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Storm Water Drainage Guidelines

Considerable resources have been spent addressing the important issue of controlling storm water within Yarrow Point. Drainage and detention systems help prevent problems by controlling discharges into the public system; this protects the capacity of the existing Town infrastructure and helps control sub-surface erosion and the springs that are common in Yarrow Point.

When Owners and Developers address a property's drainage they are helping to control or eliminate potential storm water problems on their own property as well as spill-over problems on adjoining and public properties. It is the duty of those who plan new or remodel projects to install on-site storm water detention systems and hook their private storm systems into the Town's storm drain system.

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1. Historical Information: Past Problems and the Need to Manage Drainage

Yarrow Point is responsible for maintaining a storm drainage system that benefits the entire community (232 acres). Our system is comprised of roughly 230 catch basins and 200 pipes which vary in size from four (4) inches to eighteen (18) inches in diameter. The total length of conveyance pipe is about 19,200 linear feet (3.6 miles) and over 90 percent are concrete. The storm drain lines within the Town collect and direct run-off from the streets and homes to Lake Washington.

During the early years of Yarrow Point's development, the Town's drainage facilities were designed and constructed to handle only the water collected from the public streets. These systems, still in the ground today, were designed to handle only a 10-year storm event. Because there was still plenty of room in the community, neighborhood flooding was not a major concern.

There are currently 425 parcels in the Town, just over 1,000 residents, and roughly 40% of our properties qualify for direct discharge to Lake Washington. For these reasons the Town of Yarrow Point is exempt from meeting the requirements outlined in the National Pollution Discharge Elimination System (NPDES) Phase 2 permit.

In 2008, the Town commissioned a study by ESM Consulting Engineers to evaluate the existing condition of its storm water management facilities. This study included inventorying and mapping the existing system; performing hydraulic and hydrologic modeling of existing and future conditions, and a portfolio of capital improvements. The study identified twelve (12) separate basins and one private basin. Within these basins four capital improvement projects (CIPs) were recommended at a total cost of \$1.1 million. Once completed, these CIPs would upsize 500 linear feet of pipe, replace approximately 4,800 linear feet of existing pipe, underground existing utilities, and install irrigation pumping systems. Of these four projects, the highest priority project (NE 47th Street) was complete in 2009. The Town established a storm water utility in 2012 to fund the remaining capital improvement projects.



When all the capital improvement projects are completed the Town's stormwater system will convey the 25-year flow from public roadways as well as runoff from pervious and impervious surfaces from each tributary lot. Until then however, individual on-site detention systems are required to prevent overloading of the public drainage system.

2. Code References for Drainage Requirements

The Town of Yarrow Point's drainage guidelines and assumptions are based on the requirements described in the following sections of the Yarrow Point Municipal Code (YPMC).

YPMC Chapter 15.04: Building Codes

All construction activity and construction materials shall be governed by the State Building Code as adopted in Chapter 96, Laws of 1974, as amended by SHB 1734, which updates the State Building Code to include the 2009 editions of the following codes with amendments: International Building Code; ICC/ANSI A117.1-03, Accessible and Usable Buildings and Facilities; International Residential Code; International Mechanical Code; Liquefied Petroleum Gas Code (NFPA 58); National Fuel Gas Code (NFPA 554) for LP Gas; International Fire Code; Uniform Plumbing Code; Washington State Energy Code; International Existing Buildings Code; National Electric Code (NFPA 70).

YPMC Chapter 16.20.060: Storm Sewers

All subdivisions and short subdivisions shall provide storm sewers for the control and disposal of surface and ground water runoff, including but not limited to such water as may be collected from roof downspouts, drains, surface drains and foundations drains. Such sewers and appurtenances shall be so located and designed to meet the requirements specified by the town staff, so as to conform and be compatible with adjacent natural drainage ways and storm sewers and to meet the requirements of YPMC 17.20.040.

YPMC Chapter 17.12.030(A): Accessory Uses

The only accessory uses permitted in all zones are listed in the following subsections. Specific limitations on accessory uses and structures are identified where such limitations have been established.

- A. Paving. Impervious Surfaces shall include provisions to direct rain water into a street storm drain or into a detention system or into a storm drain infiltration system in accordance with adopted stormwater standards.

YPMC Chapter 17.16.020: Structure Area

The total structure area shall not exceed 30 percent of the lot area.

YPMC Chapter 17.16.045: Impervious Surface Requirements

- A. The total percentage of a lot that can be covered by impervious surface, including buildings, is 60 percent.
- B. Exemptions. The following improvements will be exempt to the extent allowed, from calculation of the maximum impervious surface limits:
 1. Decks/ Platforms. Decks and platforms constructed with gaps measuring on-eighth of an inch or greater between boards which provide free drainage between the boards as determined by the code official shall be exempt from the calculation of maximum impervious surface limits so long as the surface below the deck or platform is not impervious.
 2. Pavers and gravel shall be calculated as 75 percent impervious, provided the area is not used for vehicular access or storage.

YPMC Chapter 17.16.080: Storm Sewers

During the development, improvement, use or construction within a lot, site, parcel, plat or area, all natural contours shall be maintained to the extent that natural drainage flow from or onto adjacent public or private property shall not be disrupted, blocked, increased, redirected or otherwise made detrimental to the use or maintenance of adjacent property; provided, that this restriction shall not prevent the installation and maintenance of a covered storm sewer under or across private property along a natural drainage course for the purpose of generally improving a particular property, in conformance with the specifications and plans meeting the approval of the town engineer. Collected water, including but not limited to such waters as may be collected from roof downspout drains, surface drains or foundation drains, shall be discharged into storm sewer facilities where such facilities are available.

YPMC Chapter 17.24.040: Repairs, remodeling, additions.

Repairs, remodeling, structural modifications, additions, and enlargements may be done to a nonconforming structure; provided, that all of the following conditions are met:

- A. The structure is a permitted use per Chapter 17.12 YPMC.
- B. The work does not increase the degree of nonconformity.
- C. The work does not add over 50 percent to the existing structure area or 100 percent to the existing habitable floor space.

Additions or enlargements over 50 percent of the existing structure area or 100 percent of the existing habitable floor space require that the entire structure be brought into conformity to the zoning code.

YPMC Chapter 17.24.050: Replacements

Whenever a building or structure which is nonconforming is destroyed by catastrophic event, such nonconforming structure may thereafter be replaced within 18 months by a similarly nonconforming structure only if the replacement structure does not exceed a duplicate of the original in any external dimensions and location.

YPMC Title 20: Site Development Code

3. When is a Drainage or Detention System Required?

The peak discharge from a subject property shall not be increased due to the proposed development. A Drainage Control Plan (DCP) therefore, is a plan for collecting, controlling, transporting and disposing of storm water falling upon, entering, flowing within and exiting the property under development. All projects which add more than 120sf of impervious area are required to prepare a DCP and adhere to the General Drainage System Requirements outlined below.

NOTE: If your scope of work results in a net increase of 750sf a detention system may be required.

Drainage System Requirements (General)

1. When existing impervious surfaces are being reconstructed, all storm water must be collected.
2. If the property's drainage system is already connected to the Town's drainage system, the drainage facilities for the newly reconstructed surfaces must be connected to that system.
3. If the property's drainage system is not currently connected to the Town's drainage system, the drainage facilities for the newly reconstructed surfaces must be connected to the Town's system, unless approved otherwise by the town engineer.
4. If storm water collected from the impervious surfaces discharges directly to Lake Washington, the drainage facilities for the newly reconstructed surfaces must discharge directly to Lake Washington.
5. If storm water collected from the impervious surfaces discharges directly to Lake Washington or if the net increase of impervious surface is less than 750 square feet, installation of a detention facility is not required.
6. If the net increase in impervious area is less than 750 square feet, but includes a driveway or parking area, while a detention facility is not required, the system must contain an oil/water separator. (See Figure 1 - Oil/Water Separator).
7. If building a new residence or if the valuation of all remodeling done within a 12-month period exceeds the threshold for Legal Non-Conforming Structures (YPMC 17.24.040), then the drainage plan shall include a detention system to collect all storm drainage on the property. It must be designed as described in the Town's document entitled *Storm Water Detention Calculations*.
8. If drainage for an existing structure is not connected to the Town's system, and the owner, whether in conjunction with a remodel, an addition or a general desire to improve drainage conditions, decides to combine a portion or all of the property's drainage into one system, then the new facilities shall include a detention system and be sized to handle all of the impervious surfaces involved. This includes the re-direction of run-off from an existing roof into the new drainage facilities.
9. If drainage for an existing structure is not connected to the Town's system, and the owner, in conjunction with a remodel or addition, decides to make a new connection to the Town system for storm water runoff from existing impervious surfaces, detention shall be provided for re-directed surfaces. An oil/water separator shall be provided for pollution generating impervious surfaces such as driveways and parking areas.
10. If storm water collected from an existing or new driveway and parking area is discharged into a gravity discharge detention system, then a separate oil/water separator is not required for the driveway and parking area.



