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Chapter 2. Stormwater Planning and Design Integration

2-1 Introduction

This chapter provides guidance for integrating the planning and design of stormwater-related project elements into the context of the Washington State Department of Transportation (WSDOT) project development process. How the process applies to a specific project depends on the type, size, and complexity of the project and individual WSDOT regional business practices.

2-2 Stormwater Management Objectives

Originally, the only function of highway stormwater management was to maintain safe driving conditions, using engineering techniques designed to prevent stormwater from ponding on road surfaces. While maintaining safe driving conditions continues to be essential for any functional highway drainage system, WSDOT also acknowledges the state's vital interest in protecting and preserving natural resources and other environmental assets, as well as its citizens' health and safety. These interests have become integrated with other vital interests committed to the department, including the cost-effective delivery and operation of transportation systems and services that meet public needs. Thus, stormwater management for WSDOT transportation facilities has two main objectives: (1) protect the functions of the transportation facility, and (2) protect ecosystem functions and the beneficial uses of receiving waters.

2-3 Project Development Overview

The integration of stormwater planning and design into WSDOT's project development process is shown in Table 2-1. While the process consists of the distinct phases described below, in practice, the phases actually overlap.

- The preliminary scope, schedule, and cost estimates for a project are generated during the *definition phase* (referred to as *scoping*). The product of the definition phase is the Project Summary, which is used to program the project.
- After the project is programmed, it is further developed through the *design phase*. The Design Documentation Package (DDP) produced during the design phase is submitted for design approval.
- The process continues through the development of project Plans, Specifications, and Estimates—the *PS&E phase*—which leads to production of contract documents for construction.

The level of effort invested during each phase of development and the extent to which the phases overlap for a specific project varies depending on the type, size, and complexity of that project. The project's design may also undergo modifications during the construction process.

Table 2-1. Stormwater Planning and Design in the Project Development Process.

Scoping ➔ ↓	***Design Approval/*** ➔ ***Environmental Documentation*** ↓	***PS&E*** ↓
Identification of water quality and hydrologic impacts and potential mitigation BMPs ↓	Selection of stormwater mitigation BMPs—type, size, and location ↓	Final design of stormwater BMPs—working plans ↓
Project Summary supported by design file documentation: ▪ Stormwater scoping package ▪ Environmental Review Summary ↓	Design report supported by design file documentation: ▪ Hydraulic Report ▪ Required environmental documentation ↓	Plans, Specifications, and Estimates package: ▪ TESC plan ▪ Provisions for SPCC plan ▪ Stormwater-related plans; general and special provisions ↓
BMP cost allocation	Preliminary BMP cost estimate	BMP cost estimate

2-3.1 Development Team

Assessment and documentation of stormwater impacts and mitigation measures begin during project scoping. The scoping and design team should involve appropriate participants (listed in Table 2-2) as part of the scoping process. Project type, size, and complexity are key factors in determining who should be consulted for development of the stormwater strategy for a project.

Table 2-2. Key Contacts for Development of Project Stormwater Strategy.

Contact	Roles	Activities
Project Design Office	Project management.	Participates in all aspects of project management and design.
Program Management (including program development)	Manages current biennial program; develops future biennial programs.	Manages set-up design and construction funding, and assists with below-the-line costs; manages project definition process.
Survey	Collects survey information.	Compiles field data; performs surveys; stakes right-of-way; verifies existing conditions.
Consultant Liaison	Consultant administration.	Issues request for proposal; assists in development of scopes of work; selects consultant; manages contract.
Developer Services	Coordinates development activity.	Provides information and contacts for other development activity in the area.

Contact	Roles	Activities
Planning Office	Determines future plans for route location.	Determines route development plans; develops proposals.
Geotechnical and Materials Laboratory	Determines geotechnical requirements; obtains data; provides analysis.	Provides scope and cost estimate of geotechnical work; reviews existing records and maps; performs soil borings; installs piezometers; conducts pH and resistivity testing. Assesses sources of materials and makes surfacing recommendations.
State Design Engineer	Approves design.	Reviews and approves overall design.
Right-of-Way Research and HQ Photogrammetry	Maintains as-built and right-of-way/access records.	Provides information regarding project location for inclusion in plans; provides aerial photos, survey, and photogrammetry development.
Maintenance	Provides recommendations.	Provides information on existing conditions; gives input on maintenance requirements of completed project.
Region and Headquarters Hydraulics	Provides assistance with hydraulic elements of design; provides approval or concurrence.	Determines hydraulic requirements; manages design, review, and approval of hydraulic and TESC design elements; assists with construction monitoring.
Region Environmental/ HQ Environmental Services	Performs analysis of environmental impacts and alternatives, and assures compliance with environmental laws and regulations.	Prepares environmental (NEPA/SEPA) documents; coordinates with resource and permitting agencies; assists with public involvement; obtains environmental permits.
Resource Agency (various)	Reviews reports; issues permits.	Provides endangered species list; approves biological assessments; issues permits that establish conditions for design and construction.
Roadside & Site Development Unit	Provides landscape design plans.	Prepares landscaping plans, specifications, and estimates, including planting and irrigation work; inspects construction; manages plant establishment period until sign-off by regulators.
Biologist	Performs biological analyses.	Delineates wetlands; prepares wetland reports, biological assessments, and mitigation recommendations.
Air and Noise	Performs air quality and noise analyses.	Conducts air and noise testing; determines wall locations.
Local Programs Office and Local Agencies	Various	Provides funding and design criteria; develops maintenance agreements.
Tribal Organizations	Various	May provide funding and comments on project.
Regional Transit Authorities	Various	Coordinates regional issues, basin plans, construction projects, and route development.
Railroads	Manages design conflicts.	Identifies facilities, relocation requirements, and design considerations.
Plan Review Office	Ensures compliance with plan standards.	Assists with preparation of special provisions and plans; provides final plan reviews.
Real Estate Services	Real estate management.	Determines ownership; estimates property costs; procures rights-of-way, easements, rights of entry, and access management.

Contact	Roles	Activities
Bridge and Structures Office	Structural design.	Assesses condition of existing structures; designs new structures; prepares PS&E for structures; coordinates backwater studies and pier placement.
Traffic	Traffic analysis and design.	Collects traffic data; develops traffic models; reviews channelization plans and work zone traffic control plans.
Safety Office	Applies safety standards.	Assists with design and provisions for stormwater features to meet regulations and codes.
Utilities	Manages existing and new utilities.	Determines utility requirements; prepares franchise inventory listing; reviews clear zone inventory; obtains utility as-built plans for inclusion on plan sheets; prepares relocation plan and utility agreements.
Construction Offices	Manages project construction.	Contributes to design considerations; provides constructibility reviews.

2-3.2 Site Assessment

Stormwater facility design is a major element for many projects, which requires significant advance data gathering and assessment to identify alternatives and develop accurate schedules and cost estimates. Data are needed to assess the project site in order to (1) determine project alignment alternatives, (2) assess impacts, (3) determine minimum requirements, and (4) develop conceptual stormwater management alternatives.

