CHAPTER 7

NONPOINT SOURCE POLLUTION CONTROL

The following sections discuss general considerations for the control of stormwater pollution from the sources identified in Chapter 6 and present specific recommendations for the Irondale & Port Hadlock UGA.

GENERAL CONSIDERATIONS IN URBAN STORMWATER

As the consequences of uncontrolled urban runoff have become more widely recognized and better understood and as the alternatives available for control have increased, the complexity of stormwater management has grown. There are, however, several general issues that provide a framework for considering how Jefferson County should address stormwater management:

- Stormwater quality versus quantity control
- Construction phase versus long-term site operation phase
- Structural versus nonstructural controls
- Source control versus downstream treatment
- Control in new versus existing development
- Sensitive area considerations

STORMWATER QUALITY VERSUS QUANTITY CONTROL

Stormwater management has traditionally been concerned with controlling runoff quantities for the purpose of preventing flooding. Accordingly, most regulations and engineering design procedures addressed this concern. Recently, runoff water quality control has become a concern due to the recognition that water quality goals often cannot be met solely through control of point sources of pollution.

Efforts at quantity and quality control must confront the same basic task: predict the amount of runoff resulting under various conditions and provide sufficient storage capacity to achieve control objectives. In the case of quantity control, the objective is to release storm runoff at a rate that does not exceed stream channel capacity (which may not be the same as matching pre-development hydrologic conditions for a given site). For quality control the objective is to provide sufficient holding time for the effective operation of gravity settling or biochemical removal of pollutants. Because storage may benefit both quantity and quality, some of the same storage technologies can achieve both goals.

CONSTRUCTION PHASE VERSUS LONG-TERM SITE OPERATION PHASE

In general, water quality problems that occur during site construction differ from those that occur during the operation of a developed site. Therefore, these periods should be treated separately in stormwater management planning. At the same time, some measures installed for the construction phase, such as infiltration systems, can be used as permanent facilities, but they must be protected from turbid and sediment-laden runoff during construction activities.

STRUCTURAL VERSUS NONSTRUCTURAL CONTROLS

Biofiltration (grass-lined) swales, oil/water separators, and wet ponds are all structural stormwater water quality treatment facilities. There are also nonstructural stormwater quality controls including facility maintenance, site design, public education, and land use regulations. The most effective stormwater quality control programs use an appropriate mix of structural and nonstructural control.

SOURCE CONTROL VERSUS TREATMENT

Source control measures generally prevent pollutants from coming into contact with stormwater runoff. They are located at the potential site of pollutant generation. They include covering or enclosing pollutants such as oil or chemicals and covering bare soils to prevent rainfall from beginning erosion. Treatment facilities remove pollutants from runoff. They are typically removed from the source. They include swales, oil/water separators, and wet ponds. Source control measures are typically applied at multiple locations, while a treatment facility often receives drainage from more than one individual source. In the extreme case, a single downstream treatment structure (such as a regional detention pond) can serve a relatively large area. Source control measures are discussed in Volume IV, Chapter 2 of the *Stormwater Management Manual*.

CONTROL IN NEW VERSUS EXISTING DEVELOPMENTS

New developments offer greater opportunities to apply stormwater management techniques than do existing developments. Retrofitting structural techniques in existing developments is generally difficult and expensive. They often require substantial land, which may not be available in built-out areas. However, existing development areas are frequently amenable to a variety of nonstructural approaches, such as modified maintenance practices or public education.

CONTROL OF ACUTE VERSUS CHRONIC IMPACTS

If antifreeze were poured into a catch basin near a creek, a fish kill might result. This would be an example of an acute impact to water quality. However, more devastating impacts to a creek may result over a long period of time from the effects of erosion and siltation. This would be a chronic impact. Reducing acute and chronic impacts requires distinct stormwater management strategies.

SENSITIVE AREAS

Areas that are sensitive to impacts from urban stormwater include stream corridors, especially those with valuable fish habitat; flood plains; wetlands; steep slopes and groundwater aquifers. Special consideration should be given to protecting these areas.

STORMWATER QUANTITY AND QUALITY CONTROL: STRUCTURAL ALTERNATIVES

Stormwater quantity and quality control are not mutually exclusive. The outdated method of designing stormwater conveyance systems that relied on curb and gutters to transport stormwater directly into pipes which discharged the stormwater directly into a stream, river or lake provided little in the way of stormwater quantity control and nothing in the way of quality control. As citizens, municipalities and designers are becoming more aware of the damaging effects of stormwater quantity and quality, the line between stormwater management alternatives which are strictly concerned with quantity issues and those concerned strictly with quality issues is becoming blurred. The remainder of this Chapter discusses stormwater management alternatives which will serve to limit the quantity of stormwater runoff and improve the quality of the runoff.

