

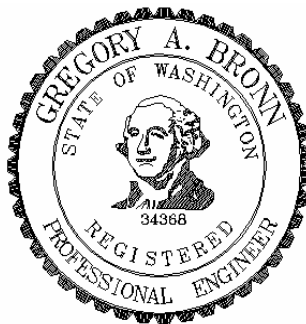
Stone's Throw Condominium
TPN 271441009

**Stormwater Site Plan (SSP)
and
Stormwater Pollution Prevention Plan (SWPPP)**

**40 Madrona St.
Orcas Island, WA**

May 2008

**Ron Malzon
P.O. Box 1869
Eastsound, WA 98245**



EXPIRES:



HART PACIFIC ENGINEERING

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Construction Stormwater Site Plan Stone's Throw Condominium

The Stormwater Site Plan presented in this report conforms to the requirements of the Washington State Dept. of Ecology's *Stormwater Management Manual for the Puget Sound Basin*, (SWMM February 2005). The plan includes a description of existing and proposed land use conditions, an analysis of downstream impacts due to development, and a drainage plan for the subject property. The structure of this report is based on the required elements for Stormwater Site Plans that are outlined in SWMM Volume I, Chapter 3, page 3-1.

The Unified Development Code for San Juan County (UDC), which outlines the storm drainage standards for the County, incorporates the *Stormwater Management Manual for the Puget Sound Basin*, (Washington State Dept. of Ecology, Feb, 1992) by reference in Section 6.7. The successor manuals to this manual were published in August 2001 and February 2005 (SWMM) and are now authorized for use in the county. The SWMM was used to determine standards for the design and implementation of best management practices (BMPs) for stormwater control and treatment at this site.

According to the requirements of the San Juan County Public Works Department the thresholds for determining which minimum requirements apply to the project will be based on the additions of impervious surfaces and the area of land disturbed *since September 1, 1991*. Existing impervious surfaces and land disturbed at an earlier date will not be added to the proposed to determine which requirements apply.

The plans presented herein have been based on proposed development plans provided by the property owner and are shown on the accompanying drawings. This plan is being submitted for approval. If final development of the property differs in any significant way from the scheme presented here, the drainage plan should be reevaluated by a qualified professional and revised accordingly.

It is the responsibility of the property owner to insure that the requirements of this plan are implemented and are binding on all future lot owners if applicable. Submit this plan to San Juan County along with all future grading and building permit applications.

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1. Project Overview

The general vicinity of the property is shown on Figure 1. The property is located on the north side of Crescent Beach Road in Eastsound on Orcas Island. An aerial photograph from the Assessor's website showing the existing condition of the property is provided on Figure 2 and the development plan for the site is shown on Figure 3. Access to site from Madrona Street is provided by an easement along the north edge of the property and an existing (pre-1991) road along the north and east edge of the property provides access from Crescent Beach Road.

Under the proposed development four condominium units will be constructed in the locations shown on Figure 3. A new driveway and parking area will be constructed in the northwest corner of the property to serve the four condo units. Foot paths (non-impervious) will also be built from the new parking area to the condo units. A tabulation of impervious surfaces and converted areas created under this project is provided in the table below. The areas listed for each unit include roofs, decks, walkways and all impervious surfaces associated with the condominium unit development.

Table 1 – New Converted Surfaces After Development**

Converted Surface	Area	
Gravel road and parking areas (PGIS)	3,550 sf	0.08 ac
Unit A	2,100 sf	0.05 ac
Unit B	1,400 sf	0.03 ac
Unit C	1,200 sf	0.03 ac
Unit D	1,700 sf	0.04 ac
Total Impervious Surface	9,950 sf	0.23 ac
Forest converted to lawn & landscaping (PGPS)	20,000 sf	0.46 ac

** Estimated based on owner provided information

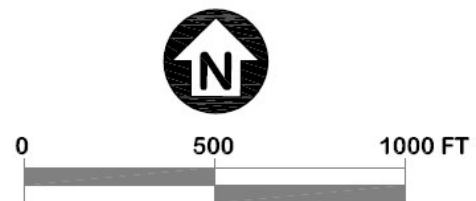
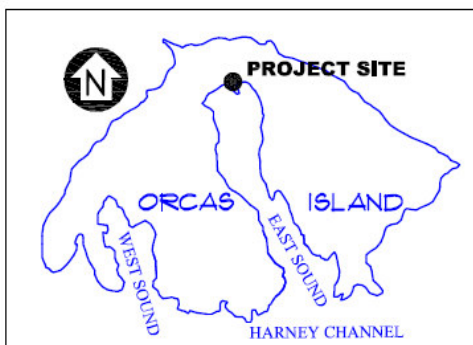
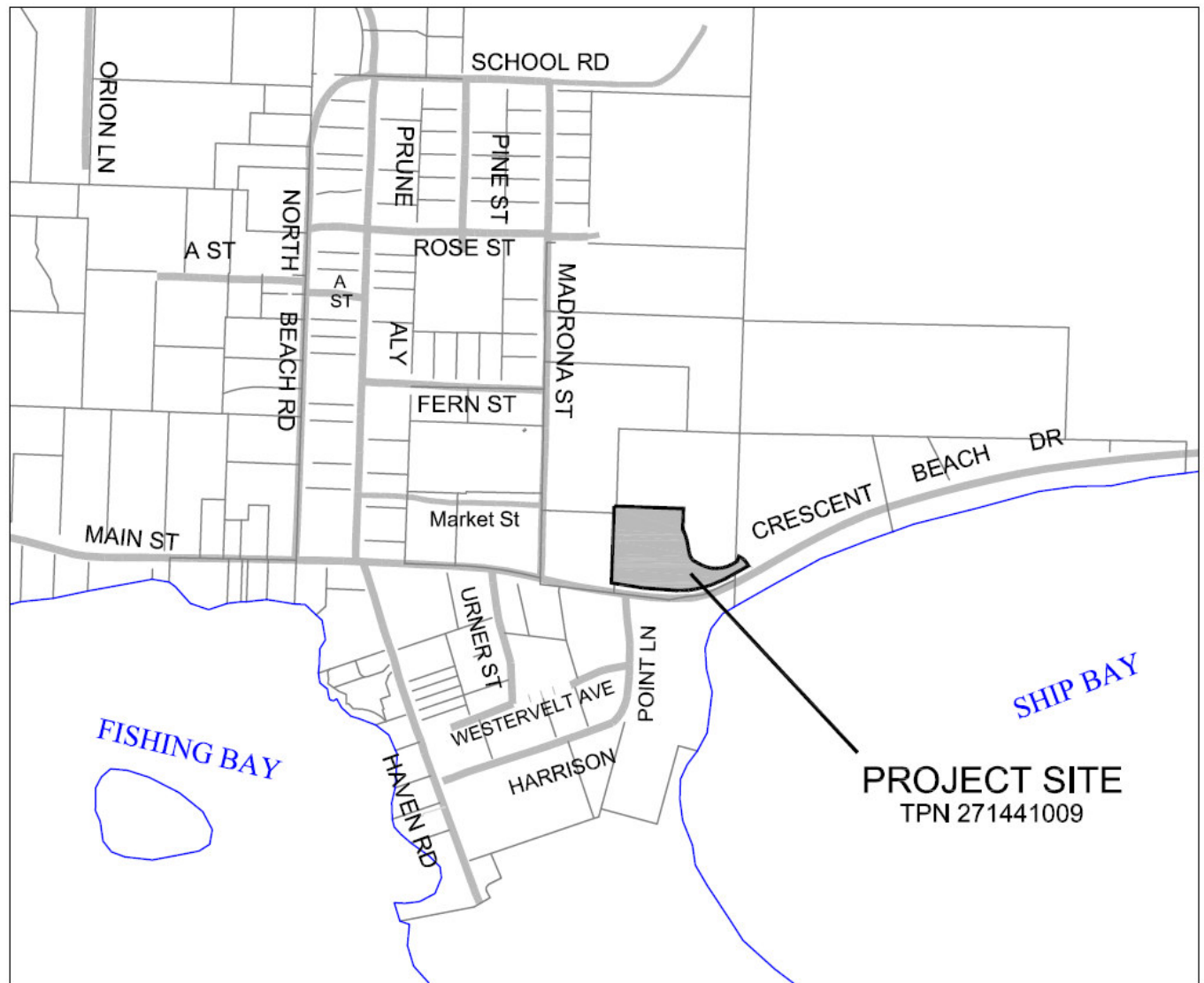
2. Existing Conditions Summary

An aerial photograph of the property taken from the County Assessor's website is provided on Figure 2. The site is composed of mostly cleared land with strips of forest remaining on the south edge of the property and in the northwest corner as shown on Figure 2. An existing road which pre-dates 1991 runs along the northeast edge of the property. The site includes an existing woodshed (pre - 1991) just south of the planned location of Condominium Unit D (see Figures 2 and 3). The woodshed will be removed.