Characterizing the site and adjacent areas allows for a determination of the limiting factors controlling local hydrology. These limiting factors can then become the focus of the project's stormwater treatment strategies.

A three-dimensional picture of site hydrology should emerge during the site assessment. This picture should include natural and altered flow paths to the site from upstream areas, and from the site to downstream areas. Natural drainage must be preserved (see Minimum Requirement 4, Section 3-3.4). The design team must identify all off-site flows coming to the site, including streams, seeps, and stormwater discharges. The transportation facility must allow for passage of all off-site flows; however, every effort should be made to keep off-site flows separate (via bypass) from the highway runoff. This may not be possible for flows that are currently permitted to discharge to WSDOT conveyance and treatment facilities.

Runoff from WSDOT rights-of-way must not adversely affect downstream receiving waters and properties. Existing drainage impacts on downstream waters and properties must be identified during scoping, and must be either corrected as part of the project or recommended for a later retrofit. Drainage impacts are identified using multiple sources of information (see Section 2-3.2.1) and site visits during storms. Section 4-7 in the WSDOT *Hydraulics Manual* provides guidance on performing and documenting a downstream analysis. The preliminary downstream analysis is used for scoping purposes; however, a more detailed analysis may be needed during the project design phase. The final downstream analysis is included in the Hydraulic Report.

The scoping phase is the time to begin identifying natural areas within or adjacent to the project boundary that can be conserved. Conserving these areas helps to minimize project impacts. Some of these areas may be used as part of the project's stormwater management approach if they are appropriate areas for dispersion and infiltration. (See Chapters 4 and 5 for information regarding dispersion and infiltration.)

Conservation areas and their functions must be permanently protected under conservation easements or other locally acceptable means. If the conservation area falls within the right-of-way, it needs to be appropriately labeled on the right-of-way plan. If the conservation area is outside the right-of-way, then WSDOT needs to purchase a conservation easement or obtain another similar real estate protection instrument.

2-3.2.1 Information Sources

As a starting point, the following data and resources are generally necessary for this task:

- Project vicinity map and site map
- Land cover types and areas (aerial photographs)
- Topography (USGS quadrangle maps and other survey maps)
- Watershed or drainage basin boundaries
- Receiving waters
- Wetlands
- Stream flow data
- Ditches and open-channel drainage
- Enclosed drainage
- Floodplains
- Utilities
- Total maximum daily loads (TMDLs)
- Water cleanup plans
- Clean Water Act Section 303(d) list of impaired waters
- Drainage patterns and drainage areas
- Basin plan data (basin-specific needs)

- Soil types, depth, and slope (Natural Resources Conservation Service soil surveys)
- Existing stormwater outfalls (outfall inventory and site reconnaissance)
- Land use types and associated pollutants
- Groundwater data, including depth to seasonal high water table
- Soil infiltration rates
- Vegetation surveys
- Land surveys
- Hazardous materials or wastes
- Average daily traffic (ADT)
- Roadway geometry (profiles/super-elevations)
- Geotechnical evaluation (see Section 2-3.2.2)

The contacts in Table 2-2 can help in collecting this information. In addition, WSDOT's *GIS Workbench* (an ArcView geographic information system tool to provide staff with access to comprehensive, current, and detailed environmental and natural resource management data) can be used to gather some of these data and can provide maps to help with project assessment, selection of stormwater management alternatives, and maintenance applications.

WSDOT's *Stormwater Management Facility Inventory Database* is another information resource. The database includes information generated from both office research and in-field site review for inventoried outfall locations. Data gathered includes information on the outfall location, watershed hydrology, and receiving water body water quality impairments and beneficial uses. The research portion also involves gathering data on the known external influences (e.g., legislative activities, the activities of other departments within state government, or the activities of local cities, communities, and tribal organizations) that may affect planning and scoping relative to the outfall location.

Data gathered in the field includes geographic and photographic information, adjacent land uses, receiving water body type, distance of outfall to receiving water body, and description of the outfall and conveyance system(s). The description of the outfall and conveyance system includes information on catchment size, percent contribution of highway runoff to watershed, conveyance system type, and other observations. Another portion of the in-field collection effort involves gathering data on aspects of the right-of-way (including right-of-way land classification) and existing BMPs and their condition. Furthermore, during dry weather, field visits assess whether any illicit discharges are present in the WSDOT drainage system.

In addition to the data used to derive retrofit priorities for each outfall, several hundred complete records contain best management practice (BMP) retrofit recommendations, conceptual design information, BMP cost estimates, drainage basin characteristics, conveyance system information, photographs, field sketches, and preliminary facility sizing calculations. Where available, that information can be used to reduce the research needs of designers for a particular project. It is important to check the date of a retrofit recommendation; older recommendations may not meet current standards and will require modification.

This database will become an increasingly valuable tool for design engineers as more stormwater management facilities are inventoried. Future plans include enhancing the database to track stormwater facility operation and maintenance. Information on the project's stormwater facilities will be input into the database as part of the project closeout procedure. Even though these database functions are not currently available, the types of data needed to support these database functions should be documented in the project's Hydraulic Report. Furthermore, stormwater management deficiencies are also tracked through the Priority Array Tracking System (PATS) and the Capital Program Management System (CPMS). When deficiencies are addressed by means of a retrofit, this is tracked through the same systems.

To obtain available stormwater database information about specific outfalls, or outfalls within the limits of a project, contact the region's Hydraulics and Water Quality offices, or the Headquarters (HQ) Environmental Services Office, Water Quality Program.

2-3.2.2 Geotechnical Evaluations

Understanding the soils, geology, geologic hazards, and groundwater conditions at the project site is essential to optimizing stormwater design for a project. Contact the WSDOT Region Materials Engineer (RME) and staff from the HQ Geotechnical Division as early as possible in the scoping phase, for inclusion on the scoping and design team.

Infiltration is the preferred method for flow control of stormwater runoff. Chapters 4 and 5 provide direction on how to apply optimal infiltration for stormwater management on transportation projects. However, the extent to which infiltration can be used needs to be assessed during the scoping phase because of its direct impact on stormwater alternatives and costs. The degree to which runoff can be infiltrated depends on the project location and context. Limiting factors include soil characteristics, depth to groundwater, and designated aquifer protection areas.

The RME evaluates the geotechnical feasibility of stormwater facilities that may be needed for the project. With assistance from the HQ Geotechnical Engineer, as needed, the RME gathers all available geotechnical data pertinent to the assessment of the geotechnical feasibility of the proposed stormwater facilities. Some subsurface exploration may be required at this stage, depending on the adequacy of the geotechnical data available to assess feasibility. For additional details, see Section 510.04 of the WSDOT *Design Manual*.