The quantity of runoff can be controlled by storage and regulated release or by site controls. Storage and regulated release includes systems such as detention vaults or ponds with stormwater release orifices. Site controls can minimize the quantity of stormwater released as well as provide water quality benefits. Site controls generally reduce runoff at or near the point where the rainfall hits the ground surface. The following are common types of site controls:

- Low Impact Development
- Infiltration devices, such as trenches and basins
- Minimizing directly connected impervious area
- Storage and regulated release
- Swales and filter strips
- Porous pavement and parking blocks

LOW IMPACT DEVELOPMENT

The primary goal of low impact development is to mimic the predevelopment site hydrology by using site design techniques that store, infiltrate, evaporate, and detain runoff. These techniques reduce runoff and increase groundwater recharge. The *Puget Sound Water Quality Management Plan* recommends that low impact development include the following:

- Maintain the pre-developed, undisturbed stormwater flows and water quality;

- Retain native vegetation and soils to intercept, evaporate and transpire stormwater on the site, rather than using ponds and conveyances;
- Maintain and improve soil quality in order to improve infiltration and reduce runoff;
- Cluster development and roads on the site and retain natural features that promote infiltration; and
- Reduce impervious surface area and use permeable surfaces instead.

Low impact development measures include bio-retention facilities, dry wells, filter/buffer strips, grass swales, rain barrels, preserving topsoil, amending soils, cisterns, and/or infiltration trenches. As with many practices, maintenance in low impact developments is essential and should be addressed prior to implementation.

INFILTRATION DEVICES

Infiltration devices capture runoff and infiltrate it into the ground. The Washington State Department of Ecology *Stormwater Management Manual for Western Washington* provides design and sizing guidance in Chapter 7 of Volume V (Runoff Treatment BMPs). Infiltration systems provide groundwater recharge and pollutant removal, can be integrated into a site's landscaped and open areas, and if designed properly, can serve larger developments. Infiltration devices should be used only in situations where the captured volume of water can infiltrate into the ground before the next storm and where soils, slope, and cover will not promote sloughing and mass wasting (landslides).

Infiltration devices are divided into two categories: above-ground infiltration basins and buried infiltration trenches.

An infiltration basin is made by constructing an embankment or by excavating in or down to relatively permeable soils. The basin temporarily stores stormwater until it infiltrates through the bottom and sides of the system. The infiltration basin can actually be a landscaped depression within open areas or even a recreational area such as a soccer field. Infiltration basins generally serve areas ranging from a front yard to a 50-acre area.

Infiltration basins can be constructed on-line or off-line with respect to the normal drainage path. When a basin is located on-line, it will capture the water quality design storm entirely. When a larger storm occurs, runoff overflows the basin, which then serves as a detention pond for those larger events.

Off-line infiltration basins are designed to divert the more polluted first flush of stormwater out of the normal path and hold it for water quality treatment. When the infiltration basin reaches capacity, the flow path for any additional stormwater returns to normal and is managed for drainage and flood control. The diverted first flush is not discharged to surface water. It is stored and gradually removed by infiltration, evaporation, and evapotranspiration. This is the most effective practice for enhancing the quality of stormwater. It also helps to reduce stormwater volume and to recharge groundwater.

Infiltration trenches are usually designed to serve areas ranging from individual lots to five to ten acres in size and are especially appropriate in urban areas where land costs are very high. An infiltration trench generally consists of a long, narrow excavation, ranging from three to twelve feet in depth, which is backfilled with stone aggregate, allowing for storage of stormwater in the voids between the aggregate material. Stored runoff then infiltrates into the surrounding soil. Soil type is an important consideration, since course soils overlying a shallow aquifer may provide a direct route for pollutants to contaminate groundwater.

There are two major types of trenches, surface trenches, and underground trenches. The major differences between the two involve the amount of stormwater that can be handled and the ease of maintenance.

Surface trenches receive sheet-flow runoff directly from adjacent areas after a grass buffer has filtered the runoff. They are typically used in residential areas where relatively small loads of sediment and oil can be trapped in grass filter strips at least 20 feet wide. Sediments can clog infiltration devices. Once these devices are clogged, rehabilitation of the infiltrative surfaces requires significant effort.

Underground trenches can be used in many development situations, although discretion must be exercised in their application. While underground trenches can accept runoff from storm sewers, they require installation of special inlets to prevent coarse sediment and oils and greases from clogging the stone reservoir. These inlets should include trash racks, catch basins, and baffles to reduce blockage by sediment, leaves, debris, and oils and greases. In addition, pretreatment by routing the flow over grassed filter strips or vegetated swales is essential to protect the groundwater.

