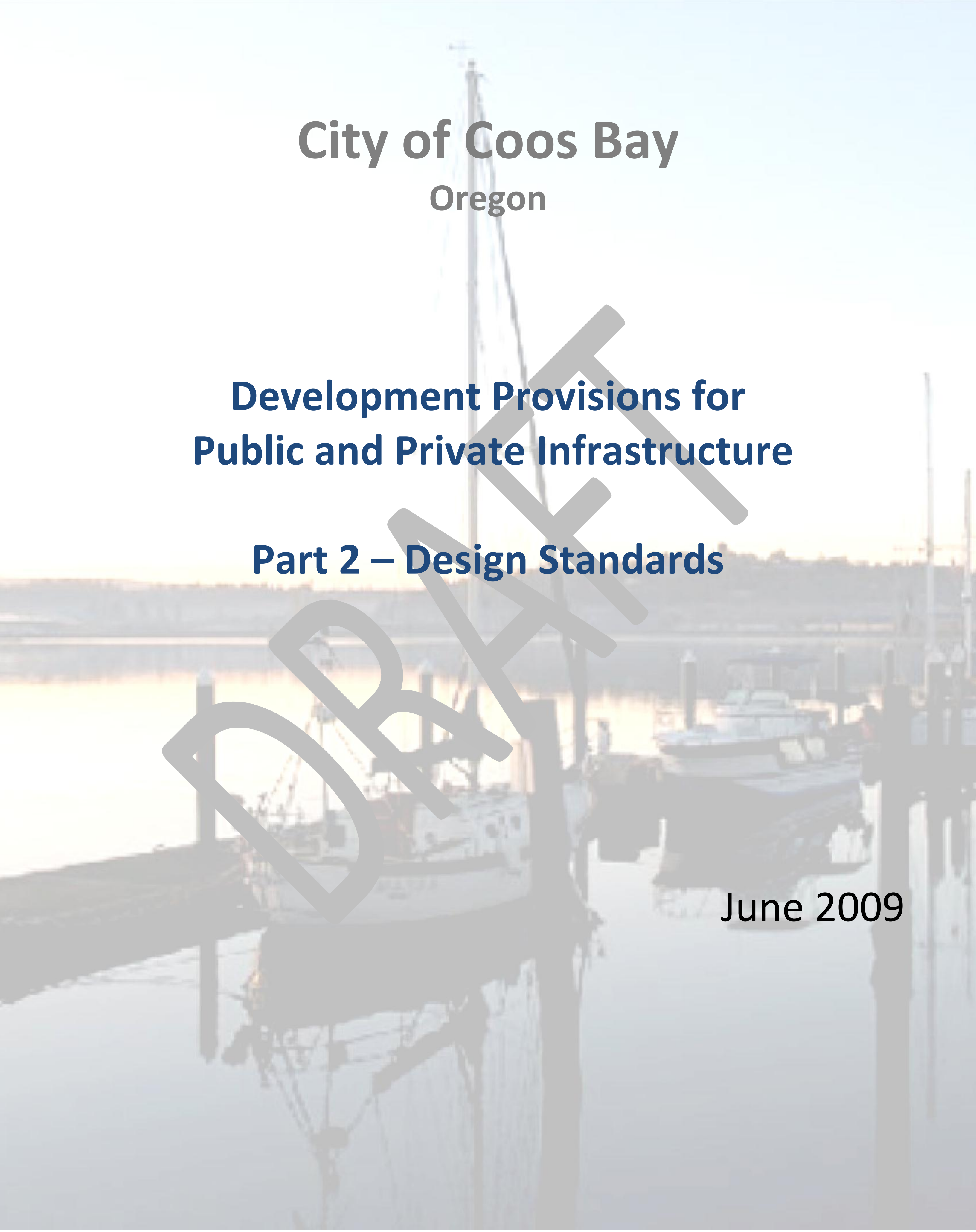

City of Coos Bay

Oregon

Development Provisions for Public and Private Infrastructure

Part 2 – Design Standards

June 2009

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1.0 STREETS AND SIDEWALKS

1.1 GENERAL

These Design Standards are intended to be used in conjunction with the Coos Bay Municipal Code (CBMC) and Coos Bay's Construction Specifications. This section of the Design Standards pertains to design of streets within the City, establishment of appropriate right-of-way widths, and standards for different City street classifications.

The location, width, and grade of streets, sidewalks, and pedestrian and bicycle pathways shall conform to the Coos Bay transportation system plan. Street and pathway location, width, and grade shall be considered in their relation to existing and planned streets and pathways, to topographical conditions, to public convenience and safety, and to proposed use of the land to be served by the streets. (Would this have resolved Gallagher?)

All streets within or abutting a proposed development shall be designed to handle the volume and level of traffic generated by the development and shall be improved to the standards of the identified class of street. All proposed developments (define) (1 SFD? 4 lot policy?) must provide paved access (see policy regarding residential construction along unpaved city street.)from an existing fully improved public street which meets city specifications and is adequate in design to handle the amount and kind of traffic generated by the development.

1.2 TRANSPORTATION IMPACT STUDY

Each proposed development that is expected to generate 200 or more daily trip ends(?) shall evaluate the transportation impacts in a Transportation Impact Study (TIS). The scope of the TIS shall be established by the Public Works and Development Department to address issues related to a specific development proposal.

1.3 STREET DESIGN STANDARDS

Grades, tangents, curves, and intersection angles shall be in accordance with the requirements of these Design Standards for the class of street being developed.

1.3.1 Basic Geometry

Street and alley dimensions shall conform to the basic dimensional requirements as presented below in Table 1.3.1. The City Engineer may modify the requirements to satisfy topographical conditions, public convenience and safety, and the relationship to existing streets.

Table 1.3.1 – Street Standards

Type of Street	Minimum Right-of-Way Width (a)	Minimum Paving Width Curb-to-Curb				Sidewalk Curb (c)	Maximum Grade
		Motor Vehicle Travel Lane	Median or Center Turn Lane	On-Street Parking	Bike Lane (b)		
Arterial							
5-lane	100’	12’	14’	-	2 @ 5-6’	2 @ 6’	8%
3-lane	80’	12’	14’	-	2 @ 5-6’	2 @ 6’	8%
2-lane	50’ (Is this enough R/W?)	12’	-	-	2 @ 5-6’	2 @ 6’	8%
Collector	70’	12’	-	2 @ 8’	2 @ 5-6’	2 @ 5’	10%
Neighborhood Route or Local							
Residential	60’	10’	-	2 @ 8’	-	2 @ 5’	10%(h)
Commercial/ Industrial (d)	60’	12’	-	2 @ 8’	-	2 @ 5’	10%(h)
Dead End (e)	60’	10’	-	2 @ 8’	-	2 @ 5’	10%(h)
Cul de Sac (f)	60’	10’	-	(e)	-	1 @ 5’ (g)	8% (e)
Alley							
1-way	20’	12’	-	-	-	-	-
2-way	20’	16’	-	-	-	-	-
Driveways							
	20’	-	-	-	-	-	10%(h)

(Regarding sidewalks: I’ve (JIM) heard, not read, of and ADA requirement that sidewalk must be wide enough for passing.)

(a) New streets shall have 10-ft Public Utility Easements (no easement needed for row) along both sides; 5-ft within right-of-way, 5-ft on private property
(b) New construction – 6 ft; reconstruction – 5 ft.
(c) Wider sidewalks may be required in commercial areas
(d) The minimum right of way width includes the option of two 6 ft. wide landscape strips for arterials or two 4 ft. wide strips for local/commercial.
(e) A dead end must be less than 400 feet in length and terminate with a circular or hammerhead turnaround with a maximum grade of 8%.
(f) No parking is permitted at the end of a cul-de-sac which must have adequate space for emergency equipment turn around, usually a 48 foot unobstructed radius.
(g) At the end of the cul-de-sac, a 5 ft. sidewalk is required along the perimeter adjacent to the development.
(h) Maximum allowable grade based on hillside design is 16% with written approval of Coos Bay Fire Chief and City Engineer during the plan review.
(i) Grades in excess of 10% will be considered only after life safety issues have been reviewed by the City Fire Chief and written comments are provided to the City Engineer for use in plan review.

Where warranted due to existing conditions such as topography, the size or shape of land parcels, or constraints posed by sensitive lands (i.e. wetlands) variances may be granted for what ROW? Paving width? See previsions pg – dept. may modify. Turn lanes and/or center medians are required on major (five-lane) arterials and optional for secondary (three-lane) arterials.

1.3.2 Design Capacity and Speed

Unless otherwise approved by the City, the minimum design capacities and speeds indicated in the following table shall be used in the design of City streets. The Design Engineer (?)is responsible for evaluating and choosing the necessary design speed for the conditions. In the event that a project is a continuation of an existing street, the design speed of the new project shall meet or exceed the existing street design speed.

(Add section on Traffic Calming?)

Table 1.3.2 – Typical Design Capacities and Speeds

Class of Street	Design Capacity (with TSP) (Vehicles per Day)	Design Speed, (mph)
Arterial	32,000	40-50
Collector	10,000	35
Commercial/Industrial other than Arterials	12,000	30
Neighborhood Routes (Serves more than 20 Dwellings)	7,000	30
Local Streets (Serves 20 or fewer Dwellings)	1,200	25
Cul-de-sacs	200	NA

1.3.3 Street Grades

Street grades shall be described in Table 1.3.1

In flat areas, allowance shall be made for finished street grades having a minimum slope of one-half percent (0.5%) in order to facilitate drainage.

1.3.4 Street Grades at Intersections

Streets intersecting with a collector or greater functional classification street, or streets intended to be posted with a stop sign or signalization, shall provide a landing area of at least 20 feet long and averaging five percent grade or less. At intersections, no part of the centerline of one street within 50 feet of the near curbline of the other street shall have a slope above the intersection in excess of six percent (6%) or below the intersection in excess of eight percent (8%). The maximum grade of either street within an intersection shall be six percent (6%).

1.3.5 Sight Distance

All streets shall be designed to the following values for adequate safe stopping sight distance at the design speed, according to AASHTO, Table 3-I

15 MPH	80'
20 MPH	115'
25 MPH	155'
30 MPH	200'
35 MPH	250'
40 MPH	305'
45 MPH	360'
50 MPH	425'

1.3.6 Curves

Centerline radii of curves shall not be less than 300 feet on Arterials, 200 feet on Collectors and Neighborhood Routes, and 150 feet on local streets. Regardless of street classification, curve radii shall be to an even 10 feet unless topographical conditions justify a variation.

1.3.6.1 Vertical Curve

The minimum centerline vertical curve length shall be as determined by AASHTO formulas given below. In general, minimum curve lengths shall be no less than three times the design speed of the roadway. For example, the minimum curve length for a local street designed for 25 mph shall be 75 feet

The minimum lengths of vertical curves shall be calculated from the following relationships.

	CREST CURVES	SAG CURVES
$S > L$	$L = 2S - (2158/A)$	$L = 2S - ((400 + 3.5\ S)/A)$
$S < L$	$L = AS^2/2158$	$L = AS^2/(400 + 3.5\ S)$

WHERE: A = Algebraic difference in grades, percent

S = Design sight distance, feet

L = Length of Vertical curve, feet

Based on AASHTO Equations 3-43 and 3-44 for eye height=3.5 feet and object height=2.0 feet

Careful consideration shall be required when K values exceed 167 as this will create flat sections at high and low points of the curve.

$$K=L/A$$

L = Length of vertical curve

A = Total change in grade, %

1.3.6.2 Horizontal Curves

The minimum horizontal curve radius shall be designed using AASHTO's side friction factor method for low-speed urban streets and superelevation distribution method 2. Minimum curve radius for various design speeds and cross slopes are shown in the following table: (How does 1.3.6 on page 1-4 compare to this (referring to table below).)

Street Classification	Design Speed	Crown	Superelevation		
	(mph)	-0.02	0.02	0.03	0.04
Major Arterial	45	1039	794	750	711

Minor Arterial	40	762	593	561	533
Collector	35	510	408	389	371
Industrial	35	510	408	389	371
Local	25	198	167	(b)	(b)

Notes:

(a) From Table 3-16, A Policy on Geometric Design of Highways and Streets, AASHTO 2004.
(b) Superelevation permitted only with approval of City Engineer.
(c) The use of superelevation above 0.04 ft./ft. will require approval of the City Engineer.
(d) Refer to AASHTO Table 3-16 for minimum radius for superelevation rate higher than 0.04 ft/ft and other design speeds.

1.3.6.3 Superelevation Rate

Superelevation is to be used only as a design element to enhance drivability of horizontal curves on arterial and collector streets. The use of superelevation for other purposes, or on local streets, will require the approval of the City Engineer and will be handled on a case by case basis and will not exceed 2%. The maximum design superelevation for collectors and arterials shall generally be 0.040 ft/ft and minimum superelevation shall be 0.020 ft/ft. Plans incorporating superelevation shall show left and right gutter on the profile and the scale shall be such that these can be distinguished.

1.3.6.4 Superelevation Runoff

The designer must be concerned with three profiles in the development of a superelevated section: left gutter, centerline and right gutter. Superelevation shall be obtained by rotating two of these profiles around the third stable profile, usually the centerline, which reflects the overall design.