The scoping office develops the stormwater facility conceptual design using input from the RME and the HQ Geotechnical Engineer. Based on this design and investigation effort, fatal flaws in the proposed stormwater plan are identified, along with potential design and construction problems that could affect project costs or the project schedule. Critical issues to be considered include:

- Depth to water table, including any seasonal variations.
- Presence of soft or otherwise unstable soils.
- Presence in soils of shallow bedrock or boulders that could adversely affect constructibility.
- Presence of existing adjacent facilities that could be adversely affected by construction of the stormwater facilities.
- Presence of geologic hazards such as earthquake faults, abandoned mines, landslides, steep slopes, or rockfall.
- Adequacy of drainage gradient to ensure functionality of the system.
- Potential effects of the proposed facilities on future corridor needs.
- Maintainability of the proposed facilities.
- Potential impacts on adjacent wetlands and impacts on other environmentally sensitive areas.
- Presence of hazardous materials in the area.
- Whether or not the proposed stormwater plan will meet the requirements of resource agencies.
- Infiltration capacity (infiltration and percolation rates for project sites).

To characterize the seasonal variation of the groundwater table, it may be desirable to install piezometers at potential infiltration sites during scoping. One year of monitoring is desirable. At a minimum, one full rainy season is necessary to acquire the data needed to make a determination of site suitability.

2-3.2.3 Right-of-Way

Once the stormwater requirements for the project are understood, the general hydrologic site characteristics are known (including approximate groundwater table elevations), and the stormwater design alternatives are determined, the area necessary for stormwater facilities can be estimated. Refer to Chapters 4 and 5 to estimate the required area for each facility. Examine the proposed layout of the project, and determine the most suitable locations available to locate the stormwater facilities. Determine where facilities are proposed outside existing right-of-way and establish estimates for right-of-way acquisition areas and costs.

2-3.2.4 Utilities

The project design office should contact the region's Utilities Office to obtain information about whether existing utilities have franchises or easements within the project limits. Whenever proposed stormwater facilities conflict with an existing utility's right-of-way and facilities, a utility agreement is required. WSDOT may be responsible for the relocation costs, the utility owner may be responsible for the costs, or the costs may be shared. More information regarding utility elements is available in the *Utilities Manual*.

2-3.3 Maintenance Review

Once a list of permanent stormwater BMPs is determined based on the site assessment, the designer shall contact the region's maintenance program to discuss treatment options available for use. Overall maintenance costs must be considered when selecting BMPs. The project design office shall consult with the region's maintenance staff regarding the proposed drainage alternatives and evaluate maintenance needs, including personnel, equipment, and long-term costs through the BMP's expected life cycle. Review the general maintenance requirements in Section 5-3.7.1 and the maintenance guidelines in Section 5.5. Maintenance concurrence shall be obtained prior to the final selection of the treatment BMP and documented in the Hydraulic Report.

2-3.4 Documentation

Thorough documentation and tracking of stormwater design commitments is often a required element of environmental permit applications.

2-3.4.1 Stormwater Scoping Package

Stormwater documentation during the scoping phase of project development is referred to here as the *stormwater scoping package*. This package contains the information used to determine project stormwater impacts and the selection of stormwater BMPs. It is the source of stormwater information needed to complete the project summary documents. This package should include a brief summary report that contains the following:

- Identification of the project program
- Brief project description
- Synopsis of data gathered during the site assessment
- Basin and subbasin identification
- Threshold discharge area delineations indicating flow paths and outfalls to receiving waters
- Area determinations

- Applicable minimum requirements
- Other applicable regulatory requirements related to stormwater (e.g., Endangered Species Act requirements)
- Design criteria required for flow control and runoff treatment
- Known problems and commitments
- Retrofit recommendations
- Design alternatives and assumptions for flow control and runoff treatment
- Cost estimates

The stormwater scoping package is critical to the efficient continuation of project development and must be retained and easily retrievable. Once the project is programmed and assigned to a project office, the file and report become the starting point for the design phase. The stormwater-scoping package should be kept and stored by the region program management or scoping office. The package should remain with the overall project scoping file to ensure that the project office to which the project is assigned for design receives the preliminary stormwater information.

2-3.4.2 Project Summary

As described in Section 2-3, the product of scoping is the *Project Summary*, which consists of the *Project Definition*, *Environmental Review Summary*, and *Design Decisions Summary*. All of these documents require stormwater-related information, as outlined in Table 2-3. Much of the stormwater-related information needed to complete permit applications can be obtained from the *Project Summary* documentation.

2-3.4.3 Hydraulic Report

The Hydraulic Report is intended to serve as a complete document record containing the engineering justification for all drainage modifications that occur as a result of project construction, including documentation of the analysis and design for the postconstruction stormwater management system. For additional details, see the WSDOT *Hydraulics Manual*.

Table 2-3. Stormwater-Related Information Needed for the Project Summary.

Project Definition (PD)	• Cost estimate and variance for preliminary engineering, right-of-way, and construction • Right-of-way needs for stormwater facilities • Preliminary environmental review: required environmental documentation, permits, and environmental commitments • Design decisions regarding stormwater • Public input regarding stormwater • Project commitments for stormwater made to others and by others • Potential impacts of stormwater facilities on utilities • Specialized workforce expertise required for geotechnical, biological, geomorphic, and other evaluations • Other stormwater-related issues
Environmental Review Summary (ERS) and Environmental Classification Summary (ECS)	• Required permits and approvals related to stormwater • Critical or sensitive areas as designated by Growth Management Act ordinances • Floodplains or floodways within (or affecting) the project site • Rivers and streams: crossing structures and types • Water quality/stormwater: impacts and mitigation • Previous environmental commitments made in project area related to stormwater • Long-term maintenance commitments related to stormwater and necessary for project
Design Decisions Summary (DDS)	• Roadway geometrics data affected by stormwater facilities • Roadside character classification and treatment level: effect on stormwater facility design (forest, open, rural, semiurban, urban) • Hydraulic decisions regarding stormwater facilities

2-3.4.4 Construction Planning

During the design phase, key stormwater documents are produced to meet stormwater site planning requirements associated with Minimum Requirement 1 (see Section 3-3-1).

All projects require spill prevention, control, and countermeasures (SPCC) plans, which are prepared by the contractor after the project contract is awarded. The WSDOT Hazardous Materials Program (🖰 http://www.wsdot.wa.gov/environment/hazmat/default.htm) and Section 1-07.15(1) within the *Standard Specifications* provide more information regarding SPCC plan expectations. Provisions of the SPCC plan should be developed during the PS&E phase to ensure plan implementation.

For soil-disturbing projects, WSDOT must also prepare temporary erosion and sediment control (TESC) plans (see Chapter 6).

2-3.4.5 Contract Plan Sheets

Infiltration, dispersion, and conservation areas need to be identified on the contract plan sheet, along with other drainage and environmental elements. Development of the contract plan sheets is defined in the WSDOT *Plans Preparation Manual*.

2-3.4.6 Plans, Specifications, and Estimates (PS&E)

For the PS&E phase of a project, a set of Plans, Specifications, and Estimates is prepared. These documents translate the stormwater management elements of the design into a contract document format for project advertisement, bidding, award, and construction.

