

2.3.5 Drainage

2.3.5 DRAINAGE

2.3.5.1 Status of Drainage in the Clean Water District

The purpose of the Stillaguamish Clean Water District includes controlling, accommodating, and discharging storm runoff; and rehabilitating drainage corridors for hydraulics, aesthetics, and fisheries benefits, as described in the Snohomish County Code (25A.05.010 (3)). This section focuses on drainage issues within the CWD that are generally associated with smaller scale conveyance systems, such as ditches, culverts, detention ponds, and drainage pipes. Surface water issues associated with larger conveyance systems, such as rivers, lakes, and streams, are addressed in other sections of this report. Section 2.2 provides a general overview of the major basins within the CWD, as well as the main factors that affect surface water runoff, such as soils and development.

Existing Drainage Districts

In general, very few drainage or diking districts lie within the CWD. The only one that lies mainly within the CWD is Drainage District 2, located immediately west of the City of Stanwood. With slightly more than one square mile (in area) inside the CWD, Drainage District 2 represents a small fraction (0.2 percent) of the Clean Water District's total area (approximately 694 square miles). Only portions of two other diking districts are partially located inside the CWD's boundaries: Drainage District 3 and Diking District 2. They overlap CWD boundaries south and southeast of Stanwood. As a result, Snohomish County is the primary drainage provider throughout nearly the entire CWD.

Existing Drainage Systems

Different varieties of drainage systems exist throughout the CWD. The predominant type consists of roadside ditches and culverts, though enclosed drainage pipes connected by catch basins are also common in some areas. These are generally considered to be conveyance facilities, since their primary function is to convey stormwater to larger receiving waters, such as streams, rivers, and lakes.

Another common type of existing drainage facility includes detention facilities, which consist of open detention ponds and underground detention pipes and vaults. These systems detain rain water during storm events and gradually release flows downstream, although some are designed to remove pollutants from stormwater as well.

Another type of drainage facility includes biofiltration swales, which are designed to remove pollutants from stormwater, through a more natural manner than traditional detention facilities.

The Snohomish County Public Works Department currently has an inventory program that collects drainage information throughout the unincorporated county. This documents the location, type of facility, dimensions, direction of flow, and other important data for individual culverts, catch basins, ditches, etc.

As indicated in Figure 2.3.5-1, most of the inventory information collected to date within the CWD is located in the area between Puget Sound and Interstate 5. East of I-5, inventory information has been collected in a few areas inside the CWD, but the majority of the District

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has not yet been inventoried. Based on the drainage inventory information collected to date, approximately 150 miles of drainage conveyance systems have been inventoried as well as nearly 600 catch basins.

In addition, the Washington State Department of Transportation (WSDOT) has collected drainage information along some of its transportation corridors within the CWD, such as culverts, catch basins, and drainage outfalls. WSDOT has inventoried a total of 62 outfalls and 276 catch basins within the CWD, which are also shown in Figure 2.3.5-1.

County Drainage Programs

Snohomish County has a handful of specific drainage programs that perform a variety of services within the CWD as well as the rest of the unincorporated county. Each of these programs is briefly summarized below. Some of these programs are funded either partially or entirely by surface water fees collected within the CWD, while other programs receive funding from other County sources, such as Real Estate Excise Taxes or the County's General Fund.

Drainage Planning

The Master Drainage Planning program in SWM performs detailed analyses of drainage systems in order to identify potential flooding problems. These analyses typically involve performing field investigations, conducting hydrologic and/or hydraulic analyses, evaluating alternative solutions, recommending capital improvements, and creating summary sheets with planning level cost estimates of the recommended projects.

Capital Drainage Program

Another drainage program within SWM, called the Drainage Infrastructure Construction Program, designs and constructs drainage improvements. These improvements typically involve constructing or replacing drainage features, such as culverts, ditches, drainage pipes, catch basins, detention facilities, etc.