Particular attention must be paid to the impact on drainage characteristics resulting from superelevation. No more than 25% of a transition section may be placed on the horizontal curve. No transition section shall be less than 100' in length. The minimum transition section lengths shall be determined in accordance with the AASHTO Policy on Geometric Design of Highways and Streets 2004 Edition, Chapter 3 Transition Design Controls. AASHTO Exhibit 3-32 provides runoff length for various design speeds, number of lanes and superelevation rates.

Select examples are provided in the table below for a road section with two 12 foot lanes and a superelevation rate of 4 percent (AASHTO Exhibit 3-32).

DESIGN SPEED	MIN. LENGTH
50 mph	96'
45 mph	89'
40 mph	83’
35 mph	77'
30 mph	73’
25 mph	69’

1.3.6.5 *Reverse Curves*

On all streets having a design speed of greater than 30 mph there shall be a minimum 100' tangent section between reverse horizontal curves. Reverse curve signing shall be shown on the plans.

1.3.6.6 *Compound Horizontal Curves*

Compound horizontal curves should be avoided on streets having a design speed of greater than 30 mph. If a compound curve is necessary, the ratio of the flatter radius to the sharper radius should not exceed the following:

31 – 49 mph design speed	2 : 1
50+ mph design speed	1.5 : 1

Where the ratio exceeds these limits, a suitable length of spiral or a circular arc of intermediate radius shall be inserted between the two curves.

1.3.7 Curbs and Gutters

A Coos Bay standard curb and gutter shall be used on any fully improved City street. The minimum gutter grade shall be 0.30 percent, and preferably 0.50 percent. The minimum gutter grades along short-radius curves, such as curb returns and cul-de-sac bulbs, shall be 0.50 percent.

No intruding structures, including, but not limited to, manholes, valves, and junction boxes shall be located within two feet of the curb or gutter.

Where intermittent emergency or maintenance vehicular access is to be provided and pedestrian access is to be discouraged, an ODOT type 'D' concrete curb, or equivalent, shall be used.

1.3.8 Road Crown and Cross Slope

Collector and arterial streets shall be designed with either a crowned or a superelevated section through curves. A shed (?) section on these classes of streets will not be acceptable. On other streets with design speeds less than 30 mph where shed sections are permissible, the cross slope shall not be greater than 2%. Slopes less than 2% require approval by the City Engineer. Where a non-standard street width is designed, the crown shall be based on a 2% side slope.

Shed sections may be used, when approved by the City Engineer, where upslope runoff is collected in a formal drainage system and is not allowed to travel across the roadway. Steeper cross slopes may be approved in accordance with AASHTO standards.

1.3.9 Intersection Alignment

As far as practical, all streets other than minor streets shall be in alignment with existing streets by continuations of the centerlines thereof. Staggered or offset street alignment resulting in "T" intersections shall wherever practical leave a minimum distance of 200 feet between the centerlines of streets having approximately the same direction and otherwise shall not be less than 100 feet. Alignment of "T" Intersections shall meet the standards established by Drawing No. XXXX, "T" Intersection Alignment Standard.

1.3.10 Intersection Angles

Streets shall be laid out to intersect at angles as near to right angles as practical except where topography requires a lesser angle, but in no case less than 60 degrees unless there is a special intersection design. Streets shall have at least 50 feet of tangent adjacent to the intersection unless topography requires a lesser distance. Intersections which are not right angles shall have a minimum corner radius of 20 feet along the right-of-way lines of the acute angle. All right-of-way lines at intersections with arterial streets shall have a corner radius of not less than 20 feet.

1.3.11 Curb Return Radii

Curb return radii for all truck routes shall be designed using a WB-67 design vehicle. Unless otherwise directed or approved by the City Engineer, all other curb return radii at public street intersections shall be designed in accordance with the following table.

Table 1.3.11 – Minimum Radii and Design Vehicles for Determining Curb Radii

Primary Street Classification	Secondary Street Classification	Zoning	Minimum Radii (ft)	Design Vehicle
Local	Local	Residential	20	Emergency
Local	Local	Non-Residential	25	Emergency
Collector	Local	Residential	25	Emergency
Collector	Local	Non-Residential	25	WB-50*
Collector	Collector	Residential	25	Emergency
Collector	Collector	Non-Residential	25	WB-50*
Arterial	Collector	All	35	WB-67**
Arterial	Arterial	All	35	WB-67**

Note: The above minimum radii and design vehicles are minimums only. Larger radii and/or design vehicles may be required to accommodate existing or planned turning movements.
* A WB-50 vehicle consists of a 42.5-foot intermediate semitrailer with a 35.5-foot kingpin to center of rear tandem (KCRT) distance.
** A WB-67 vehicle consists of a 53-foot interstate semitrailer with a 45.5-foot KCRT distance.

Design vehicles are required to begin and end their turn in the travel lane closest to the curb without encroaching into bike lanes (if applicable). Three center curves, which are right-of-way efficient and decrease the pedestrian crossing distance, are encouraged when designing for larger vehicles.

1.3.12 Street Striping

Street striping shall be designed in accordance with the current ODOT Traffic Line Manual. See Standard Drawing 2-1 for striping requirements by road classification.

1.3.13 Street Signs

Signs, sign posts, bases, and installation shall meet requirements of Coos Bay Standard Detail No. T-450. Sign and lettering dimensions shall conform to Standard Detail No. T451. All street sign legends and names shall be verified prior to installation.

1.3.14 Street Lights

Street lights shall be shown on the plans and provided at the following locations:

- Intersections
- Cul-de-sac if over 200 feet from the intersection
- Mid-block for blocks longer than 400 feet from center to center of intersections.
- High-use driveways and other locations designated by the City.

Poles and fixtures shall conform to the standards of Pacific Power. Standard cobra head fixtures shall be used unless decorative design is approved or directed by the City. (Didn't we have standards?)

1.4 SIDEWALK DESIGN STANDARDS

1.4.1 Sidewalks & Pedestrian Access Ramps

Concrete sidewalks shall be located on both sides of the street for all major and minor arterial, collector and local streets, and shall be designed to the following criteria:

A. Sidewalks shall conform to the existing or planned street grades.

B. Sidewalks shall conform to current ADA standards.

C. Sidewalks shall be six (6) feet wide along all arterial streets, and five (5) feet wide along all collector and local streets unless otherwise approved by the City. A five (5) foot wide sidewalk shall be constructed along at least one side of cul-de-sacs. (Is 8’ walk for commercial district no longer valid?)

D. New sidewalk design shall be consistent with existing sidewalk design in the same block in relation to width and type, i.e., setback or curbside. All transitions shall be made at intersections.

E. Local residential streets may have either integral or setback sidewalk, as determined by the developer, engineer, or agency funding and/or designing the street project.

F. To promote pedestrian safety, local commercial, collector, and arterial streets shall normally have setback sidewalks (new recommendation?) unless curbside sidewalks are specifically requested by affected property owners or conditions prohibit doing so, as approved by the City Engineer. Wider sidewalks (7' or greater) may be required to mitigate for the placement of curbside sidewalk in these locations.

G. Obstructions including, but not limited to, mail boxes, utility poles, trees, benches, fire hydrants, and signs shall not be located within the sidewalk. Obstructions shall be removed or relocated prior to the construction or reconstruction of the sidewalk, unless otherwise approved by the City Engineer. If these obstructions are permitted to remain, provisions shall be made to maintain at least five feet of unobstructed width on arterial class streets and four feet on all other streets. (Exception for street signs.)

H. All sidewalks shall be a minimum of four inches thick concrete placed on a minimum of two inches of compacted 3/4"-minus crushed rock base. Sidewalks behind or integral to driveway approaches shall be designed to the standards set forth in Section 1.4.2 “Driveway Approaches.” All concrete shall meet or exceed the mix design standards defined in the current version of the Coos Bay Construction Specifications.

1.4.2 Driveway Approaches

All driveway approaches shall be defined on the plans as either Residential or Commercial. Any driveway serving property which is used for purposes other than Single Family Residential or Duplexes shall be designated as and built to the standards of a residential driveway. A concrete alley apron serving public right-of-way or alley shall also be built to the standards of a residential driveway. Driveway approaches shall conform to the applicable Standard Detail.

Driveways may be deferred until lots are built upon, if approved by the City. If the developer chooses to delay the installation of driveways, additional repair of curb and gutter, sidewalk, and other facilities may be required when the driveway is installed.

The cost of installing driveway approaches and the associated repairs to curb and gutter, sidewalk, and other facilities will be borne, solely, by the developer.

1.5 Private Improvements

Infrastructure improvements to be privately owned and maintained shall be so identified on the construction drawings when shown thereon as reference. Private streets shall be designed to the same standards as public streets. When proposed private systems, such as storm drainage or water quality features, are essential for public improvement projects to function properly, they shall be shown on the public improvement plans. (Must be labeled “private”.)

2.0 SANITARY SEWERS AND PUMP STATIONS

2.1 PURPOSE

These Sanitary Sewer Design Standards were drafted to provide a consistent standard for implementing certain physical aspects of sewer design. These standards have the objective of developing a sanitary sewer system that will:

A. Be consistent with ORS 468 and OAR 340.

B. Be of adequate design capacity to carry the expected flow within the sewer's design life and be installed at a sufficient depth and location to serve adjacent properties likely to be developed in the future.

C. Have a self-cleaning flow velocity, generally a minimum velocity of two feet per second when the pipe is flowing half full.

D. Have sufficient structural strength to withstand all external loads that may be imposed.

E. Be of materials resistant to both corrosion and erosion with a minimum design life of 50 years.

F. Be economical and safe to build and maintain.

G. Prevent infiltration or inflow of ground and surface waters.

H. Be located within public rights-of-way or public utility easements where access for maintenance is readily available.

Materials and methods shall conform to City of Coos Bay Construction Specifications, or if alternate materials or methods are proposed, they will be considered for approval on the basis of the above objectives.

2.2 GRAVITY SEWERS

Sanitary sewer system improvements shall be designed by a Professional Engineer licensed in the State of Oregon. Sanitary sewers shall be designed to collect domestic sewage and industrial wastes from residential, commercial or industrial buildings, and all public and private establishments. Storm water, including street, roof, or footing drainage, shall not be discharged into the sanitary sewer system.

2.2.1 Off-Site Flows

When land outside a new development will logically direct flow to sanitary sewers in the new development, the sewers in the new development, unless determined otherwise by the City Engineer, shall be public sewers and shall be extended to one or more of the development boundaries. The pipes shall be sized and located to accommodate all potential off-site flows.

The City of Coos Bay may participate through use of SDC reserves in costs of over-sizing and over-depth of sewers designed to accommodate off-site flows. If greater than eight inch diameter piping is required or if sewers are placed at a greater depth than necessary to serve the developing parcel then cost sharing may be warranted.

2.2.2 Sewer Study

A sewer study shall be completed and submitted to the City when a public sanitary system is extended to serve a development generating flow above ________gallons per day or exceeding ten percent of the total flow in the downstream system. The study shall include analysis of the potential upstream contributions and downstream capacities until the contribution is ten percent or less of the total flow. The study shall include, but not be limited to, sewer service area map, sewage flow calculations, pump systems, and pipe hydraulic calculations. The study map shall include as a minimum the following:

A. Streets and street names.

B. Lot lines.

C. Minimum 2-foot contours for the proposed development and minimum 5-foot contours for off-site areas that may contribute future flows.

D. Proposed and future pipe system, complete with manholes, pipe slopes, manhole invert elevations, and pipe sizes.

E. Ultimate service area boundaries (from consultation with the City).

F. North arrow and scale.

G. Design company name and address, designer's name, date, etc.

H. Design calculations for pump stations, pipe sizing and design flows must be stamped by an Oregon Registered Professional Engineer and submitted to the City.

When two or more existing sanitary sewers are available for use by a new development, the study should consider all available routes of service, including downstream hydraulic characteristics of each route.

2.2.2.1 *Design Flows*

Design for average daily wastewater flows for new systems shall be based on per capita flows in Table 2-1 below. These figures are assumed to cover normal infiltration/inflow (I/I), but an additional allowance shall be made if high groundwater or other unfavorable conditions are known to exist.

In order to determine the number of people per household, the latest available data from the U.S. Census should be used.

Table 2-1: Design Basis for Average Daily Flow (Excerpted from Washington Department of Ecology, "Criteria for Sewage Works Design)

Discharge Facility	Design Units	Flow* (gpd)	Flow Duration (hr)
Dwellings	Per person	100	24
Schools with showers and cafeteria	Per person	16	8
Schools without showers and cafeteria	Per person	10	8
Boarding schools	Per person	75	16
Motels at 65 gal/person (rooms only)	Per room	130	24
Trailer courts at 3 persons/trailer	Per trailer	300	24
Restaurants	Per seat	50	16
Interstate or through-highway restaurants	Per seat	180	16
Interstate rest areas	Per person	5	24
Service stations	Per vehicle serviced	10	16
Factories	Per person per 8-hr shift	15-35	Operating period
Shopping centers	Per 1,000 sq ft of ultimate floor space	200-300	12
Hospitals	Per bed	300	24
Nursing homes	Per bed	200	24
Homes for the aged	Per bed	100	24
Doctor's office in medical center	Per 1,000 sq ft	500	12
Laundromats, 9 to 12 machines	Per machine	500	16
Community colleges	Per student & faculty	15	12
Swimming pools	Per swimmer	10	12
Theaters, drive-in type	Per car	5	4
Theaters, auditorium type	Per seat	5	12
Picnic areas	Per person	5	12
Resort camps, day and night, with limited plumbing	Per campsite	50	24
Luxury camps with flush toilets	Per campsite	100	24

2.2.2.2 *Peaking Factors*

(Does OR DEQ have recommended factor?)