The topography of the property is fairly uniform with land slopes of 5 -10 percent towards the east. The steeper sloping land is located along the south edge of the property.

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Figure 1 – Vicinity Map





AERIAL PHOTOGRAPH FROM SAN JUAN COUNTY ASSESSOR

LEGEND

	PROPERTY BOUNDARY
	INTERPOLATED USGS CONTOURS (CI = 5')



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Figure 2 – Existing Conditions



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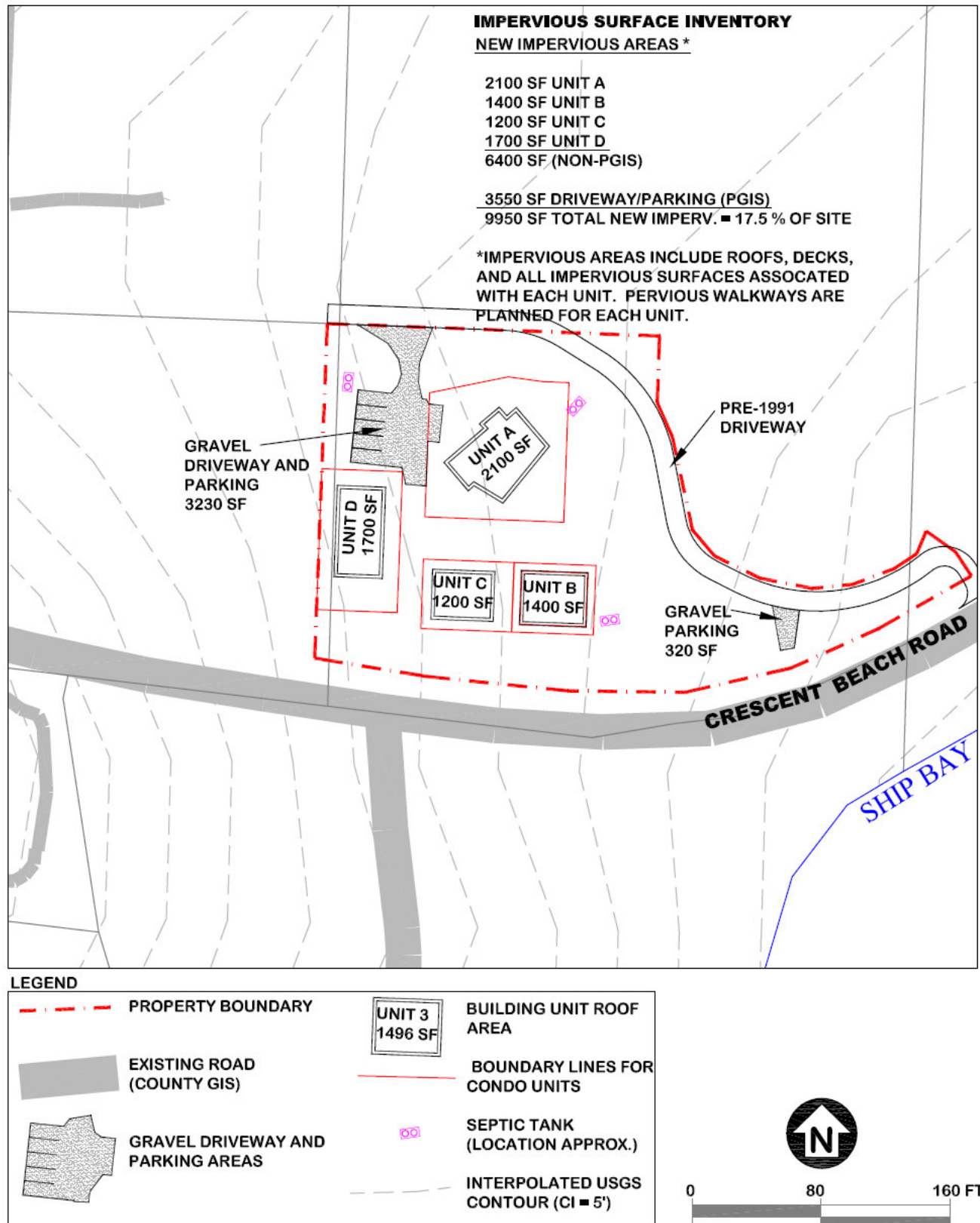


Figure 3 – Development Plan



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Figure 4 provides a map of the soils in the vicinity of the project area. The soils covering the property are classified by the SCS Soil Survey of San Juan County as Roche-rock outcrop complex and Bow gravelly silt loam soils. According to the SCS the Roche rock outcrop soils are comprised of 15 to 50% rock outcrops. In general, the soil thickness overlying bedrock ranges from 20 to about 48 inches. Permeability is slow above the substratum and very slow in the substratum which consists of dense, fine sandy loam. According to the SCS, surface runoff in the Roche-rock outcrop soil is slow to medium except in areas of rock outcrop where runoff is very rapid. The Roche-rock outcrop soil is classified as having a moderate hazard for water erosion.

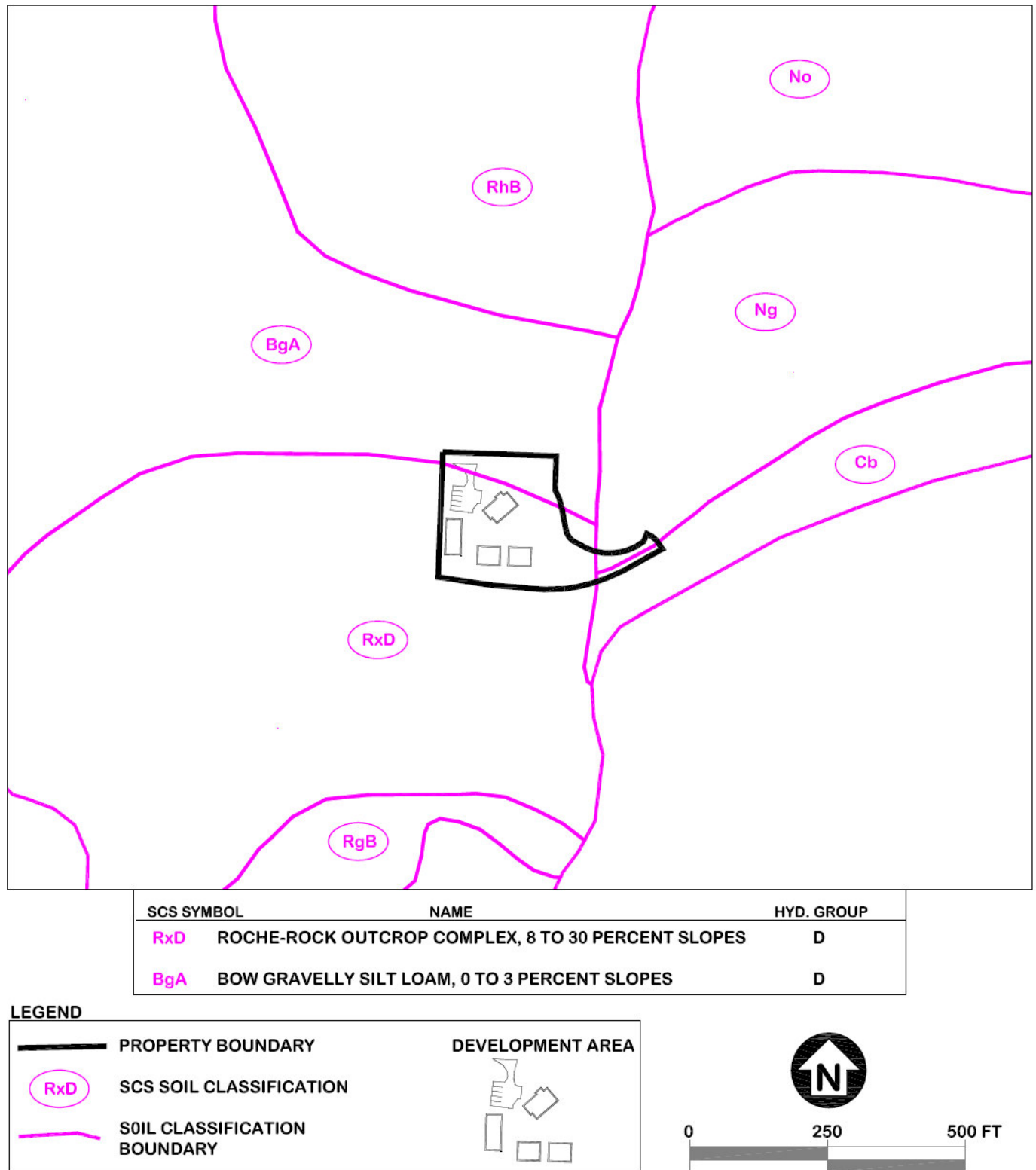
Based on information from the SCS Soil Survey, the Bow gravelly silt loam soil consists of a silt loam surface layer with approximately 20% to 50% gravel overlying a dense silty clay substratum. Based on descriptions from the SCS survey this soil also exhibits slow to medium surface runoff and represents a moderate hazard for water erosion.