If properly constructed, with pretreatment practices in place to prevent heavy sediment loading, infiltration trenches can provide stormwater benefits without tremendous maintenance requirements. Since trenches are usually "out of sight, out of mind," getting property owners to maintain them can be difficult. Accordingly, a public commitment for regular inspection of privately owned trenches is essential, as are legally binding maintenance agreements and education of owners about the function and maintenance needs of trenches.

Inspection of trenches should occur frequently within the first few months of operation and once per year thereafter. Such inspections should be done after large storms, in order to check for water-ponding. Water levels in the observation wells should be recorded over several days to check drawdown. In addition, grass buffer strips should maintain a dense, vigorous growth of vegetation, which should receive regular mowing (with bagging of grass clippings) as needed. Finally, pretreatment devices should be checked periodically and cleaned when the sediment reduces available capacity by more than 10%.

MINIMIZING DIRECTLY CONNECTED IMPERVIOUS AREA

Directly connected impervious area (DCIA) is defined as the impermeable area that drains directly to a drainage system such as paved gutter, improved ditch, or pipe. Minimizing DCIA delays the concentration of flows into the improved drainage system and maximizes the opportunity for rainfall to infiltrate at or near the point at which it falls. Figure 7-1 illustrates the difference between an area where the DCIA is extensive and one where DCIA has been minimized. The residential lot on the north side of the street has all impervious areas on the lot draining directly to the gutter. This drainage plan allows no opportunity for rainfall to infiltrate into the ground. In fact, the system is laid out so that rainfall is quickly concentrated and drained to the gutter. The result is a greatly increased peak runoff rate and runoff volume compared to the pre-development condition. The pollutants contained in the runoff from the driveway and street must be dealt with further down in the drainage system.

In contrast, the drainage layout for the lot on the south side of the street has been designed to minimize DCIA. All impervious areas drain to a pervious area before they reach the grassed swale that serves as the primary conveyance facility for runoff from the lot. The roof runoff drains to the lawn and sheet-flows across it, the driveway is sloped to drain to the lawn instead of the street. The sidewalk and the street sheet-flow across a grass filter strip before reaching the grassed swale. All of these techniques combine to provide maximum opportunity for infiltration and slowing the runoff rate. This approach to drainage system layout, which emphasizes peak-flow reduction and pollutant capture, is stormwater management, in contrast with the north lot design, which is simply a drainage plan.

The majority of residences in Irondale & Port Hadlock, particularly the older homes, have been constructed with minimal DCIA. Commercial development and more recent multiple housing tends to exhibit greater DCIA. Future development within the UGA area should address this issue.

STORAGE AND REGULATED RELEASE

Storage and regulated release of stormwater is not generally practiced throughout the Irondale & Port Hadlock UGA, although detention does occur in the form of ponding in yards, vacant lots, and ditches. Storage and regulated release of stormwater requires the installation of detention systems to insure that the rate of stormwater runoff leaving the site for the design storm event during the post-development condition is no greater than the pre-development rate for the same design storm event. This method of stormwater control minimizes downstream impact on the existing conveyance system.

Detention systems can be either wet or dry systems. Detention systems are widely used for runoff quantity control. However, if wet detention systems are properly sized they can act as effective runoff quality control devices as well.

A wet detention basin consists of: 1) a permanent water pool, 2) an overlying zone with capacity to temporarily store the design runoff volume for release at the allowed peak discharge rate, and 3) a shallow littoral zone (the biological filter), which serves to treat the permanent volume between storm events. The permanent water pool volume and the vegetated littoral zone are importance for water quality enhancement. Wet detention ponds are often used in series with swale interconnectors. If properly designed and maintained, wet detention ponds can provide not only effective flood and water quality protection, but also ancillary benefits, such as enhanced aesthetics and wildlife habitat.

The removal of stormwater pollutants in a wet detention system is accomplished by a number of physical, chemical, and biological processes. Gravity removes particles through the physical process of sedimentation. Chemical flocculation occurs when heavier sediment particles overtake and coalesce with smaller, lighter particles to form still larger particles. Biological removal of dissolved stormwater pollutants includes uptake by aquatic plants and metabolism by phytoplankton and microorganisms that inhabit the bottom sediments.

Dry detention basins are the most common type of detention basin for peak-flow attenuation. Dry detention systems perform very poorly as runoff treatment devices. This is primarily due to short residence time and the fact that these basins do not remove any dissolved pollutants.

Design, sizing, and maintenance criteria for detention facilities can be found in Chapter 3 of the DOE *Stormwater Management Manual for Western Washington*.

