that the 100 year storm will not back up in the pipes to the point of connection at the building, or a backflow prevention or overflow device must be provided.

c) Channels
   - All channels shall be designed for the 25-year storm with 0.5-foot freeboard. These channels will also be required to contain the 100-year storm when overtopping of the channel could result in flooding of any structures or excessive damage to private property.
   - Sizing of channels shall be in accordance with the design methodology described in the *ODOT Hydraulics Manual.*
   - Channels shall be designed to provide required conveyance capacity while minimizing erosion and allowing for aesthetics and preservation of riparian habitat.
   - All channels shall be designed to be stable with flexible linings such as vegetation, riprap, temporary matting, etc… Reference the Federal Highway Administration *Design of Roadside channels with Flexible*

Linings for design methodology. The following table summarizes acceptable channel types based on design flow velocities.

Velocity at Design Flow (fps)	Channel Type	Min. Height above Design Water Surface	Maximum Side Slopes
0-5	Vegetative Lining	6 inches	3:1
>5 – 8	Riprap or Bioengineered Lining	1 foot	2:1
>8 – 12	Riprap	2 feet	2:1
>12 – 20	Site specific design by qualified engineer and approved by the City Engineer.		

- If the design velocity of a channel to be vegetated by seeding exceeds 2 fps, a temporary channel liner (erosion control matting) is required before the channel can be used to convey storm water.

d) Culverts
   - Roadway culverts shall be designed to carry the 25-year storm unless more stringent criteria is required by other governing jurisdictions.
   - For new culverts up to 18-inches in diameter, the maximum allowable design storm headwater (measured from the inlet invert) shall not exceed two times the pipe diameter and shall not overtop the road or driveway.
   - For larger culverts, the maximum allowable design storm headwater shall be a minimum of 1 foot below the road or parking lot surface.
   - Culvert design shall be in accordance with the design methodology described in the *ODOT Hydraulics Manual.* The Federal Highway Administration's *Hydraulic Design of Highway Culverts* is also a good reference.

e) Overflow Route – Plans must show that an overflow route exists for the 100 year storm allowing for a 1-foot freeboard above building finished floors.

4) Water Quantity Controls (Detention)

Water quantity control is required for all developments, new or existing, that add over 3,000 square feet of impervious surface area or for redevelopment projects with a combination of 6,000 square feet or more of new and/or redeveloped impervious area. Water quantity control is also required for all developments that ultimately flow through one of ODOT's culverts unless it can be shown by the Applicant that ODOT's detention criteria can be met without providing water quantity controls. Developments requiring water quantity control will require construction of detention or retention to limit runoff at the downstream discharge of the site to a rate less than or equal to the peak flow for the 2,10, and 25-year storms under existing conditions.

Existing conditions for redevelopment are forest, orchard, or field ground cover type, whichever was applicable when the original development was built.
If an acceptable channel or stormwater facility downstream does not exist, the applicant may be required, as a condition of approval, to build conveyance infrastructure to an approved stormwater conveyance facility. If the cost of building such infrastructure is considered disproportionate to the project cost and the design engineer can satisfactorily demonstrate to the City Engineer that the site layout, grades, and stormwater design will mitigate the potential for damage to properties immediately downstream of the development, the concentrated mitigated flows may be evenly re-dispersed over the original area where the existing runoff sheet flowed from the property. (Note: If the site discharges directly to an ODOT culvert, ODOT criteria shall apply.)

a) For sites not otherwise required to provide water quantity controls as outlined above:
   - Water quantity controls may be required if, in the opinion of the City Engineer, the downstream pipe or drainage course does not have sufficient capacity to convey the design storm.

b) For all sites regardless of size:
   - Limiting increases in post-development runoff is encouraged. Landscaping, landscape planters, vegetative filters, vegetated swales, porous pavement, and eco-roofs are examples of the types of systems that reduce runoff while also improving water quality. A good reference for the appropriate application of these types of systems is the *City of Portland Bureau of Environmental Services Stormwater Management Manual*.