The sewers shall be designed to carry at least the peak hourly flow when operating at capacity. Peak hourly flow shall be the design average daily flow in conjunction with a peaking factor. The peaking factor should be calculated using the following formula as recommended by the Washington State Department of Ecology:

$$\frac{Q_{\text{peak hourly}}}{Q_{\text{design average}}} = \frac{18 + \sqrt{P}}{4 + \sqrt{P}}$$

Where: $Q_{\text{peak hourly}}$ = Maximum rate of wastewater flow (peak hourly flow)
$Q_{\text{design average}}$ = Design average daily wastewater flow
P = Population in thousands

The peaking factor shall not be less than 2.5.

2.2.3 Sewer Alignment

Sewers shall be installed in a straight alignment between manholes and clean-outs. Horizontal and vertical curves for sanitary sewer lines shall not be permitted.

Incremental bends (mitered corners) shall be considered and may be required for large diameter (36" and above) where the deflection angle is greater than 30 degrees and flow characteristics are disturbed by a standard manhole.

Sanitary sewer piping shall be located 10 feet horizontally (outside to outside) away from any parallel water main or service when possible. All water line and sewer line shall be separated in accordance with OAR 333-061-0050 provisions.

2.2.4 Cover

Minimum depth of cover is normally 63-inches over top of pipe barrel for gravity sewer mains (based on providing 18-inch vertical separation below an 8-inch water line with 36-inch cover). Shallower depths may be allowed providing at least 18-inches of vertical separation is provided at all water main and water service crossings. For dead end sewers which are geographically or otherwise restricted from future extension, minimum cover of four feet may be approved provided appropriate separation is maintained from all water mains and services.

Sewers shall be sufficiently deep to receive sewage from all existing and planned dwellings by gravity flow. Where topographic conditions prevent gravity service to a given parcel, a statement identifying the condition shall be recorded on the Plat.

2.2.5 Watertight Joints

Watertight joints shall be used for all sanitary sewers. Design documents must specify acceptable pipe materials (e.g., PVC type, coated ductile iron for pipes < 15") or reference City of Coos Bay Construction Specifications.

2.2.6 Manhole Placement

Manholes shall be placed at the following locations:

A. Every change in grade or alignment of a sewer.
B. Every point where there is a change in size or abrupt change in invert elevation of a sewer.
C. Each intersection or junction of a public sewer, excluding service lateral connections.
D. At intervals of 400 feet or less. (For all pipe sizes?)
E. At any point where a service or private sewer of eight inches or larger intersects a sewer main.
F. Upper end of all collector or local sewers, except as provided for clean-outs:
   1. Adjacent to the radius point of a cul-de-sac which has three or more parcels of land fronting on the cul-de-sac; and
   2. In front of the last property or lot being served, ten feet past the common lot line the adjoining property served if right-of-way or easement is available and the line is not capable of being extended. For development where the system will be extended in the future, the line must extend to the edge of the development.
G. On each end of inverted siphons.

All manholes from which future sewer line extensions are anticipated shall have a pipe stub designed and installed at the grade and direction of the sewer main extension. Pipe stubs shall be a minimum of eight inches in size and shall protrude at least one foot outside of the manhole base. In the event the alignment of the future sewer extension will be paved as a part of the project being currently designed, or an intersection is being rehabilitated, the sewer stubs shall extend to the limits of new construction.

Manholes shall be located at the center line of the roadway or outside the normal wheel travel lanes depending on street width. Manhole lids are not permitted within designated existing or future bike lanes.

Location of the center of manholes in a vehicle wheel track is not acceptable. Location of the center of manholes within 5 feet of the curb line is not acceptable. Location of manholes outside of paved areas is not generally acceptable. If manholes can not be located in the pavement, then a six inch thick concrete pad 5 foot square centered on the manhole cover must be provided. Manholes shall not be located in the curb or in the gutter (in sidewalk?). Consideration shall be given to sewer lines which already exist behind the curb.

Internal drop manholes will not be acceptable for drops equal to or greater than 18 inches. Angle between inlet and outlet lines of sewer manholes less than 90º shall be avoided, but if necessary, the invert of the inlet line shall be at or above the crown of the outlet line, but not to exceed 18 inches.

Existing manholes which are located within proposed sidewalk areas shall be flush with the finished surface and shall be fitted with standard locking manhole lids.

2.2.7 Manhole Channel Design

The slope of the channel through a manhole shall be the same as the pipe upstream from the manhole. In no case shall the fall across a manhole be less than 0.10' without prior approval of City Engineer (called out at 2, elsewhere see 2.2.16.) . Any change of manhole channel slope shall occur evenly between pipe inlet and pipe outlet.

All pipes within the manhole shall be installed within the bottom 12 inches of the manhole, or an exterior drop manhole will be required. Rigid pipes connected to the sanitary sewer manhole shall be provided with a flexible joint at a distance from the face of the manhole of not more than two feet. For precast concrete manholes, the cut through the manhole wall and steel mesh shall be such that the cut is flush with face of the concrete. Also, it shall be cut so that it will not loosen the reinforcement in the manhole wall. All openings cut through the wall shall be watertight.

2.2.8 Sewers in Streets and Easements

Sewers shall be located in the right-of-way at the street centerline, or within five feet thereof, but outside of the traveled wheel lane. Sewers shall be designed parallel to street centerlines. Skewed sewers are prohibited in tangent street sections.

Sewers in easements will be allowed only after all reasonable attempts to place the mains in the right-of-way have been exhausted. All sewers shall be centered in the easements. Sewer easements shall be a minimum of 15 feet wide for sewers less than 8 feet deep. For deeper sewers, the easement width should be increased to the nearest foot such that a 1:1 theoretical slope from the springline of the pipe would daylight within the easement. (Maintenance access for MH's not in R/W for public status.)

(Add access and maintenance section like 3.6 D)

2.2.9 Pipe Slope Anchors

When pipes are laid at slopes in excess of 20% slope anchors shall be installed to prevent pipe movement and washout of pipe backfill. Pipe slope anchors shall be constructed in conformance with Standard Drawing No. S-150, Pipe Anchor/Trench Cutoff Wall.

2.2.10 Pipe Size Requirements

A. Gravity Mains – The minimum diameter allowed for a public gravity sewer main shall be eight inches. However, public sewer mains with a total length of 250 feet or less may be six inches diameter if no future extension is possible.

B. Service Laterals – New service laterals shall consist of 4-inch ASTM D3034 PVC pipe for individual residential services, or 6-inch ASTM D3034 PVC pipe for duplex residential or commercial services unless otherwise allowed by the City Engineer. Duplex residences may also be served by two separate 4-inch service laterals. The minimum slope of service laterals within the public right-of-way or sewer easement shall be two percent (0.0200 ft/ft) for 4-inch pipes, or one percent (0.0100 ft/ft) for 6-inch pipes.

2.2.11 Minimum Slope

All sanitary sewer mains shall be laid on a slope that will produce a minimum velocity of 2 ft/sec when flowing half-full, based upon Manning's pipe friction formula using a roughness coefficient valued at not less than 0.013, or the pipe manufacturer's recommendations, whichever is greater. The minimum acceptable slopes for various pipe sizes with an "n" value of 0.013 are as follows:

Pipe Size (inches)	Minimum Slope (ft/ft)
6	0.0050
8	0.0040
10	0.0028
12	0.0022
15	0.0015
18	0.0012
21	0.0010

Pipe slopes less than 0.0010 ft/ft are considered impractical and therefore no pipe shall be laid at a lesser grade.

Engineers shall not use sizes of sewer pipe which are larger than necessary for carrying satisfactory capacities in order to meet grade requirements, e.g., a 10-inch pipe instead of an 8-inch pipe to allow a decrease in slope.

Grades, or slopes, shall be determined to the center of the manhole. The average between any inlet slope and outlet slope across the manhole shall not exceed 25 percent.

2.2.12 Manning's 'n' Value

Any sewer pipe which has a manufacturer's "n" value of less than 0.013 shall be considered as having a true "n" value of 0.013 due to the build-up of sand, grit and slime on the pipe walls over a period of time. The "n" value for concrete, ductile iron and PVC pipe shall be 0.013.

2.2.13 Watertight Manhole Covers

Watertight manhole covers shall be used when the cover is either below the 100-year flood plain or in a location where overland runoff could enter the manhole. Ventilation of gravity sewer systems shall be considered in systems with continuous watertight sections greater than 1,000 feet in length.

2.2.14 Manhole Taps and Inverts

When an existing manhole is tapped to install a new sewer main or sewer service lateral which will drain into the manhole, the new sewer shall enter the manhole with the invert a minimum of 0.10 feet below the shelf elevations of the manhole and a channel shall be formed in the shelf of the manhole to the invert of the existing sewer. Only after all other means have been exhausted and with prior approval can a new sewer service lateral tap into a manhole.

2.2.15 Manhole Drop Structures

When the invert elevation of a pipe entering a manhole is 18 inches or more above the invert elevation of the outlet pipe in the manhole, an exterior structure shall be used for the elevated pipe. Refer to Standard Drawing No. S-225 Standard Outside Drop Manhole.

Drop structures in manholes shall only be used in extreme cases of elevation difference between existing and proposed sewer lines or when very special conditions exist such as a conflict with existing facilities which cannot be relocated.

2.2.16 Drop Across Manholes

The drop across manholes shall normally be one-tenth (0.10) of a foot. Where there is more than 60 degrees of horizontal deflection between the inlet and outlet, the vertical drop from the inlet and outlet line shall be at least two-tenths (0.20) of a foot.

2.2.17 Cleanouts

Cleanouts shall not be substituted for manholes on sanitary sewer mains except in special circumstances as allowed or directed by the City Engineer.

When a sewer main is terminated at the limits of construction on a phased project, a cleanout may be installed provided that the sewer main will be extended at the same slope and alignment during the subsequent phase of construction.

Cleanouts shall be provided on all service laterals within the public right-of-way or sewer easement 12 to 18 inches from the property line unless otherwise directed by the City Engineer.

All cleanouts shall have a water-tight compression plug fitted into the end of the vertical pipe, and a traffic rated cast iron cover placed over the pipe so as to prevent traffic loads from being exerted on the pipe. If a service lateral cleanout is located in a landscaping area, the City may allow substitution of a plastic cover in lieu of cast iron.

2.2.18 Service Laterals

Laterals serving multiple parcels are not allowed.

New service laterals shall conform to the size and slope requirements indicated in Section 2.10.10 – B unless otherwise allowed by the City Engineer.

A manufactured "wye" fitting shall be used to connect each lateral pipe to new sewer mains. Lateral piping shall be run perpendicular to the right-of-way or easement in which the main lies. Cleanouts shall be provided on all service laterals within the public right-of-way or sewer easement 12 to 18 inches from the property line unless otherwise directed by the City Engineer. When a parcel is not going to be developed until a later time, the service lateral shall be terminated at the property line and a watertight plug installed in the end of the pipe. A 2x4 post, painted white, shall be used to mark the location of the end of the lateral.

For connection of new service laterals to existing sewer mains or reconnection of existing service laterals, comply with the following:

A. Service lateral taps on existing smooth wall plastic piping (i.e. PVC or HDPE), including inversion or slip liners, shall utilize strap-on "wye" saddles designed for the specific size of main. Strap-on saddles shall be as manufactured by GPK Products, Inc.; Fernco, Inc.; or approved equal.
B. For installation of new service laterals along non-plastic pipe (i.e. concrete, transite, clay, CMP, etc.) a section of existing sewer main shall be removed and a new, properly sized manufactured PVC "wye" fitting, along with two approximate 12-inch stubs of equally sized D3034 PVC pipe, inserted and sealed to the original sewer main with clamp-down flexible couplers. Flexible couplers shall be as manufactured by Fernco, Inc.; or approved equal.
C. New or reconnected service laterals shall be placed perpendicular to the sewer main in the sewer easement or public right of way, unless otherwise approved during design.
D. New or reconnected service laterals shall have a cleanout constructed 12 to 18 inches from the property line as specified in Section 2.2.17. (See note 2.2.17.)

2.2.19 Waterline Crossings

Vertical and horizontal separation between sanitary sewers and water lines shall be maintained in accordance with rules and criteria approved by the Oregon Department of Human Services, Public Health Division, Drinking Water Program (DWP). DWP rules are detailed in the Oregon Administrative Rules 333-061-0050(9) Crossings-Sanitary Sewers and Waterlines. In general, at least 10 feet of horizontal separation (outside to outside) for water and sewer lines should be provided, along with minimum 18-inch vertical separation where waterlines cross over sewers. For other scenarios, refer to the cited rules.