SWALES AND FILTER STRIPS

Swales and filter strips are among the oldest stormwater quality control measures, having been used alongside streets and highways as well as farmers for many years. A swale is a shallow trench that has the following characteristics:

- Side slopes flatter than three feet horizontally to one foot vertically.
- Contiguous areas of standing or flowing water <u>only</u> following rainfall.
- Planted with or containing vegetation suitable for soil stabilization, stormwater treatment, and nutrient uptake.

A filter strip is simply a strip of land across which stormwater from a street, parking lot, rooftop, etc., sheet-flows over before entering adjacent receiving waters.

For small storms, both swales and filter strips remove pollutants from stormwater by 1) slowing the water and settling or filtering out solids as the water travels over the grassed area and 2) allowing infiltration into the underlying soil. Heavy metals are typically trapped in the upper regions of the soil column. In addition, the vegetation tends to function as fixed media to support growth of microorganisms, which can break down dilute concentrations of organics such as oil residues. Low velocity and shallow depth are key design criteria. In general, the higher the flow rate, the lower the efficiency. A swale designed with a low bottom slope and check dams will perform much more efficiently than one without check dams. Raised driveway culverts can be effective as swale check dams. For maximum efficiency of pollutant removal during small storms, a trapezoidal swale with as large a bottom width as can be fitted into the site plan is desirable, since this will maximize the amount of runoff in contact with the vegetation and soil. Design equations for swales and filter strips can be found in Chapter 3 of the DOE *Stormwater Management Manual for Western Washington*.

Maintenance of these facilities is an important consideration both for aesthetics and hydraulic efficiency. In the case of the swale, care must be taken to insure that flows through a swale used for drainage purposes during large storms are not impeded by overgrown vegetation. To prevent this, the vegetation planted in the channel should be suitable for mowing, and the channel designed so that mowing machines can be easily and efficiently operated along the swale. The swale should be mowed on a regular basis. For filter strips that are not part of the drainageway during large storms, maintenance is purely an aesthetic matter. These strips can be planted in grass and mowed, or natural vegetation can be used. Ground cover must be sufficiently dense to keep the overland flow from channeling and eroding rivulets through the filter strip.

PARKING BLOCKS

Parking blocks are a very effective site-control device. Parking blocks are hollow concrete blocks similar to but smaller than those used in construction. In commercial parking lots, the use of parking blocks in the less frequently used areas will give them an attractive appearance and will considerably reduce runoff quantity, flow rates, and pollution. This is also true for private driveways and parking areas where more than half of the area is used less than 20 percent of the time.

Parking blocks are put in place in rows, with soil surrounding each one. Soil areas are planted with appropriate vegetation. Runoff quantity reduction occurs as infiltration takes place in the planted areas. Greater flow resistance of the grassed areas retards the runoff rate, especially during small storms. Finally, the quality of the runoff is much enhanced over that from a normal parking lot because the pollutants, restrained by the vegetation matrix, will be more difficult to wash off than if they were simply lying on asphalt or concrete. Entrapped heavy metals are typically contained in the upper soil column, while microorganisms attached to the vegetation can act to break down low concentrations of organic pollutants.

In designing a parking block area, the block manufacturer should be consulted to determine the most suitable sub-base to use. Also, only the actual parking spaces should be paved with the blocks, since they do not hold up well under traffic. The traffic lanes through the lot should be paved in the normal fashion.

Considerations for Structural Alternatives

The incorporation of runoff quality controls into urban landscape design is more an art than a science. However, if the design is developed with the following concepts in mind, a good water quality management system will result.

- Design runoff quality controls to capture small storms.
- Design to maximize sediment removal, and removal of other pollutants will generally be good.
- The most effective method for reducing urban runoff pollution is to minimize directly connected impervious area (DCIA).
- Infiltration devices are most efficient but are most difficult to maintain, and may not be used on sites with poor soil conditions.
- Dry detention is easiest to design and operate, but efficiency can be low.
- Wet detention is more difficult to design but more efficient than dry detention, and often more aesthetic.

With thoughtful planning and careful design, cost-effective runoff quality controls can be integrated into urban development plans to achieve the required level of pollutant reduction with minimal negative impact on aesthetics. The aesthetic character of a development site can often be enhanced by properly integrating runoff quality controls into the site plan.

STORMWATER QUANTITY AND QUALITY CONTROL: NON-STRUCTURAL ALTERNATIVES

Stormwater management can be improved through the use of non-structural alternatives including:

- Facility Inspection and Maintenance Program
- Staff training
- Changes to the County Unified Development Code
- Enforcement actions for non-compliance with stormwater regulations
- Public education
- Water Quality Monitoring and Stream Gauging
- Stormwater Best Management Practices

FACILITY INSPECTION AND MAINTENANCE PROGRAM

The objective of a stormwater maintenance program is to assure the continued functioning of stormwater management facilities. A complete maintenance program includes more than the physical tasks of cleaning catch basins, pipes and open ditches; maintenance of vegetation in biological treatment structures; and proper disposal of debris from the maintenance activities. Maintenance programs also involve management items such as completing and maintaining a facilities inventory, including updating a base map, scheduling inspections and maintenance activities, assessing costs for contract maintenance versus staff maintenance, and record keeping.