Drainage System Requirements (Detention)

A storm water detention system is a drainage system wherein storm water run-off from roof downspouts, foundation, driveway and patio drains and other impervious surfaces is collected and stored in a large pipe and then released gradually through a small hole (orifice), or is pumped to an approved point of discharge, generally the closest Town catch basin.

1. If the amount of impervious surface ranges between 750 and 6,000 square feet, Table 1 may be used to determine the required amount of detention or storage volume.
2. If the amount of the impervious surface is in excess of 6,000 square feet, the plans and calculations relating to the design of the detention facilities shall be prepared by a Civil Engineer, licensed in the State of Washington. The detention facilities shall be designed in accordance with the Town's document entitled *Town of Yarrow Point Storm Water Detention Calculations*.
3. In designing the detention facilities, the storage volume shall be calculated for a 25-year storm, utilizing an orifice with head discharge outlet. The allowable discharge rate, and thus the sizing of the orifice, shall be determined by calculating the existing conditions flow rate based upon a 10-year storm.
4. If (1) an existing house or structure is demolished and a new structure built, (2) an existing house is Substantially Remodeled, or (3) the owner, in conjunction with a remodel or addition, decides to combine all of the property's drainage into one system, a detention system shall be designed for the entire site, and the property shall be assumed to be an undeveloped site. The applicant shall consult with the Town for determination of the appropriate runoff coefficients.
5. Detention storage pipes shall be installed at 0.5 percent (0.5%) slope as shown on the Figure 2 - Storage Facility Plan and Profile. Flow control is shown in Figure 3 - Flow Control Manhole.
6. If the topography of the property is such that it is not possible to discharge from the flow control manhole with a gravity system, then the orifice structure shall be replaced with a discharge pump. Once again, the discharge line shall be connected to the Town's system. The size of the detention storage pipe, and the allowable release rate, shall be calculated the same as for an orifice outlet system. To meet the allowable discharge rate, the pump may have to be throttled by use of a valve in the discharge line. The pump shall be placed at least one foot up from the floor of the manhole to allow for the accumulation of silt without blocking the pump intake.
7. When a pump system is required, the drainage facilities shall also include an emergency overflow trench. A 4-inch or 6-inch discharge line shall be installed from the flow control manhole to the discharge trench. The pipe within the trench must be perforated. The invert elevation of the discharge line at the manhole shall be equal to or higher than the top of the storage pipe at the high end. The top of the emergency overflow trench must be lower than the invert elevation of the discharge pipe at the manhole. The trench shall be at least 20 feet long and shall be located at least 10 feet from any adjacent property. The top of the trench shall run parallel to the finished grade contours and the 2" x 12" installed horizontally level.

Detention System Storage Requirements

To determine the amount of storage required, proceed as follows:

1. Calculate the area of new impervious surface, including, but not limited to, all roof, driveway, patio and sidewalk areas.
2. Select the proper size storage pipe from Table 1 – Detention Storage Pipe Table. (Or calculate the required length of pipe if the applicant desires to use a larger diameter pipe.)
 - Enter Column A with the total impervious area rounded to the next larger 500 ft².
 - Column B gives the volume of storage required.
 - Column C gives the orifice size.
 - From Column D select the pipe diameter and length that corresponds to the calculated impervious area and which best suits the site conditions.

4. Preparation and Submittal of Plans

For permitting purposes, an applicant shall submit three copies of the Drainage Control Plan for review and approval. These plans should be kept separate from the building permit plans because they will be reviewed by different entities.

The Drainage Control Plan shall include three sets of the following:

1. A site plan showing the location of all structures, driveways, sidewalks, patios and any other impervious surface relating to the development. The plans shall also show the existing and proposed final grade contours.
2. Calculations of the impervious area from each of the above. (For drainage purposes, in calculating the impervious surface area, the water surface of swimming pools shall not be included, unless the public works director determines that such pool contributes to water run-off.)
3. The proposed elevation for the lower floor, including the garage floor slab, new or reconstructed driveways, patios, sidewalks or other new impervious surfaces.
4. The plans shall show the location, size and length of all drainage pipes within the collection system as well as their connections to the storage pipe or flow control manhole. Include the pipe invert elevation (the elevation at the bottom of the pipe) at catch basins and at any other point critical to the design and construction. All drainage pipes shall have a minimum one-percent (1%) (1/8 inch per foot of pipe) slope, unless otherwise noted. The storage pipe is to be installed at a 0.5 percent (0.5%) slope.
5. An erosion and sediment control plan based on measures defined in the 2009 King County Surface Water Design Manual, Appendix D.7 – Small Site ESC.
6. Details and specifications applicable to the project.

After the plans have been approved, one set will be returned to the applicant and one set stays on-file at Town Hall. If the drainage plans were submitted in conjunction with a building permit, the building plans and the drainage plans will be released as a package.



Inspections

Applicants are required to call for inspections. If the work does not conform to the approved plans, or the inspection reveals other conditions that require modifications or additional information, that portion of the work will be stopped. No final occupancy shall be permitted until the drainage control facility is completed, inspected and approved.

Other Permit Requirements

Applicants may be required to obtain a Right of Way Use Permit if drainage work is to be done in the Town's right-of-way.

Homeowner Maintenance Requirements

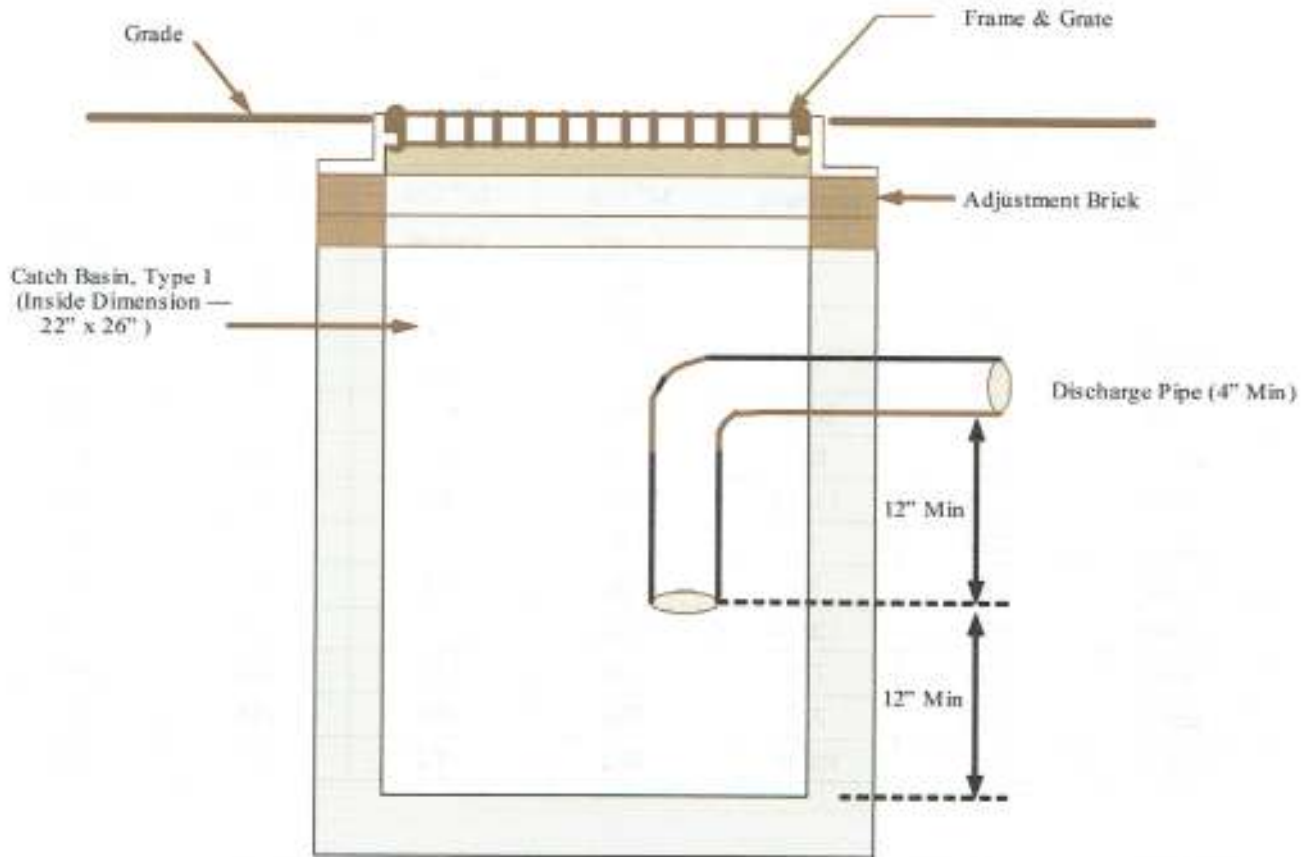
The owner of the property shall be responsible for maintaining the drainage/detention system in good working condition, including the removal of any sand, silt or other debris that may accumulate in the drainage system catch basins and flow control manhole. Depending upon the amount of soil that is permitted to wash into the drainage system, cleaning could be required every 3 to 5 years.