Both of these soil types are classified by the SCS as belonging to hydrologic soil group D. In general, hydrologic group D soils are characterized by semi-impermeable soils within 30 to 40 inches of the surface that contribute to relatively high rates of runoff during prolonged rainfall periods. During a recent inspection seepage and high groundwater conditions were observed at this site which confirms the presence of low permeability soils. These conditions are most likely due to the saturation of the soil profile which overlays a dense substratum of slow permeability, especially during the wet winter season. For this reason, these soils are not generally considered suitable for BMPs which require the infiltration of surface runoff.

Figure 5 provides a drainage basin map for the project area. The map which is based on the USGS 7.5 minute series shows the general stormwater drainage routes in the vicinity of the site. The *Long Range Drainage Plan for Eastsound Village Urban Growth Area* (LRDP) which was prepared by the San Juan County Public Works Department in May 2005 was reviewed for information relative to this project and the drainage basin divides used in the LRDP have been added to the basin map. The project site is located within Basin 10 which is discussed in detail in the LRDP.

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Figure 4 – Soil Map



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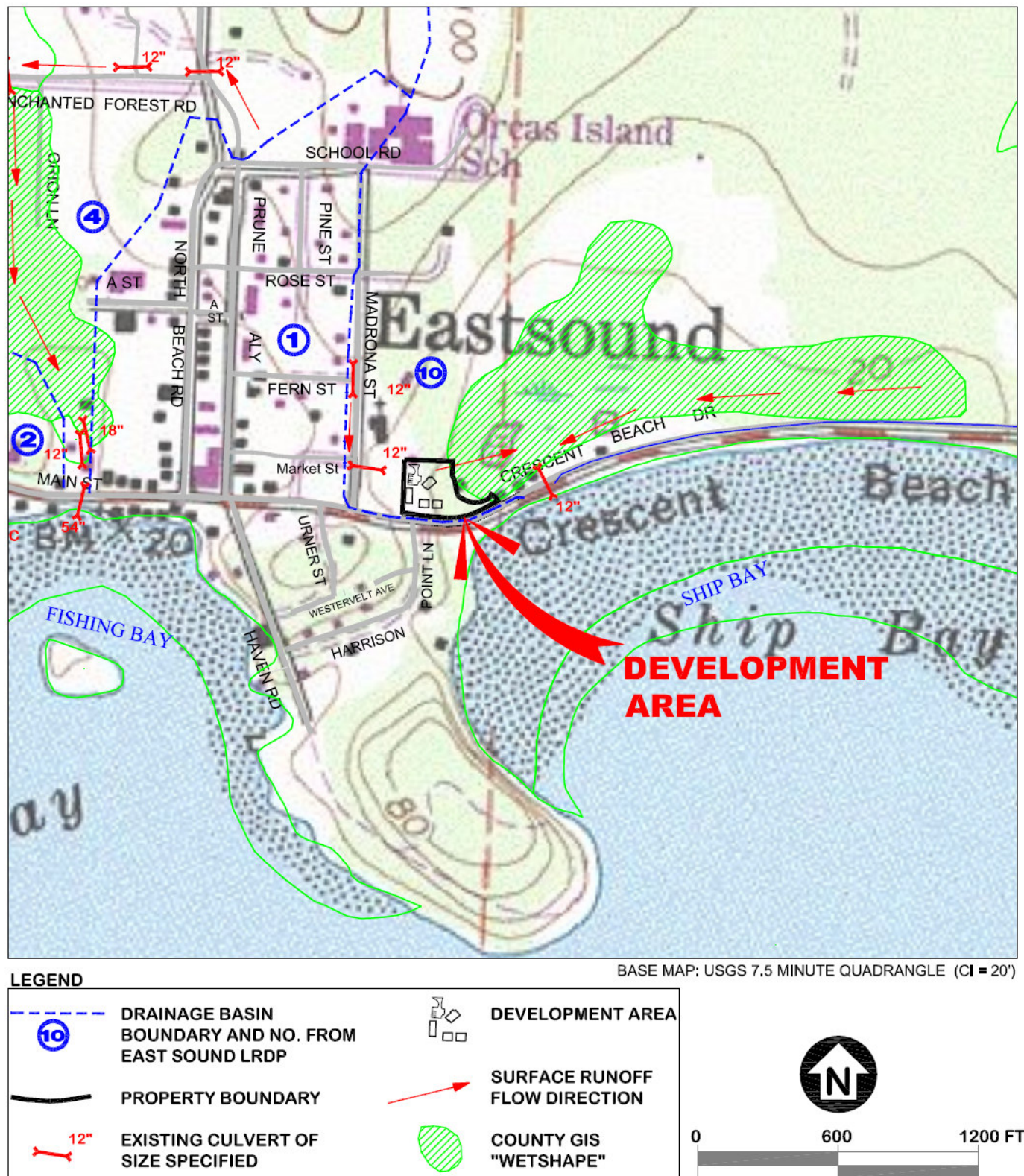


Figure 5 – Basins and Wetlands

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3. Offsite Analysis Report

Upstream surface runoff enters the project area from the east edge of LRDP Basin 1 which includes a small portion of the Eastsound commercial district. The stormwater is conveyed under Madrona Street by a 12" culvert crossing near the Market Street intersection. This stormwater and the runoff generated within the project area then flows through the property via overland flow, ditches, and culverts towards the east and enters the large Class 1 wetland located north of Crescent Beach Road (see Figure 5). The wetland area discharges into Ship Bay via a 12" culvert under Crescent Beach Road.

The LRDP identified flooding problems associated with the Crescent Beach wetland in Basin 10. The large wetland experiences seasonal flooding due to clogging of the 12" outlet culvert. The LRDP recommended that a combined outlet be provided for Basins 9 and 10 with a by-pass for high flows to limit flooding of the Crescent Beach wetland and a tidal gate to help prevent clogging (see LRDP attachment). In addition, the LRDP recommended the application of specific flow control and treatment standards for the basin (LRDP Table E-2, pg. 67) to reduce flooding problems. At the present time however, no new flow control or treatment standards have been implemented for basin. There is no change in the existing flow pattern through the site proposed by this project.

4. Applicable Minimum Requirements

The SWMM sets out the minimum requirements for all new development and redevelopment projects depending on the size of the project. The thresholds are as follows:

1. Projects proposing less than 2000 square feet of new plus replaced impervious surface must meet SWMM requirement #2.
2. Projects proposing more than 2000 sf but less than 5000 sf or have land disturbing activity of 7000 sf or greater are required to meet SWMM requirements #1 through #5.
3. Projects proposing 5000 sf or more of new impervious surface, converts $\frac{3}{4}$ acres, or more, of native vegetation to lawn or landscaped areas, or converts 2.5 acres, or more, of native vegetation to pasture are required to meet SWMM requirements #1 through #10.

The development planned for this property is shown in Figure 3. The total area converted to landscaping and impervious surfaces for this project are tallied in Table 1. The plan for this property includes 9,950 sf of impervious surface. The level of development planned for this site falls into the threshold limits specified under category 3 above. Therefore, the development must comply with SWMM requirements #1 through #10. The SWMM requirements for this site are evaluated and summarized below.



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Minimum Requirement #1: Preparation of Stormwater Site Plans

This drainage plan shall satisfy the requirement for a stormwater site plan. This report is intended to satisfy that requirement and has been prepared in accordance with Chapter 3 of the SWMM.

Minimum Requirement #2: Construction Stormwater Pollution Prevention Plan (SWPPP)

This is a requirement for implementing erosion and sediment control measures during construction. Hart Pacific Engineering has prepared a SWPPP which is attached to this report. See Item 6 below for a description of the elements of the SWPPP.