2-3.4.7 Underground Injection Control Wells

Drywells and infiltration trenches that contain perforated pipe are considered injection wells and require registration per the Washington State Department of Ecology's (Ecology's) Underground Injection Control (UIC) Program. Registration information is available at:
🖰 http://www.ecy.wa.gov/programs/wq/grndwtr/uic/registration/reg_info.html

For further guidance, consult region environmental staff or HQ Environmental Services Office staff.

2-4 Developer Projects

WSDOT must provide for the passage of off-site flows through its right-of-way to maintain natural drainage paths. If a private developer's project discharges off-site flow to WSDOT right-of-way, the project must provide stormwater BMPs that will prevent any increase in flow rates or volumes and any degradation of water quality within the state right-of-way. WSDOT will not concur with designs or allow discharges that do not comply with these requirements. Once WSDOT accepts discharge of water onto its right-of-way, the state becomes liable for the quality and quantity of that discharge. For this reason, WSDOT requires the discharge water to be treated at a minimum in accordance with provisions of this *Highway Runoff Manual*, Ecology stormwater management manuals, or an Ecology-approved local equivalent manual used by the local government having primary jurisdiction over the project.

For details regarding the WSDOT requirements and the process for review and concurrence of private project drainage design, refer to WSDOT's *Development Services Manual* and *Utilities Manual*.

2-5 Stormwater Facility Design Approach

2-5.1 Context Sensitive Design

It is important to understand how transportation facilities, in combination with other development, can affect the natural hydrology of watersheds and the water quality of receiving waters; in other words, the watershed context of a project. This understanding can guide the planner and designer in choosing stormwater management solutions that more successfully achieve the objective of protecting ecosystems.

Context sensitive design (CSD), also known as *context sensitive solutions* and *thinking beyond the pavement*, is an approach to transportation planning that broadens the focus of the project development process to look beyond the basic transportation issues, and develop projects that are integrated with the unique context(s) within the project setting. This approach considers the elements of mobility, safety, environment, community, and aesthetics from the beginning to the end of the project development process. The CSD also involves a collaborative project development process that obligates participants to understand the impacts and trade-offs associated with project decisions. Further discussion of and guidance on the context sensitive design/context sensitive solutions approach can be found at the following web site:
🖰 http://www.wsdot.wa.gov/biz/csd/

2-5.2 Stormwater Facility Design Strategy

Stormwater management facilities (i.e., runoff treatment and flow control) can be utilized to mitigate both the hydrologic impacts and the water quality impacts of a development project by applying the following fundamental strategy:

> *Maintain the preproject[1] hydrologic and water quality functions of the project site as it undergoes development.*

This strategy is accomplished through the following steps:

Step 1 Avoid and minimize impacts on hydrology and water quality.

Step 2 Compensate for altered hydrology and water quality by mimicking natural processes.

Step 3 Compensate for altered hydrology and water quality by using end-of-pipe solutions.

Steps 1 and 2 can be achieved by minimizing impervious cover; conserving or restoring natural areas; mimicking natural drainage patterns (e.g., using sheet flow, dispersion, infiltration, or

[1] The term *preproject* refers to the actual conditions of the project site before the project is built.

open channels); disconnecting drainage structures to avoid concentrating runoff; and using many small redundant facilities to treat, detain, and infiltrate stormwater. This approach to site design reduces reliance on the use of structural management techniques. Step 3 refers to the use of traditional engineering structural approaches (e.g., detention ponds) to the extent that Steps 1 and 2 are not feasible.

The methods listed for achieving Steps 1 and 2 above are commonly referred to as low-impact development (LID) approaches. By using the project site's terrain, vegetation, and soil features to promote infiltration, the landscape can retain more of its natural hydrologic function. Low-impact development methods will not be feasible in all project settings, depending on the physical characteristics of the site, the adjacent development, and the availability and cost of additional right-of-way, if needed. However, the designer should always investigate the feasibility of using low-impact development methods. Since the use of low-impact development methods requires understanding of soil characteristics, infiltration rates, water tables, native vegetation, and other site features, it is important to gain the participation of design support services and others from the beginning through the end of the project development process.

2-6 Special Design Considerations

2-6.1 Critical and Sensitive Areas

The Washington Growth Management Act (RCW 36.70A), combined with Article 11 of the Washington State Constitution, requires local jurisdictions to adopt ordinances that classify, designate, and regulate land use in order to protect critical areas. *Critical areas* are defined as wetlands, floodplains, aquifer recharge areas, geologically hazardous areas, and those areas necessary for fish and wildlife conservation.

2-6.1.1 Wetlands

Altering land cover and natural drainage patterns may increase or decrease stormwater input into surrounding wetlands. Land use changes and stormwater management practices usually alter hydrology within a watershed. Hydrologic changes have more immediate and greater effects on the composition of vegetation and amphibian communities than do other environmental changes, including water quality degradation.

Wetland ecosystems can be highly effective managers of stormwater runoff; they can remove pollutants and also attenuate flows and recharge groundwater. Minimum Requirement 7 (see Section 3-3.7) addresses wetland protection. While natural wetlands for the most part may not be used as pollution control facilities in place of runoff treatment BMPs, Ecology's SMMEW allows the use of lower-quality wetlands as runoff treatment BMPs if requirements for hydrologic modification are met. For detailed guidance on this issue for eastern Washington projects, refer to *Use of Existing Wetlands to Provide Runoff Treatment* (in Section 2.2.5, page 2-26) and *Application to Wetlands and Lakes* (in Section 2.2.6, page 2-33) in Ecology's

SMMEW, and the *Eastern Washington Wetland Rating Form* at:
🖰 *http://www.wsdot.wa.gov/environment/biology/docs/WetlandRatingForm_EasternWA_050426.doc*

For western Washington projects that may potentially alter the wetland hydroperiod, refer to *Guide Sheet 1B* in Appendix I-D of Ecology's SMMWW. Additional information on wetland hydroperiods is provided in Section 4-6 of this manual.

Region or HQ hydraulics and environmental staff can provide further assistance on hydroperiod modeling. For guidance on wetland creation or restoration as mitigation for direct wetland impacts, contact the region's wetland biologist or consult the following web site:
🖰 http://www.wsdot.wa.gov/environment/biology/bio_wetlands.htm

2-6.1.2 Floodplains

Hydrologic storage that is displaced by roadway fill or other structures may result in increased stream flows, channel erosion, downstream flooding, and decreased infiltration and summer base flows. Projects may be required to mitigate loss of hydrologic storage by creating new hydrologic storage elsewhere in the watershed.

A decision to locate structural detention facilities in floodplains should depend on the flow control benefits that can be realized. If a detention facility can be placed so that it is functional through at least the 10-year flood elevation, it will accomplish most of its function by controlling peaks during smaller, more frequent events that cumulatively cause more damage. Stormwater facilities that are located outside the 2-year, 10-year, and 25-year flood elevations do not compromise any flood storage during those floods. If it is not possible to locate stormwater facilities anywhere but within the 100-year floodplain, and if flood storage is an issue, consult with the region's Hydraulics Office to identify alternative mitigation opportunities.