2.2.20 Stream Crossings

The pipe and joints shall be tested in place, exhibit zero infiltration, and be designed, constructed, and protected against anticipated hydraulic and physical, longitudinal, vertical, and horizontal loads, erosion, and impact. Construction methods and materials shall be such that sewers will remain watertight and free from change in alignment or grade. Minimum cover of five feet for stabilized channels and seven feet for shifting channels shall be provided.

2.3 WASTEWATER PUMP STATIONS

Wastewater pump stations shall be designed in accordance with the requirements of the Oregon Standards for Design and Construction of Wastewater Pump Stations, May 2001 or latest edition, as published by the Oregon Department of Environmental Quality (DEQ), and these guidelines.

2.3.1 Location and Site Selection

Sewage pump stations are usually located at the low point of the service area. The pump discharges to the treatment works or to a high point in the sewer system for continued conveyance by gravity. In general, sewage pump stations shall only be used when gravity flow is not possible.

There is often little choice in siting sewage pump stations. Locations shall be selected as most practical based on present or proposed development areas to reduce community impacts. The amount of land area required is a direct function of the station's size and type and of the need or desire for ancillary facilities such as a maintenance building. The station shall be sited to accommodate reasonable pumping head, force main length, and depth of the gravity influent sewer(s). Other factors which shall be considered are:

A. Local land use and zoning regulations.
B. Location along public rights-of-way versus private easements.
C. Permits (or variances) which might be required, such as grading, building, and so on.
D. Availability of needed utilities, such as water, electricity, and natural gas.
E. Applicable noise ordinances, especially when an emergency backup generator will be present.
F. Space for future expansion, especially if population growth or development in the drainage area may increase substantially.
G. Aesthetic design considerations to fit the surrounding land uses.

2.3.2 Flood Protection

The station shall be designed to remain fully operational during the 100-year flood/wave action. All-weather access to the pump station above the 100-year flood plain is required unless waived by the City Engineer.

2.3.3 Access for Maintenance Vehicles

Adequate access to the site shall be provided for maintenance personnel and equipment. Adequate access during construction shall be provided as required for construction equipment and inspection.

The access road grade shall not be excessively steep. The road and parking configuration shall be adequate for vehicle turnaround or allow for one-way access. Adequate parking spaces for maintenance equipment shall be provided. Additional easements or site area as may be required for the access road shall be acquired by the developer. Adequate ingress and egress to the site shall be provided and shall take into account the effect of traffic on access on busy public right-of-ways.

2.3.4 Fire Protection

The pump station designer shall contact the Coos Bay Fire Chief (541/269-1191) for fire protection requirements and conform to those requirements. The designer shall contact the Coos Bay-North Bend Water Board (541/267-3128) to determine fire flow availability. Conform to the requirements of Standards for Fire Protection in Wastewater Treatment and Collection Facilities (NFPA) 820.

2.3.5 Site Piping Layout

Site piping layout shall conform to the following requirements:

A. Avoid installing buried pipes directly underneath each other, and minimize pipes crossing one another.
B. Maintain appropriate minimum and/or maximum velocities in pipes.
C. Provide appropriate restraint or thrust blocking for pressure pipe bends, etc.
D. Conform to Coos Bay Utility Board's current water service installation and backflow prevention installation policies.
E. Provide potable water cross-connection protection in accordance with OAR Chapter 340, Division 52.
F. Provide flexible pipe connections to pipe penetrations through vaults and other underground structures.
G. Consider a pig launch facility for the force main.

2.3.6 Other Site Design Factors

Site design shall conform to the following additional requirements:

A. Landscaping shall be designed to provide aesthetic appearance and to comply with local land-use agency codes. Use low-maintenance landscaping wherever possible.
B. Provide exterior photo-cell operated lighting in case night maintenance is required.
C. Provide appropriate security against vandalism.
D. The station shall not be located under overhead power lines due to truck crane interference.

2.3.7 Design Flow Rates

The firm capacity of a pump station shall be equal to or greater than the peak hourly design flow. This peak design flow shall be based on projected growth in the tributary area, future improvements anticipated in the collection system, present and future projected infiltration and inflow, and any phased improvements planned for the pump station and force main. It shall also allow for a reasonable amount of wear to pump equipment, particularly in a tributary area that is at or near build-out. Because mechanical and electrical equipment is typically designed for a 20-year life, the peak design flow shall be based on a 20-year forecast or greater.

In addition to establishing the peak design flow, the designer shall consider minimum flows and determine how the station will operate under low flow conditions.

Where applicable, projected flows and/or service area build-out conditions shall be as indicated in the Coos Bay Wastewater Collection System Master Plan (HBH Consulting Engineers, Inc., 2006). Where design flows are uncertain or planning data is considered outdated, a flow study should be conducted to establish existing flow conditions. Future flow projections should be based on expected increases due to proposed or expected development within the 20-year design period.

2.3.8 System Hydraulics

Pump station hydraulics shall be designed in conformance with the referenced DEQ Standards. The design shall provide an optimum balance for the project's force main characteristics, pump selection, and minimum and maximum flows. The force main shall be small enough in diameter to minimize solids deposition yet large enough that the total head loss is minimized. In general, the force main should be designed for velocities of 2 to 3.5 ft/sec at low flow conditions, 5 to 7 ft/sec at the 20-year firm flow, and 6 to 8 ft/sec at the projected build-out firm flow. Depending on service area characteristics, it may not be feasible to optimally size a force main for both 20-year and build-out conditions. In such cases, the 20-year firm flow shall govern design.

Pump stations shall be designed to operate under the full range of projected system hydraulic conditions. Both new and old pipe conditions shall be evaluated, along with the various combinations of operating pumps and minimum and maximum flows, to determine the highest head and lowest head pumping conditions. The system shall be designed to prevent a pump from operating for long periods of time beyond the pump manufacturer's recommended normal operating range. Start/stop cycles shall not exceed motor manufacturer's recommendation.

Selection of head loss coefficients for pipes and valves shall be conservative to allow for installation and equipment variations and normal effects of aging.

2.3.9 Pump Selection

The minimum number of pumps shall be two. Pumps shall be selected to meet the firm flow capacity and head with the largest pump out of service. Pumps shall also be designed to prevent excessively short pump run times under low flow (i.e. dry season) conditions. Pumps shall be carefully selected to operate within the best efficiency portion of the pump curve. The number and size of pumps shall correlate to the wetwell size.

Pumps shall be submersible units in either a wetwell or drywell setting. Regardless of setting, pumps shall be oiled-filled explosion proof type with internal over temperature and leak sensors. Pumps shall be “non-clog” type capable of passing solids at least three inches in diameter. Pump suction and discharge shall be four inches or greater.

On constant speed pump stations, the number of pumps is often based on the pumping capacity required to provide a minimum scour velocity in the force main. Variable frequency drives (VFD’s) shall be utilized as necessary to facilitate pumping through the full range of flows projected.

2.3.10 General Equipment Requirements

In general, the following standards shall apply to the selection of pumps and station design:

A. Stations less than 0.5 MGD:

1. On/Off pump operation.
2. Consider pre-manufactured canned station.
3. Submersible pumps with a separate vault for discharge piping.
4. Control building to house control panel, on-site backup generator, and telemetry. (Exterior weather-proof control panel and/or backup generator may be allowed in some circumstances.)
5. Standard PLC controller with ultrasonic level sensor or discrete level sensing probe (i.e. Multi-Trode).

B. Stations 0.5 MGD to 3.0 MGD:

1. Consider use of VFD’s.
2. Built on-site or precast wetwell.
3. Submersible pumps with a separate vault for discharge piping.
4. Control building to house control panel, on-site backup generator, and telemetry.
5. Standard PLC controller with ultrasonic level sensor or discrete level sensing probe (i.e. Multi-Trode). If used, VFD’s to increase/decrease pump speed based on PLC signal for wetwell level set points.

C. Stations 3.0 MGD and larger:

1. Continuous variable speed operation.
2. Prefer self cleaning trench style wet well (built on-site).
3. Consider caisson construction.
4. Consider pumps in dry well.
5. Control building to house control panel, on-site backup generator, and telemetry.

6. Standard PLC controller with ultrasonic level sensor or discrete level sensing probe (i.e. Multi-Trode). VFD's to increase/decrease pump speed based on PLC signal for wetwell level set points.

2.3.11 Wetwells

Wastewater pump station wetwells shall be designed to provide acceptable pump intake conditions, adequate volume to prevent excessive pump cycling, and sufficient depth for pump control, while minimizing solids deposition.

For constant speed pumps, the minimum volume between pump on and off levels can be calculated using the following general formula:

$V = tQ/4$, where
V = minimum volume (gallons)
t = minimum time between pump starts
Q = pump capacity (gallons/minute)

At normal operating levels, the designer shall consider the following recommendations:

A. Reduce or eliminate the free fall of sewage into the wetwell.
B. Minimize pre-rotation of water at the pump intake.
C. Provide adequate submergence to minimize surface vortices.
D. Locate the pump intakes to minimize the forming of subsurface vortices from the walls or floor.

There are exceptions, however, to these criteria. For example, a pre-rotation chamber can be used to swirl the water in the same direction as the pump is turning in order to reduce flow through the pump at low wetwell levels. This provides turndown ability for the pump without requiring a variable speed drive. Another exception is drawing down the water level to flush out solids buildup in the wetwell.

Wetwells shall be designed to minimize solids buildup. The wetwell shall be either trench or hopper style with side slopes of 45 degrees or steeper (60 degrees is preferred).

Wetwells shall be vented to the outside and not inside the control building. All electrical equipment shall be located above ground within the control building unless otherwise approved during design.

2.3.12 Grit, Grease, and Clogging Protection

If it is necessary to pump sewage prior to grit removal, the design of the wetwell shall receive special attention. In particular, the discharge piping shall be designed to prevent grit settling in discharge lines of pumps when not operating. At some pump stations, it may be beneficial to use bar screens, grinders, or comminutor devices. Design of bar screen facilities shall include odor control and a method for handling the screening.

Grease in the flow entering sewage pump stations can present problems, both for the sewage collection pipelines (from the source to the station) and in handling or removal after flow is present in the wetwell. Grease floats on the surface of the liquid in the wetwell and tends to cake on the walls and accumulate at the upper level control setting. Grease/foam can interfere with the pump control systems.

Grease can also contribute to odor in the pump station. Allowed to build up to the point of collapse from the wall or other surface, chunks of grease can clog the pump suction, restrict flow through other features such as vortex breakers and flow-directing vanes, or just increase operation or maintenance problems in the station or the force main downstream from it. Adequate access to the wetwell for grease removal using mechanical means, such as vactor or septic pumping-truck suction pipes or hoses, blasting using high-pressure water to loosen the material, injecting grease control chemicals by pumping, drip, shock or maintenance dosing, or hand scraping and removal methods shall be provided.

2.3.13 Flow Measurement

Suitable devices for measuring sewage flow shall be provided at pump stations. Run timers shall be provided on all pumps.

A wide variety of pump station level and flow control devices and instrumentation exist. The designer shall consider strategies that use instrumentation, monitoring, control, or process-driven concepts to integrate flow measurement into the overall perspective of the pump station design.

With complete information at hand, or data available for computer analysis, great gains can be made in operating efficiency, maintenance prediction, budgeting, coordination of treatment processes, and other useful productivity steps.

2.3.14 Surge Analysis – General

Hydraulic surges and transients (water hammer) shall be considered during design of pump stations and force mains. All systems shall be at least conceptually reviewed for the possibility of damaging hydraulic transients. The transients can cause vapor cavities, pipe rupture or collapse, joint weakening or separation, deterioration of pipe lining, excessive vibration, noise, deformation, or displacement, and otherwise unacceptable pressures for the system.

Possible sources of damaging conditions include closing or opening a valve, pump starts and stops, sudden power loss, rapid changes in demand, closure of an air release valve, pipe rupture, and failure of surge protection facilities. Particular care shall be taken in design if the expected change occurs in less than two wave periods, velocities are high (greater than 4 feet per second), the force main is long, the piping system has dead ends, or significant grade changes occur along the force main.

2.3.14.1 *Surge Modeling*

If it is not possible in conceptual design or with simple manual calculations to ensure that the system is safe from excessive water hammer conditions, the system shall be computer modeled. It is important that a computer modeling program is selected that suits the complexity of the project and has proven accuracy when compared to field-test results. The design methodology shall include some method of checking the model results before construction. During facility startup, modeled results shall be verified by gradually generating increasingly severe conditions. In this way it can be shown that the system will work as predicted prior to generating the worst-case design conditions.

2.3.14.2 *Surge Protection Facilities*

In general, the following methods shall be utilized to provide surge protection:

A. Appropriate check valve attachments.
B. Pump control valves.
C. Electric soft start/stop and variable speed drives for pumps.
D. Electric interlocks to prevent more than one pump from starting at the same time.

If the above methods are not expected to be sufficient to control or mitigate surges, additional methods shall be considered including, but not limited to the following:

A. Surge relief valves.
B. Surge anticipator valves.
C. Vacuum relief valves.
D. Regulated air release valves.
E. Optimizing the force main size and alignment.

A combination of methods may be necessary to provide a safe operating system. Care shall be taken in design so that adding a protection device does not precipitate a secondary water hammer equal to or worse than the original condition.