Drainage Inventory & Mapping

The Drainage Inventory and Mapping program inventories the existing drainage systems within the unincorporated areas of the county. One phase of the program is conducted within SWM and primarily focuses on the unincorporated urban growth areas (UGAs). During a series of drainage studies called the Drainage Needs Report project, the drainage systems within the unincorporated UGAs of Stanwood, Arlington, and Granite Falls were inventoried and drainage maps of these areas were created. The other phase of the program is conducted by the Road Maintenance division and focuses on the unincorporated areas outside of the UGAs. As indicated in Figure 2.3.5-1, the inventory of public drainage systems within the CWD between Puget Sound and I-5 is mostly complete, while the inventory of areas east of I-5 are still in the early stages.

Drainage Maintenance

The County's Public Works Department also has an ongoing program to perform maintenance of existing drainage systems, which helps to reduce road and property flooding, improve water quality, and protect aquatic habitat. One phase of the program, called The Drainage Facility Maintenance Program, is conducted within the Surface

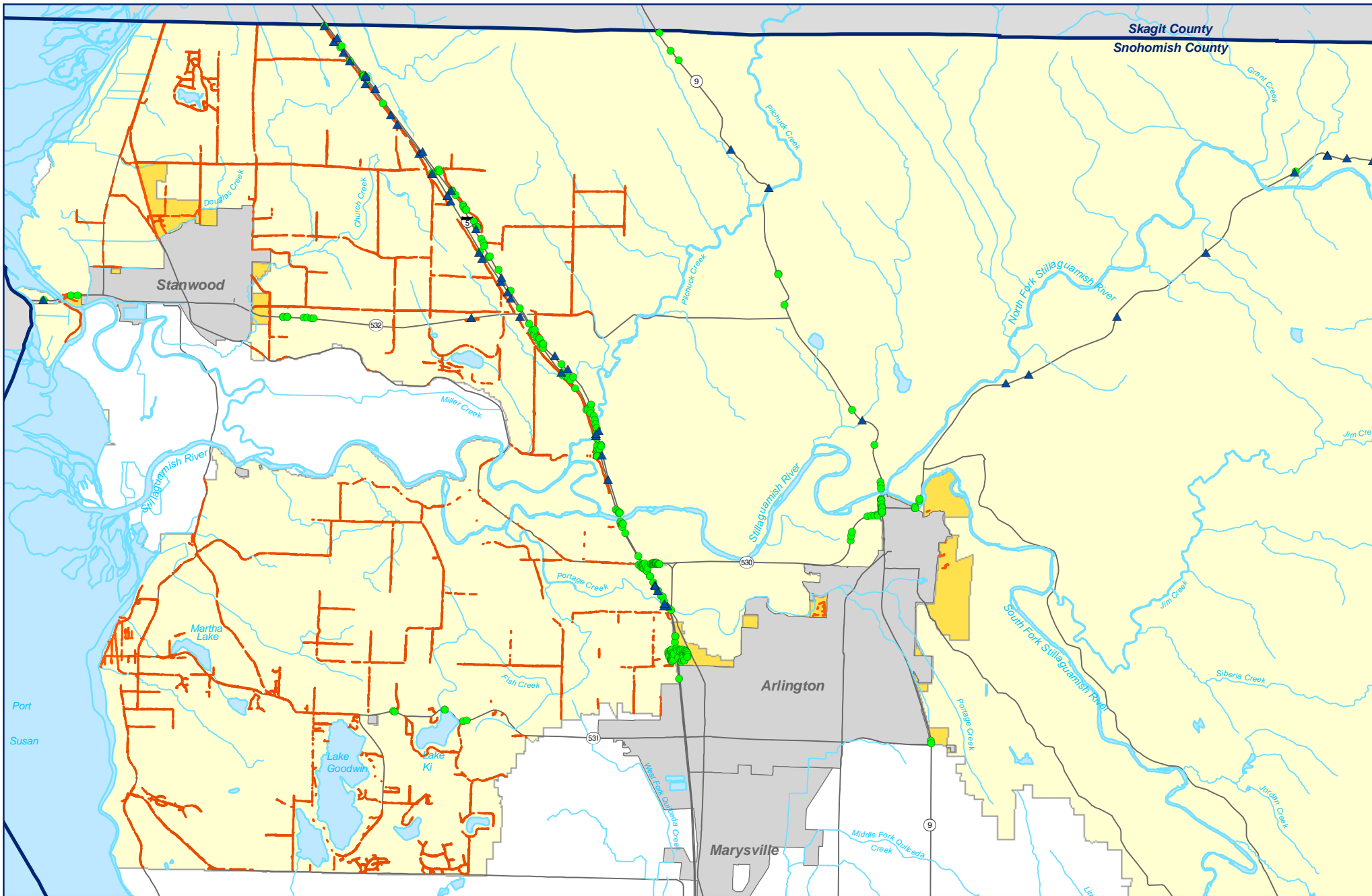


Figure 2.3.5-1 Drainage Inventory Completed in the CWD

- ▲ WADOT Outfalls
- WADOT Catch Basins
- Major Roads
- Rivers & Streams
- Lakes & Bays
- Cities
- Stillaguamish CWD
- Stillaguamish CWD UGA



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Water Management (SWM) division. This part of the program performs inspections and maintenance of stormwater detention and water quality facilities. Although the county maintains some stormwater detention and water quality facilities within the CWD, maintenance of most facilities is the responsibility of individual property owners or the shared responsibility of the homeowners in a plat. The other phase of this program is conducted by the Road Maintenance division and consists of maintaining drainage facilities within the road right-of-way, such as ditches, culverts, catch basins, and pipe systems.

Drainage Technical Assistance

SWM also has a Drainage Technical Assistance Program, which collects drainage complaints and questions from county residents. In most cases, SWM staff will investigate the reported drainage problems in the field, evaluate the cause of the problems, and recommend potential solutions. Each investigation is followed up with a written report to the citizen.

Drainage Standards

Drainage designs in Snohomish County must meet SCC Chapter 30.63A, Engineering Design and Development Standards (EDDS), and where applicable, SCC Chapter 30.63C setting Low Impact Development requirements. Requirements of outside agencies such as the Snohomish Health District, Washington Department of Fish and Wildlife Hydraulic Project Approval permits, federal Army Corps of Engineers, and Washington State Department of Transportation permits also apply, depending on the proposed development.