2-6.1.3 Aquifers and Wellhead Protection Areas

To ensure that highway improvement projects protect drinking water wells, WSDOT has entered into an agreement with the State Department of Health. (The agreement is posted at:
🖰 http://www.wsdot.wa.gov/NR/rdonlyres/426DEF64-3BE9-4965-8414-441B878F0D46/0/SCAScreeningCriteria.pdf.) This agreement includes the following screening criteria to determine the conditions under which a highway project will not be considered a potential source of contamination to drinking water wells according to the State Department of Health:

1) Road location and construction setbacks are maintained such that the drinking water source intake structure is not in danger of physical damage.

2) All concentrated flows of untreated roadway runoff are directed via impervious channel or pipe and discharged outside the *Sanitary Control Area*.

3) If roadside vegetation management practices are identified as a potential source of contamination, the water purveyor will provide the location of the SCA to the appropriate WSDOT maintenance office for inclusion in the *Integrated Vegetated Management Plan* for that section of highway, as necessary to protect the wellhead.

4) WSDOT complies with all National Pollutant Discharge Elimination System permits, as required per Section 402 of the federal *Water Pollution Control Act*.

5) WSDOT provides the well purveyor with contact information to be used in the event of any problems or questions that may arise.

The project design team shall gather and document information on all drinking water wells along the project corridor. Refer to the local critical areas ordinances for details on aquifer and wellhead protection areas applicable to the project area. To locate wells in the project area, check Ecology's web site for listed well logs at: http://apps.ecy.wa.gov/welllog/. This web site contains a database of wells constructed and registered since the 1930s, and wells managed by Ecology since 1971. The WSDOT *GIS Workbench* can also provide a preliminary assessment of wellhead and aquifer protection areas in the vicinity of a given project. Recognize that some wells may not be registered and can only be identified through field investigations. Contact region environmental staff early in the project design phase if there are wells located within the radius of concern.

County health departments set well protection buffers, called *Sanitary Control Areas* (SCAs), presuming that the well protection buffer width will adequately protect wells from contamination. When highway projects encroach into well SCAs, however, WSDOT must document how the project will avoid impacting the well and water supply.

When a road project is expected to intersect a public water supply well's SCA, contact the water purveyor to confirm the location of the well and its SCA. If the project intersects the SCA, a licensed professional engineer, using the screening criteria listed above, needs to establish the conditions under which a highway project will not be considered a potential source of contamination to drinking water wells. Then, the engineer needs to attest to the well purveyor in writing, on WSDOT letterhead, that the screening criteria's conditions are satisfied. It is expected that the purveyor will identify and sign SCA-restrictive covenants and/or WSDOT will check for such covenants filed with the County Auditor's office.

If a disagreement arises between the water purveyor and WSDOT region staff regarding the potential impacts of the project to a public water supply well that cannot be resolved, elevate the issue to the HQ Water Quality Program. Likewise, contact the HQ Water Quality Program to evaluate mitigation options if it is not possible to meet the screening criteria.

Projects that include large cuts or compaction of soil over shallow aquifers could potentially intercept groundwater flows and restrict the quantity of water reaching a well. Groundwater quantity issues are not covered by the State Department of Health agreement, thus potential groundwater quantity impacts must be analyzed as a hydrogeologic issue in consultation with the HQ Materials Laboratory and the HQ Hydraulics Office.

2-6.1.4 Streams and Riparian Areas

Avoiding encroachment into riparian areas is important to prevent direct impacts on stream channels and stream ecosystems. Removing riparian vegetation may directly result in channel instability and streambank erosion; loss of aquatic and wildlife habitat; loss of spawning gravels; increased sedimentation; increased water temperatures; decreased dissolved oxygen concentrations; and other water quality impacts. When a highway-widening project is located parallel to a stream, stormwater facility placement should occur away from the stream to the extent feasible and measures should be taken to preserve or enhance riparian buffers.

2-6.2 Endangered Species

Projects with a federal nexus (i.e., federal funding, permit, or approval) must go through consultation pursuant to Section 7 of the federal Endangered Species Act (ESA). A biological evaluation or biological assessment must be prepared whenever ESA-listed species are suspected to occur in the vicinity of a project.

The design team works with a WSDOT region biologist to develop the required documentation. The information needed to complete the biological evaluation or biological assessment can be obtained from existing documents and resources for the given conceptual project design alternatives. Ideally, the majority of the final information will be gathered during the scoping phase of project development. The scoping team should contact the biologist early in the scoping process to request assistance in determining ESA-related issues, and to determine how these issues and needs affect project design and cost considerations.

Information necessary to complete a biological evaluation or biological assessment for stormwater-related impacts is compiled in the ESA Stormwater Design Checklist included as Appendix 2B.

2-6.3 Contaminated and Hazardous Waste Sites

If a project contains a contaminated or hazardous waste site, or if such a site is suspected to exist within the project limits, contact WSDOT HQ hazardous materials staff for further direction. Also, see the WSDOT *Environmental Procedures Manual*, Section 447.05, Technical Guidance.

2-6.4 Airports

Special consideration must be given to the design of stormwater facilities for projects located near airports. Roadside features, including standing water (e.g., wet ponds) and certain types of vegetation, can attract birds both directly and indirectly. The presence of large numbers of birds near airports creates hazards for airport operations and must be avoided. Before planning and designing facilities for a project near an airport, contact WSDOT Aviation, the airport, and the Federal Aviation Administration for wildlife management manuals and other site-specific guidance.

2-6.5 Bridges

Because the over-water portion of the bridge surface captures only the portion of rainfall that otherwise would fall directly into the receiving water body, that portion of the bridge makes no contribution to the increased rate of discharge associated with surface runoff to the water body. This reasoning assumes that the conveyance system is constructed to prevent any localized erosion between the bridge surface and the outfall to the water body. While this fact may simplify needs for flow control, bridges present challenges associated with pollutant removal from runoff generated by their surfaces.

Bridges are typically so close to receiving waters that it is often difficult to find sufficient area in which to site a treatment solution. In the past, bridges have been constructed with small bridge drains that discharge the runoff directly into the receiving waters by way of downspouts. This practice is no longer allowed; thus creating the challenge of incorporating runoff collection, conveyance, and treatment facilities into the project design.

Use of suspended pipe systems to convey bridge runoff should be avoided whenever possible because these systems have a tendency to become plugged with debris and are difficult to clean. The preferred method of conveyance is to hold the runoff on the bridge surface and intercept it at the ends of the bridge with larger inlets. This method requires adequate shoulder width to accommodate flows so that they do not spread farther into the travel way than allowed (see Chapter 5 of the WSDOT *Hydraulics Manual* for allowable spread widths). In cases where a closed system must be used, it is recommended that bridge drain openings and pipe diameters be larger, and that 90º bends be avoided, to ensure the system's operational integrity. Early coordination with the HQ Bridge and Structures Office is essential if a closed system is being considered.