2.3.15 Odor and Noise Control

The design of both sewage pump stations and related pipelines shall consider odor and noise producing conditions and solutions. Gravity and pressure mains carrying wastewater to and from the station present separate problems. The physical layout of the pump station shall allow a variety of accessory systems to be applied that meet whatever odor concern is indicated, either before construction, in the planning/design phase, or after starting operation. Both the expected waste load, with associated chemical or unusual physical parameters, and the detention time and hydraulic characteristics of pipes and wetwell shall be considered.

2.3.15.1 *Odor Prevention*

The presence of odors associated with wastewater collection and pumping facilities can be a major source of public complaint. Odors are normally associated with anaerobic conditions, but can also occur because of industrial discharges. General approaches to odor control which shall be considered include prevention of production through facility design, facility operation or chemical/biological inhibition, containment, and collection and treatment. Hydrogen sulfide corrosion concerns shall be addressed in addition to the issues associated with odor control whenever containment is utilized.

2.3.15.2 *Noise Control*

Noise control for sewage pump station design depends on location, type, and layout of the station components, and local conditions, such as zoning, property use, or other ordinances.

The most significant sources of noise are emergency generators, ventilation equipment, and, in some cases, motor or pump operations. Of these, the emergency generator is most significant. The designer shall consider manufacturers' recommendations and careful study of the rated noise production values assigned to each component of a pump station to implement a successful noise-reduction strategy.

2.3.16 Operations and Maintenance

During the design of sewer pump stations, consideration shall be given to operations and maintenance (O&M) needs. This shall be documented in an O&M manual which conforms to the operating agency's O&M plan. The O&M manual shall include provisions for:

A. Detailed descriptions of all operating processes.
B. Design data for pumps, motors, force main, standby power, overflow point and elevation, telemetry, and sulfide control system, as applicable.
C. Pump curve with computed system curve showing design operating point.
D. Startup and shutdown procedures.
E. Analysis of critical safety issues.
F. Inventory of critical components, including nameplate data for pumps and motors, etc.
G. Description of the maintenance management system, including preventive and predictive maintenance.
H. Vulnerability analysis.
I. Contingency plan, including redundancy considerations.
J. List of affected agencies and utilities, including after-hour contacts.
K. List of local contractors for emergency repairs, including after-hours contacts.
L. List of vendors and manufacturers of critical system components, including after-hour contacts.
M. Staff training plan.
N. Record Drawings. All construction changes and location of underground pipe, conduit, buried facilities, shall be recorded by the contractor and be made part of the record drawings.

2.3.17 Reliability

Sewage pump stations shall be designed to provide enough reliability that accidental spills of wastewater into the environment or backups of sewage into structures do not occur. All pump stations shall be designed to EPA Class 1 reliability standards, unless otherwise approved by the City. The designer shall refer to OAR Chapter 340 Division 52 Appendix B for additional information on reliability.

2.3.18 Emergency Power

All sewage pump stations shall be designed with capability for emergency power in case the primary electrical feed is out of service. Each pump station shall be equipped with a permanently mounted standby generator unless otherwise approved by the City Engineer. Determining the required generator size depends upon the requirements of starting and operating the pumps at peak load and all ancillary equipment in the sewage pump station that could operate during a power outage.

2.3.18.1 *Portable Engine Generators*

As noted above, portable engine generators are not allowed except under special circumstances specifically approved by the City Engineer.

If a portable engine generator is allowed, it shall be trailer-mounted and include adequate fuel storage. A suitable towing vehicle shall be available at all times. A pump station that relies on a portable engine generator shall have a pigtail or proper electrical connection for the generator and a properly sized manual transfer switch.

For pump stations where portable engine generators are allowed, the wetwell shall be sized to provide at least one hour of holding time at the 5-year peak hour design flow.

2.3.18.2 *Permanent Engine Generators*

Properly sized permanent engine generators and automatic transfer switches shall be provided for quick transitions to standby power when the primary power fails. Permanent engine generators shall have diesel or natural gas engines, depending on size, availability of natural gas at the site, or as directed by the City Engineer.

Permanent engine generators shall be located inside a building or other weather-tight enclosure. Enclosure buildings shall be designed with appropriate accommodations for cooling and supply air for the engine, exhaust discharge, building ventilation, and sound attenuation. Where externally located engine generators are approved, they shall be equipped with sound attenuating enclosures appropriate for the neighborhood in which the pump station is located. Externally located generators also shall be equipped with block heaters to ensure reliable startup in cold weather.

2.3.18.3 *Fuel Storage*

Fuel storage for both portable and permanent engine generators shall be adequate to operate the pump station for a minimum of 24 hours continuously without refueling. In general, subbase fuel tanks are preferred. Decisions pertaining to fuel storage volume shall also consider access to a refueling vendor, accessibility of pump station during extreme weather conditions, and fuel storage location.

Above ground fuel storage shall have liquid containment capability equal to the volume in the tank and shall be covered to prevent accumulation of precipitation. The fuel fill tube shall be equipped to prevent overfilling of the tank.

Below ground fuel storage tanks and buried piping shall have double-wall containment and a leak detection system to prevent contamination of soils and ground water.

Regardless of fuel tank location, a fuel gauge shall be provided in the instrumentation system for remote readings of the fuel supply status.

2.3.19 Pump Controller

The pump controller shall provide continuous monitoring of the liquid level within the wet well and shall be compatible with the liquid level sensor utilized. It shall be 100 – 230 VAC, 60Hz powered and enclosed in a NEMA 4X polycarbonate enclosure designed for panel mounting. The controller shall be programmable by use of a hand held programmer provided by the manufacturer, or by use of a PC running manufacturer supplied integration software. The controller shall be HydroRanger 200 as manufactured by Siemens – Milltronics unless otherwise directed.

2.3.20 Level Sensing

Water levels within the wetwell shall be determined using either a suspended, ultrasonic level sensing transducer or an immersed, discrete level sensing probe.

If an ultrasonic level transducer is used, it should be a non-contacting, hermetically sealed unit designed for resistance to methane, hydrogen sulfide, and harsh chemicals common to wastewater. It should be fully submersible in the event of an overflow and should be able to provide reliable measurement even in conditions with obstructions, turbulence or foam. Ultrasonic level sensor shall be Siemens – Milltronics Echomax XRS-5; or approved equal.

If a level sensing probe is used, it shall transmit water level signals based on contact of discrete points along the probe with the water surface. A control relay by the same manufacturer shall be furnished with the probe. The probe shall be designed for use in wastewater applications and shall not be negatively affected by fat, grease, debris or foam. Level sensing probe shall be as manufactured by MultiTrode, Inc.; or approved equal.

2.3.21 Alarms and Telemetry

All sewage pump stations shall be equipped with sensors for key operational conditions and the alarm signals shall be connected to telemetry. The telemetry system shall send alarm signals to emergency phone numbers as directed by operations staff. (Per SCADA master plan?)

The telemetry system shall conform to the following, unless otherwise directed:

A. 120 VAC, 60Hz powered, equipped with an internal 12-hour battery backup and built-in charger, and include built-in power failure monitoring.
B. Self enclosed in a NEMA 4 fiberglass enclosure designed for wall mounting.
C. Equipped with a built-in LCD display to show alarm dialing status and shall have dual-color LED indicators for each input channel.
D. Programmable both locally on a built-in keypad and remotely from a touch-tone telephone.
E. Include 8 universal input channels which can be configured in the following formats: Normally open dry contact, normally closed dry contact, pulse counter, 4 – 20 mA analog, and 0 – 5 Volt analog.
F. Built-in sound level monitoring to detect smoke/fire alarms.
G. Built-in relay, SPST latching 2A, 250 VAC.
H. Allows recorded voice alarm messages; one for each input channel.
I. Capable of storing 48 phone numbers with 32 digits each and shall allow alarm specific dialing. Multiple phone lists for days, nights, and weekends.
J. Express II Remote Monitoring System as manufactured by Sensaphone, Inc.

2.4 FORCE MAINS

Force mains shall comply with the requirements of the Oregon Standards for Design and Construction of Wastewater Pump Stations, May 2001, as published by the Oregon Department of Environmental Quality (DEQ), and these guidelines.

2.4.1 Size & Velocity

Piping for publically owned/operated wastewater pump stations shall not be less than four inches in diameter. Force mains shall be designed such that the minimum velocity at pump startup is 3.5 feet per second (fps). For pump stations equipped with VFD's, the fluid velocity may be reduced to 2 fps after an initial flushing velocity of at least 3.5 fps is achieved at pump startup.

Force mains shall be sized such that the maximum velocity is not more than 8 fps at the 20-year peak design flow. If a velocity in excess of 8 fps will occur at peak flow conditions then a larger force main should be provided.

2.4.2 Air Release Valves

An air release or air/vacuum valve shall be placed at high points in the force main to relieve air locking. The surge effect on the system shall be considered when sizing these valves. Air release and air/vacuum valves shall be designed with cleanout or flushing attachments to facilitate maintenance. These valves shall be protected from freezing and from damage by heavy equipment. Generally, these valves should be located in a manhole or vault centered and supported over the force main. Since they are subject to grease and scum accumulation, these valves must be inspected periodically to determine the need for flushing or other maintenance.

2.4.3 Termination

The force main shall enter the receiving manhole with its centerline horizontal and an invert elevation that will ensure a smooth transition of flow to the gravity piping. In no case shall the force main enter the receiving manhole at a point more than one foot above the downstream flow line. Typically, a separate receiving manhole shall be provided such that force main flows are not discharged into gravity flow streams. If this is not possible due to space restrictions, a separate receiving channel shall be formed in the manhole base and the design shall minimize turbulence at the point of discharge.

Consideration shall be given to the use of inert materials or protective coatings for the receiving manhole and downstream piping within 250 feet thereof to prevent deterioration from hydrogen sulfide or other chemicals. Such chemicals are especially likely to be present on long force mains or where low seasonal flow conditions occur.

2.4.4 Construction Materials

Materials to be considered for force mains shall include PVC, polyethylene, ductile iron, or reinforced plastics. The pipe material and interior lining shall be selected to adapt to local conditions, including industrial waste and soil characteristics, exceptionally heavy external loading, internal erosion, corrosion, and similar problems. The pipe material selected shall be such that required valves and fittings are readily available. The pressure rating of the pipe material selected shall at least 1.25 times the calculated maximum pressure within the force main. A combination of static pressure and surge pressure should be considered.

Installation specifications shall contain appropriate requirements based on the criteria, standards, and requirements established by the industry in its technical publications. Requirements shall be set forth in the specifications for the pipe and methods of backfilling to preclude damage to the pipe or its joints, impede future cleaning operations, and prevent excessive pressures that may deflect the pipe or seriously impair flow capacity.

2.4.5 Pressure Testing

Force mains shall be hydrostatically tested at a minimum pressure of 1.5 times the design working pressure. The method of testing shall be in accordance with AWWA 906 test pressures. Leakage shall not exceed the amount given in the following formula:

$$L = (ND\sqrt{P}) / 7400$$

L = allowable leakage, gallons per hour
N = number of joints in length of pipeline tested
D = nominal diameter of the pipe in inches
P = average test pressure during the leakage test (psi)

2.4.6 Connections

In order to avoid shearing force main pipes because of differential settlement, flex couplings shall be used on force main pipes between the pump station structures, such as the pump station and the valve box. Flex couplings shall also be used between the final pump station structure and the force main.

2.4.7 Thrust Restraint

Thrust forces in pressurized pipelines shall be restrained or anchored to prevent excessive movement and joint separation under all projected conditions. Common methods include thrust blocking and various types of restrained joints. Thrust restraint shall be designed based on a minimum pressure of 1.5 times the design working pressure.

If thrust blocks are used, the surface area calculated should be based on an allowable soil bearing pressure of 1,500 pounds per square foot unless specific geotechnical data is available that supports use of a higher soil bearing pressure. Concrete for thrust blocking should be poured against firm, undisturbed soils.

For vertical anchor blocks resisting upward thrust, design should be based solely on the weight of concrete necessary to resist the calculated thrust force. No allowance will be allowed for the weight of soil over the anchor block.

2.4.8 Pig Launch / Retrieval Facilities

Provisions for launching and retrieving cleaning pigs shall be incorporated into the design of force mains at the direction of the City Engineer. Pig launching facilities may be as simple as a pipe wye or more elaborate, with a special launch chamber, bypass piping, and valves. In either case, provisions shall be made for attaching gauges to monitor pressure during cleaning. Retrieval facilities may also be elaborate or simple. Elaborate retrieval devices are usually mirror images of the launch device; baskets, traps, or screens placed in the receiving manhole are among the simpler retrieval methods. The design of pig launch and retrieval facilities, if required, will be as approved by the City Engineer.

3.0 STORM DRAINAGE AND DETENTION

3.1 PURPOSE

The purpose of these Storm Drainage and Detention Design Standards is to provide a consistent policy under which physical aspects of storm drainage design will be implemented. These standards have the objective of developing a storm drainage system which will:

A. Be consistent with the most current Storm Drainage Studies for Coos Bay and the City of Coos Bay Standard Construction Specifications;
B. Be of adequate design to safely manage all volumes of water generated upstream and on the site to an approved point of discharge;
C. Be designed based on future land use;
D. Provide points of disposal for stormwater generated by future developments upstream;
E. Prevent the uncontrolled or irresponsible discharge of stormwater onto adjoining public or private property;
F. Prevent discharge that exceeds the capacity of existing downstream channels and storm drainage facilities;
G. Have sufficient structural strength to resist erosion and all external loads which may be imposed;
H. Avoid impacts to stream water quality and quantity;
I. Maximize efficient use of the City's natural drainage systems and wetlands;
J. Be designed in a manner and use materials that allow economical future maintenance; and
K. Be designed using methods and materials that insure a minimum practical design life of 50 years for all systems and 75+ years in traveled rights-of-way.