In order to perform inspections and maintenance at the appropriate time, a budget, staff, and priority schedule needs to be established. Certain types of maintenance are more important than others. It is important that catch basins and conveyance facilities be inspected before the wet season to assure that debris has not blocked a channel or taken up capacity in a manhole. Street sweeping in the fall is important because leaves block catch basin grates, which could result in overland flow across private property or flooding of roadways. Loss of vegetative cover in treatment swales and filter strips during summer drought conditions can result in reduced effectiveness during the "first flush" of autumn storms.

Reports and record keeping are important feedback mechanisms that enable management to compare actual versus planned costs, production, and efficiency. Reports provide a database for improved budgeting and resource allocation. Records and reports should include man-hours, equipment hours, materials used, and the unit of work completed.

Maintenance control establishes accountability for specific results within a specific time frame and budget. The maintenance program needs a control hierarchy to establish a chain of command to complete the work.

The following section identifies the requirements and guidelines for maintaining stormwater facilities. It describes potential problems and the necessary corrective actions for typical stormwater treatment, detention, and conveyance facilities. The table also identifies a recommended period of time between routine maintenance activities. Of course, as these facilities are maintained the need may arise for maintenance at a level more (or less) than these typical values. It should also be noted that at the time of facility installation, the County should request a manual describing specific maintenance necessary for the facility. This, coupled with a routine schedule, will help ensure proper maintenance of the facility.

One item of critical importance is inspecting privately owned facilities to ensure that they are properly maintained. Jefferson County does not currently perform this function. The County does require developers to enter into a Stormwater Management Facility Maintenance Agreement with the County. The developer agrees to maintain the facility as per the approved plans. This Agreement could form the basis for an inspection program.

Some jurisdictions provide stormwater utility credits or refunds for those private facilities that are properly and routinely maintained. Jefferson County does not currently provide for this. Therefore, with no financial incentive, it is even more critical that the County performs these inspections and issues notices of inspections to those private parties who are not maintaining their facilities. Because the proper operation and maintenance of stormwater facilities benefits the public as a whole, the County should utilize innovative solutions to accomplish the goals of stormwater management in those cases where a private entity will not, or cannot, maintain their facility, rather than enacting civil penalties for the sake of punishment. It is highly recommended that the County seek easements for those portions of the system that lie outside of the right-of-way.

The various stormwater facilities that require maintenance are described below.

1) Street Sweeping

   Streets with concrete curb and gutter or thickened edges are part of the stormwater conveyance system. All streets accumulate vehicular emission particles, silt, and, leaves and other debris and pollutants that could enter the stormwater conveyance system. Street sweeping (not washing) is an important maintenance item to reduce pollution in the receiving waters and to reduce the potential for blocking of the conveyance system. High efficiency street sweepers are recommended due to the fact that they have evolved into a useful technique for picking up small particulates, which accumulate pollutants along County streets. Street sweeping is recommended at least once per year in the fall, after the leaves have fallen.

2) Catch Basin Cleaning

   Catch basins in the County include types with and without sumps. Sumps are important features that allow deposition of particulate matter carried in the stormwater. When sumps become filled to 60 percent of their volume, the efficiency of silt removal diminishes significantly. All catch basins should be inspected at least twice per year. Once a maintenance program is in place, the County will be able to develop a history on particular areas to determine which basins require more frequent attention. Catch basins are normally cleaned with a vactor truck that removes the sediment from the basin. This sediment must be disposed of properly into an appropriate disposal site. Jefferson County Public Works currently uses the Port Hadlock maintenance facility. For the purposes of this plan, catch basin cleaning is estimated to be required an average of twice a year.

3) Pipe Cleaning

Pipes in the UGA vary in size from 12-inch to 24-inch diameter. Pipe types include concrete, corrugated metal and HDPE. All pipes should be inspected annually and cleaned, at a minimum, every third year. A vacuum system is recommended for cleaning. If pipe flushing is used, adequate downstream siltation control must be in place.

4) Open Ditch Cleaning

Some roads are drained by means of roadside ditches. Ditches and swales can provide biofiltration, if vegetation is allowed to remain within the channel and on the sides. The primary pollutant removal mechanism of a bioswale (or ditch) involves filtration by grass blades, which enhance sedimentation, as well as trapping and adhesion of pollutants to the grass and thatch. To be most effective, the vegetation within the ditch should be cut down to a height between 2 and 6 inches. Swales can be cleaned by the use of a horizontal auger. Ditches should be cleaned twice a year, preferably during the summer months to allow vegetation to grow back before the rainy season. The edges of the ditches should be mowed four times a year.