Stormwater treatment and pollution control design guidance is found in Snohomish County's drainage manual which is the 1992 Washington State Department of Ecology Stormwater Management Manual for the Puget Sound Basin in conjunction with the Snohomish County addendum. Under the County's Phase I National Pollutant Discharge Elimination System (NPDES) stormwater discharge permit, the County is required to develop and adopt an equivalent manual to the 2005 Stormwater Management Manual for Western Washington by the Department of Ecology (Ecology). The 2005 Ecology Manual has more stringent stormwater treatment requirements than the 1992 manual, such as flow duration control, construction stormwater pollution control training and certification, and use of more sophisticated computer modeling for treatment design. The 2005 Ecology Manual also allows for innovative Low Impact Development methods, which are encouraged for infiltrating and dispersing stormwater runoff.

Water Quality Complaints

The goal of the SWM water quality complaint investigation program is to respond to citizen or agency concerns regarding threats to the quality of surface waters and gain voluntary compliance through providing technical assistance to responsible parties. Cases are also referred, if necessary, to Planning and Development Services Code Enforcement for consideration of official enforcement action under Snohomish County's Water Pollution Control Code (SCC 7.53).

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The water quality complaint investigation service also visits 100 drainage system outfalls County wide, and if found flowing, samples them for the presence of an illicit discharge. Outfalls exhibiting characteristics of polluted discharge are flagged and systematic investigations take place upstream to identify and remove the source. The County is required by its NPDES municipal stormwater permit to focus efforts in urban, commercial and industrial areas. Additional discussion on the illicit discharge program is given in the Appendix to this report.

Drainage System Challenges

As noted above, in the Stillaguamish CWD, the majority of drainage systems consist of driveway culverts, ditches, and culverts that take drainage under the road, from one side of the road to the other. However, there are also portions of longer piped drainage systems and catch basins, typically found in the more urbanized areas. These constructed drainage systems need periodic maintenance, repair, and replacement. The very nature of these systems, being underground and out of sight, makes it challenging to determine whether replacement is needed, and replacement costs often far exceed the original construction costs. Oftentimes, the only sign that a system is failing is when a culvert collapses and either washes out the road, or the road above the culvert sinks.