The Town may make periodic maintenance inspections and can issue a deficiency notice if maintenance requirements have not been met or if the system is deemed to pose danger. Such notice will specify the nature of the maintenance deficiency and a date of compliance. If corrections are not made by the date specified, the Town may have the necessary work performed and bill the cost of correcting the deficiency to the property owner.

TYPE 1 — OIL/WATER SEPARATOR

(Figure 1)

(Mandatory for all new or re-built driveways when a storm water detention system is not required)



DETENTION STORAGE PIPE TABLE

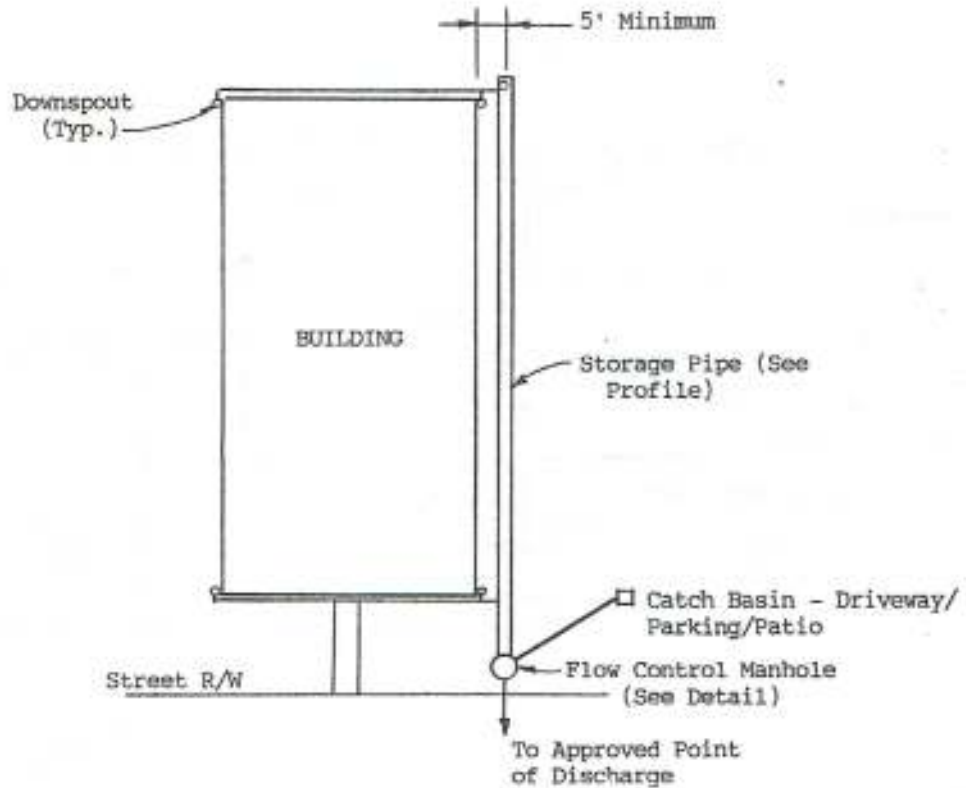
(Table 1)

A	B	C	D			
Total Impervious Area (Square Feet)	Storage Volume Required (Cubic Feet)	Orifice Diameter (Inches)	Storage Pipe Size (Inches) Storage Pipe Length (Feet)			
			12" Dia.	15" Dia.	18" Dia.	24" Dia.
			Length	Length	Length	Length
750	19	½	36	23	16	9
1000	37	½	47	30	21	12
1500	55	½	71	45	31	18
2000	74	9/16	94	60	42	24
2500	92	5/8	118	75	52	29
3000	110	11/16	141	90	62	35
3500	129	¾	165	104	73	41
4000	147	¾	188	119	83	47
4500	165	13/16	212	134	93	53
5000	184	7/8	235	149	104	59
5500	202	7/8	259	164	114	64
6000	220	15/16	283	179	125	70

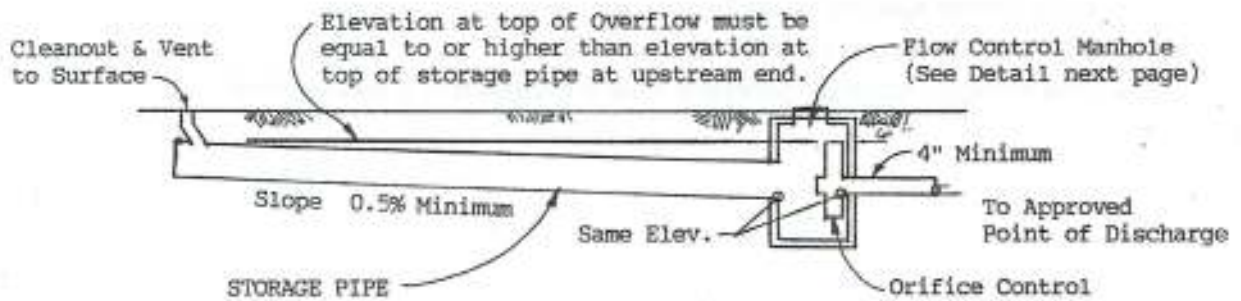
NOTE: Larger detention pipe sizes may be used if an equivalent amount of storage is provided.

STORAGE FACILITY PLAN & PROFILE

(Figure 2)