Roof drains shall not be piped directly to the public or private stormwater conveyance systems unless site conditions warrant. Properly designed retention systems or splash blocks are preferred. It will be the Applicant's
   - responsibility to confirm that DEQ's Underground Injection Control, UIC, requirements are met.

c) Additional Quantity Control Requirements - The City Engineer may impose additional requirements for sites where existing downstream erosion or flooding problems may be aggravated due to increased total runoff volume. The additional measures may include but are not limited to:

   - Additional detention to further control peak flows (e.g. Applicant may be required to over-detain to match the capacity available in the downstream system.)
   - Retention of storm water rather than detention or a combined detention/retention system to limit discharge to predevelopment volumes.
   - Upsizing of downstream pipes to address the problem.

d) For small Pre-Development Flows, methods to decrease the post-development peak flows through lengthening of the time of concentration and use of surface infiltration facilities where appropriate are encouraged.

e) Control Structures
   - Appropriate screening devices shall be provided for all outlets with a clogging potential.
   - For open ponds, the minimum orifice size for quantity control facilities shall be two (2) inches. Buried detention facilities with filters protecting control structures should have an orifice not smaller than one (1) inch.
   - All detention or retention systems shall have an overflow designed to safely convey the 100-year design storm in case of clogging of the primary discharge.

f) Acceptable Systems
   - Ponds – Ponds are the most desirable alternative for detention facilities for water quality benefits, relative ease of inspection and access for maintenance. All ponds shall:
     - ◊ Maximize the flow length from inlet to outlet with a minimum length to width ratio of 2:1. Should site conditions necessitate short circuiting, additional water quality features may be required.
     - ◊ Have an emergency overflow capable of discharging the 100-year storm assuming the primary discharge is clogged.
     - ◊ Provide a minimum of 1-foot-freeboard above the design storm to the emergency overflow and 1-foot-freeboard between the emergency overflow and the top of berm.
     - ◊ Have sufficient depth such that the maximum design water surface in the pond is below the invert of the pond inlet pipe. If this is not possible, then a backwater analysis will be required to show that the pond backwater does not adversely impact the operation of the upstream storm drain system.
     - ◊ Have maximum interior slopes of 3:1 and be seeded with mixes that are water tolerant and require minimal mowing or do not need to be mowed. If the slopes are intended to be mowed, the interior slopes shall not exceed 4:1.
     - ◊ Have maximum exterior slopes of 2:1 unless they will be mowed, in which case they shall be 4:1 max.
     - ◊ Construction requirements for pond berm embankments addressing compaction, keys, lifts, etc… shall be clearly noted on the plans. The Owner will be responsible for addressing all slope stability issues and involving a qualified geotechnical engineer as necessary.
     - ◊ Have an access road to the pond for maintenance.

- ◊ Provide a minimum of 5 feet or ½ the berm height, whichever is greater, between toe of berm and adjacent property lines.
- ◊ Include fencing if required by the City Engineer (note: fencing is not desirable).
- ◊ Be designed to avoid standing water unless designed as a constructed wetland or wet pond.
- ◊ Be lined if necessary to protect downstream properties.

➢ Underground Pipes and Vaults – Underground detention pipes and vaults, although a more efficient use of land, provide less water quality benefit. The design engineer will include in his or her design adequate provisions for cleaning, accessing, and maintaining the buried facility and its flow control mechanisms. The design shall include methods for preventing or minimizing sediment and debris from entering the buried facility such as pretreatment devises and filtering mechanisms.

➢ Private Parking Lot Ponding

The following guidelines shall apply for parking lots used for detention volume:

- ◊ The depth of the detained water cannot exceed 0.5 feet at any location.
- ◊ The minimum gradient of the parking lot area subject to ponding shall be 2%.
- ◊ The emergency overflow path shall not create a hazard.
- ◊ Fire lanes used for emergency equipment shall be free from standing water.
- ◊ The parking lot shall remain functional during the design event (ie. pedestrian pathways to parked vehicles)

➢ Retention – Retention systems are an acceptable alternate to detention and can provide both water quantity and quality improvements when properly designed and constructed. These systems are only appropriate in specific conditions where the soils infiltrate well and the potential for groundwater contamination has been properly addressed. A report from a qualified geotechnical professional is required to confirm the site's suitability for the proposed systems. All retention facilities must comply with the Oregon Department of Environmental Quality UIC Rules and be approved by the City Engineer.

g) Design Methodology – There are many references describing accepted practices for the design of detention and retention facilities including the *Federal Highway Administration Hydraulic Engineering Circular 22: Urban*

Drainage Design Manual. The following minimum procedures shall be followed:

- Stage-storage and Stage-discharge calculations shall be used to model the proposed system. Typically, ½ -foot intervals provide a satisfactory model. Note that a prismoidal formula, or other accepted procedure, shall be required to determine the stage-storage curve for sloped pipes.
- The inflow hydrograph shall be routed through the detention/retention system using the Storage Indication method:
  Inflow – Outflow = Change in Storage

5) Water Quality Controls

Recognizing that the regulatory controls for non-point source pollution are steadily increasing, the following criteria are established as minimum measures and are expected to be updated on a regular basis.