Material Lifespans and Failures

Generally, pipes and culverts need the most frequent repair or replacement. Concrete culverts, which have generally been used for driveway culverts and stream crossings, have a lifespan of approximately 50 years, and were generally installed up to the late 1960s or early 1970s. Concrete culverts fail in a way that destabilizes surface structures, such as roadbeds, which can cause the road above the pipe collapse or sink. Corrugated metal pipe a lifespan of approximately 20 years, although they can fail in as little as 5 to 7 years. Corrugated metal pipe was generally used in the late 1960s through the early 1990s, for longer pipe systems, stream crossings, and driveway culverts. Corrugated metal pipe failure usually results from rust. Drainage conditions with fluctuating water levels and adverse water chemistry accelerates rust. Newer pipe systems are usually a double-walled plastic pipe, aluminum, or aluminized metal pipe.

Infrastructure Replacement Challenges

Replacement of existing storm drainage systems presents unique challenges, when compared to installing systems in new developments. Conflicts with existing utilities and road/traffic conditions may greatly increase the construction costs. Culverts that carry streams under the roadway must be upgraded and significantly enlarged (both width and height) to improve fish passage through the new culvert.

The end result is that drainage system replacements are often costly. Costs for replacing culverts that carry streams under roads could range from about \$30,000 to well over \$500,000 per replacement. Given the large number of stream culverts in the CWD and the age of most of the culverts, this could represent a costly burden to the County. Replacement of stormwater detention pipes (underground stormwater storage systems, generally attached to older residential developments) could range upward of \$400,000 each to replace.

2.3.1.2 Activities and Trends

Drainage Studies/Planning

SWM has conducted several recent drainage planning studies within the CWD. One of these studies was completed in 2002 as part of a larger study of the unincorporated UGAs throughout the county called the Drainage Needs Report. The study areas for that project that are located within the CWD include the unincorporated UGAs for the Cities of Stanwood, Arlington, Darrington, and Granite Falls. These studies are summarized in two reports: The Stanwood UGA Drainage Needs Report (Snohomish County Public Works 2002b) and the North UGAs Drainage Needs Report (S Snohomish County Public Works 2002a).

For the Stanwood UGA, a total of six surface water projects was recommended, which consists of four projects to correct flooding problems, one project to correct an erosion problem, and one project to address a stream habitat project. Out of the five recommended projects that address flooding and erosion issues, three projects have been constructed, one project was partially completed, and one project was not completed since the area was annexed into the City of Stanwood. For the unincorporated UGAs in the other three cities, no specific drainage problems were identified and therefore no drainage projects were recommended.

Another drainage planning study within the CWD was performed in 2004 during the county's 10-year update of its Comprehensive Plan. During this study, hydrologic and hydraulic analyses were conducted within the Eagle Creek drainage basin located east of Arlington. During this study, no specific drainage problems were identified and therefore no drainage projects were recommended.

The other recent study within the CWD was completed in 2006 and was called the South Warm Beach Master Drainage Plan (Snohomish County Public Works 2006). This study performed detailed hydrologic and hydraulic analyses of four of the drainage systems and portions of two streams within this neighborhood. Based on the results of these and other analyses, the study recommended a total of ten surface water projects, nine of which address identified flooding problems. Of the nine drainage projects, the county has constructed one these projects to date.

Drainage Capital Program

The SWM division constructs drainage improvements through the Drainage Infrastructure Construction Program. This program is partly funded by Real Estate Excise Taxes and partly funded by an increase in the surface water management fees charged to property owners within the UGAs. Within the CWD, the county has constructed some of the drainage projects that were recommended in the recent drainage planning studies previously described. Table 2.3.5-1 lists the recent drainage improvements that were constructed between 2003 and 2006.