Minimum Requirement #3: Source Control of Pollution

This is a requirement to provide controls to prevent stormwater from coming into contact with pollutants. The site development includes the construction of a residential condominium units and gravel driveway and parking areas, which do not require source control.

Minimum Requirement #4: Preservation of Natural Drainage Systems and Outfalls

This is a requirement to maintain historical natural drainage patterns for the site, if possible. Stormwater runoff from this site has historically drained to the large wetland directly east of the property. No new channels to divert stormwater runoff are proposed for this site. Following development, stormwater will continue to flow from this site to the wetland. The dispersion BMPs proposed for this development will help to minimize impacts to the wetland.

Minimum Requirement # 5: On-site Stormwater Management

This is a requirement to employ appropriate permanent on-site stormwater management BMPs to infiltrate, disperse, and retain stormwater runoff onsite to the maximum extent feasible. Appropriate BMPs will be used for this project. See Figure 6 and Item 5 below for a description of the elements of the Permanent Stormwater Control Plan for this project.



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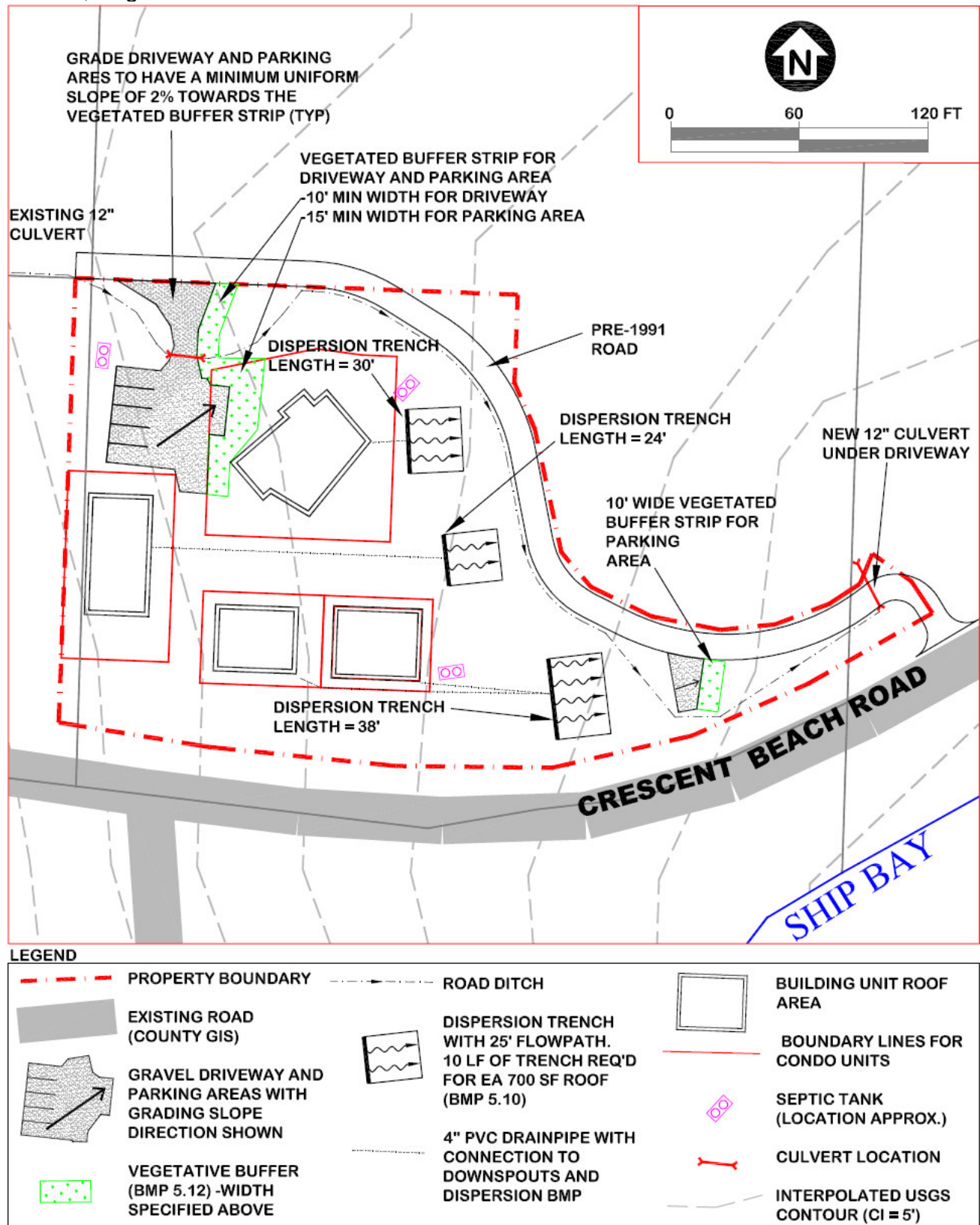


Figure 6 – SSP

Minimum Requirement # 6: Runoff Treatment

This requirement applies to:

- Projects in which the total of effective, pollution-generating impervious surface (PGIS) is 5,000 square feet or more in a threshold discharge area of the project, or
- Projects in which the total of pollution-generating pervious surfaces (PGPS) is three-quarters (3/4) of an acre (32,670 sf) or more in a threshold discharge area, and from which there is a surface discharge in a natural or man-made conveyance system from the site.

The development planned for this site includes 3,550 sf of PGIS and is proposing less than $\frac{3}{4}$ acre of PGPS. These levels of development are below the limits specified under this requirement. Therefore, the requirement for runoff treatment does not apply to this site.

Minimum Requirement #7: Flow Control

This is a requirement to reduce the impacts of increased storm water runoff from new impervious surfaces and land cover conversions. This requirement applies to:

- Projects in which the total of effective impervious surfaces is 10,000 square feet or more in a threshold discharge area, or
- Projects that convert $\frac{3}{4}$ acres (32,670 sf) or more of native vegetation to lawn or landscape, or convert 2.5 acres or more of native vegetation to pasture in a threshold discharge area, and from which there is a surface discharge in a natural or man-made conveyance system from the site, or
- Projects that through a combination of effective impervious surfaces and converted pervious surfaces, cause a 0.1 cubic feet per second (cfs) increase in the 100-year flow frequency from a threshold discharge area as estimated using the Western-Washington Hydrology Model or other approved model. (Ecology has approved a simple proportional method for determining if 0.1 cfs increase is caused).

The development planned for this property is shown in Figure 3. The total impervious area estimated for this plat is tallied in Table 1. The level of development planned for this site is less than the 10,000 sf effective impervious surface limitation described above and the total area of the property is less than $\frac{3}{4}$ acre. Therefore, this development does not need to meet the flow control requirement.

Minimum Requirement #8: Wetlands Protection

This requirement is for the protection of wetlands where stormwater is discharged to them either directly or indirectly. The county GIS data base shows a large wetland ("wet shapes") directly east of this site shown on Figure 5. The wetland was classified as a

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Class I wetland by the Amanda Azous of Herrera Environmental as part of the May 2005 Long Range Drainage Plan for Eastsound. Surface runoff from the property presently drains to the wetland areas and this pattern will be maintained after development. The topography is such that the proposed building sites are 15'-20' above the apparent wetland elevation. The BMPs recommended in this permanent stormwater control plan will be used to mitigate potential impacts to the wetland area.

Minimum Requirement #9: Basin/Watershed Planning

This is a requirement for the implementation of more stringent pollution controls in basins, which have adopted Basin/Watershed Plans. The LRDP identified flooding problems associated with the large wetland on the north side of Crescent Beach Road and made recommendations regarding flow control and treatment standards for this basin. However, at this time there are no known special requirements for development or for stormwater treatment or control within this basin. Therefore, Minimum Requirement #9 should therefore not apply to this project.

Minimum Requirement #10: Operation and Maintenance

This is a requirement for the preparation of an O & M manual for the proposed stormwater treatment and flow control facilities proposed under this plan. Since no such facilities are required for this project Minimum Requirement #10 does not apply.

5. Permanent Stormwater Control Plan

A drainage plan has been developed for this site to address the above-referenced requirements. This plan employs on-site stormwater management BMPs for mitigation of runoff impacts. A description of the proposed drainage plan is provided below and the location of the BMPs is shown on Figure 6.

DESCRIPTION OF PROPOSED NEW DRAINAGE FACILITIES

Roof downspout dispersion (BMP T5.10): Since the building sites are up gradient from the property boundary, a downstream vegetated flow path greater than 25 feet is available below each proposed building site. Due to flowpath space limitations, dispersion trenches are recommended to spread out the flow and prevent erosion of the soils near the discharge points. The location of these BMPs and length recommended for each trench are shown on Figure 6.