2-6.6 Ferry Terminals

A ferry dock consists of the bridge (trestle and span), piers, and some of the holding area (parking facility). The terminal is the dock and all associated upland facilities. Requirements and consideration for the terminal's upland facilities are the same as for park-and-ride lots, rest areas, and maintenance yards as describe in Section 2-6.7 (where similarities exist). Requirements and considerations that apply to bridges also apply to the trestle, span, and other over-water portions (see Section 2-6.5).

2-6.7 Maintenance Yards, Park-and-Ride Lots, and Rest Areas

The Ecology stormwater management manuals for western (SMMWW) and eastern (SMMEW) Washington provide more specific stormwater BMP information related to parking lots and commercial and industrial land uses. Stormwater facility design should give first consideration to the use of low-impact development methods such as permeable pavement and bioretention (see Chapter 5 for these and other applicable BMPs).

2-7 How Stormwater Management Applies to a Project

2-7.1 HRM Minimum Requirements and Exemptions

Chapter 3 contains the manual's minimum requirements for stormwater management. Section 3-2 aids in determining the minimum requirements that apply and Section 3-3 provides further detailed direction as to their application. Even when projects do not trigger a particular minimum requirement (e.g., flow control), the intent of the minimum requirement should still be considered in project design.

Section 3-2 provides information on projects that are exempt from the minimum requirements. Sections 3-3.5 and 3-3.6 provide specific information on limited exemptions from runoff treatment (Minimum Requirement 5) and flow control (Minimum Requirement 6), respectively.

2-7.2 Local Requirements

Section 1-1.5 explains the conditions under which local requirements apply to stormwater management on WSDOT projects. By state statute, WSDOT projects on state right-of-way are not subject to local permits, except for *shoreline* permits required by the local shoreline master program and permits required by *critical* or *sensitive areas* ordinances promulgated under the Growth Management Act (see Section 2-6.1).

Permitting staff in the region's Environmental Office should be consulted as to the individual permits required for a project. If the project will result in a new stormwater discharge to a municipal storm sewer system, a permit may be required by that jurisdiction's stormwater utility. Local agencies may have special design requirements for projects in which a portion of the local system will be replaced and turned over to the local jurisdiction for operation and maintenance.

The above information is intended to specify the local permits that may be applicable to WSDOT projects; it is not intended to preclude the need to work with local authorities to address concerns they may have regarding the potential impacts of a project. Additional information on applicable statutes, regulations, and environmental permitting can be found in WSDOT's *Environmental Procedures Manual*.

2-7.3 Watershed and Basin Plans

Incorporating watershed and basin planning, and local requirements into stormwater management is addressed in Minimum Requirement 8 (see Section 3-3.8). Project planners and designers need to familiarize themselves with the planning efforts for the watersheds and local jurisdictions in which the project is located, and identify any specific requirements, recommendations, and opportunities that relate to stormwater management. Watershed plans may also identify priority mitigation needs within the watershed that may present off-site opportunities to mitigate project impacts. Local plans may have identified specific stormwater-related needs and/or contain useful analyses.

Statewide-organized watershed planning efforts occur under two state laws: the Watershed Planning Act (2514 Planning) and the Salmon Recovery Act (2496 Planning). Each uses *water resource inventory areas* (WRIAs) as its basic geographic unit.

Basin planning conducted by local governments focuses on drainage basins at a local, sub-WRIA scale. Unfortunately, there are no uniform state standards defining an adequate basin plan. As stated in Minimum Requirement 8 (see Section 3-3.8), standards developed from basin plans cannot modify any minimum requirement until the basin plan is formally adopted and implemented by the local governments within the basin, and has received approval or concurrence from Ecology.

Entities with basin planning responsibilities for an area where transportation projects are planned should be contacted as early as possible in the project planning process. Such groups include *lead entities* under the Salmon Recovery Act and *watershed planning units* under the Watershed Planning Act, as well as city and county public works departments responsible for basin planning. There may be shared funding opportunities for local priority mitigation projects , which could significantly reduce project mitigation costs. Also, such entities may have data and analyses that can be used in the project planning process.

- More information on activities under the Watershed Planning Act, including a map of Washington’s water resource inventory areas, can be found at:
  🖰 http://www.ecy.wa.gov/watershed/index.html
- More information on activities under the Salmon Recovery Act can be found at:
  🖰 http://wdfw.wa.gov/recovery.htm
- Watershed data, reports, and other related information can be found at:
  🖰 http://www.ecy.wa.gov/programs/eap/wrias/index.html

Also, the region’s Environmental Office or the HQ Watershed Management Program Office can arrange meetings and help coordinate with watershed-related efforts.

The Watershed Program staff of the HQ Environmental Services Office has developed a project screening and watershed characterization process to identify alternatives to managing stormwater impacts within the right-of-way. The objectives in pursuing the watershed-based approach are to improve environmental benefits and reduce costs compared to standard runoff treatment and flow control facilities constructed within the right-of-way. Factors to consider with watershed-based options include:

1. *Have all source controls been included?* Source control may be the most cost-effective practice to control pollutants. This should be the first step in the investigation of alternative treatment options.
2. *What size watershed scale is appropriate for this alternative mitigation approach?* While the smallest subbasin may be appropriate for healthy watersheds, a larger watershed scale may be more appropriate in highly degraded watersheds depending on the nature of impairment(s).
3. *Can stormwater treatment be coordinated with habitat mitigation?* Stream restoration, floodplain restoration, riparian replanting, or other practices could provide both habitat mitigation and stormwater treatment.
4. *Has a regional facility been evaluated?* If on-site stormwater facilities are not feasible, combining several project stormwater treatment/control needs into one regional facility may be a more cost-effective option.
5. *Are there legal or regulatory constraints to off-site stormwater treatment?*

For more information on activities of WSDOT's Watershed Program, including the watershed-based mitigation method, see: 🖰 http://www.wsdot.wa.gov/environment/watershed/default.htm

2-7.4 Engineering and Economic Feasibility

For some projects, practical limitations may present obstacles to fully meeting certain requirements, particularly runoff treatment and flow control, within the project right-of-way. Limitations may be infrastructural, geographical, geotechnical, hydraulic, environmental, or benefit/cost-related. For these projects, the planning and design team must make a formal assessment of the project and identify constraints on meeting the minimum requirements. This assessment is referred to as *engineering and economic feasibility* (EEF).

The Engineering and Economic Feasibility Evaluation Checklist, included in Appendix 2A, is an evaluation based on 18 project- and site-specific criteria that assesses the practical limitations of constructing stormwater facilities within or adjacent to a project's right-of-way. The assessment should be performed as early as possible in project development. If the assessment reveals that stormwater requirements for a project cannot be met because it is not feasible to do so, an explanation must be provided in the project's Hydraulic Report. The explanation must include the reasons why the requirements cannot be met for the site and the amount of stormwater treatment/control that can be provided. Whenever an EEF assessment shows that meeting the HRM's minimum requirements for a project is not feasible within the project's right-of-way, in whole or in part, the project team should consult with the region's Environmental Office or the

HQ Watershed Management Program Office regarding whether alternative mitigation opportunities have been identified for the project area.