Table 2.3.5-1. Recent Drainage Projects Constructed in Clean Water District

Project Area	Project Title	Project Number	Constructed Improvements	Construction Date
Stanwood UGA	Pioneer Highway Outfall Stabilization	ST-ST-01	Installation of slope drain to prevent channel erosion	2006
Stanwood UGA	284th Street NW Culvert and Ditch Improvements	ST-ST-04	Replacement of a failing culvert	2003
Stanwood UGA	68th Avenue NW Drainage Improvements	ST-ST-06	Upgrades to a ditch system	2003
South Warm Beach	192nd St. NW Drainage System Upsize	WB-M3-03	Replacement of an undersized ditch and culvert system	2004

Source: Snohomish County Public Works 2002a, 2002b, 2006

Drainage Maintenance

As previously described, the County’s Public Works Department also has an ongoing program to perform maintenance of existing drainage systems, which helps to reduce road and property flooding, improve water quality, and protect aquatic habitat. The Road Maintenance division implements one phase of the program by maintaining drainage facilities within the road right-of-way, such as ditches, culverts, catch basins, and pipe systems. SWM implements the other phase of this program by performing inspections and maintenance of some stormwater detention and water quality facilities, though most of these facilities are maintained by property owners or homeowners associations.

Currently, SWM inspects and maintains a total of four detention facilities within the CWD, which consist of three detention ponds and one detention pipe. The most common maintenance activities for detention ponds include managing vegetation and cleaning the control structure, while less frequent activities include things such as dredging the pond bottom to remove sediment and repairing fences. Maintenance of detention pipes typically involves cleaning the pipe system and the control structure. The frequency of maintenance varies for each facility depending on factors at the site, such as vegetation growth and the amount of sediment entering the facility, as well as other maintenance priorities throughout the county.

SWM also currently inspects and maintains a total of 18 facilities whose primary function is to improve stormwater quality. This includes six biofiltration swales, three infiltration facilities, eight pollution control structures, and one other swale facility. Maintenance activities typically include removing invasive vegetation and replacing grass in swales, cleaning the pollution control structures, and a combination of removing vegetation and cleaning for infiltration facilities. The frequency of maintenance for each facility varies depending on the same types of factors listed above for detention facilities.

The County replaces failing or failed infrastructure as part of its Road Maintenance program and as part of its capital improvement programs. Generally, failing systems are located either through drainage complaints, inspections that are done before roads are paved, or, unfortunately, as systems begin to fail. Sometimes the County contracts to use a remote controlled video

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system to inspect pipe systems for potential failures, but there is no County program to routinely inspect underground pipe systems for potential structural problems. Because so many of the County’s pipe systems are past their expected lifespan, this problem is expected to worsen significantly and costs are expected to increase.

Drainage Complaints

As previously described, the County’s Drainage Technical Assistance Program receives drainage complaints and questions from residents, investigates the reported problems, and provides recommendations in written reports. Figure 2.3.5-2 shows the locations of all drainage complaints reported to county staff within the CWD between 1999 and 2006. Table 2.3.5-2 lists the annual number of drainage complaints received from residents within the CWD in comparison to the rest of the county for this same period. Over this eight year period, a total of 299 drainage complaints were reported to SWM by CWD residents. While the number of complaints listed in the table fluctuates from year to year, this could be due to a variety of factors that likewise fluctuate annually, such as weather patterns and new development. Over this period, the average annual number of drainage complaints reported to county staff within the CWD is approximately 37. This represents an average of approximately 11 percent of the complaints reported to SWM for the entire county each year.

Table 2.3.5-2. Annual Number of Drainage Complaints in Clean Water District

Year	Drainage Complaints within CWD	Drainage Complaints for Entire County	Percent in CWD
2006	47	460	10.2%
2005	48	358	13.4%
2004	23	267	8.6%
2003	27	313	8.6%
2002	31	300	10.3%
2001	39	333	11.7%
2000	34	307	11.1%
1999	50	364	13.7%
Average	37.4	337.8	11.0%

Source: Snohomish County Public Works 2007

While the data in Table 2.3.5-2 does not indicate any general trends, SWM staff have observed two general trends in the types of drainage complaints reported by residents within the CWD over the past ten years. One trend is that there has been a general increase in the number of complaints made by longstanding rural property owners about stormwater from adjacent or uphill property owners and new development. This may be associated with the general increase in population and new development in these rural areas.

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Another general trend is that there has been an increase in the number of complaints from rural residents about the way in which existing drainage systems function. Examples include complaints about standing water in ditches, complaints that ditches should be replaced with enclosed pipes, and complaints that stormwater from roads should not flow onto private property. One potential reason for this may be that as residents move from urban areas to rural areas, they have expectations that drainage systems in rural areas should be similar to those in urban areas.