5) Detention System Cleaning

Upon installation of a detention system the County should request a manual regarding specific maintenance requirements for facilities such as detention ponds. At a minimum, when detention systems are installed, they should be monitored annually for sediment accumulation. Removal of accumulated sediment is anticipated to be required once every five years.

6) Oil/Water Separators

Oil/water separators must be maintained in order to be effective. If deposited material is not removed on a periodic basis; it may be flushed downstream by winter storms. Inspection of oil/water separators should be scheduled bimonthly and maintenance cleaning scheduled at least annually and more frequently if required.

7) Biofiltration Swales

The grass in the swale should be mowed periodically to keep it at the proper height. If the grass is damaged, for example by drought or storms, it should be replaced. Leaves, grass clippings, and other debris should be removed.

All components of the stormwater system should be inspected at least twice per year. Additional inspections may be warranted in problem areas and also in areas where land development is occurring, due to the potential for erosion and sedimentation. Routine maintenance should be performed on all components based on these inspections. In general, most jurisdictions do not provide an appropriate level of maintenance for all portions of their system. Maintenance is often reactive, rather than proactive.

Several benefits can be realized by maintaining all portions of the stormwater system. With a well maintained system better treatment and flow control is accomplished, the public recognizes a well run maintenance program, it becomes easier to identify problems and resolve complaints, and problems such as flooding, icing of roadways, and damage to the system are minimized.

STAFF TRAINING

A fundamental part of the stormwater program includes training for personnel on how to address stormwater issues. The County should ensure that the staff is well trained on how to inspect and maintain best management stormwater practices as outlined in Section 4.6 of the *Stormwater Management Manual for Western Washington*. At a minimum, staff should be educated on how to maintain catch basins, detention ponds and control structures, bioswales/ditches, Stormfilter vaults, and any other best management practices implemented within the UGA. Staff shall also be knowledgeable in identifying pollutant sources and in understanding pollutant control measures, spill response procedures, and environmentally acceptable material handling practices. Ecology's "Stormwater Pollution Prevention Planning for Industrial Facilities" (WQ-R-93-015, 9/93) may be used as a training reference. The County Engineer or Road Supervisor should be designated as responsible for setting up training for new employees regarding these issues. Renewal training for all employees on a biannual basis is recommended as well. Currently Jefferson County Public Works maintains drainage facilities in County road rights-of-way. The Washington Department of Transportation is responsible for facilities in State Highway rights-of-way.

Personnel must also be well trained on sediment and erosion control issues so they can properly investigate and advise contractors regarding problem areas during construction. Staff members should be certified through the "Construction Site Erosion and Sediment Control Certification Course" offered by the Associated General Contractors of Washington Education Foundation or an approved equivalent. Equivalent certificates include:

- WSDOT certification in Construction Site Erosion and Sediment Control.
- Certified Professional in Erosion and Sediment Control (CPESC) offered by the International Erosion Control Association (IECA).

Erosion and sediment control certification for staff members should be renewed every three years. Jefferson County currently provides this training to road maintenance and engineering personnel.

REVISIONS TO THE UNIFIED DEVELOPMENT CODE

Federal, State, and local rules, regulations, and guidelines that govern stormwater have been discussed in Chapter 2 of this document. The Jefferson County Unified Development Code should be revised as necessary to ensure that it provides adequate regulation of stormwater management.

ENFORCEMENT

Staffing levels must be sufficient to monitor construction activity, respond to stormwater complaints, and provide periodic inspection of private stormwater treatment facilities such as oil/water separators and detention facilities. County staff should document the hours spent on site inspections, together with the frequency of inspection of construction sites and private stormwater facilities. From these records and the records of time spent responding to complaints, an understanding of the adequacy of the current staffing level can be gained.

PUBLIC EDUCATION AND OUTREACH

An important element of a stormwater management plan is public education and outreach. The involvement of the public is necessary to insure the overall success of the stormwater management plan. For the public to be motivated to participate in stormwater management, it must first be aware of existing stormwater and surface water problems, the public’s role in creating these problems, and actions to avoid and correct them.