If on-site options are unavailable and opportunities to create off-site runoff treatment and/or flow control capacity cannot be identified or are not chosen, the project needs to pursue the *demonstrative approach* to propose a treatment option for the stormwater discharge (see Sections 1-1.3 and 5-3.6.3). The *demonstrative approach* requires demonstrating that the project will not adversely affect water quality by providing appropriate supporting data showing that the alternative approach satisfies state and federal water quality laws. The timeline and expectations for providing technical justification depend on the complexity of the individual project and the nature of the receiving water environment. Thus, this approach may be more cost effective for large, complex, or unusual types of projects. In developing alternate treatment and control options, it is important to consider and document the site limitations using the Engineering and Economic Feasibility Evaluation Checklist.

2-7.5 Stormwater Retrofit

Project-related stormwater retrofit provides stormwater improvements for existing impervious surfaces where treatment/controls are substandard. The decision to apply current standards for runoff treatment and flow control to existing impervious surfaces within the project limits should occur during project scoping. The guidelines for applying project-related retrofit actions are provided in Section 3-4.

Stormwater retrofit may also occur as a stand-alone programmed project. Those responsible for scoping a project should work closely with the region or HQ Program Management Office to learn if any such programmed retrofit actions apply to their project. The level of retrofit should be documented in the Hydraulic Report.

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Chapter 6. Temporary Erosion and Sediment Control Design Guidance and Process

6-1 Introduction

The primary focus of construction stormwater planning is to prevent sediment and other pollutants associated with construction activity from impacting soil, air, and water quality. Such impacts can increase project costs through regulatory and legal fines, and through repair of site damage that causes delays to project delivery.

Temporary erosion and sediment control (TESC) plans and spill prevention control and countermeasures (SPCC) plans are required to adequately and systematically identify and minimize project risk. Together, the TESC and SPCC plans satisfy the construction Stormwater Pollution Prevention Plan (SWPPP) requirements.

All projects that disturb soil must comply with the 12 TESC Elements (see Section 6-2.1.2), and must apply the appropriate best management practices (BMPs) presented in this chapter. A TESC plan must be prepared if a construction project adds or replaces (removes existing road surface down to base course) more than 2,000 square feet of impervious surface or disturbs more than 7,000 square feet of soil. Projects that disturb fewer than 7,000 square feet of soil must address erosion control and the 12 TESC Elements; however, a stand-alone TESC plan is optional and plan sheets are not required. All Washington State Department of Transportation (WSDOT) staff designing or implementing TESC plans must attend the Construction Site Erosion and Sediment Control Course (course code BPW). WSDOT TESC plan designers should also attend the TESC Planning Tool training (course code CAY). Consultants who will be creating TESC Plans for WSDOT projects should attend WSDOT's Construction Site Erosion and Sediment Control Course. Contact the Statewide Erosion Control Coordinator (360-570-6649) for class dates, locations, and availability, and to register for the training.

SPCC plans are prepared by the contractor as required in the *Standard Specifications for Road, Bridge, and Municipal Construction* (Standard Specifications) 1-07.15(1). Instructions for plan preparation are available to contractors at the Headquarters (HQ) Hazardous Materials Program web site (🖰 http://www.wsdot.wa.gov/Environment/HazMat/SpillPrevention.htm).

6-2 Temporary Erosion and Sediment Control (TESC) Plan

The purpose of a TESC plan is to clearly establish when and where specific BMPs will be implemented to prevent erosion and the transport of sediment from a site during construction. A TESC plan must address the 12 TESC Elements, which are described later in this chapter.

A TESC plan consists of a narrative section and plan sheets. The narrative section includes an analysis of erosion risk for each TESC Element and a list of Standard Specifications, general special provisions (GSPs), and special provisions used to satisfy the risk. The plan sheets show the BMP locations and other features such as topography and locations of sensitive areas for multiple project stages. It is recommended that large projects that will be under construction for multiple seasons create phased TESC plans (one year of construction focusing on the wet seasons).

The HQ Erosion Control Program offers an 8-hour Construction Site Erosion and Sediment Control Certification Course, which covers basic principles of erosion and provides in-depth analysis of BMPs. Recertification is required every three years.

WSDOT has a web-based planning tool that helps designers create thorough and contractually enforceable TESC plans. The designer reviews requirements, selects BMPs, and identifies contractual tools to ensure enforcement of TESC plans. The planning tool helps ensure consistency in plan format as it automatically organizes and writes the TESC plan narrative. It also greatly accelerates the process for TESC plan review. Training is available in ATMS (course code CAY). For further information, contact the Erosion Control Coordinator at the Environmental Services Office.

A TESC plan template, which provides information on how to create an effective TESC plan, is available online for non-WSDOT TESC plan designers at the HQ Erosion Control Program web site (🖰 http://www.wsdot.wa.gov/Environment/WaterQuality/ErosionControl.htm).

6-2.1 Step-by-Step Procedure for Preparing TESC Plans

6-2.1.1 Data Collection and Risk Analysis

Collect site-specific data on soil, precipitation, topography, drainage patterns/off-site water, groundwater, sensitive areas on or near the site, vegetated areas, and other relevant project characteristics. Evaluating the risks associated with each of these factors is necessary to select the appropriate BMPs and determine the level of effort needed to address the 12 TESC Elements. Most high-risk projects involve more than 5 acres of soil disturbance; discharge to state waters within 300 feet of the project; and meet at least three of the following four characteristics:

- More than 50% of the site consists of soils in Hydrologic Groups C and D. This information is obtained from Natural Resource Conservation Service (NRCS) county soil surveys.

- The project involves wet-season work or lasts more than one year.
- Cut/fill slopes exceed more than 50 feet in length.
- There are active seeps or there is shallow groundwater on the project site.

Information on collecting data for each factor is provided below.

1. **Soils**

   The proportion of sand, silt, and clay particles in the soil determines soil texture. Soil texture affects the erodibility of the soil, how quickly the particles settle out of runoff, and the amount of infiltration that will occur at a site. Information on soil texture can be obtained for any given project from several sources, including geotechnical reports/soil boring logs, jar testing, on-site evaluation, and NRCS soil survey reports for individual counties.

   The *Construction Site Erosion and Sediment Control Certification Course Manual* and Chapter 4 (Hydrologic Analysis) of this manual provide guidance for determining soil-related risks, including the methods listed above. Additional WSDOT resources include region environmental, maintenance, and landscape offices, region materials engineers, and the HQ Erosion Control Program.

2. **Precipitation**

   The frequency, intensity, and duration of rainfall events affect the potential for erosion on a site. All three factors must be accurately evaluated to assess the potential for erosion.