Water Quality Complaints and Illicit Discharges

From 1995 through 2006, SWM received 116 water quality complaints within the CWD. The four most commonly received complaint types have been potential discharges of manure, turbid water from construction sites, petroleum and sewage (Figure 2.3.5-3). Water quality complaints are grouped by subbasin for the purposes of identifying potential areas of concern. Lake Goodwin, Church and Portage Creek subbasins combined have received 30% of the total complaints. The majority of those complaints have been related to potential discharges of manure, turbid water due to construction, and sewage.

Since 1998, 31 outfalls within the CWD have been visited, some on numerous occasions. Of primary concern are locating discharges of sewage and industrial waste water. Typical signatures of these discharge types have been developed by Brown et al.(2004). Using benchmarks established by Brown et al. (2004), SWM developed a geodatabase with automated queries (Snohomish County Public Works 2007). This database is used to plan annual sampling events and identify locations of outfalls which may exhibit signatures of sewage or industrial effluent. No outfalls in the CWD boundaries have exhibited true signatures of industrial effluent.

Several outfalls, all found within rural residentially zoned areas in the Port Susan Drainages, have exhibited characteristics of sewage. Outfalls of concern are centered in the South Warm Beach Community. As a result of these findings, to address CWD goals, and implement actions under the Stillaguamish TMDL, SWM and the Stillaguamish Tribe conducted water quality sampling in the winter of 2005 and summer of 2006 to identify the presence of sewage in natural and built drainage systems in the Warm Beach area. Illicit discharge sampling in the Warm Beach area and outreach to a small number of citizens is planned for the summer of 2007. More discussion on the Warm Beach study is given in Section 2.3.7 Marine Shoreline and Shellfish, and in Appendix A.3 to this report.