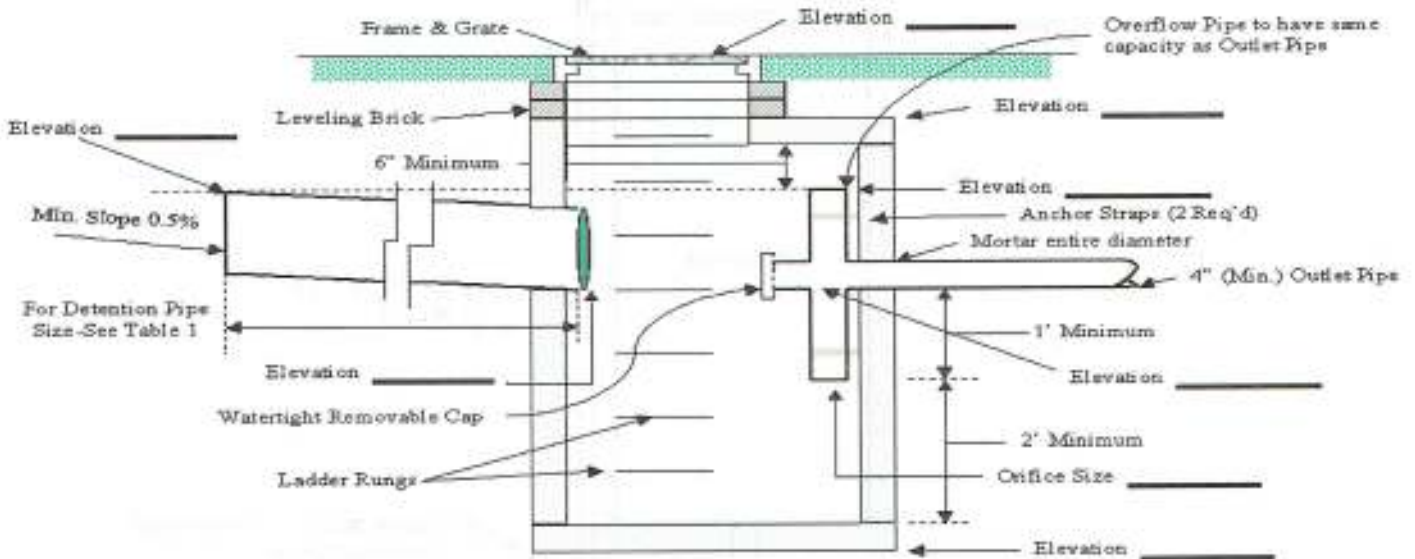


PLAN
No Scale



Flow Control Manhole

(Figure 3)



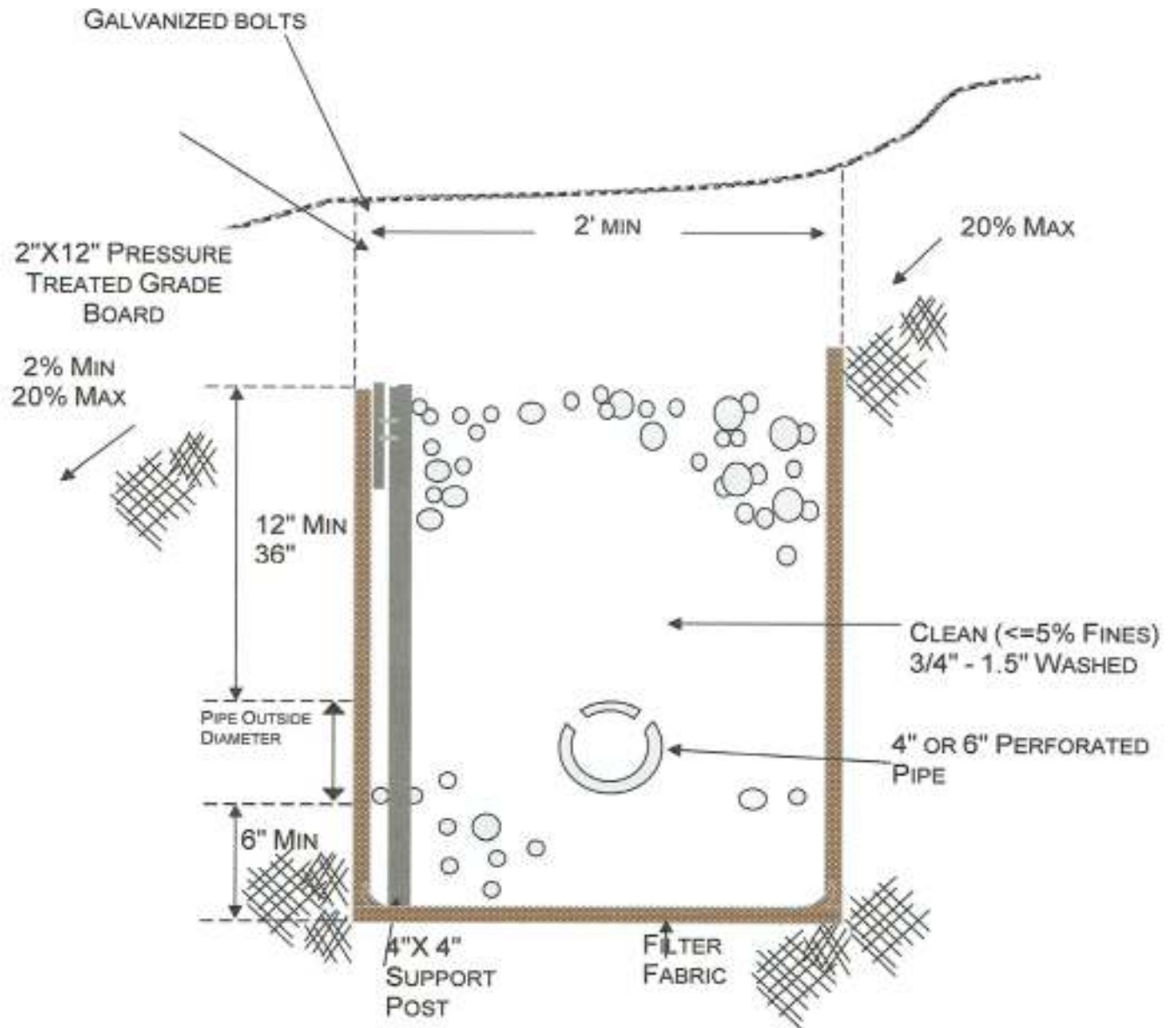
(Not Scale)

Notes:

- Frame and grate shall be set directly over the ladder and offset so that the overflow pipe shall be visible at the edge of the access opening
- Elevations () of component parts shall be provided by the Applicant
- The Flow Control Manhole shall be a standard Type II Catch Basin. Ladder runs shall be uniformly spaced 12" to 16 1/2" vertically
- All steel pipe and parts shall be galvanized
- The storage pipe shall generally have a minimum of 2 feet of cover

Emergency Overflow Trench

Figure 4



NOTES:

- This trench shall be constructed so as to prevent point discharge and/or erosion.
- Trenches may be placed no closer than 50 feet to another.
- Trench and grade board must be level, aligned to follow contours of site.
- Grade board support post spacing as required by soil conditions.



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Storm Water Detention Calculations

The following guidelines shall be used when the area of impervious surface within the entire site exceeds 6,000 square feet.

These guidelines have been taken from the King County Storm Drainage Control Requirements and Guidelines manual, May 1979. Because these calculations are being used for individual lots or for two to three lot short plats, the County's guidelines have been modified slightly to fit Yarrow Point's requirements.

See the sketch on Page 3 for the example site to be used in these calculations. If you have any questions about these calculations, call the Town Engineer at 206-276-8922.

Calculate the average slope of the site by using the highest and lowest elevation points on the site. The length, L, is the straight line distance between the high and low elevation points.

Using the average slope from above, determine the average velocity, V, from Chart 1 on Page 4. Use the graph for "Forest with heavy ground cover or Meadow".

Using the determined velocity, calculate the Time of Concentration or Duration:

$$T_c = 10 + L/(V \times 60)$$

Using this T_c , determine the Intensity for a 10 year storm, I_{10} , (inches per hour) from Chart 2, on Page 5.

Calculate $Q_{Existing}$ (cfs) = $C_{Ex} I_{10} A$

C_{Ex} is the runoff factor for Undeveloped Land as found in Table 1, on Page 6, and A is the total lot area in acres.

C_{Ex} will be determined by using the line for Sparse Trees and Ground Cover and the appropriate slope.

The allowable release rate, Q_{Allow} , for all detention systems = $Q_{Existing}$.

Calculate $Q_0 = Q_{Allow}/(A \times C_{Fut})$ (cfs/acre)

C_{Fut} , the runoff coefficient for the developed conditions, must be calculated from the following:

$$C_{Fut} = ((A_{Imp} \times C_{Imp}) + (A_{Per} \times C_{Per}))/A$$

A_{Imp} = the area of impervious surface on the entire lot (Acres)

A_{Per} = the area of pervious surface on the entire lot (Acres)

C_{Imp} = the runoff coefficient for the impervious area per Table 1, Developed Area section

C_{Per} = the runoff coefficient for the pervious area per Table 1, Developed Area section

The required storage volume for all detention systems, regardless of whether a pump system or an orifice-gravity discharge structure is used, shall be calculated for a 25-year storm in accordance with the following formulae:

$$T = -25 + (2138/Q_o)^{1/2} \text{ (Minutes)}$$

$$V_s = ((3420 \times T)/(T + 25)) - (40 \times Q_o \times T) \text{ (cubic feet)}$$

$$\text{Required storage volume } V_{Total} = V_s \times A \times C_{Fut} \text{ (cubic feet)}$$

As stated above, the allowable release rate for all detention systems = Q_{Allow} .