Water quality treatment is required for all sites that add over 3,000 square feet of net new impervious surface area Water quality treatment is not required for infiltration systems receiving roof runoff from one single family home.

a) Design Criteria

- The water quality design storm = 0.6" in 24 hours
- The water quality volume and runoff rates are calculated using the net new impervious surfaces only. (Net new impervious surface = All new impervious surfaces minus existing impervious surfaces to be removed with the project.)
- All water quality facilities shall be designed to bypass or convey the larger storm events.
- Vegetation/plantings within the water quality facilities shall be appropriate for the intended use (ie. water tolerant, dense stand of vegetation, etc…). The construction plans will specify all plants and seed mixes and all installation requirements. Several current seed mixes and appropriate uses are included in Appendix F. Consultation with a landscape designer or biologist is recommended and may be required by the City Engineer depending on the proposed facility.

b) Acceptable Systems

The following systems are the most common acceptable facilities. Other types of facilities shall be approved on a case by case basis. Incorporation of Best Management Practices, BMP's, in the site design and the use of "natural" systems such as vegetated swales, vegetative filters, etc… incorporating bio-filtration are preferred. Additional stormwater treatment measures (oil separation etc…) shall

be required for sites converted to a use that is a potentially significant source of pollution.

- Extended Dry Pond
  - ◊ The water quality storm shall be released over a minimum of 48 hours.
  - ◊ The water quality storm shall be routed through the pond to size the pond and outflow controls or the following simplified approach may be used:
    - Use total effective runoff volume (V) of the water quality storm to determine the water quality storage requirements.
    - The water surface at the top of the water quality storage volume is used to determine the effective head, "H", to be used in solving for the required orifice size or other outlet control. The water quality storage outflow rate in cfs is Q = V/(48)(60)(60), where V is in cubic feet.
    - If this simplified approach is used for combined facilities (water quality and quantity controls), the water quality volume shall be assumed **full** prior to routing of the water quantity storm.
  - ◊ See additional criteria for Ponds in the Water Quantity Control section.
  - ◊ When the primary orifice is required to be less than 2" to meet the water quality criteria of this section, the secondary outlet shall be a weir or other non-clogging outlet control.

- Vegetated Swale
  - ◊ Minimum hydraulic residence time = 9 minutes preferred, 5 minutes minimum
  - ◊ Maximum Design Depth = 0.5 feet
  - ◊ Mannings "n" value = .24 (appropriate vegetation must be used)
  - ◊ Maximum velocity = 2 fps
  - ◊ Minimum length = 100 feet
  - ◊ Minimum slope = 0.5 %
  - ◊ Minimum bottom width = 4 feet
  - ◊ Maximum side slope = 4:1 (within treatment depth)
  - ◊ Include flow spreader where pipe enters swale and at 50-foot intervals

- Vegetated Filter Strips
  - ◊ Maximum length of impervious area flowing towards the filter is 60 feet.
  - ◊ Minimum length of filter in the direction of flow is 15 feet.
  - ◊ Width of filter shall be the same as the tributary area.
  - ◊ Maximum filter slope = 10%
  - ◊ Filter slopes greater than 5% require check dams at 5' intervals.

- ◊ Check dams, when required, shall be 3-5" high, constructed of durable, non-toxic material and run the full length of the vegetated filter.
- ◊ Flow spreaders may be required at the entrance to the vegetated filter, depending on site conditions.
- ◊ Filters shall be maintained with complete vegetative covering and shall be kept free of sediment build-up.
- ◊ All vegetated filter strips shall drain to an approved stormwater conveyance/disposal system.