3.2 GENERAL DESIGN CONSIDERATIONS

Storm drainage system design within a development area shall include provisions to adequately address the collection and conveyance of runoff from all public and private streets and easements, as well as from the roof, footing, and area drains of residential, multi-family, commercial, or industrial buildings.

Furthermore, the design shall provide for the future extension of the drainage system to the entire drainage basin in conformance with current adopted Storm Water Master Plan or approved modifications to those plans.

All storm drain system designs shall be based on an engineering analysis which takes into consideration runoff rates, pipe flow capacity, hydraulic grade line, soil characteristics, pipe strength, and potential construction problems.

3.3 Accountability for Drainage Design

This document presents the City of Coos Bay's underlying standards for engineering and design of drainage facilities. While the City believes these standards are appropriate for a wide range of development proposals, compliance solely with these requirements does not relieve the Design Engineer of the responsibility to ensure drainage facilities are engineered to provide adequate protection to public and private property and natural resources.

Other agencies may require some form of drainage review and impose drainage requirements that are separate from and in addition to those of the City. The Owner/Developer shall coordinate with agencies having jurisdiction to resolve any conflicts or concerns in drainage or water quality requirements.

3.3.1 Drainage Study

All developments (does this include infill single family dwelling?)which will increase or modify impervious surface shall, if further study is not required by the criteria outlined below, submit a drainage study and plan for the development site which provides for system capacity design for a 2 year storm event. The time of concentration for the study shall be determined by using a 10 minute start time and calculated travel times in gutters, pipes and swales for each drainage basin on the development area. The drainage design shall be checked for overflow impacts that may occur as a result of the 25-year storm event and shall include contingency measures to protect both on-site buildings and abutting properties. (For a SFD?)

A complete drainage study, as outlined below, shall be submitted for all developments which generate public and/or private storm drainage from more than one acre of land or generate peak flows in excess of 0.5 cfs. Developments or redevelopments that create 5,000 (Some SFR's do. Is it required to follow this?) square feet of new impervious surface or modify an existing drainage system with a capacity of 0.5 cfs or greater shall also submit a complete drainage study as outlined below. Drainage studies shall be prepared by a Civil Engineer licensed in the state of Oregon. All developments containing or adjacent to a floodplain, stream, wetland, natural resource area, or wellhead protection zone shall review and report their impact to those systems as part of the drainage study.

If required by the criteria stated above, a complete drainage study shall be prepared and shall include the following:

A. A written narrative describing the proposed drainage system in detail, including connections to the public system, a description addressing water quality measures (BMPs) proposed, as well as any necessary quantity measures which may be required for development (i.e. – Detention pond).

B. Hydrologic calculations to establish runoff volumes (see analysis method requirements and design event in following sections regarding Drainage Study Types).

C. Hydraulic calculations to establish runoff volumes.

D. A hydrological study map, which shall contain the following:

1. The entire drainage basin, well defined, and an appropriate amount of area beyond the drainage basin limits; 100 foot minimum distance.
2. Streets important to the study, and street names.
3. Flow arrows along streets, ditches, and natural drainage features.
4. Contours or spot elevations for verification of direction of overland flow and pipe cover.

Contour intervals on the Site Plan shall be as follows:

Slope (%)	Contour Interval (Feet)
0 - 10	2
11 - 25	5
> 25	10

5. Drainage areas of all sub-basins (in acres).
6. Collection points (nodes) at downstream limits of all sub-basins, complete with node numbers.
7. A profile of the storm drain system showing invert elevations, manhole top and bottom elevations, existing utilities, and existing and finished ground line elevations.
8. Existing and proposed storm drain pipes and channels with sizes and or cross-sections included.
9. Future pipes in the system, complete with proposed sizes, slopes, pipe cover, flow line elevations at manholes, etc.
10. Storm Water Master Plan information such as node numbers, basin names, drainage boundaries, etc.
11. North arrow, scale, company name and logo, designer, date, etc.
12. Environmentally sensitive areas (e.g. gullies, ravines, swales, wetlands, steep slopes, springs, creeks, etc.)
13. Show 100-year flood plain with flood elevations and 100-year flood way, as applicable.

3.3.2 Drainage Study Types

A. Small Site Study - a Small Site Study shall be required when ALL of the following criteria are met:

1. Study area less than five acres in size.
2. Study area drains into an established public system with available capacity for the peak flow based on the storm event frequency required under the Hydrologic Calculations Section below.
3. The development proposed is residential (infill SFR?) development. Commercial and Industrial developments may also qualify under small site study, provided the proposed development area is less than 1 acre.

4. Study area does not contain and is not adjacent to a floodplain, stream, wetland, or natural resource area.

B. Mid-Level Development Study - a Mid-Level Development Study shall be required when the criteria for a Small Site Study cannot be met and when ALL of the following criteria are met:

1. Study area less than 25 acres in size.
2. Study area drains to an established public system within the City limits.
3. Study area does not contain and is not adjacent to a floodplain, stream, wetland, or natural resource area.

C. Full Drainage Development Study - a Full Drainage Development Study shall be required when the criteria for a Small Site Study and Mid-Level Development Study cannot be met. Some examples of when a Full Drainage Development Study shall be required include, but are not limited to cases where ANY of the following conditions are met:

1. Study areas greater than 25 acres in size.
2. Developments which require creation of a new outfall and/or exceed existing system capacity.
3. Study sites which contain or are adjacent to a floodplain, stream, wetland, or natural resource area.
4. Any development which does not qualify for a Small Site or Mid-Level Development study and which either generates a peak flow in excess of 0.5 cfs, or modifies a drainage system with a capacity of 0.5 cfs or greater, or is a redevelopment or development which creates 5,000 square feet or more of new impervious area.

D. The City Engineer will make the final determination on the level of study required for any specific development.

3.3.3 Hydrologic Calculations

A. Small Site

1. The Rational Method. (When the 'C' factor in the Rational Method peak flow analysis is 0.5 or greater, the time of concentration / flow time and the peak flow from the impervious areas shall be computed separately and compared to the combined area. The higher of the two peak flow rates shall then be used to size the conveyance.) (New SFD)
2. 2-year storm event frequency for volumes up to 5 cfs.
3. 5-year storm event frequency for volumes from 5 cfs to 20 cfs.

B. Mid-Level Development

1. Unit Hydrograph Method. Use SCS Type 1 A distribution for rainfall.
2. Storm event as Small Site and using the ten-year event for volumes of 20 cfs to 40 cfs.

3. 25-year storm event for detention facilities where necessary to meet downstream capacity issues.
4. 50-year storm event for volumes above 40 cfs or where the primary drainage crosses a State Highway.

C. Full Drainage Development

1. Unit Hydrograph Method. Use SCS Type 1A distribution for rainfall.
2. Floodplain analysis if development impacts a floodplain.
3. Storm event as volumes outlined in Small and Mid-Level above and 100-year flood for areas in the floodplain.

3.3.4 Hydraulic Calculations

A. In each instance, the method of hydraulic calculations shall be subject to City approval.

B. Site development improvement projects shall address on-site and off-site drainage concerns, both upstream and downstream of a project, including but not limited to:

1. Modifications to existing on-site storm drainage facilities shall not restrict flows or create backwater onto adjacent properties to levels greater than the existing situation unless approved by the affected property owner(s) and the City. The affected property owner(s) shall agree to and sign an easement identifying the location of the backwater storage.
2. Storm drainage facilities shall be designed and constructed to accommodate all flows generated from upstream property from the most recent approved land use plan at full development.
3. The design of storm drainage facilities shall analyze the impact of restrictions downstream of the project site. Downstream restrictions that create on-site backwater shall be removed by the developer or the on-site backwater shall be addressed in the design of the development's storm system. The removal of downstream obstructions shall not be allowed if this removal creates downstream capacity problems.

C. Review of Downstream System

1. The design engineer for each development constructing new impervious surface of more than 5,000 square feet shall submit documentation, for review by the City, of the downstream capacity of any existing storm facilities impacted by the proposed development. The design engineer must perform an analysis of the drainage system downstream of the development to a point in the drainage system where the proposed development site constitutes ten percent or less of the total tributary drainage volume, but in no event less that 1/4 mile.

2. If the capacity of any downstream public storm conveyance system or culvert is surpassed during the Event/CFS level requirements, due directly to the

development, the developer shall correct (mitigate) the capacity problem or construct an on-site detention facility unless approved otherwise by the City.

3. If the projected increase in surface water runoff which will leave a proposed development will cause or contribute to damage from flooding to existing buildings or dwellings, the downstream stormwater system shall be enlarged to relieve the identified flooding condition prior to development, or the developer must construct an on-site detention facility.

4. Any increase in downstream flow shall be reviewed for erosion potential, defined as downstream channels, ravines, or slopes with evidence of erosion/incision sufficient to pose a sedimentation hazard to downstream conveyance systems or pose a landslide hazard by undercutting adjacent steep slopes.

3.4 Design of Storm Water Facilities

3.4.1 General

A. The conveyance system shall be designed to carry and contain at least the peak runoff for the Event/CFS design requirements. Structures for proposed pipe systems shall provide a minimum of one foot of freeboard between the hydraulic grade line and the top of the structure or finish grade above pipe for a 25-year peak rate of runoff. Surcharge in pipe systems shall not be allowed if it will cause flooding in portions of a habitable structure, including below-floor crawl spaces. All public pipes shall be laid at a positive slope, and no system shall be designed to be permanently surcharged.

B. The design shall be supplemented with an overland conveyance component demonstrating how a 100-year event will be accommodated. This overland component shall not be allowed to flow through or inundate an existing building.

3.4.2 Manhole Design

A. Manholes shall be provided at least every 500 feet, at each change in pipe grade or alignment, and at each junction of two or more lines. Manhole lids shall have a minimum of six inches of clearance from the edge of curbs and shall not be in wheel paths of the traveled way.

B. All manholes shall be a minimum of 48 inches in diameter.

C. Pipe crowns of branch or trunk lines entering and exiting junctions shall be at the same elevation. If a lateral is placed so its flow is directed against the main flow through the manhole or catch basin, the lateral invert shall be raised to match the crown of the mainline pipe.

D. Manholes on sealed joint systems and all drainage systems on slopes greater than ten percent shall be constructed with a 20-foot, parallel perforated line to drain ground and trench water into the system.

E. Inside drop and water quality manholes shall be at least 60 inches in diameter with at least 42 inches of clear space.

F. All manholes shall have a minimum 12-inch ledge on one side of the channel in the base at an elevation of 0.8 of pipe height, except for water quality manholes.

G. Details shall be submitted with the plans where pipes into or out of a manhole are larger than 24 inches, or where more than four mainline connections are made.

H. Horizontal location of connections to an existing manhole, elevation of the existing ledge, and elevations of existing inlets and outlets shall be submitted with the plans.

I. Connections are allowed directly into a manhole providing that they are properly channelized. No more than three side laterals shall be connected to a manhole unless otherwise approved by the City. There shall be a minimum of eight inches separating connections as measured from the outside edge of adjacent pipes.

J. A manhole may have a free inside drop of up to two feet.

K. Line Manholes may be 'T' top design for pipe diameters 42 inches and larger where no side line connections are present or planned.

3.4.3 Water Quality Components

A. Water quality manholes/structures shall be an approved, manufactured unit. All capacity, efficiency, operation and maintenance data shall be submitted at the time of plan review.

B. Each water quality manhole shall be designed for the runoff from the upstream watershed at build out, based on the applicable comprehensive land use plan. No flow shall be introduced into the manhole in addition to the design amount.

C. Water quality manholes shall be a minimum of 60 inches in diameter. Larger structures may be required depending on the type and extent of treatment desired.

D. Water quality manholes shall not be used in a submerged or surcharged system. The manufacturer's required head losses shall be accommodated for in the system design.

E. Water quality components will only be required if determined necessary by the City Engineer or if required by a regulating agency (i.e. DEQ).

3.4.4 Pipe and Conduit Design

A. Mainline piping shall be a minimum of 12-inches diameter.

B. Branch piping serving catch basins shall be a minimum of 12-inches (?) diameter unless otherwise approved by the City Engineer. Smaller piping may be allowed where space restrictions prevent use of 12-inch diameter pipe.

C. Service laterals for single-family residences (downspouts, foundation drains, etc.) shall be 6-inches diameter, minimum.

D. All other lateral or branch piping shall be a minimum of 12-inches diameter unless otherwise approved by the City Engineer.

E. All pipes shall be designed to achieve a minimum self-cleaning velocity of three feet per second (fps) at half-full based on the following table of Manning's 'n' values.