For pump systems, simply convert Q_{Allow} to gallons per minute.

For an orifice outlet system, calculate the diameter of the orifice as follows:

$$\text{Area, } a = Q_{Allow}/((0.62(64.4 \times h)^{1/2})) \text{ (Square feet)}$$

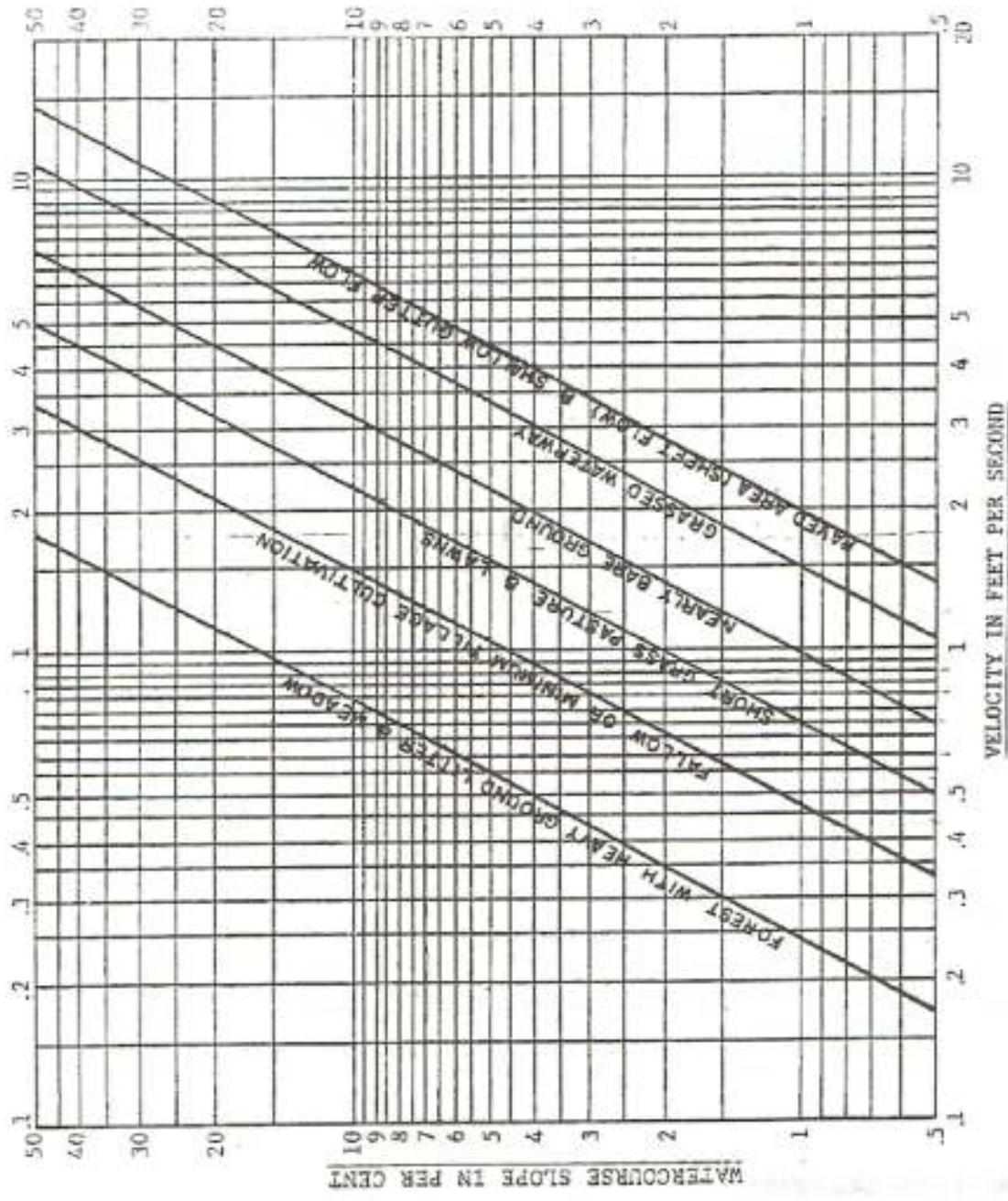
h = differential elevation between the top of the overflow and the invert elevation of the discharge pipe.

$$d = \text{orifice diameter} = (4a/\pi)^{1/2} \text{ (feet)}$$



Example of slope calculation

$$S = \text{Differential Elevation}/L = (114 - 100)/224 = 0.0625 \text{ or } 6.25$$



AVERAGE VELOCITIES FOR ESTIMATING TRAVEL TIME FOR OVERLAND FLOW

Chart 1

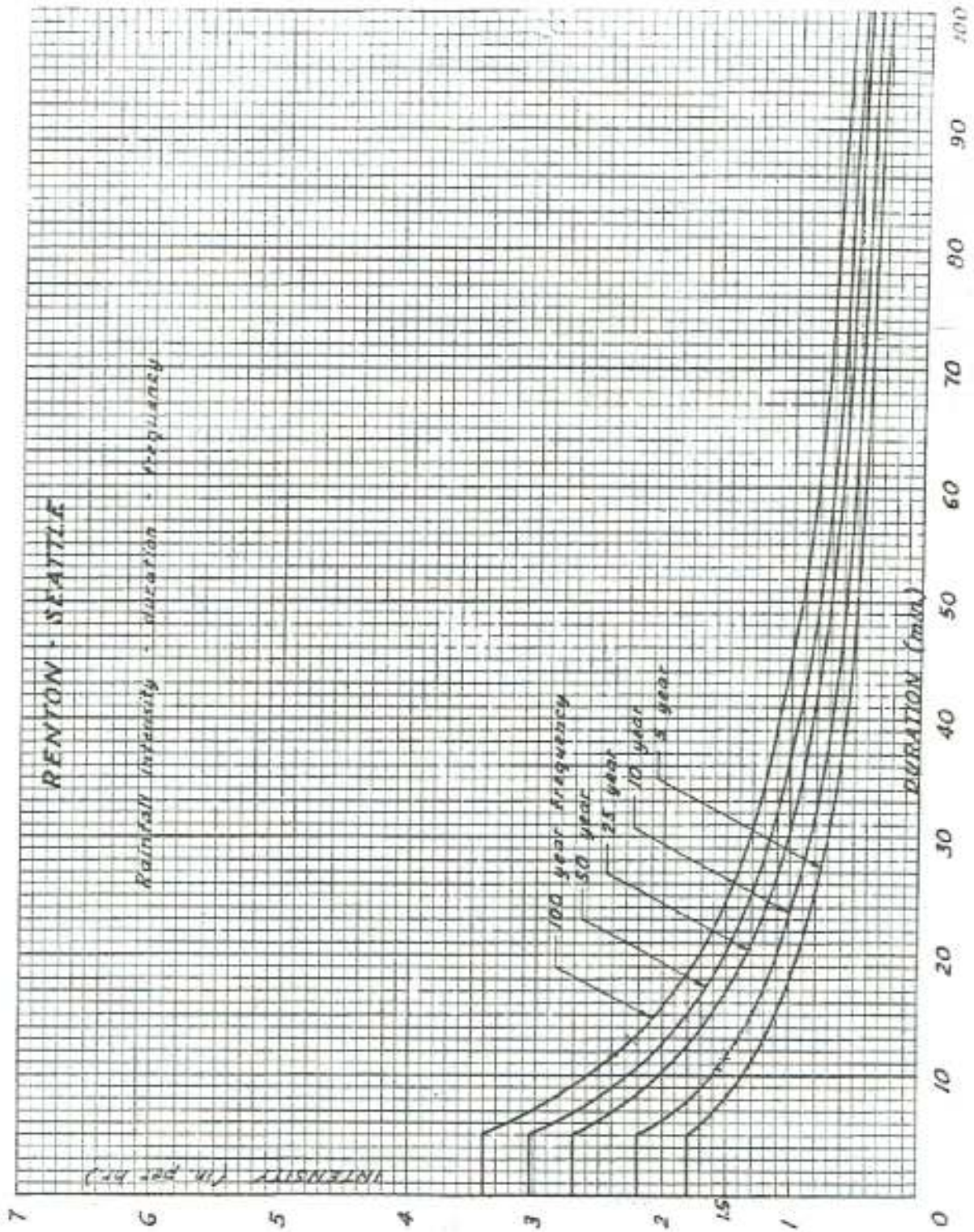


Chart 2

**Table 1
Runoff Factors for Storm Sewers**

	Flat 0-5%	Rolling > 5%
<u>Undeveloped Land</u>		
Sparse Trees and Ground Cover	0.10	0.15
<u>Developed Area</u>		
Pavement, Roofs, Compacted Crushed Rock, Unit Pavers. . .	0.90	0.90
Playground	0.25	0.30
Lawns, Meadows and Pastures	0.20	0.25
Parks	0.15	0.20

D.7 SMALL SITE ESC

Smaller project sites have similar erosion and sediment control (ESC) needs. This section offers a simplified set of requirements for applying erosion and sediment controls to certain smaller project sites and guides the user through the preparation and submittal of a Small Site ESC Plan with the permit application.