➢ Alternative Water Quality Treatment Methods

- ◊ The basic treatment goal of the water quality treatment facilities is to remove 80% of total suspended solids for an influent concentration range of 100 mg/L to 200 mg/L. For influent concentration less than 100 mg/L the effluent goal is 20 mg/L total suspended solids. For influent concentrations higher than 200 mg/L, enhanced treatment at a higher level than 80% removal may be required. Proprietary water quality treatment methods approved for basic treatment are those listed in Washington State Department of Ecology's list of Stormwater Treatment Technologies Approved through the Treatment Assessment Protocol Program (TAPE) and Chemical Treatment Assessment Protocol Program (CTAPE) process.
- ◊ Calculations showing the pollutant removal capability of the structure for the specific site shall be required.
- ◊ An operation and maintenance manual shall be provided for all water quality structures to be maintained by the City.
  In General Water Quality Maintenance contracts with qualified providers will be required for the approval of priority systems

4.5 E. Storm Water Piping

1) Minimum pipe sizes are as follows:
   a) Mains & Culverts: 12 inches
   b) Laterals (catch basin to main): 10 inches

2) Materials shall conform to:
   a) Service laterals shall be **white** PVC, SDR 35 pipe meeting ASTM D3034 for pipes 4" through 8".
   b) Mains shall be PVC, SDR 35 pipe meeting ASTM D3034 for pipes 10" through 15" and ASTM F679 for larger pipes with gasketed bell end, or other approved materials.
   c) Acceptable materials for culverts may include HDPE, ADS N-12, concrete, CMP (aluminum or galvanized steel), or ductile iron pipe.
   d) It shall be the responsibility of the Design Engineer to specify the appropriate pipe for the design conditions (soil, depth, and design loadings).

3) Minimum cover is as follows:
   a) Mains & Laterals: 3 feet (except at catchbasins use standard detail)
   b) Culverts: 2 feet preferred, depth of pavement section minimum*

   *Note: All proposed culverts shall be designed to meet traffic loadings (HS-20) based on the cover provided and the material used.

4) Minimum pipe slopes are as follows:
   a) Mains and Laterals: Minimum desirable slopes for mains and laterals are 1% with an absolute minimum of .5%. In all cases where less than 1% is used, a Design Exception is required.
   b) Culverts: Minimum slope is .5%, 1% preferred.

5) Steep slopes – Pipes on slopes steeper than 20% shall be properly anchored.

6) Downstream decrease in pipe size is not a recommended practice and will only be allowed as a design exception.

7) Trash racks are required for all inlet and outlet ends of pipes 18" and larger accessible by the public.

4.5 F. Catch Basins and Manholes

1) Junction structures, typically manholes, shall be required at all changes in horizontal or vertical alignment and at all pipe intersections. Catch basins may be used in lieu of manholes for pipe diameters 18" and smaller

2) Maximum manhole spacing is 350 feet. The manhole floor elevation shall be no lower than 18' below the invert elevation of the exiting pipe.
3) Private storm sewer services shall be connected directly to the catch basins or the public main and not to publicly owned manholes.
4) Catch basin size or manhole diameter shall be determined by pipe size and orientation at the junction structure. A plan view of the junction structure, drawn to scale, will be required when angles of approach and clearance between pipes is a concern. The integrity of the structure to support the design loadings shall not be compromised. The minimum manhole diameter shall be 48 inches.
5) The Contractor shall be required to verify all existing invert elevations prior to making connections to existing structures or constructing new manholes over existing pipes. Any required changes to the plan must be approved through procedures defined in Section 2.
6) Steps shall not be allowed in manholes.

4.5 G. Provisions for Maintenance and Operation

1) The City will provide operation and maintenance on all publicly owned facilities.
2) If the City agrees to provide operation and maintenance for privately-owned storm water facilities, the private owner(s) will remain financially responsible for the operation and maintenance required and will enter into an agreement with the City to manage the funds. This agreement will be in place prior to final plat approval and shall be recorded with the deed for each individual lot/unit.
3) Public ingress/egress easements shall be provided for all stormwater facilities (both public and private) which require maintenance. The easement shall be a minimum of 15-feet-wide and shall have an all-weather access road as described in Section 4.1B.
4) Private storm drains within the public right-of-way that drain individual residences or other parcels to a City storm sewer system are the responsibility of the private owner. Driveway culverts across roadside ditches are the responsibility of the private owner.
5) As part of the Final Plan Submittal, the Design Engineer shall submit:
   a) a narrative detailing which portions of the proposed storm sewer system will be dedicated to the City, which will remain in private ownership, and easements (if any) that will be provided (with map if necessary).
   b) A detailed O&M Plan describing the required maintenance criteria (frequency of inspection, description of maintenance practices, etc…) for all water quality and quantity systems, and who will be responsible for maintenance of these facilities once the project is completed.