The public must also be aware of how their normal activities affect stormwater quality and quantity. Most citizens believe that stormwater management is someone else's problem. In order to educate the public, issues with local relevance must be identified and programs must be designed to address them. The following is the outline of a public education and outreach program:

Port Hadlock UGA Stormwater Management Plan Public Education and Outreach Program

Background

The Irondale and Port Hadlock Urban Growth Area is located in proximity to two important and vulnerable aquatic resources, Chimacum Creek and Port Townsend Bay. In addition, the UGA depends on groundwater resources for its potable water. One of Jefferson County's overall goals in designating the UGA is to ensure that development of the UGA doesn't degrade these resources. Development of a UGA Storm and Surface Water Management Public Education Program will be an important component of meeting this goal. An anticipated effect of the Program is to provide residents and business owners with timely reminders of the role they play and the effect they have on water quality in the UGA.

Program Goals

Use public education and outreach activities to:

- Increase understanding of stormwater and surface water management issues as they relate to the UGA;
- Generate support for protecting water quality and aquatic resources including Chimacum Creek salmon and shellfish in Port Townsend Bay; and
- Increase compliance with UGA stormwater management regulations.

Strategies

- Jefferson County will work with the Jefferson County – WSU Cooperative Extension, Jefferson County Conservation District, and Jefferson County Public Utility District to develop and implement an Irondale and Port Hadlock UGA Storm and Surface Water Management Program Public Education Program.

- The Public Education Program will include:
  - Program identity, themes, and logo;
  - Educational and outreach activities;
  - A library of educational materials, brochures or fact sheets;
  - Alternative information sources such as web sites, community news letter, bumper stickers, and refrigerator magnets; and
  - Partnerships with community and environmental groups, public schools, and the Jefferson County Library.

- The Public Education Program will adapt existing public education materials developed by other sources (ex. WSU, Jefferson County Conservation District, WA Department of Ecology, WA Department of Fish and Wildlife), to specific Irondale and Port Hadlock UGA issues and conditions.

- The Public Education Program will identify groups within the UGA to target for public education activities including school children, business owners, the Chamber of Commerce, community groups, Chimacum Creek landowners, and the Port Hadlock Marina and boat owners.

- The Public Education Program will develop ways to measure the effectiveness of public education and outreach activities and adapt the program to increase its effectiveness.

Activities

The following Public Education Program activities are based the NPDES Phase II Public Education and Outreach guidelines and the Draft County-wide Surface Water Management Plan Public Education Program developed by Jefferson County – WSU Cooperative Extension:

- Inform community organizations, the Chamber of Commerce, and business owners about the relationship between Chimacum Creek salmon, groundwater resources, and urban stormwater management;
- Chimacum Creek Primary School programs such as salmon, forests, and Chimacum Creek;
- Community event participation, including Hadlock Days and Wild Olympic Salmon Festival;
- Sign Chimacum Creek as a salmon stream;
- Catch basin stenciling: “Dump No Waste – Drains to Ground Water” and “Dump No Waste – Drains to the Bay”;
- Inform the public about the importance of waste oil recycling and that waste oil is collected by Jefferson County Public Works solid waste and recycling program at the Port Hadlock Marina;
- Inform homeowners regarding appropriate fertilizer and pesticide use and household hazardous waste reduction and disposal;
- Inform Chimacum Creek land owners regarding maintaining and restoring salmon habitat;
- Port Hadlock Marina: Marina and boater education programs and signing best management practices;
- Urban stormwater management displays at the Jefferson County Library;
- Use handouts in PUD water bills to educate residents and business owners regarding the relationship between stormwater runoff, household and business pollution prevention, and safe drinking water;
- Work with Jefferson County-WSU to recruit and train volunteer educators.

WATER QUALITY MONITORING AND STREAM GAUGING

Typically stormwater management requirements are significantly different in urban areas compared to rural or suburban areas. There are significantly larger areas of impervious surface coverage and higher volumes of runoff. There are also typically higher concentrations of pollutants in stormwater runoff. In the case of the Irondale and Port Hadlock UGA, its location in proximity to Chimacum Creek and Port Townsend Bay and reliance on groundwater as its drinking water source create the potential for significant impacts related to stormwater runoff. A stormwater management program therefore requires not only providing a full complement of structural and non-structural controls, but also conducting an on-going monitoring program to measure its effectiveness. If the monitoring program detects water quality degradation or increased stormwater flows, the program can be reassessed and modified. This could include adding additional capital facilities or program activities or revising UGA land use designations or development regulations. Such a program is typically termed adaptive management.

Jefferson County Natural Resources Division currently maintains two stream gauges on Chimacum Creek, one upstream from the UGA and one downstream from Irondale Road. This activity is currently funded by a grant from the Washington Department of Ecology.

Jefferson County Conservation District conducts water quality monitoring at several locations on Chimacum Creek including Irondale Road and the SR19 bridge in Chimacum. Parameters include dissolved oxygen, temperature, conductivity, pH, nitrate-nitrogen, total suspended solids, turbidity, and fecal coliform.