D.7.1 INTRODUCTION TO SMALL SITE ESC

What is ESC and Why is it Required for My Site?

The basic erosion and sediment control requirement—that sediment transport and other construction related pollutants shall be prevented to the maximum extent practicable from leaving the site—**applies to all projects in King County**. All projects, including those with small project sites, are required to use erosion and sediment control (ESC) measures. ESC measures prevent soil erosion during development of the site. The types of measures required for small sites are generally simple to construct and easy to maintain, and with few exceptions do not require engineering or formal design. Examples of such measures include silt fences, phasing or minimizing clearing, routing water around exposed soils, and placing straw or other mulching materials and cover exposed soils.

ESC is required because soils eroded from the site are *always* deposited downstream in pipes, streams, or lakes. Soils deposited in a pipe or channel reduce its capacity to convey flows and can increase the likelihood of flooding. Soils in streams can also clog the gravels that salmon use for spawning. Nutrients associated with soils that reach lakes can upset the chemical balance of the lake, causing excessive growth of algae and decreasing recreational uses such as swimming, boating, and fishing.

Which Projects May Use Small Site Erosion and Sediment Control Requirements?

All projects that do any amount of land disturbing activity are subject to the ESC standards in this appendix per KCC 16.82.095(A) regardless of whether a permit is required or drainage review under the *Surface Water Design Manual* is triggered. Any such project that is not subject to drainage review under the *Surface Water Design Manual* and that disturbs soil on less than 1 acre of land may use the Small Site ESC requirements contained in this section. In addition, these projects must apply erosion and sediment control in accordance with KCC 16.62.

Any proposed project subject to Small Project Drainage Review as determined in Section 1.1.2.1 of the *Surface Water Design Manual*, and which disturbs soil on less than 1 acre of land, may use the Small Site ESC requirements contained in this section. These same requirements are contained in Appendix C of the *Surface Water Design Manual*, which details the drainage requirements for small agricultural and single family residential building or subdivision projects subject to Small Project Drainage Review.

What Will I Be Required To Do?

It is the responsibility of both the applicant and the contractor to minimize erosion and the transport of sediment to the greatest extent possible. You and/or your contractor will be required to evaluate each of the small site ESC requirements specified in Section D.7.2 below for applicability to your project site. This evaluation and the proposed ESC measures to be used to meet these requirements will need to be documented in a Small Site ESC Plan that must be submitted to DDES for approval prior to commencing land disturbing activities. See the submittal requirements in Section D.7.5.

D.7.2 SMALL SITE ESC REQUIREMENTS

For projects that disturb less than 1 acre of land, all of the following small site ESC requirements must be evaluated for applicability to the proposed project:

A. MARK CLEARING LIMITS/MINIMIZE CLEARING

Prior to beginning land disturbing activities, all clearing limits, sensitive areas and their buffers, and trees that are to be preserved within the construction area shall be clearly marked, both in the field and on the small site ESC plan, to prevent damage and offsite impacts. Also, clearing shall be minimized to the maximum extent practicable. See "**Mark Clearing Limits/Minimize Clearing**," Section D.7.4.1 (p. D-87), for more detailed specifications.

B. MINIMIZE SEDIMENT TRACKED OFFSITE

1. Establish a stabilized entrance for construction vehicle access to minimize the tracking of sediment onto public roads. Entrance and exit shall be limited to one route, if possible. See "**Stabilized Construction Entrance**," Section D.3.4.1 (p. D-39), for detailed specifications.
2. If sediment is tracked offsite, public roads shall be cleaned thoroughly at the end of each day, or more frequently during wet weather, if necessary to prevent sediment from entering waters of the state. Sediment shall be removed from roads by shoveling or pickup sweeping and shall be transported to a controlled sediment disposal area. Street washing will be allowed only after sediment is removed in this manner. Street wash wastewater shall be controlled by pumping back onsite, or otherwise be prevented from discharging into drainage systems tributary to surface waters. This requirement **shall be included as a note** on the small site ESC plan.

C. CONTROL SEDIMENT

Runoff from disturbed areas must pass through a sediment control measure to prevent the transport of sediment downstream until the disturbed area is fully stabilized. Sediment controls must be installed as one of the first steps in grading and shall be functional before other land disturbing activities take place. One or more the following sediment controls may be used to meet this requirement:

- **Silt Fence** (See Section D.3.3.1, p. D-30)
- **Vegetated Strip** (See Section D.3.3.3, p. D-34)
- **Triangular Silt Dike** (See Section D.3.3.4, p. D-34)
- **Storm Drain Inlet Protection** (See Section D.3.5.3, p. D-51)

D. STABILIZE EXPOSED SOILS

All exposed and unworked soils shall be stabilized through the application of **cover measures** to protect the soil from the erosive forces of raindrop impact, flowing water, and wind erosion. One or more of the following **cover measures** may be used to meet this requirement during the construction phase:

- **Mulching** (See Section D.3.2.2, p. D-13)
- **Plastic Covering** (See Section D.3.2.4, p. D-17)
- **Nets and Blankets** (See Section D.3.2.3, p. D-15)
- **Seeding** (See Section D.3.2.6, p. D-21)
- **Sodding** (See Section D.3.2.7, p. D-25)

Cover measures shall be **applied in accordance with the following requirements:**

1. Cover measures must be installed if an area is to remain unworked for more than seven days during the dry season (May 1 to September 30) or for more than two consecutive working days during the wet season (October 1 to April 30). These time limits may be relaxed if an area poses a low risk of erosion due to soil type, slope gradient, anticipated weather conditions, or other factors. Conversely, the County may reduce these time limits if site conditions warrant greater protection (e.g., adjacent to significant aquatic resources or highly erosive soils) or if significant precipitation is expected.
2. Any area to remain unworked for more than 30 days shall be seeded or sodded unless the County determines that winter weather makes vegetation establishment infeasible. During the wet season, exposed ground slopes and stockpile slopes with an incline of 3 horizontal to 1 vertical (3H:1V) or steeper and with more than ten feet of vertical relief shall be covered if they are to remain unworked for more than 12 hours. Also during the wet season, the material necessary to cover all disturbed areas must be stockpiled on site. The intent of these cover requirements is to have as much area as possible covered during any period of precipitation.

E. CONTROL RUNOFF

Stormwater runoff originating on the *site* and/or entering the *site* from offsite areas must be controlled so as to minimize erosion of disturbed areas and exposed cut and fill slopes. The following runoff control measures shall be used as needed per the conditions of use and specifications for each measure:

- **Interceptor Dikes and Swales** (see Section D.3.6.1, p. D-57 for conditions of use and specifications)
- **Ditches** (see Section D.7.4.2, p. D-87 for conditions of use and specifications)
- **Pipe Slope Drain** (see Section D.7.4.3, p. D-88 for conditions of use and specifications)

F. CONTROL DEWATERING

Accumulated water in foundation areas, excavations, and utility trenches shall be removed and disposed of in a manner that does not pollute surface waters or cause downstream erosion or flooding. See "Dewatering Control," Section D.3.7 (p. D-65), for detailed specifications.