4.6 *Potable Water Systems*

4.6 A. Pipe Sizing & System Capacity

Pipe sizing shall be as shown in the Water Master Plan or as required to provide peak domestic demand with fire flow for existing, planned, and future development. Capacity and flow calculations may be required which meet the Department of Human Services, Drinking Water Program Regulations for specific sites. It is recommended that the Applicant meet with the City Engineer early in the process to discuss connection to the City's existing water system and determine if there are any existing system problems that would need to be addressed in order to provide adequate capacity to the proposed development.

1) Pressure: All water mains shall be designed to maintain a minimum pressure of 20 psi at ground level for peak day plus fire demand. Higher residual pressures may be required in areas of multi-story buildings or hilly terrain. Normal working pressures in the system shall be approximately 60 psi and not less than 35 psi.

2) Minimum distribution pipe size is 8 inches.

3) Fire Protection: All distribution systems shall be designed to provide the minimum fire flow as defined by the International Fire Code with modifications as may be required by the City Engineer and Fire Marshall.

4) Distribution piping shall be looped. When looping is not feasible and not required to meet minimum pressures, fire hydrants (preferable) or blow-off assemblies shall be placed at the end of the dead end line.

5) Pipeline velocities shall not exceed 8 fps under peak hourly demand flows.

6) Unless otherwise specified, all materials shall meet the appropriate AWWA standards.

4.6 B. Valves

1) Resilient Seat Gate Valves shall be provided to minimize inconvenience and sanitary hazards during repairs. Valves shall be located as follows:

   a) Maximum 600 foot spacing along mains
   b) In fire hydrant line at hydrant locations (locate close to main)
   c) In main at each branch location (on all legs)

2) Gate valves shall be used in mains less than 12". Butterfly valves shall be used for mains 12" and larger. A design exception will be required for all butterfly valves.

4.6 C. Hydrants

1) Fire Hydrants shall be Mueller Centurion and shall generally be located as follows:
   a) Within 250-feet of facilities to be served
   b) At or near every roadway intersection
   c) At a maximum spacing of 500 feet along mains.

   The Applicant shall be responsible for obtaining approval from the Fire Marshall for the location of all proposed fire hydrants.

2) Line size from main to Fire Hydrant shall be 6".

4.6 D. Air Relief Valves

Mains shall be designed to eliminate high points. If high points are unavoidable, hydrants shall be used in lieu of air relief valves at these locations.

4.6 E. Mains

1) All piping shall be PVC C-900 colored blue throughout the entire composition of the pipe. Pressure class of pipe shall exceed the anticipated operating pressures by a minimum of 50 psi. Consult with the City Engineer regarding operating pressures within the existing system. Under certain conditions, ductile iron pipe may be allowed with specific approval.

2) All fittings shall be compact ductile iron meeting the requirements of AWWA and NSF 61.

3) Minimum cover is 36 inches from finished grade to top of pipe. A minimum cover of 30" may be approved under certain localized situations on a case by case basis.

4) See Section 4.7 B 6) for water and sanitary sewer line separation requirements.

5) Thrust restraints (thrust blocks or restrained joints) shall be required at all tees, bends, plugs, hydrant, and blow-off locations per OAR Section 333-061.

4.6 F. Water Services

Single family residential services shall be ¾" seamless copper or CTS poly tubing. No splices shall be allowed in service lines. All other services shall be sized appropriately by the Applicant for the intended use.

Backflow prevention devices will be required in accordance with the City's cross-connection ordinance.

4.6 G. Material Requirements

All material and products in contact with domestic water shall meet the requirements of NSF Standard 61 per OAR Section 333-061.

4.6 H. Disinfection

Disinfection of all new facilities shall be performed according to OAR Section 333-061 - 0050 before new lines are put in service.

4.6 I. Easements

All required easements shall conform to the requirements of *Section 4.1B: City Utility Easements*.

4.6 J. Testing Requirements

All testing shall conform to the requirements of *Section 2.7: Construction Testing Requirements* and the ODOT/APWA Oregon Standard Specifications for Construction.