Table 3-1: Manning's 'n' Values for Pipes

Pipe Material	Uniform Flow (Preliminary Design)	Backwater Flow (Capacity Verification)
Concrete pipe and Lined Corrugated PE Pipe	.014	.012
Annular Corrugated Metal Pipe		
2-2/3" x 1/2" plain or fully coated	.028	.024
Paved Invert	.021	.018
3" x 1" corrugation	.031	.027
6" x 2" corrugation (field bolted)	.035	.030
Helical 2-2/3" x 1/2" corrugation & Corrugated PE pipe	.028	.024
Spiral rib metal pipe & PVC pipe	.013	.011
Ductile iron pipe cement lined	.014	.012
Solid Wall PE pipe (butt fused only)	.009	.009

F. All pipes exceeding critical flow velocities shall have analysis data submitted showing the effects of hydraulic jump at manholes and downstream water levels for peak flow situations.

G. Pipe Location

1. All storm drain pipes shall be located within the public right-of-way. Exceptions for systems with physical constraints precluding location within the public right-of-way may be granted at the discretion of the City Engineer.
2. Storm pipes shall not be located closer than ten feet from the edge of a public street right-of-way, unless otherwise approved by the City Engineer.
3. Storm pipes in easements shall be located in the center of the easement unless otherwise approved by the City Engineer. The centerline of a storm pipe shall not be located closer than seven feet to an easement side line. Minimum 15-foot wide easements required for public lines on private property.

4. Storm pipes shall be located so that manholes are not in the wheel path.
5. Drainage laterals shall be provided on the down slope side of all lots in developments where drainage to the street cannot be provided.
6. The crowns (inside tops) of pipes shall match wherever practical when changing pipe sizes at manholes.

H. Distance Between Drainage Structures – The maximum length of pipe between drainage structures shall be 500 feet for all systems with pipe 24 inches and smaller. Large diameter trunk systems shall not exceed 600 feet between structures.

I. Alignment – Pipes shall be laid on straight alignments at a uniform grade from structure to structure.

J. Pipe Cover

1. Pipe cover shall be measured from the finished ground elevation to the top of the outside surface of the pipe in areas outside paved areas. In paved areas, the pipe cover shall be measured from the lowest point of the gutter section to the top outside surface of the pipe.
2. The minimum pipe cover shall be 36 inches for plain concrete and plastic pipe materials and 18 inches for reinforced concrete and corrugated (double wall) HDPE pipe. An engineered solution may be accepted if a project is unable to meet these conditions. (Under roadways current policy is 4' under street.)
3. In flat drainage basins, the design engineer shall demonstrate that the storm pipe has been laid at a depth sufficient to properly drain the remainder of the upstream tributary area.

K. Perforated pipe systems or 'French drains' shall be engineered and be approved by the City Engineer.

3.5 Catch Basin / Inlet Design

A. All inlet and catch basin openings shall be designed to accept flow from a ten-year storm event. Grates shall, as far as practical, be designed to avoid failure due to accumulation of debris.

B. All inlets to the public storm drain system shall be equipped with trash racks, debris barriers, removable oil/grease traps as applicable, and 18-inch sumps.

C. All catch basins shall be constructed with an 18-inch sump.

D. Flows in streets during the two-year event shall not run deeper than four inches against a curb or extend more than two feet into the travel lane. Streets classified as collector and above and streets in commercial areas shall meet the above requirements for the ten-year event. Inlets in sag locations shall be designed with no more that one foot of depth during the 25- year event.

E. A catch basin shall be provided just prior to curb returns on streets with a centerline gradient of three percent or more and a street gutter drainage run of 100 feet or more.

F. Catch basins may connect to main storm lines with a tee connection when the main storm line is at least one size larger that the catch basin line. When the catch basin line is the same size as the main storm line, the connections shall be made at a manhole or other approved structure. The maximum length of pipeline between the catch basin and the mainline shall be 60 feet. Oversize catch basins (one 30-inch inside dimension) shall be installed when a tee connection is used.

G. Ditch inlets shall be located at the upper terminus of a main storm line or shall connect to a main storm line only at a manhole.

3.6 Channels and Ditches

A. Vegetation-lined channels shall be used whenever possible.

B. Rock-lined channels shall be used where a vegetative lining will not provide adequate protection from erosive velocities.

C. Channel Design

1. Constructed open channels shall be sized to pass the required flows and have side slopes no steeper than 2:1. Any proposed constructed channel improvement that does not meet these requirements may be required to be piped by the City Engineer.
2. Channels designed to handle the runoff from a development shall be constructed from the development to an existing public drainage conveyance system with an established outfall to a receiving water.
3. Channels shall not contain protruding pipes, culverts or other structures that reduce or hinder the flow characteristics of the channel, except for structures which are required and designed to dissipate velocities. Channels shall be designed to prevent scouring and erosion.
4. Channel protection shall be as shown in the following table.

Table 3-2: Channel Protection for Channel Construction

Velocity Greater Than (FPS)	Velocity Less Than or Equal To (FPS)	Required Protection	Thickness	Min. Height Above Design Water Surface
0	5	Vegetation Lining	N/A	0.5 ft.
5	8	Riprap class 50	1 ft.	1 ft.
8	12	Riprap class 100	2 ft.	2 ft.
12	20	Gabion or Velocity Dissipaters	Varies	2 ft.

D. Access & Maintenance

1. Access roads or other suitable access ways for maintenance purposes shall be provided when channels do not abut public right-of-way. Access shall be provided along one side of the channel as necessary for vehicular maintenance access.
2. Access roads shall have a maximum grade of 15 percent and a maximum cross slope of 3 percent.
3. Access roads shall be a minimum of 15 feet wide on curved sections and 12 feet on straight sections.
4. Access roads in excess of 50 feet in length shall have a turnaround unless otherwise approved by the City Engineer. A 40-foot minimum outside turning radius or hammerhead shall be provided for turn around.
5. Access roads shall be capable of supporting a 20-ton vehicle under all weather conditions.

3.7 OUTFALLS

A. Outfalls shall conform to the requirements of all federal, state, and local regulations.

B. Outfalls shall be above the mean low water level except as approved by the City Engineer. Installation of tide gates may be necessary when the outfall is in a tail-water condition.

C. Erosion must be prevented at the outfall. All outfalls shall be provided with a rock splash pad or other approved erosion control protection measures. Mechanisms which reduce velocity prior to discharge from an outfall are encouraged and may be required. Examples are drop manholes and rapid expansion into pipes of much larger size. Other forms of energy dissipation may include stilling basins, drop pools, hydraulic jump basins, baffled aprons, or bucket aprons, and shall be provided for outfalls with velocity at design flow greater than 10 FPS.

D. If required, tide gates, flap gates, or other backwater control devices shall meet the requirements of ODFW, NOAA, and other applicable regulatory agencies.

3.8 Downstream Protection Requirement

Each new development or redevelopment shall mitigate the impacts, on both the quantity and quality of stormwater, of that development upon the existing public stormwater system. The development may be able to mitigate water quantity impacts on the system through the use of the following techniques, subject to the limitations and requirements of these Design Standards and the approval of the City Engineer.

A. Construction of permanent on-site stormwater quantity detention facilities designed in accordance with current water quantity practices.

B. Enlargement or improvement of the downstream conveyance system.

3.9 Criteria for Requiring Onsite Detention

On-site detention facilities shall be constructed when any of the following conditions exists:

A. There is an identified downstream deficiency, and detention, rather than conveyance system enlargement, is determined to be the more effective solution.

B. There is an identified regional detention site within the boundary of the development.

C. The need for pre-treatment of stormwater discharge dictates that flows be detained for water quality processes.

D. There is a need to mitigate flow impacts on receiving streams.

E. There is a need for additional detention due to an increase in impermeable surface area.

3.9.1 Onsite Detention Design Requirements

A. When required, onsite stormwater detention facilities shall be designed to capture runoff so the post-development runoff rates from the site do not exceed the pre-development conditions, based upon a 2-year through 25-year, 24-hour return storm. Volume and duration of pre-development conditions will be considered.

B. When required because of an identified downstream deficiency, onsite stormwater detention facilities shall be designed so that the peak runoff rates will not exceed pre-development rates for the specific range of storms that cause the downstream deficiency.

C. Construction of on-site detention shall not be allowed as an option if such a detention facility would have an adverse effect upon receiving waters in the basin or sub-basin in the event of flooding, or would increase the likelihood or severity of flooding problems downstream of the site.

3.9.2 Impervious Area Used in Design

A. For single family and duplex residential subdivisions, stormwater quantity detention facilities shall be sized for all impervious areas created by the subdivision, including all streets, residences on individual lots at a rate of 2,640 square feet of impervious surface area per dwelling unit, and other impervious area. Such facilities shall be constructed in conjunction with the subdivision's public improvements.

B. For all developments other than single family and duplex, the sizing of stormwater quantity detention facilities shall be based on the impervious area to be created by the development, including structures and all streets and impervious areas. Impervious surfaces shall be determined based upon building permits, construction plans, or other appropriate methods deemed reliable by the City.

3.10 DETENTION POND DESIGN

A. Detention ponds and other open impoundment facilities such as landscape areas, open playing fields and parklands, shall comply with the requirements of ORS 537, in general and more specifically ORS 537.4 Ponds and Reservoirs. All detention ponds shall be designed by a Civil Engineer licensed in the state of Oregon.

B. Facility Geometrics

1. Interior side slopes up to the maximum water surface shall be no steeper than 3H:1V. If the interior slope needs to be mowed, the slope shall be 4H:1V.
2. Exterior side slopes shall not be steeper than 2H:1V unless analyzed for stability by a geotechnical engineer.
3. Pond walls and/or dikes may be retaining walls, provided that the design is prepared and stamped by a registered professional engineer a fence is provided along the top of the wall and that at least 25 percent of the pond perimeter will be a vegetated soil slope of not greater than 3H:1V. (Fencing should be a requirement at all detention ponds.)

C. Water Quality Considerations

1. Pond bottoms shall be level, and shall be located a minimum of 0.5 feet below the inlet and outlet to provide sediment storage.

2. The inlet and outlet structures should be on opposite ends of the pond to promote maximum residence time and to prevent short-circuiting. Baffles may be allowed in order to increase residence time or in such cases where locating the inlet and outlet structures on opposite sides of the pond is not practical.
3. Detention facilities shall be designed so that the drawdown time does not exceed 48 hours. In the event drawdown time exceeds 48 hours, the proposed facility shall be sized to contain an additional 25-year, 24-hour return storm.
4. The use of a sedimentation fore-bay shall be required during the construction process if the pond is to be used for sedimentation control. After construction is complete, the pond shall be completely cleaned and all sediment shall be removed prior to hook up to City infrastructure.

D. Overflow - Emergency Spillway

1. A pond overflow system shall provide controlled discharge of the design storm event for developed contributing area without overtopping any part of the pond embankment or exceeding the capacity of the emergency spillway.
2. The design shall provide controlled discharge directly into the downstream conveyance system.
3. An emergency overflow spillway (secondary overflow) shall be provided to safely pass the 100-year, 24-hour design storm event over the pond embankment in the event of control structure failure and for storm/runoff events exceeding design.
4. The spillway shall be located to direct overflows safely towards the downstream conveyance system.
5. The emergency spillway shall be stabilized with riprap or other approved means and shall extend to the toe of each face of the berm embankment.

E. Access/Maintenance

1. Pond access easements and roads shall be provided when ponds do not abut a public right-of-way. Access roads shall provide access to the control structure and along one or both sides of the pond as necessary for vehicular maintenance as determined by the City Engineer.
2. Access roads shall have a maximum grade of 15 percent; and a maximum cross slope of 3 percent.
3. Access roads shall be a minimum of 15 feet wide on curved sections and 12 feet on straight sections.
4. Access roads in excess of 50 feet in length shall have a turnaround unless otherwise approved by the City Engineer. A 40-foot minimum outside turning radius or hammerhead shall be provided for turn around.
5. Access roads shall have the capability of supporting a 20-ton vehicle under all weather conditions.

F. Slope Stabilization

1. Pond berm embankments higher than six-feet shall be designed by a geotechnical engineer.

2. The berm embankment shall have a minimum 15-foot top width where necessary for maintenance access; otherwise, top width may vary as recommended by the design engineer, but in no case shall top width be less than four feet.
3. The toe of the exterior slope of pond berm embankment shall be no closer than five feet from the tract or easement property line.
4. The pond berm embankment shall be constructed on native consolidated soil (or adequately compacted and stable fill soils analyzed by a geotechnical engineer) free of loose surface soil materials, roots and other organic debris.
5. The pond berm embankments shall be constructed by excavating a 'key' equal to 50 percent of the berm embankment cross-sectional height and width or as designed by a geotechnical engineer.
6. The berm embankment shall be constructed on compacted soil (95 percent minimum dry density per AASHTO T99) placed in maximum six-inch lifts, with the following soil characteristics:
    a. A minimum of 30% clay,
    b. A maximum of 60% sand,
    c. A maximum of 60% silt,
    d. With nominal gravel content,
    e. Or as designed by a geotechnical engineer. (Fencing?)
7. Anti-seepage collars shall be placed on pipes in berm embankments which impound water greater than four feet in depth at the design water surface.
8. Exposed earth on the pond bottom and side slopes shall be seeded with seed mixture approved by the City Engineer.

3.11 Underground Detention Facilities

A. In general, the City preference is to have stormwater runoff detention occur above ground. Underground detention facilities may be allowed in select locations if all means of surface detention have been explored and exhausted.