- **Driveway and Parking Area Flow Dispersion (BMP T5.12):** Runoff control for the new driveway parking areas will be accomplished by sheet flow dispersion (BMP T5.12). The parking area surface will be graded to provide a minimum cross slope of 2 percent and a vegetated buffer with a minimum width of 10 ft will be provided on the down-grade side of the areas to encourage sheet flow of runoff from the surface. See Figure 6 for the location of these BMPs. For the portions of the parking lot that



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will be over 20' but under 40' wide, a minimum 15' vegetated strip will be provided per BMP T5.12.

- **Constructed slopes:** All cut and fill slopes shall be designed and constructed in a manner that will minimize erosion. The maximum side slope shall be 2H:1V for this project and all side slopes shall be stabilized as specified in the attached SWPPP – see Elements 3, 4, and 5.

6. Construction Stormwater Pollution Prevention Plan (SWPPP)

The SWPPP is attached. Also see Figure 1 in the SWPPP for the location of the required BMPs.

7. Other Permits

No other permits that affect drainage on this property are believed to be required for this project. A NPDES permit will be required for this project if 1 acre or more is disturbed during the preparation of the roads, driveways and building areas. If warranted it will be submitted separately.

8. Operations and Maintenance Manual

There are no flow control or treatment facilities recommended for this development. Therefore an O & M Manual is not required.

9. Bond Quantities Worksheet

There are no bonds for this condominium project. At this time San Juan County does not require a bond for residential construction.

Prepared by:
Gregg Bronn, PE

Attachments:

- Long Range Drainage Plan For Eastsound Village Urban Growth Area (San Juan County Dept. of Public Works Draft Document, May 2005) (Sections Relevant to Basin 10)
- 2005 SWMM BMPs
 - T5.10 Downspout Dispersion, pp 5-3 to 5-8.
 - T5.12 Sheet Flow Dispersion, pp 5-11 to 5-12.
- Stone's Throw Condominium SWPPP Report - HPE May 2008



Long Range Drainage Plan
For Eastsound Village Urban Growth Area (San Juan County
Dept. of Public Works Draft Document, May 2005)
(Sections Relevant to Basin 10)

10. BASIN 10 – CRESCENT BEACH

Basin Characteristics

Basin 10 includes approximately 203 acres located north of Ship Bay. All but 12 acres of Basin 10 are within the current UGA boundary. Drainage direction in the basin is variable with the east side of the basin draining west across Terrill Beach Road via a 12-inch culvert (C4) towards the center of the basin. The north and west sides of the basin drain to the south toward the basin outlet. The only structural outlet to the basin consists of a 12-inch culvert (C1) crossing Crescent Beach Drive and discharging to Ship Bay. A small area along the west side of Madrona Street also drains via culverts C2 and C3 from the southwest corner of the basin to the outlet.

The topography of the basin forms a saddle with higher terrain on the east and west sides and a low, poorly defined divide as the north boundary. The center of the basin slopes at about 2 to 3% to the south. The steepest slopes are on the farthest east edge of the basin along the foothills of Buck Mountain. In this area steep slopes of 40% are common. The topography flattens west of Terrill Beach Road with 8 to 10% slopes. The west side of the basin has slopes of about 8% in the northwest corner which flatten to approximately 1 to 3% within the low wetland area upstream from the outlet.

The soils in Basin 10 are a mix of low and high permeability soils (see Figure 5). The more permeable Indianola soils (SCS hydrologic soil Group A) are located in a wide band of approximately 22 acres located along Terrill Beach Road. There may be some opportunity for infiltration systems in this area. The remainder of the basin is composed of Roche, Norma, Neptune and Bow series soils which are hydrologic soil Group D soils with limited permeability and therefore greater runoff potential. There is little or no chance for infiltration systems in these areas.

Runoff from the high terrain to the east of Terrill Beach crosses the road at culvert C4 and proceeds west along the north side of Crescent Beach Drive to the outlet at culvert C1. Runoff from the south end of Madrona Street at the west side of the basin flows south along the west side of the street and across Madrona Street via culvert C2 to the outlet. Culverts C1 through C4 in the basin are all 12-inch.

Land cover in the basin is mixed second growth forest, wetland and grassland meadow. Development within the basin is light with most of the residential and commercial development. Development in the basin is fairly well concentrated in the vicinity of Crescent Beach Drive and Terrill Beach Road.

Most of the basin with the exception of the area east of Terrill Beach Road is within the UGA boundary. The 12 acres outside the UGA boundary is designated Rural Farm Forest at a density of 1 DU/5 acres. Within the UGA portion of the basin the most prevalent land use designation is single family residential development. 87 acres of residential land use at a density of 4 to 12 DU/Ac is specified in the central part of the

basin, 28 acres of residential land use at 2DU/Ac is specified on the east side of the basin and additional area at 2DU/Ac is set aside in the southwest corner and along the west border of the basin. Commercial land use is designated at the far west side of the basin, in the Village Commercial area along Madrona Street and Service Park zones of about 5 acres each are located to the north and south of the residential area.

Figure 16 shows the existing stormdrainage facilities in Basin 10. The estimated peak runoff rates for Basin 10 are shown in Table D-1. The peak runoff flow rates are calculated for the basin discharge at culvert C1. See Table D-1.

It is estimated that a 42-inch culvert will be required to replace the 12-inch culvert to accommodate the future flows from Basin 10. Additional hydrologic analysis will be required to size this culvert at the time of installation.

It is recommended that an additional outlet be constructed to jointly serve Basins 9 and 10 as described below. Table D-1 displays the future peak flows expected from each basin and the peak flows expected from commingling the discharge of the two basins.

A 48-inch culvert would be required to carry the anticipated future flows that would be directed to this culvert. Additional hydrologic analysis is recommended to properly size this culvert at the time of installation. A single improved outfall would be more effective than two separate outfalls and design and construction costs should be significantly less.

Drainage Issues (Problems)

Flooding

Seasonal flooding occurs along the western and southern edges of the Crescent Beach Wetland where two or three houses have been sited within the wetland, an existing condition, not without problems. The flooding of the Crescent Beach Wetland area is reportedly due to frequent clogging of the 12-inch outfall culvert, which has no tide gate structure. The Public Works Department has repeatedly responded to complaints of a flooded septic system in the area. When the culvert is plugged water builds up behind the culvert and when the culvert is unplugged a channel is often eroded in the sandy beach.

Flooding also occurs in a residential area on the flat dome west of Terrill Beach Road along Bracken Fern Lane. To mitigate existing and anticipated flooding conditions in Basin 10, it is recommended that Type-3 flow control standards as defined in the King County Surface Water Design Manual be applied to development in Basin 10 until downstream conveyance improvements are completed.

Erosion

There are no significant locations of erosion in Basin 10.

Flow Control and Treatment

There are no stormwater treatment or detention systems in Basin 10.

Conveyance

The lack of a conveyance system near Bracken Fern Lane contributes to the flooding problems in that area.

Wetlands

Increased flow to existing regulated wetlands is generally not allowed by the Stormwater Management Manual. The Stormwater Management Manual precludes sending increased flows to existing wetlands unless specific wetland studies determine that the wetlands have capacity to receive increased flows without causing adverse effects on the wetland. A preliminary wetland assessment by Herrera Environmental Consultants suggests that the primary wetlands in Basin 10 should be protected by upstream treatment and flow control. If increased flows are anticipated they should bypass the wetlands to avoid degradation of the wetland environment. Historic flows to the wetlands should be maintained.

Easements

There are no County drainage easements in this drainage basin. The San Juan County Land Bank owns the "Buck Property" which includes much of the wetland areas. Without drainage easements in place the County cannot maintain the channels and erosion and flooding may result. This could be cause for future litigation as flows increase.

Recommended Projects (Solutions)

The proposed storm drainage improvements for Basin 10 are shown by Figure 19.

Regional Improvements

The development of the "Buck Property" may allow a bypass system to be developed that would divert increased flows around the Crescent Beach Wetland. This system could intercept upstream flows and provide a regional solution for conveyance.

Flow Control and Treatment

It is recommended that an enhanced treatment requirement be applied to Basin 10 due to the outflow into East Sound. The threshold for triggering the treatment requirements should be lowered in Basin 10 from 5000 SF pollution generating impervious surface to 1000 SF pollution generating impervious surface.