G. CONTROL OTHER POLLUTANTS

All construction activities shall be done in a manner that prevents pollution of surface waters and ground waters as specified in the King County's *Stormwater Pollution Prevention Manual (SPPM)*. See "Control of Other Pollutants," Section D.7.4.4 (p. D-89), for specific measures and references to applicable activity sheets in the *SPPM*. References to applicable activity sheets in *SPPM* shall be included in the small site ESC plan.

H. FINAL STABILIZATION

1. Prior to final construction approval, the *project site* shall be stabilized to prevent sediment-laden water from leaving the *project site* after project completion. All disturbed areas of the *project site* shall be vegetated or otherwise permanently stabilized. At a minimum, disturbed areas must be seeded and mulched to ensure that sufficient cover will develop shortly after final approval. Mulch without seeding is adequate for small areas to be landscaped before October 1.
2. All temporary ESC measures shall be removed within 30 days after final site stabilization is achieved or after the temporary measures are no longer needed. Trapped sediment shall be removed or stabilized onsite. Disturbed soil areas resulting from removal of measures or vegetation shall be permanently stabilized with seeding or sodding.

D.7.3 SMALL SITE ESC IMPLEMENTATION REQUIREMENTS

Projects that disturb less than 1 acre of land must implement the ESC measures determined necessary in Section D.7.2 in accordance with the following requirements:

1. The placement and type of proposed ESC measures are to be shown on a **Small Site ESC plan**. This plan must be in accordance with the specifications for such plans outlined in Section D.7.5 unless otherwise directed by DDES.
2. If DDES finds that implementation of the proposed **Small Site ESC plan is insufficient** to prevent the discharge of sediment or other pollutants to the maximum extent practicable, additional measures will be required by DDES. In some cases, an ESC plan or a complete Construction Stormwater Pollution Plan prepared by a *civil engineer* per Chapter 2 of the *Surface Water Design Manual* may be required.
3. The contractor or other persons performing construction activities shall comply with the **stormwater pollution prevention measures/BMPs** specified for such activities in the *King County Stormwater Pollution Prevention Manual*. A note to this effect must be put on the approved Small Site ESC plan.
4. Prior to commencing construction, the applicant must identify to the County a **contact person** responsible for overseeing the installation and maintenance of required ESC measures and compliance with the *Stormwater Pollution Prevention Manual* during construction. The name and contact information for this person must be on or attached to Small Site ESC plan at the time of construction.
5. Both the **applicant and contractor are responsible** for implementation and maintenance of the approved ESC plan and any additional measures required by the County.
6. The **Small Site ESC plan shall be retained onsite** or within reasonable access to the site. The plan shall be modified whenever there is a significant change in the design, construction, operation, or maintenance at the construction site that has, or could have, a significant effect on the discharge of pollutants to surface waters. The plan shall be modified, if during inspections or investigations conducted by the County, it is determined that the plan is ineffective in eliminating or significantly minimizing pollutants in stormwater discharges from the site. The plan shall be modified as necessary to include additional or modified measures designed to correct problems identified.

D.7.4 ESC MEASURES MODIFIED FOR SMALL SITES

This section presents supplementary or modified ESC measures for use on small sites (i.e., construction sites of projects disturbing less than 1 acre of land).

D.7.4.1 MARK CLEARING LIMITS / MINIMIZE CLEARING

Purpose

Minimizing clearing is the most effective method of erosion control. Undisturbed vegetation intercepts and slows rainwater. Plant roots hold soil in place, and dead vegetation on the ground acts as a mulch.

Applications

Clearing limits shall be marked and clearing minimized on any *site* where significant areas of undisturbed vegetation will be retained.

Design Specifications

1. Minimizing clearing should be incorporated into the *site* design. Clearing limits must be marked on the small site ESC plan.
2. On the ground, clearing limits must be clearly marked with brightly colored tape or plastic or metal safety fencing. If tape is used, it should be supported by vegetation or stakes, and should be about 3 to 6 feet high and highly visible. Equipment operators should be informed of areas of vegetation that are to be left undisturbed.
3. The duff layer, native top soil, and natural vegetation shall be retained in an undisturbed state to the maximum extent practicable. If it is not practicable to retain the duff layer in place, it should be stockpiled on-site, covered to prevent erosion, and replaced immediately upon completion of the ground disturbing activities.

Maintenance

Fencing shall be inspected regularly and repaired or replaced as needed.

D.7.4.2 DITCHES

Purpose

Ditches intercept and convey runoff from disturbed areas to sediment control locations. They also convey runoff intercepted from undisturbed areas around the construction site to a non-erosive discharge point.

Conditions of Use

Ditches may be used anywhere that concentrated runoff is to be conveyed on or around the construction site. Temporary pipe systems may also be used to convey runoff.

Design and Installation Specifications

1. Up to 30,000 square feet may be drained by a 12-inch deep trapezoidal ditch with a 1-foot bottom width. Up to 2 acres may be drained by an 18-inch deep trapezoidal ditch with a 1-foot bottom width. Ditches draining larger areas will need to be sized by a *civil engineer*.
2. Ditch side slopes shall be no steeper than 2H:1V.

3. Ditches on 5% or steeper grades shall be armored with rip rap or contain crushed rock check dams spaced such that the crest of each dam is even with the toe of the next upstream dam. See Figure D.3.6.E (p. D-62) for details on check dam installation.

Maintenance Standards

1. Any sediment deposition of more than 0.5 feet shall be removed so that the channel is restored to its design capacity.
2. If the channel capacity is insufficient for the design flow, it must be determined whether the problem is local (e.g., a constriction or bend) or the channel is under-designed. If the problem is local, the channel capacity must be increased through construction of a berm(s) or by excavation. If the problem is under-design, the design engineer shall be notified and the channel redesigned to a more conservative standard to be approved by King County.
3. The channel shall be examined for signs of scouring and erosion of the bed and banks. If scouring or erosion has occurred, affected areas shall be protected by riprap or an erosion control blanket or net.

D.7.4.3 PIPE SLOPE DRAIN

Purpose

Pipe slope drains are designed to carry concentrated runoff down steep slopes without causing erosion, or saturation of slide-prone soils. Pipe slope drains may be used to divert water away from or over bare soil to prevent gullies, channel erosion, and saturation of slide prone soils

Conditions of Use

Pipe slope drains should be used when a temporary or permanent stormwater conveyance is needed to move water down a steep slope to avoid erosion. Pipe slope drains may be:

1. Used on any slope with a gradient of 2H:1V or greater and with at least 10 feet of vertical relief.
2. Used to drain water collected from aquifers exposed on cut slopes and convey it to the base of the slope.
3. Used to collect clean runoff from plastic sheet cover and direct away from any exposed soils.
4. Installed in conjunction with silt fence to drain collected water to a controlled area.

Design and Installation Specifications

1. See Figure D.3.6.D (p. D-60) for details.
2. Up to 30,000 square feet may be drained by each 6-inch minimum diameter pipe. Up to 2 acres may be drained by each 12-inch minimum diameter pipe.
3. The **maximum drainage area** allowed for any 12-inch pipe is 2 acres. For larger areas, more than one pipe shall be used.
4. The **soil** around and under the pipe and entrance section shall be thoroughly compacted.
5. The **flared inlet section** shall be securely connected to the slope drain and be fused or welded, or have flange-bolted mechanical joints to ensure a watertight seal. Ensure that the entrance area is stable and large enough to direct flow into the pipe.
6. Slope drains shall be continuously fused, welded, or flange-bolted mechanical joint pipe systems with proper anchoring to the soil.
7. Re-establish cover immediately on areas disturbed by the installation.

Maintenance Standards

1. The inlet shall not be undercut or bypassed by water. If there are problems, the head wall shall be appropriately reinforced.
2. No erosion shall occur at the outlet point. If erosion occurs, additional protection shall be added.

D.7.4.4 CONTROL OF OTHER POLLUTANTS**Purpose**

To prevent the discharge of pollutants resulting from construction activities.

Application

Pollution control measures shall be used whenever there is a potential for the discharge to ground or surface water of any pollutants used on the site.