4.7 *Sanitary Sewers*

4.7 A. Pipe capacity requirements

1) Pipe Sizing: Pipe sizing shall be as shown in the Capitol Facilities Plan or as required to provide capacity for the ultimate flow (existing, planned, and future development) for the contributory basin. For developments not accounted for in the preparation of the Capitol Facilities Plan or for special situations, capacity and flow calculations which meet the Oregon State Department of Environmental Quality Guidelines, these Standards, and accepted professional practice may be required. There are documented existing problem areas within the existing system. Therefore, it is recommended that the Applicant meet with the City Engineer early in the process to discuss any existing downstream system problems that would need to be addressed in order to provide adequate capacity to the proposed development.

2) Flow Design: Accepted flow design practice must be employed. Flow parameters, peaking factors, and infiltration and inflow must be consistent with the most recent Capital Facilities Plan unless site conditions warrant modifications. The Manning's coefficient value ("n") to be used in calculating sewage flows is .013.

4.7 B. Sanitary Sewer Piping – Gravity Conveyance Systems

1) Minimum pipe size is 8 inches for mains and 4 inches for service laterals.

2) All piping shall be **green** PVC, SDR 35 pipe meeting ASTM D3034 for pipes 4" through 15" and ASTM F679 for pipes 18" through 24" with gasketed bell end.

3) Minimum cover is 3 feet from finished grade to top of pipe.

4) Minimum slope for mains is 1% but flatter slopes may be acceptable where topography constraints dictate and when approved in advance by the City Engineer. Any slopes less than 1% require a design exception. The absolute minimum slopes are determined by a minimum flushing velocity of 2 feet/second flowing full and are as follows:

Pipe Size	Minimum Slope in Feet Per 100 Feet
8"	.4
10"	.28
12"	.22
15"	.15
18"	.12

Minimum slope for 4" laterals is 2%. Minimum slope for 6" laterals is 1%.

5) Steep slopes – Pipes on slopes steeper than 20% shall be properly anchored.

6) Sanitary Sewer and Waterlines - Sanitary sewers and potable waterlines shall not be laid in the same trench. Parallel water and sanitary sewer lines shall have a minimum 10 feet horizontal separation. When sanitary sewer and waterlines must cross, the crossing angle should be as close to 90 degrees as practical with the waterline on top. A minimum vertical clearance of 18" is required. Pipe sections shall be centered over the crossing. Construction shall conform to the requirements of the OAR Section 333-061.

7) Depending on the relationship between the finished floor elevation and the nearest upstream manhole, buildings may be required to have an approved backwater valve on the sanitary drain line. Contact the State Building Codes Division field office located in The Dalles (541 298-4461) for additional information on the backwater valve.

4.7 C. Manholes

1) Manholes shall be required at all changes in horizontal or vertical alignment and at all pipe intersections.

2) Maximum manhole spacing is 350 feet.

3) Intersecting pipes shall have at least 0.2 foot of fall through the manhole when the incoming pipe slope is 5 percent or less, otherwise the pipe grade shall be maintained across the manhole. Outside drop manholes shall be used whenever the difference in flow line elevations between pipes exceeds 24 inches. Inside drop manholes are highly discouraged and will be evaluated on a case by case basis only. When a smaller sewer joins a larger one, pipe crowns shall be matched.

4) Manhole diameter shall be determined by pipe size and orientation at the junction structure with a minimum diameter of 48 inches. A plan view of the junction structure, drawn to scale, will be required when angles of approach and clearance between pipes is a concern. The integrity of the structure to support the design loadings shall not be compromised.

5) The manhole flow channels should be smooth and conform to the shape and slope of the inlet sewer(s).

6) Flat top manholes will be required when there is less than 8" below the bottom of the cone section and the crown of the highest intersecting pipe.

7) The Contractor shall be required to verify all existing invert elevations prior to making connections to existing structures or constructing new manholes over existing pipes. Any required changes to the plan during construction must be approved through procedures defined in Section 2.

8) Steps shall not be allowed in the manholes.

9) Service laterals shall not be connected directly to a manhole.

4.7 D. Pressure systems and pump stations

The Applicant is required to discuss any plans for proposed pump stations and pressurized systems which are intended to be dedicated to the public with the City Engineer early in the process as these systems can be maintenance intensive and may warrant additional requirements to those stated below.