BEST MANAGEMENT PRACTICES

In most communities a major source of stormwater contamination comes from sources that are lumped together and called non-point pollution. Non-point pollution sources can generally be defined as "pollution that does not have a single point of discharge." Non-point pollution discharges can be divided into commercial and residential categories.

The treatment of stormwater runoff prior to discharge to surface water or prevention of non-point pollution in stormwater should be accomplished by using Best Management Practices (BMPs). Best Management Practices are defined as physical, structural, and/or managerial practices, which when used singly or in combination, prevent or reduce pollution of water.

The *Stormwater Management Manual* contains BMPs for urban land uses. Best Management Practices can be placed into two general groups: source control BMPs, and runoff treatment BMPs. The former group includes those BMPs that keep pollutants from coming in contact with stormwater; the latter group consists of methods for treating stormwater. Source control BMPs are preferred as they are generally less expensive and more effective. BMPs and general strategies for their use are listed below in order of preference:

Alter the activity: The preferred option is to alter any practice that may contaminate surface water or groundwater by either not producing the pollutant to begin with or by controlling it in such a way as to keep it out of the environment. An example would be recycling used oil rather than dumping it down a storm drain.

Enclose the activity: If the practice cannot be altered, it should be enclosed in a building. Enclosure accomplishes two things. It keeps rain from coming into contact with the activity and since drains inside a building must discharge to sanitary or process wastewater sewers or a dead-end sump, any contamination of runoff is avoided.

Cover the activity: Placing the activity inside a building may be infeasible or prohibitively expensive. A less expensive structure with only a roof may be effective although it may not keep out all precipitation. Internal drains must be connected to the sanitary sewer to collect water used to wash down the area as well as any rain that may enter along the perimeter.

Segregate the activity: Segregating an activity that generates more pollutants than other activities may lower the cost of enclosure or covering to a reasonable level.

If the segregated activity cannot be covered, it may be possible in certain situations to connect the area to the public sanitary sewer, subject to approval. Drains may also be connected to a businesses' own process wastewater system if the business operates independently of the local authority.

Discharge stormwater to the process wastewater treatment system: Many industries have their own process wastewater treatment system with final disposal directly to the receiving water. In these cases, stormwater from areas of significant pollution sources can be plumbed to the process treatment system as long as its capacity is not exceeded.

Discharge small, high frequency storms to public sanitary sewer: This BMP would be limited to those few outside activities that contribute unusually high concentrations of pollutants and/or pollutants of unusual concern. Limited entry of these few special cases may not overtax the public sanitary sewer.

The entry of stormwater to the sanitary or combined sewer can be limited to the small high-frequency storms that carry off the majority of pollutants over time. Storm flows in excess of the hydraulic capacity of the sanitary or combined sewer would be discharged to the storm drain.

Discharge small, high frequency storms to a dead-end sump: This BMP would be limited to those few activities that contribute unusually high concentrations of pollutants and/or pollutants of unusual concern. This option would be used when discharge into a sanitary sewer or process wastewater treatment is not available or feasible. This option requires the capacity to pump out the sump regularly and to dispose of the pumpage in an appropriate manner.

Treat the stormwater with a stormwater treatment BMP: The treatment of stormwater is the least-preferred option for several reasons. Source control BMPs keep the pollutants completely away from stormwater. In contrast, stormwater treatment devices are not 100 percent effective. In fact, a highly effective BMP is considered successful if 80 percent of the pollutants are removed. Even after treatment, freshwater criteria may not be met for commercial areas.

Given the above strategies for use of BMPs, DOE has developed mandatory BMPs for many different business groups. Section 2.2 and Appendix IV-A of Volume IV in the DOE *Stormwater Management Manual for Western Washington* lists each group of business in the following way:

- Title of business group
- Standard Industrial Code (SIC)
- Description of business activities
- Potential pollution generating sources
- Pollutant Control Approach
- Applicable Operation BMPs
- Applicable Structural Control BMPs

The source control BMPs are in Volume IV and stormwater treatment BMPs are in Volume V of the *Stormwater Management Manual for Western Washington.* The Department of Ecology recommends implementing oil control measures for "high use areas" including:

- An area of a commercial or industrial site subject to an expected average daily traffic count equal to or greater than 100 vehicles per 1,000 square feet of gross building area,
- An area of a commercial or industrial site subject to petroleum storage and transfer in excess of 1,500 gallons per year, not including routinely delivered heating oil,
- An area of a commercial or industrial site subject to parking, storage or maintenance of 25 or more vehicles that are over 10 tons gross weight,

A road intersection with a measured average daily traffic count of 25,000 vehicles or more on the main roadway and 15,000 vehicles or more on any intersection roadway, excluding projects proposing primarily pedestrian or bicycle use improvements.