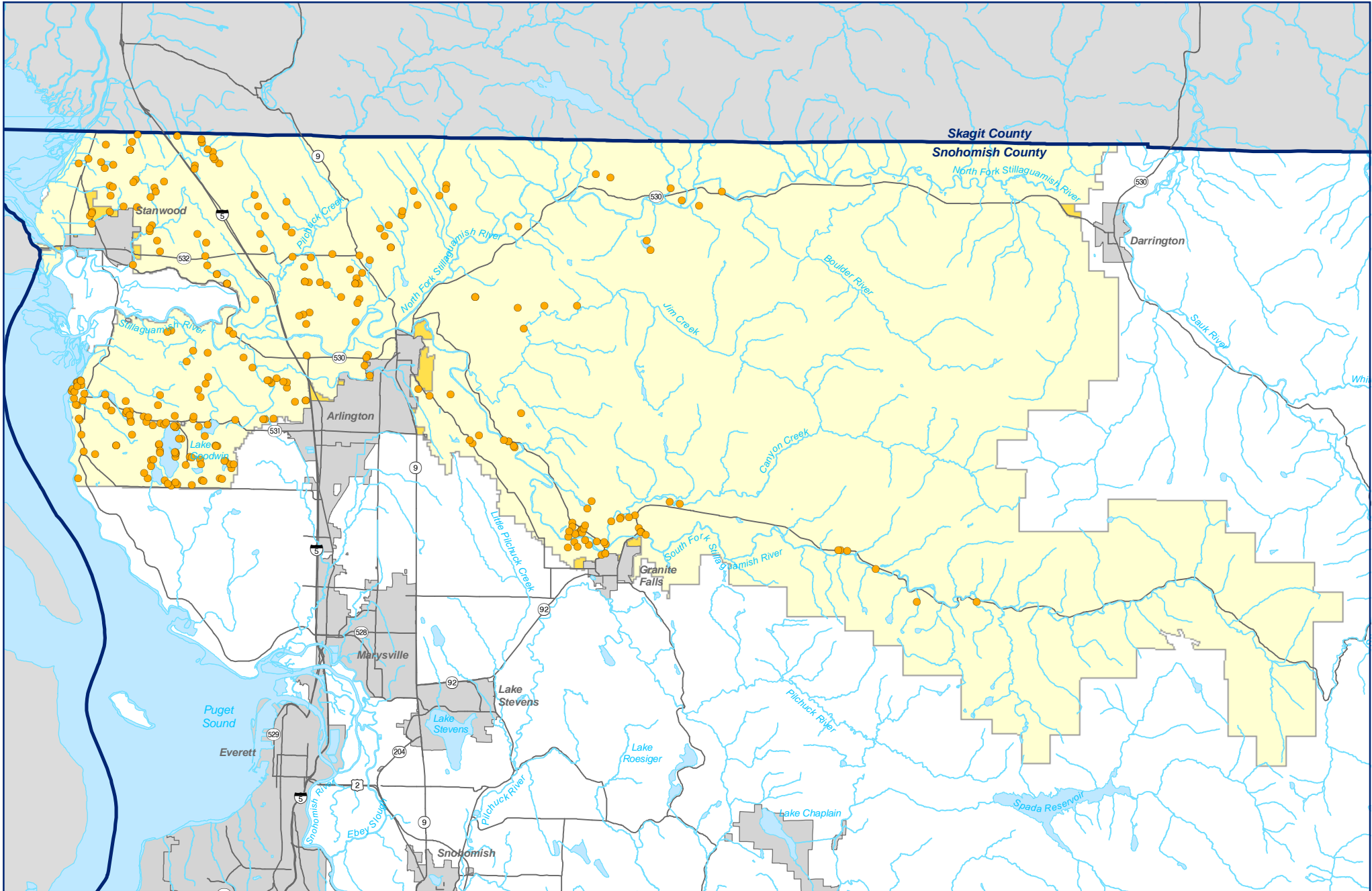


Figure 2.3.5-2 Drainage Complaints in the CWD

- Drainage Complaints 1999-2006
- Major Roads
- Rivers & Streams
- Lakes & Bays
- Cities
- Stillaguamish CWD
- Stillaguamish CWD UGA