B. Underground detention facilities shall be used as a means of controlling stormwater quantity only.

C. All underground detention facilities shall be designed by a Civil Engineer licensed in the state of Oregon.

3.11.1 Detention Tanks & Vaults

A. For the purpose of this design manual, underground detention tanks shall be limited to large diameter pipes. Detention vaults typically are of box-shaped design, and constructed with reinforced concrete.

B. Detention tanks and vaults should be designed for factors such as environmental conditions (soil corrositivity, inundation, etc.), maintenance access, and ground and/or surface loadings.

C. Detention tanks and vaults shall comply with the following criteria:

1. All tanks/vaults shall be designed as flow-through systems, incorporating the use of in line manholes for maintenance and sediment removal.
2. The bottoms of detention tanks/vaults shall be level, and shall be located a minimum of 0.5 foot below the inlet and outlet to provide sediment storage.
3. The minimum pipe size allowed for a detention tank in the public drainage system shall be 36 inches in diameter. Acceptable materials include the following:
    a. Reinforced concrete pipe;
    b. Lined corrugated polyethylene pipe;
    c. Others as approved by the City Engineer.
4. For detention vaults, minimum 3,000 psi reinforced concrete shall be used. All joints shall be equipped with water stops.
5. City owned tanks/vaults shall be located in the right-of-way; tanks proposed to be located outside the right-of-way shall be located in a Public Drainage Easement, dedicated to the City of Coos Bay.

D. Buoyancy – The effects of buoyancy shall be considered in design of underground detention tanks. Measures such as concrete anchors, concrete backfill, subsurface drains, etc. shall be utilized to counteract buoyancy forces. Supporting engineered calculations are required as part of design.

E. Structural Stability – Consideration shall be given to ensure tanks meet requirements for potential traffic loading and overburden support. Tanks shall be placed on stable, well consolidated native material with appropriate bedding. A structural analysis, geotechnical analysis, and engineered calculations may be required with the design, demonstrating stability and constructability. For tanks proposed under the traveled way, H20 live loadings shall be accommodated.

F. Access/Maintenance

1. Access easements and roads shall be provided when tanks are not located within the public right-of-way.
2. Access openings shall be provided at a distance of no less than 50 feet from any location within the tank, shall be a minimum of 36 inches in diameter, and shall have water-tight round lids.
3. All access openings shall have surface access for maintenance vehicles.
4. The distance from tank invert to finished grade shall be not more than 20 feet.
5. OSHA confined space requirements shall be met for tanks, and entrances to confined spaces shall be clearly marked.

G. Access Roads – If required, access roads shall meet the requirements stated in Section 3.10-E of this manual.

4.0 SITE GRADING AND EROSION CONTROL

4.1 PURPOSE

A. The purpose of this Section is to protect existing public and private improvements against damage that may occur as a result of grading activities on private properties within the City of Coos Bay. In addition, minimum erosion control measures are identified which are intended to prevent or minimize sediment discharge from sites where grading is planned.

B. Depending on the location and nature of the work, permits may also be required from the Oregon Department of Environmental Quality (DEQ), Oregon Division of State Lands (DSL), the Army Corps of Engineers, the Oregon Department of Fish and Wildlife (ODFW), or US Fish and Wildlife. If such permits are required, the applicant shall provide evidence to the City that a permit has been obtained prior to any clearing, grading, or excavation activities.

4.2 GRADING PERMITS

A. Grading Permits are required for all proposed grading on parcels within the City of Coos Bay, including lot leveling, slope grading, site drainage, retaining wall excavation and fill, and other grading activities associated with site development.

B. Grading Permits are not required for sites on which excavation is limited to footing or foundation excavations and utility trenches. These items shall be covered under the Building Permit.

C. Grading Permits, when required, shall be obtained from the City of Coos Bay Public Works and Development Department. The permit application form is available on the City's website (http://www.coosbay.org/) or from the Department (Phone: 541/269-8918).

4.2.1 Grading Plan

A. Each application for a grading permit shall be accompanied by a plan which clearly shows the nature and extent of the work proposed.

B. Grading plans as described herein are intended for proposed grading, excavation, or fill projects on existing platted parcels within the City of Coos Bay. Grading plans for land division projects shall be included with plans submitted for development review as specified in Part 1 – Procedural Requirements of these Development Provisions for Public and Private Infrastructure.

C. The following items shall be included on each proposed grading plan:

1. Name of the property owner and the person or firm that prepared the plan.
2. Site address and parcel number (Map (define) and Tax Lot).

3. Property lines and any easements on or across the property.
4. Limits of clearing.
5. Extents of proposed grading, including depth of cut and fill.
6. Location of all existing and proposed buildings or structures and location of any buildings or structures within 15 feet of the proposed grading.
7. Location of any existing or proposed retaining walls (label wall height).
8. Location of any existing or proposed drainage courses or piping.
9. Configuration of all proposed cut and fill slopes (i.e. 2H:1V).

4.3 Grading and Fill Requirements

A. Fill slopes shall not exceed two feet horizontal to one foot vertical (2:1). The toe of fill slopes shall be setback from property boundaries at least one-half the height of the fill with a minimum of 2 feet and a maximum of 20 feet (?). Where a fill slope is to be located near the site boundary and the adjacent property is developed, precautions shall be taken to protect the adjoining property from damage as a result of such grading. These precautions may include but are not limited to:

   1. Additional setbacks.
   2. Provision for retaining or slough walls.
   3. Mechanical or chemical treatment of the fill slope surface to minimize erosion.
   4. Provisions for the control of runoff.

B. Cut slopes shall be no steeper than two feet horizontal to one foot vertical (2:1) unless a Geotechnical Engineering report is submitted which justifies a steeper slope can be safely constructed and will not create a hazard to adjoining public or private property. The top of cut slopes shall not be made nearer to a site boundary line than one-fifth the height of cut with a minimum of 2 feet and a maximum of 10 feet (?). The setback may need to be increased if an interceptor drain is required.

C. Surface vegetation and topsoil must be grubbed to a depth of at least six inches (6") prior to placement of fill material. All existing vegetation must be removed from areas designated to receive fill prior to placement.

D. Fill material shall be free of all rubbish, organic material, and other deleterious substances which could be detrimental to the stability of the fill. Fill material shall be free of rock or similar irreducible material with a maximum dimension greater than 12 inches.

E. Fill shall be compacted to at least 90% of maximum density as determined by the ASTM D1557 (Modified Proctor) test method. Fill material shall be placed in lifts not exceeding 12 inches compacted depth.

F. A report prepared by a Geotechnical Engineer licensed in the State of Oregon is required when fills in excess of 12 inches are planned within future building areas. The specified fill material shall be placed and compacted in accordance with the recommendations of the report. Any required testing shall be as recommended in the report.

G. Disturbed areas not scheduled for construction of buildings or other improvements shall be stabilized to prevent erosion once grading is complete. Methods of stabilization shall be as described in Section 4.5 below. Stabilization shall be completed within 30 days of the date all grading is finished. Temporary stabilization measures may also be required prior to completion of the project if the City determines it is necessary due to windblown dust or erosion at the site.

4.4 Other Requirements

A. For sites located partially or entirely within a Special Flood Hazard Area as identified on the FEMA Flood Insurance Rate Maps, pre and post elevation certificates are required prior to and after placement of any structures within the floodplain. If the proposed fill raises the property above the floodplain, the applicant may be eligible to formally remove the property from the Special Flood Hazard Area. Forms are available from the City if the applicant wishes to apply for an amendment to the mapping.

B. The disturbance of one or more acres requires application for a National Pollutant Discharge Elimination System (NPDES) General Permit 1200-C as administered by the Oregon Department of Environmental Quality (DEQ). The application form is available on online or can be obtained from the local DEQ office. Issuance of a Grading Permit from the City of Coos Bay does not meet or negate the requirement to obtain an NPDES General Permit 1200-C.

C. Excavations exceeding 5,000 cubic yards within a 12-month period require an Operating Permit from the Oregon Department of Geology and Mineral Industries (DOGAMI). Application forms are available online at www.oregongeology.com or by contacting DOGAMI at (971) 673-1555.

D. If the proposed grading includes import or export of materials a heavy hauling permit may be required by the City of Coos Bay. Heavy hauling permits require bonding to insure against damage to existing infrastructure within the right-of-way. The amount of bonding required is based on the volume of import/export and will be determined at the time the Grading Permit application is submitted. (By Whom?) (Guidelines for this needed.)

4.5 Erosion Control Policies and Criteria

4.5.1 General

Submission of an Erosion Control Plan is required in conjunction with each Grading Permit application. The best management practices (BMPs) listed below in Section 4.5.3 are required minimum measures but may not be appropriate for every site. The City will review Erosion Control Plans for completeness and compliance with requirements. However, it is the responsibility of the applicant to meet the following erosion control performance standard:

- Erosion control measures shall be designed and implemented as required to prevent visible and measureable erosion or sediment.

4.5.2 Referenced Standards

For erosion control best management practices (BMP's) refer to the Oregon Department of Environmental Quality Erosion and Sediment Control Manual. It is available from DEQ's website at http://www.deq.state.or.us/wq/stormwater/docs/escmanual/manual.pdf.

4.5.3 Required Best Management Practices (BMP's)

The BMP's listed below are required, where applicable, for grading projects within the City of Coos Bay. Additional measures may be required depending on project scope or as a condition of other required permits such as the NPDES General Permit 1200-C.

A. Mark Clearing Limits – Clearing and grading of the site should be planned properly. It is important to clear only the areas needed, thus keeping exposed areas to a minimum. Clearing should be phased so that only those areas that are actively being worked are uncovered. Clearing limits shall be flagged prior to the initiation of clearing.

B. Stabilized Construction Entrance – A stabilized construction entrance shall be the sole entrance or egress from the site. Prior to initiating grading, construct a stabilized construction entrance. Do not install gravel on paved surfaces. Stabilized construction entrances shall be installed and maintained in accordance with the requirements of Appendix F – Part SC-10 of the Erosion and Sediment Control Manual.

C. Protect Stockpiles and Staging Areas – Soil and material stockpiles shall be situated so that the material does not erode into the street or adjoining properties. Excavated soil and material stockpiles should be located at least 10 feet behind the curb, such as in the backyard or side yard area. This practice will increase the distance eroded soil and stockpiled material must travel to reach the stormwater conveyance system. If applicable to the site, concentrated flows shall be diverted away from staging areas and stockpiles using BMP's from the Erosion and Sediment Control Manual. Soil and material stockpiles shall be covered when not in use (e.g. when not accessed for 48 hours or more) during the period of October 1st to May 31st. This requirement may be waived for soil and gravel stockpiles on flat (<5%) slopes if in the opinion of the inspector, the risk of erosion is minimal.

D. Sediment Fence – Install sediment fence along a level contour, with the last 6 ft of fence turned up slope. Except for the ends, the difference in elevation between the highest and lowest point along the top of the sediment fence shall not exceed one-third the fence height. Sediment fence shall be installed and maintained in accordance with the requirements of Appendix F – Part SC-1 of the Erosion and Sediment Control Manual.

E. Storm Drain Inlet Protection – Protect storm drain inlets immediately downstream from the site using BMP's from Appendix F – Part SC-8 of the Erosion and Sediment Control Manual.

F. Slope Protection and Temporary Cover – Slope stabilization measures (for slopes 3:1 and steeper) must be initiated within 14 calendar days between June 1st and September 30th and within 7 days between October 1st and May 31st in portions of the site where grading activities have temporarily or permanently ceased. Slopes shall be stabilized using mulch, erosion control matting, or other methods as approved. Methods for slope protection shall be as recommended in Appendices E and F of the Erosion and Sediment Control Manual.

G. Establish Permanent Cover – Prior to removal of erosion control and temporary slope protection measures, permanent cover must be established on the site. Permanent cover shall be installed within 30 days of the date all grading and other site work is finished. Permanent cover shall include seeding, vegetative plantings, and other methods as approved. Refer to Appendices E and F of the Erosion and Sediment Control Manual.

4.5.4 Inspection

A. Preconstruction Inspection – Inspection of sediment and erosion control measures is required prior to initiation of clearing and grading activities. Contact the Public Works and Development Department (Phone: 541/269-8918) to schedule inspections.

B. Final Inspection – Final inspection of permanent cover is required for closeout of Grading Permits. Inspections should be scheduled immediately following installation of permanent cover. If any additional work is required as identified during inspection, follow-up inspection may be required. (Inspections should require sign off/on grading permit.)

5.0 STANDARD DRAWINGS

5.1 General Standard details

Drawing No.	Title

5.2 STREETS AND SIDEWALKS

Drawing No. Title

5.3 SANITARY SEWER

Drawing No.	Title

5.4 STORM DRAINAGE

Drawing No. Title

5.5 Erosion and Sediment Control

Drawing No. | Title

6.0 DEVELOPMENT REVIEW & PERMIT APPLICATION FORMS

Form No.	Title
____	Engineering Division Review Application
____	
____	
____	
____	Grading/Fill/Excavation Permit Application
____	Excavation, Grading , and Fill Requirements
____	Sewer Connection/Sewer Cap Permit Application
____	Service Driveway Access/Removal Curb Cut Application
____	Right of Way Use Application
____	Sign Permit Application