Detention should be required in Basin 10 until adequate conveyance improvements (including wetlands bypass) have been made downstream of the development. Conveyance improvements to the County stormdrain system may be made by

developers in lieu of providing on-site detention.

Conveyance

A ditch and culvert system should be developed to relieve flooding conditions near Bracken Fern Lane and allow increased future flows. A flow splitter would maintain existing flows to the northern wetland while diverting increased flows to the new outfall at Crescent Beach.

Wetlands

To mitigate impacts to the wetlands from future development, the development of two intercepting stormdrain systems with flow splitters is recommended. In order to avoid rising water levels in the Crescent Beach Wetland an 18-in overflow outfall should be added with a flow line elevation determined on the basis of a wetland impact analysis. The overflow would prevent flooding and degradation of the wetland by releasing flow that would otherwise be unavoidably retained by the wetland.

Easements

Drainage easements will be required to construct and maintain the new stormdrain systems.

Projects

Below is a listing, with brief descriptions, of the drainage improvement projects recommended to meet future development in Basin 3. The anticipated timing and estimated cost (in 2005 dollars) are given in Table E-1.

10.1 Buck Property Stormdrain, With Flow Splitter

Construct 600 lf of 18-inch stormdrain with three 48-inch manholes (one to be a flow splitter) and 1100 lf of 24-inch stormdrain with two 48-inch manholes. The 72-inch manhole at the juncture where Basins 9 and 10 commingle and the downstream outfall are included in Basin 9 projects.

Project is necessary to protect Crescent Beach Wetland by bypassing increased flows to the beach while maintaining historic flows to the wetland.

10.2 Bracken Fern Lane Stormdrain, With Flow Splitter

Construct 1200 lf of 36-inch stormdrain w/four 54-inch manholes (one to be a flow splitter), 650 lf of 24-inch stormdrain, 1100 lf of 18-inch stormdrain and 800 lf of 12-inch stormdrain with nine 48-inch manholes.

Project is necessary to protect existing wetland by bypassing increased flows to the beach while maintaining historic flows to the wetland. The project would relieve flooding problems near Bracken Fern Lane.

Table E-2
Recommended Changes in Current Standards

Basin	Flow Control	Treatment	Comment
1	Detain runoff pending completion of Project 4.1	Reduce threshold for treatment to 1000 SF	Discharge to East Sound
2	Detain runoff pending completion of Project 2.1	Reduce threshold for treatment to 1000 SF	Discharge to East Sound
3	Detain runoff pending completion of Project 3.1	Reduce threshold for treatment to 1000 SF	Discharge to East Sound
4	Detain runoff until downstream conveyance including wetlands bypass is completed	Reduce threshold for treatment to 1000 SF	Basin contains Class 2 wetlands and discharges to East Sound
5	Require KCSWDM* Type 3 flow control (see notes)	Reduce threshold for treatment to 1000 SF	Basin contains Class 1 wetlands
6	Current Standards are adequate	Current Standards are adequate	Current Standards are adequate
7	Detain runoff in area upstream of wetlands and areas of flooding	Current Standards are adequate	Basin contains Class 2 wetlands
8	Detain runoff pending completion of Basin outfall	Reduce threshold for treatment to 1000 SF	Discharge to East Sound
9	Detain runoff pending completion of Project 9.1	Reduce threshold for treatment to 1000 SF	Discharge to East Sound
10	Detain runoff until downstream conveyance including wetlands bypass is completed	Reduce threshold for treatment to 1000 SF	Basin contains Class 1 and Class 2 wetlands and discharges to East Sound

* KCSWDM: King County Surface Water Design Manual

Table E-2 summarizes recommended basin specific changes to the stormwater detention and treatment standards as set forth in the San Juan County Uniform Development Code. An enhancement of stormwater treatment standards are recommended for basins that discharge to either East Sound or a Class 1 wetland.

If current standards are changed as recommended, most basins will require onsite detention or retention for new development before the larger basin-wide projects are built downstream. Although this strategy would limit flow increases, the proliferation of scattered, privately operated and maintained stormwater facilities may not be desirable. Many facilities, particularly detention facilities, would become unnecessary when downstream improvements are completed thus, if feasible, it is generally wise to accelerate the construction of the larger, basin-wide solutions and minimize the number of on-site facilities. For this reason, the Stormwater Facilities Plan proposed in this report gives priority to construction of the larger basin-wide facilities

**2005 SWMM BMP T5.10 Downspout Dispersion
pp 5-3 to 5-8, Figure 5.1, 5.2, and 5.3**

5.3.1 Dispersion and Soil Quality BMPs (Required for Manual Equivalency)

The following BMPs pertain to dispersion and soil quality applications.

BMP T5.10 Downspout Dispersion

Purpose and Definition

Downspout dispersion BMPs are splashblocks or gravel-filled trenches that serve to spread roof runoff over vegetated pervious areas. Dispersion attenuates peak flows by slowing entry of the runoff into the conveyance system, allows for some infiltration, and provides some water quality benefits.

Applications and Limitations

- Downspout dispersion is required on all subdivision single family lots which meet one of the following criteria:
 1. Lots greater than or equal to 22,000 square feet where downspout infiltration is not being provided according to the requirements in Volume III, Chapter 3.
 2. Lots smaller than 22,000 square feet where soils are not suitable for downspout infiltration as determined in Volume III, Chapter 3 and where the design criteria below can be met.
- All other projects required to apply Roof Downspout BMPs must provide downspout dispersion if downspout infiltration is not feasible or applicable as determined in Volume III, Chapter 3, and if the design criteria below can be met.

Flow Credit for Roof Downspout Dispersion

If roof runoff is dispersed according to the requirements of this section on single-family lots greater than 22,000 square feet, and the *vegetative flowpath*^{*} is 50 feet or larger through undisturbed native landscape or lawn/landscape area that meets BMP T5.13, the designer may click on the “Credits” button in the WWHM and enter the percent of roof area that is being dispersed.

General Design Guidelines

- Dispersion trenches designed as shown in the Figures 5.1 and 5.2 shall be used for all downspout dispersion applications except where

^{*} *Vegetative flow path* is measured from the downspout or dispersion system discharge point to the downstream property line, stream, wetland, or other impervious surface.

splashblocks are allowed below. See Figure 5.3 for a typical splashblock.

- Splashblocks may be used for downspouts discharging to a vegetated flowpath at least 50 feet in length as measured from the downspout to the downstream property line, structure, sensitive steep slope, stream, wetland, or other impervious surface. Sensitive area buffers may count toward flowpath lengths. The vegetated flowpath must be covered with well-established lawn or pasture, landscaping with well-established groundcover, or native vegetation with natural groundcover. The groundcover shall be dense enough to help disperse and infiltrate flows and to prevent erosion.
- If the vegetated flowpath (measured as defined above) is less than 25 feet on a subdivision single-family lot, a perforated stub-out connection may be used in lieu of downspout dispersion (See Volume III, Chapter 3). A perforated stub-out may also be used where implementation of downspout dispersion might cause erosion or flooding problems, either on site or on adjacent lots. This provision might be appropriate, for example, for lots constructed on steep hills where downspout discharge could be cumulative and might pose a potential hazard for lower lying lots, or where dispersed flows could create problems for adjacent offsite lots. This provision does not apply to situations where lots are flat and onsite downspout dispersal would result in saturated yards.

Note: For all other types of projects, the use of a perforated stub-out in lieu of downspout dispersion shall be as determined by the Local Plan Approval Authority.