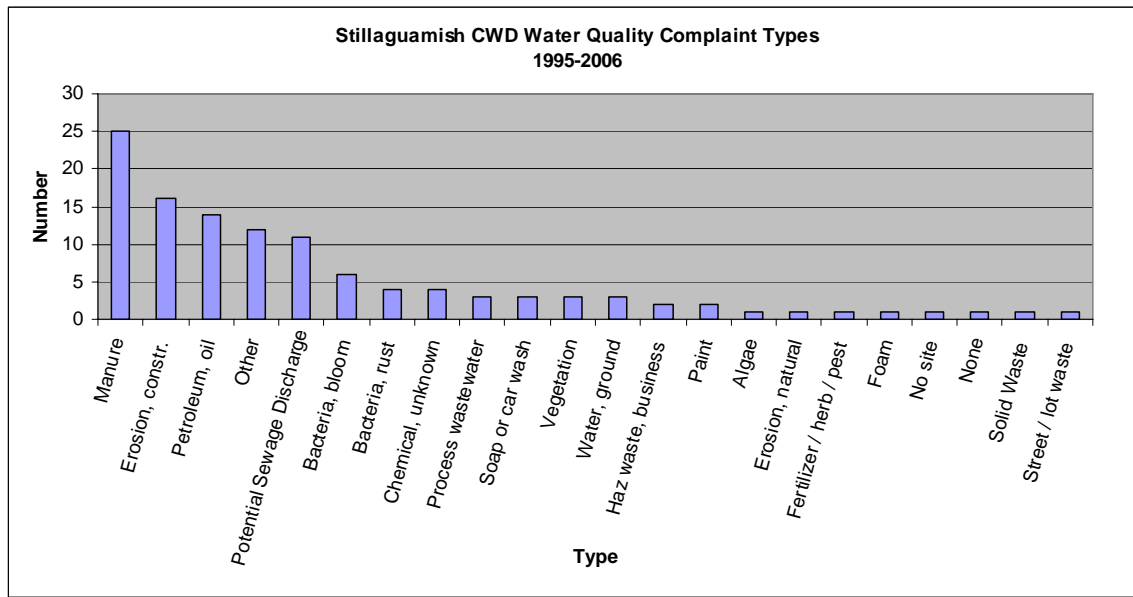

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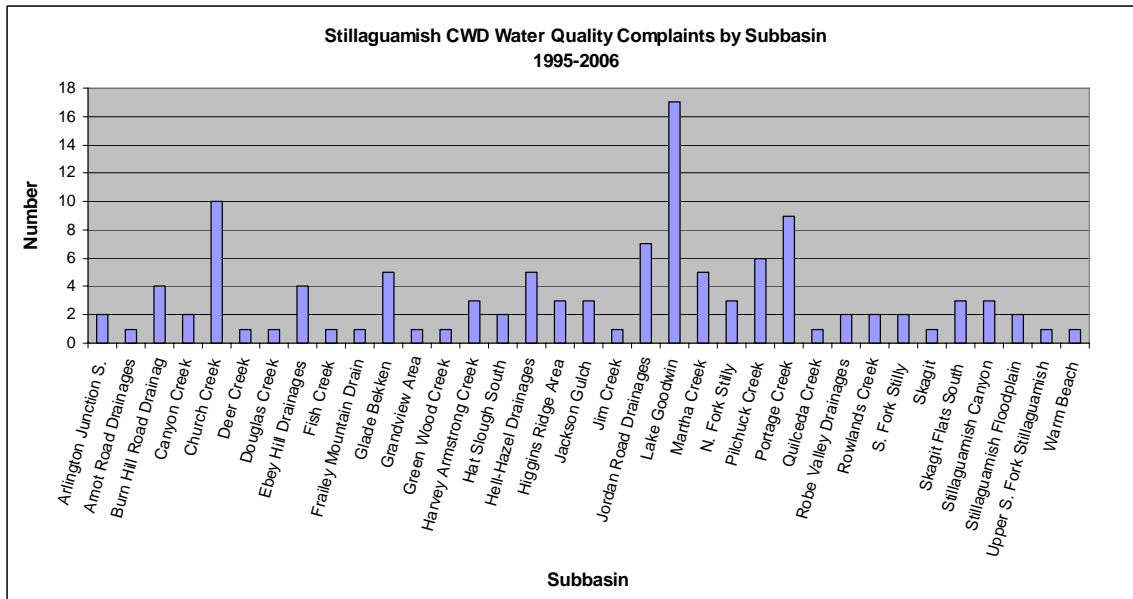
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Figure 2.3.5-3. Types of Water Quality Complaints



Water quality complaints were grouped by subbasin for the purposes of identifying potential areas of concern in Figure 2.3.5-3. Lake Goodwin, Church and Portage Creek subbasins combined are the source of 30 percent of complaints. The majority of those complaints have been related to potential discharges of manure, turbid water due to construction, and sewage.

Figure 2.3.5-4. Water Quality Complaints by Subbasin



2.3.1.3 Problems and Gaps

Explained below are the existing problems regarding drainage, as well as any gaps in data or analysis, and gaps in SWM's programs regarding drainage management.

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Drainage Infrastructure Aging

Development of an ongoing inspection and replacement program for older underground drainage systems is needed. This may require a detailed GIS analysis of the most likely systems needing replacement, and acquisition of equipment to inspect those systems, as well as funding for replacement.

Demand for Drainage Expected to Increase

There is a continuing need to provide drainage services, including planning, technical assistance, maintenance, and improvement projects, particularly as the County's drainage infrastructure ages.

NPDES Program Impacts Expected to Increase

As water quality requirements place more demands on drainage facilities, such as the County's NPDES permit, the need for performance monitoring and upgrades programs increases, in the form of inspections, retrofits and new projects. Demands will also increase on illicit discharge detection and elimination.

Unquantified impacts of increased runoff volumes

Although new standards are resulting in reduced peak flows, and new ordinances, such as the Low-Impact Development ordinance, encourage infiltration of stormwater, the total effect of increased runoff volume from new development and significant redevelopment is unknown, however, along with the continued effects of runoff from existing development designed to earlier standards.

Inventory of Drainage Facilities Needed

The inventory of roadside drainage facilities has not yet been completed. There is a continuing need to maintain and extend the existing inventory of drainage facilities in the CWD, in order to manage and maintain the County's drainage assets.

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