Pollution Control Measures

The following pollution control measures shall be implemented as applicable using activity-specific BMPs detailed in the King County *Stormwater Pollution Prevention Manual (SPPM)*:

1. All pollutants, including waste materials, that occur onsite shall be handled and disposed of in a manner that does not cause contamination of stormwater. See *SPPM* Activity Sheets A-8, A-11, A-12, A-16, A-17, A-22, A-29, A-38, and A-41.
2. Cover, containment, and protection from vandalism shall be provided for all chemicals, liquid products, petroleum products, and non-inert wastes present on the site (see Chapter 173-304 WAC for the definition of inert waste). Onsite fueling tanks shall include secondary containment. See *SPPM* Activity Sheets A-2, A-3, A-4, A-6, A-8, and A-9.
3. Maintenance and repair of heavy equipment and vehicles involving oil changes, hydraulic system drain down, solvent and de-greasing cleaning operations, fuel tank drain down and removal, and other activities which may result in discharge or spillage of pollutants to the ground or into stormwater runoff must be conducted using spill prevention measures, such as drip pans. Contaminated surfaces shall be cleaned immediately following any discharge or spill incident. Emergency repairs may be performed onsite using temporary plastic placed beneath and, if raining, over the vehicle. See *SPPM* Activity Sheets A-13, A-17, and A-18.
4. Application of agricultural chemicals, including fertilizers and pesticides, shall be conducted in a manner and at application rates that will not result in loss of chemical to stormwater runoff. Manufacturers' recommendations for application rates and procedures shall be followed. See *SPPM* Activity Sheets A-5, A-25, and A-26.
5. Measures shall be used to prevent or treat contamination of stormwater runoff by pH modifying sources. These sources include, but are not limited to, bulk cement, cement kiln dust, fly ash, new concrete washing and curing waters, waste streams generated from concrete grinding and sawing, exposed aggregate processes, and concrete pumping and mixer washout waters. Stormwater discharges shall not cause or contribute to a violation of the water quality standard for pH in the receiving water. See *SPPM* Activity Sheets A-19, A-20, A-29, A-43, and A-44.

D.7.5 SMALL SITE ESC SUBMITTAL REQUIREMENTS

A *Small Site ESC Plan* must be submitted for all projects that are eligible to use the Small Site ESC requirements in this section. For projects in Small Project Drainage Review that disturb soil on less than 1 acre of land, this plan is part of the Small Project Drainage Plan described in the *Small Project Drainage Requirements* (Appendix C of the *Surface Water Design Manual*). For other projects, including those that may not be subject to drainage review, this plan would be submitted as directed by DDES. Directions for preparing a Small Site ESC Plan are provided below, and a sample plan is presented in Section D.7.5.3 (p. D-91).

D.7.5.1 SMALL SITE ESC PLAN MAP

The Small Site ESC Plan includes information that is routinely collected for a **single family residence site plan or a short plat plot plan** already required to be submitted with a permit application. One copy of the site plan or plot plan shall be used to show how ESC measures are to be applied to the site to comply with the Small Site ESC requirements. The approximate location and size of clearing limits, rock construction entrance, flow paths, silt fences, etc., should be indicated on the Small Site ESC Plan. Any plan must contain at a minimum the features listed in Section D.7.5.2.

Single family residential projects that qualify for Small Site ESC requirements should use the Residential Site Plan (see DDES Bulletin No. 9, "Obtaining a Residential Building Permit") as the base map for the ESC plan.

Proposed short plats that qualify for Small Project Drainage Review should use the Small Project Drainage Plan (see *Small Project Drainage Requirements*, detached Appendix C of the *Surface Water Design Manual*) as a base plan for the ESC plan. All projects subject to Small Project Drainage Review are required to submit these plans and a drainage assessment. If engineering plans are required for a short plat application, they may be used as a base plan for Small Site ESC plans. How the ESC measures are to be applied on the site are added directly to the base map. For more complicated sites, an erosion control professional should be readily able to add Small Site ESC BMPs to the base map with minimal additional effort or expense.

The ESC plans for short plats usually apply only to the site development, since siting of homes on lots created by short plats is done after the short plat is approved (when the home applies for a residential building permit). It is the responsibility of the applicant for a proposed single family residence to show in detail how ESC requirements are met. The applicant is also responsible for Single family residential development is required to comply with the Stormwater Pollution Prevention Manual and KCC 9.12.

D.7.5.2 FEATURES REQUIRED ON SMALL SITE ESC PLANS

The Small Site ESC Plan should be drawn on 8-1/2" x 11", 8-1/2" x 14", or 11" x 17" paper (see the sample plan in Figure D.7.5.A, p. D-93), and must include the following information.

Identification

1. Name, address, and phone number of the applicant
2. Scale—use a scale that clearly illustrates drainage features and flow controls (1"=20' is standard engineering scale; minimum acceptable scale is 1"=50')
3. Parcel number
4. North arrow
5. Dimension of all property lines, easements, and building setback lines
6. Street names and existing or proposed property address

7. Section, township, and range of proposal.

Topography

1. Corner elevations
2. Benchmark (a permanent mark indicating elevation and serving as a reference in the topographic survey)
3. Datum (assumed datum is acceptable in many cases, i.e., fire hydrant base = 100'; datum for projects in or near FEMA floodplains should be NGVD 1929)
4. If over 15% slope: 5-foot contours, top of slope, toe of slope, and any erosion or landslide areas.

Proposed ESC

1. Delineation of proposed clearing limits
2. Type and location of erosion control facilities
3. Location of any significant offsite drainage features within 200 feet of the discharge point(s) for the lot, including streams, lakes, roadside ditches.

Topography/Drainage Features

1. Outline of any stream, wetland, lake, closed depression, or other water feature (including any required buffer width)
2. Location of all steep slopes, landslide hazard areas, and coal mine hazard areas (including buffers)
3. Location of all existing and proposed drainage easements, ditches, swales, pipes, etc.
4. Location of all critical areas as shown on any recorded critical areas notice on title.

D.7.5.3 SAMPLE SMALL SITE ESC PLAN

All sites are required to control erosion and contain sediment. The planning and use of ESC measures will be illustrated for a single family residence. Although the specifics of any lot will differ from those shown here, the process will be similar. The first step in the process is to determine whether the site is eligible to use the Small Site ESC requirements. This evaluation and the following materials are usually included in the drainage assessment that accompanies the Small Site ESC Plan.

The proposed house is to be placed on an existing 1.69-acre lot (see Figure D.7.5.A). Impervious surfaces are the roof, a driveway, and a parking area. The total proposed impervious surface is 6,950 square feet as determined from the residential site plan layout of residence and driveway (the site plan provides the base map for the Small Site ESC Plan). The amount exceeds 2,000 square feet but falls below the 10,000-square-foot limit for Small Project Drainage Review. Therefore, a Small Site ESC Plan is applicable.

The proposal is not in a basin plan area or critical drainage area that might contain clearing limits. However, a portion of a wetland and an erosion hazard area have been identified on the site, and their approximate locations are shown in Figure D.7.5.A. While neither the wetland and its buffer, nor the erosion hazard area would be disturbed during construction, the locations of these critical areas must be verified.

Approximately the southern 2/3 of the site will be cleared. Trees and other native vegetation will be left intact along the northern edge, near the street. Buffers will be maintained around the wetland and erosion hazard areas, respectively. The site slopes towards the street.

In order to prevent erosion and to encourage sedimentation, the following BMPs are used:

1. **Clearing will be minimized** to the extent possible, and **clearing limits will be marked** by fencing or other means on the ground.

2. Water will be **routed** around the erosion hazard area and around the steep section of the driveway by constructing an interceptor dike or ditch that will intersect and direct water away to the east of the site.
3. Water will be **filtered** before it reaches the wetland. Silt fencing or other perimeter protection will be placed along slope contours at the limits of clearing in the vicinity of both the wetland and the erosion hazard area.
4. A rocked construction entrance will be placed at the end of the driveway.
5. **Mulch** will be spread over all cleared areas of the site when they are not being worked. Mulch will consist of air-dried straw and chipped site vegetation. Other cover methods that prevent erosion may also be installed.

The BMPs shown in Figure D.7.5.A must be installed as clearing progresses. For example, the rock construction entrance must be installed as soon as the path for the driveway has been cleared. Additional ESC measures must be installed if the ones proposed above prove insufficient.

FIGURE D.7.5.A SAMPLE SMALL SITE ESC PLAN