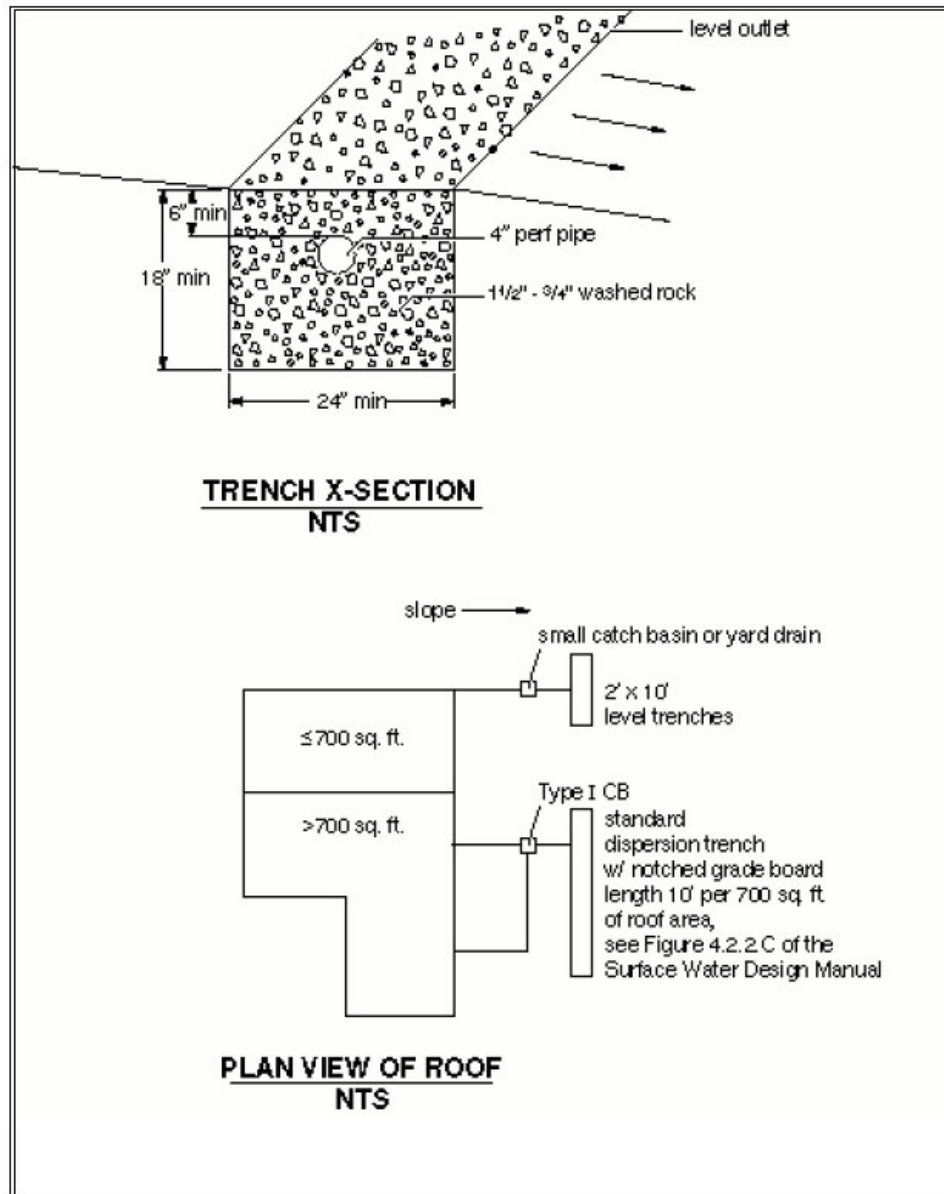


Figure 5.1 – Typical Dispersion Trench

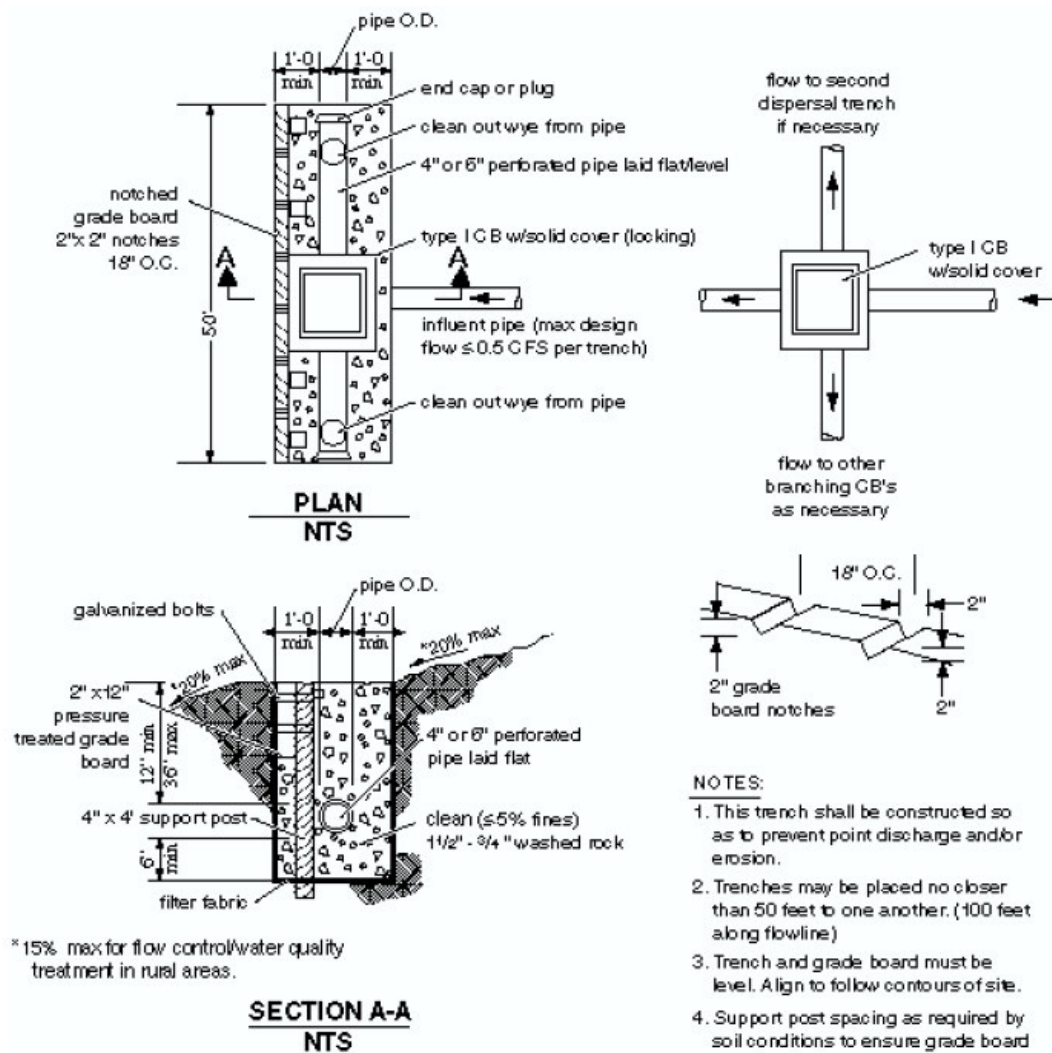


Figure 5.2 – Standard Dispersion Trench with Notched Grade Board

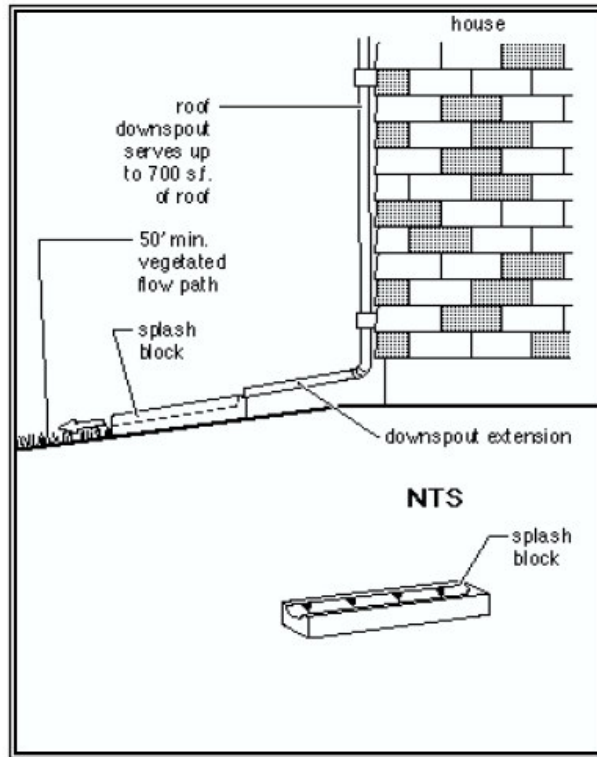


Figure 5.3 – Typical Downspout Splashblock Dispersion

Additional Design Criteria for Dispersion Trenches

- A vegetated flowpath of at least 25 feet in length must be maintained between the outlet of the trench and any property line, structure, stream, wetland, or impervious surface. A vegetated flowpath of at least 50 feet in length must be maintained between the outlet of the trench and any steep slope. Sensitive area buffers may count towards flowpath lengths.
- Trenches serving up to 700 square feet of roof area may be simple 10-foot-long by 2-foot wide gravel filled trenches as shown on Figure 5-1. For roof areas larger than 700 square feet, a dispersion trench with notched grade board as shown in Figure 5-2 may be used as approved by the Local Plan Approval Authority. The total length of this design must provide at least 10 feet of trench per 700 square feet of roof area and not exceed 50 feet.
- A setback of at least 5 feet must be maintained between any edge of the trench and any structure or property line.
- No erosion or flooding of downstream properties may result.