1) General
   a) All structures and associated equipment shall be protected from the 100-year flood.
   b) The pumping station shall be readily accessible by maintenance vehicles during all weather conditions. Protective fencing may be required for security reasons.
   c) Provisions shall be made to facilitate removing pumps, motors, and other mechanical and electrical equipment.
   d) Adequate ventilation shall be provided for all pump stations. Air treatment may be required.
   e) Suitable devices for measuring wastewater flow shall be provided at all pump stations.
   f) Alarm systems meeting the City Engineer's requirements shall be provided for all pumping stations. The alarm shall be activated in the event of any system failure.
   g) All pump stations shall be equipped with the means to rapidly connect to portable pumps in case of system failures.
   h) The system shall be designed with a 24-hour holding capacity before subsequent flooding of basements, streets, and other public and private property in the event of system failure.
   i) All systems shall be provided with an emergency standby power backup in case of extended power outages.

2) Wet Wells
   a) Suitable and safe means of access shall be provided.
   b) Buoyancy of the structures shall be considered where high groundwater conditions exist.

c) The wet well size shall be determined from the design fill time and minimum pump cycle time. The filling time shall not exceed 30 minutes using the design average flow. The pump manufacturer's duty cycle recommendations shall be used in selecting the minimum cycle time.
d) All pumping stations will need to meet applicable building and electrical codes.

3) Pumps
a) Pump redundancy is required. Where only two units are provided, they shall be the same capacity. Should any one unit be out of service, there shall be adequate capacity for the remaining units to handle the design peak hourly flow.
b) Any pumps handling raw waste water shall be capable of passing spheres at least 3 (three) inches in diameter. Pump suction and discharge openings shall be at least 4 (four) inches in diameter unless specifically approved otherwise by the City Engineer.
c) Motors shall be designed with a 1.15 Service Factor and be non-overloading over the entire pump curve. Premium efficiency motors shall be required.

4) Force Mains
a) Minimum diameter for raw wastewater shall be 4 inches. When using grinder pumps, smaller diameter pipelines may be acceptable depending on velocity and other factors.
b) At design pumping rates, force mains shall be designed for 3 fps with a minimum cleansing velocity of 2 fps. Velocities should not exceed 8 fps.
c) PVC Class 100 (minimum) shall be used for force mains. All fittings shall be long body ductile iron.
d) Friction losses through force mains shall be based on the Hazen and Williams formula with the following "C"* factors:

100	Iron or steel pipe
120 max.	Other smooth pipe material

*Note: When initially installed, the C factor will be significantly higher. The higher C factor should be used to compute maximum power requirements and duty cycle time to prevent damage to the motor.

e) Isolation valves shall be plug type valves. Check valves shall be cushion type valves to address water hammer issues
f) Air relief valves shall be placed at all high points.
g) Force mains shall enter the gravity sewer system at a point no higher than 2 (two) feet above the flow line of the receiving manhole and shall be deflected downward with a 90° bend anchored to the inside manhole wall and terminating no more than 6" above the manhole floor. Corrosion protection shall be provided on the interior surface of the receiving manhole.

h) Force mains shall be appropriately identified in the ground so as not to be confused with potable water mains.

4.7 E. Easements

All required easements shall conform to the requirements of *Section 4.1B: City Utility Easements*.

4.7 F. Testing

All testing shall conform to the requirements of *Section 2.7: Construction Testing Requirements*.

4.8 *Signing, Pavement Marking, and Roadway Lighting*

4.8 A. Street Signs

Street signs shall be provided and installed by the City. All costs for this work shall be reimbursed by the Applicant.

4.8 B. Pavement Marking

Pavement Marking shall be required on arterials and collectors only and shall be in accordance with the latest MUTCD Manual and approved by the City Engineer. Parking stall markings are an exception and will be required as appropriate on local streets.

Handicap ramps are to be provided with either yellow composite cast in place truncated dome panels meeting current ADA requirements or;

Thermoplastic panels installed by the City Public Works Department. The cost for City installation is time and materials plus 20%.

Panels using adhesive or caulking to adhere to the surface of the concrete are not acceptable.

4.8 C. Roadway Lighting

Roadway lighting shall be provided at all intersections, mid-block, and a maximum of 300-foot spacing. The standard pole height for residential streets is 25-feet. In residential areas, "flat glass" shall be used so that the light is directed downward resulting in a dark sky effect. The Applicant shall coordinate with the local utility owner for bulb wattage and spacing requirements. The Applicant shall be responsible for all costs associated with this work.

5. Standard Details

See Appendix G.