- Runoff discharged towards landslide hazard areas must be evaluated by a geotechnical engineer or qualified geologist. The discharge point may not be placed on or above slopes greater than 20% or above erosion hazard areas without evaluation by a geotechnical engineer or qualified geologist and jurisdiction approval.
- For sites with septic systems, the discharge point must be downgradient of the drainfield primary and reserve areas. This requirement can be waived by the jurisdiction's permit review staff if site topography will clearly prohibit flows from intersecting the drainfield.

Additional Design Criteria for Splashblocks

In general, if the ground is sloped away from the foundation, and there is adequate vegetation and area for effective dispersion, splashblocks will adequately disperse storm runoff. If the ground is fairly level, if the structure includes a basement, or if foundation drains are proposed, splashblocks with downspout extensions may be a better choice because the discharge point is moved away from the foundation. Downspout extensions can include piping to a splashblock/discharge point a considerable distance from the downspout, as long as the runoff can travel through a well-vegetated area as described below.

The following conditions must be met to use splashblocks:

- A vegetated flowpath of at least 50 feet must be maintained between the discharge point and any property line, structure, steep slope, stream, wetland, lake, or other impervious surface. Sensitive area buffers may count toward flowpath lengths.
- A maximum of 700 square feet of roof area may drain to each splashblock.
- A splashblock or a pad of crushed rock (2 feet wide by 3 feet long by 6 inches deep) shall be placed at each downspout discharge point.
- No erosion or flooding of downstream properties may result.
- Runoff discharged towards landslide hazard areas must be evaluated by a geotechnical engineer or qualified geologist. Splashblocks may not be placed on or above slopes greater than 20% or above erosion hazard areas without evaluation by a geotechnical engineer or qualified geologist and approval by the Local Plan Approval Authority.
- For sites with septic systems, the discharge point must be downslope of the primary and reserve drainfield areas. This requirement can be waived by the Local Plan Approval Authority if site topography clearly prohibits flows from intersecting the drainfield.

**2005 SWMM BMP T5.12 Sheet Flow Dispersion
pp 5-11 to 5-12, Figure 5.5**

BMP T5.12 Sheet Flow Dispersion

Purpose and Definition

Sheet flow dispersion is the simplest method of runoff control. This BMP can be used for any impervious or pervious surface that is graded so as to avoid concentrating flows. Because flows are already dispersed as they leave the surface, they need only traverse a narrow band of adjacent vegetation for effective attenuation and treatment.

Applications and Limitations

Flat or moderately sloping (<15% slope) impervious surfaces such as driveways, sport courts, patios, and roofs without gutters; sloping cleared areas that are comprised of bare soil, non-native landscaping, lawn, and/or pasture; or any situation where concentration of flows can be avoided.

Design Guidelines

- See Figure 5.5 for details for driveways.
- A 2-foot-wide transition zone to discourage channeling should be provided between the edge of the driveway pavement and the downslope vegetation, or under building eaves. This may be an extension of subgrade material (crushed rock), modular pavement, drain rock, or other material acceptable to the Local Plan Approval Authority.
- A vegetated buffer width of 10 feet of vegetation must be provided for up to 20 feet of width of paved or impervious surface. An additional 5 feet of width must be added for each additional 20 feet of width or fraction thereof.
- A vegetated buffer width of 25 feet of vegetation must be provided for up to 150 feet of contributing cleared area (i.e., bare soil, non-native landscaping, lawn, and/or pasture). Slopes within the 25-foot minimum flowpath through vegetation should be no steeper than 8 percent. If this criterion cannot be met due to site constraints, the 25-foot flowpath length must be increased 1.5 feet for each percent increase in slope above 8%.
- No erosion or flooding of downstream properties may result.
- Runoff discharge toward landslide hazard areas must be evaluated by a geotechnical engineer or a qualified geologist. The discharge point may not be placed on or above slopes greater than 20% or above erosion hazard areas without evaluation by a geotechnical engineer or qualified geologist and approval by the Local Plan Approval Authority.
- For sites with septic systems, the discharge point must be downgradient of the drainfield primary and reserve areas. This requirement may be waived by the Local Plan Approval Authority if site topography clearly prohibits flows from intersecting the drainfield.

Flow Credits

- Where BMPT5.12 is used to disperse runoff into an undisturbed native landscape area or an area that meets BMP T5.13, the impervious area may be modeled as landscaped area. This is done in the WWHM by entering the impervious area into the "landscaped area" field.

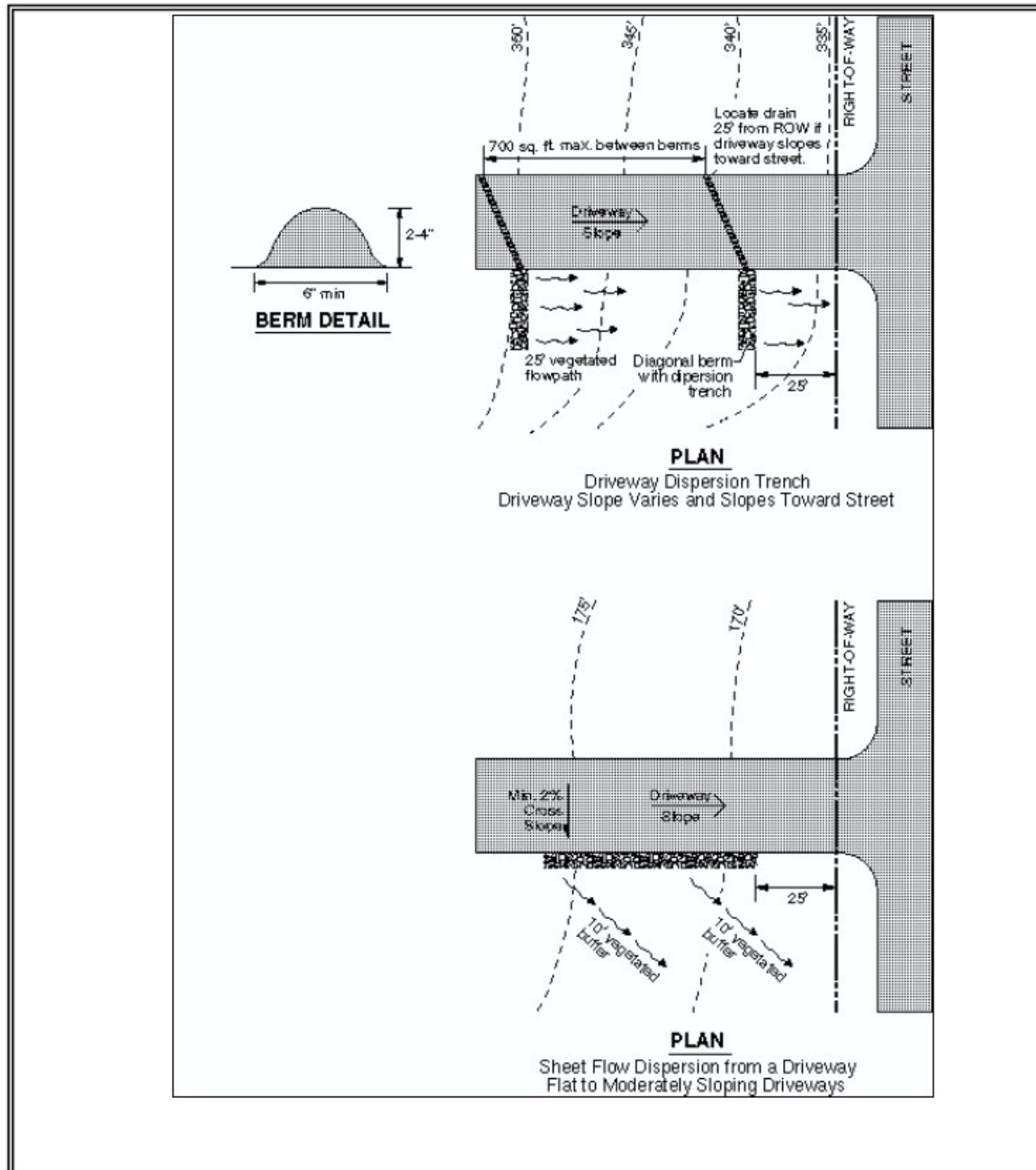


Figure 5.5 – Sheet Flow Dispersion for Driveways

Stone's Throw SWPPP Report - HPE May 2008