   The WSDOT *Hydraulics Manual* (Chapter 2, Appendix 2-2) contains isopluvial maps for mean annual precipitation, design storm events, and mean annual runoff that can all be used to get a general idea about rainfall patterns in any given part of the state.

   The Western Regional Climate Center web site (http://www.wrcc.dri.edu/summary/climsmwa.html) has statistical information on precipitation, temperature, and several other climatic measurements for over 200 sampling stations throughout the state. This web site includes tabular and graphical information, as well as interactive probability-graphing capabilities. This information is vital to the timing and phasing of projects to minimize erosion potential.

3. **Topography**

   The size, gradient, and stability of slopes in the project work area should be evaluated to assess potential risks during construction. The potential for erosion increases exponentially with increasing slope length and gradient, because runoff travels faster, with more erosive energy. Higher velocity runoff forms rills and gullies that concentrate erosive flows and energy even further. Whenever slopes are created with Hydrologic Group C or D soils, there is an increased risk of large slope failures, especially when silt content exceeds 30%. All soil types, regardless of composition, are vulnerable to rapid rill and gully erosion when concentrated flows are not diverted away from slopes. In addition, groundwater seepage greatly increases the potential for slope failures with all soil types.

Site topography evaluation should identify areas that can be taken advantage of to reduce the risk of turbid water discharges. Closed depressions, flat areas, or gently sloped/heavily vegetated areas can disperse and infiltrate runoff, and thereby eliminate or greatly reduce the risk of turbid water discharges during construction. Dispersion, infiltration and bioinfiltration areas must be labeled on the TESC plan sheets and visually inspected at least once per day when in use to ensure they are functioning as intended. Flow to these areas must be controlled to encourage complete infiltration and avoid discharges whenever possible.

4. **Drainage Patterns/Adjacent Areas**

Off-site water that runs onto a project can cause tremendous damage, because the contributing area may generate stormwater volumes that far exceed the capacity of the on-site stormwater conveyance and treatment BMPs. Some of WSDOT's largest erosion-related cost overruns and fines in past years were related to off-site water entering construction sites.

Off-site water sources may include natural sheet flow from neighboring facilities; permitted or illicit stormwater outfalls from neighboring buildings and parking lots; groundwater seeps; neighboring construction projects; or unmapped seasonal drainages. The risk of site damage from off-site flows is especially high if off-site water crosses slopes, because slope cover BMPs cannot adequately protect a slope from concentrated runoff. Off-site water should be handled separately from stormwater generated on-site. Whenever possible, off-site stormwater should be diverted around the site. Diverted flows will be redirected to the natural drainage location at or before the property boundary.

Take the following actions to evaluate the potential for off-site stormwater problems:

- ◻ When prescribing temporary measures, refer to the Hydraulic Report to quantify the potential for off-site water
- ◻ Consult maintenance personnel to determine drainage patterns and general volumes
- ◻ Visit the site during a rainstorm and confirm runoff patterns

5. **Groundwater**

Seasonably high groundwater levels affect stormwater infiltration and timing of construction. The groundwater levels can usually be determined from the geotechnical survey of the site. County soil surveys also provide general information on groundwater levels, including the seasonality of high water tables. Groundwater levels can fluctuate greatly throughout the year; data from winter (wet season) is the most important to determine the level of risk associated with groundwater.

The probability of intercepting damaging groundwater seeps and springs can be evaluated using geotechnical reports, county soil maps, and on-site field evaluations. To further evaluate project risk, contact WSDOT project engineers for information about past projects in the area to determine if problems were encountered with the seasonality, quantity, treatment, and disposal of groundwater.

6. **Sensitive Areas**

Stream and wetland boundaries must be delineated and shown with their buffer zones on the plan sheets. Perimeter control BMPs (high visibility fence and possibly a sediment control BMP such as silt fence or vegetated buffer strips) should always be placed between the site and downslope sensitive areas.

Ditched streams and other sensitive areas shall never be considered for dispersion, infiltration and bioinfiltration activities. Dispersion and infiltration in Critical Aquifer Recharge Areas will not be allowed in areas with less than 5 feet between the ground surface and the seasonal high groundwater table, as identified in the Geotechnical Report.

When developing the TESC plan, always refer to environmental studies and permits for the project, if they have been prepared/completed. These documents often provide an assessment of how sensitive the receiving waters are, and specify measures that are required as conditions of the project. Region environmental staff should be consulted if the studies and permits are not yet completed.

7. **Vegetation Preservation/Utilization**

Whenever vegetation is preserved, the potential for erosion is reduced and potential sediment treatment areas remain available for use throughout construction. Accordingly, clearing limits are set to minimize the removal of vegetation. Preserved vegetated areas can be highly effective for dispersing and infiltrating runoff.

8. **Existing Encumbrances**

Check for existing encumbrances, such as utilities, wells, or drain fields, to ensure that the TESC plan identifies them, protects them from erosion impacts, and addresses any potential erosion risks.

9. **Timing and Duration**

During the design phase, it is often impossible to know the timing and duration of a project. As timing is often dependent on funding, permitting, and other issues, and duration varies with contractors and weather conditions, most TESC plans should be prepared assuming worst-case conditions for timing and duration.

6-2.1.2 BMP Selection/TESC Elements

For comprehensive descriptions of individual BMPs, see Appendix 6A.

Using the information obtained in Step 1 (below), determine the applicability and level of effort needed for each of the 12 TESC Elements, in order to select appropriate BMPs for each. All must be considered and included in the TESC plan, unless site conditions render an Element unnecessary and the exemption is clearly justified in the narrative of the TESC plan.

1. **BMP Selection**

   The three categories of BMPs that exist include *design*, *procedural*, and *physical*. A combination of all three is needed to create effective TESC plans. Each BMP type is described in detail below.

   The priority in selecting BMPs should be to prevent erosion, rather than to treat turbid runoff that results from erosion. This is accomplished by maximizing the use of design and procedural BMPs prior to prescribing physical BMPs. The effectiveness of physical BMPs is limited if proper consideration is not first given to design and procedural BMPs.

   - ***Design BMPs***

     A project design that minimizes erosion risk can greatly reduce complications, both during and after construction. All possible measures should be taken to minimize clearing and grading that expose soil to erosion. For example, projects should be designed to integrate existing land contours as much as possible and minimize the gradient and continuous lengths of slopes. Drainages should be designed to convey water generated both on and off the site to infiltrate and flow away from the disturbed areas as much as possible.

   - ***Procedural BMPs***

     How and when a project is built can greatly affect the potential for erosion. Construction sequencing should minimize the duration and extent of soil disturbance. Whenever possible, major soil-disturbing activities should occur in phases to minimize exposed areas. Likewise, major grading operations should be limited to the dry season. Installation of sediment control BMPs prior to grading operations is one of the most important procedural BMPs.

- ***Physical BMPs***

  Physical BMPs include all erosion and sediment control measures that are installed after all possible design and procedural BMPs have been considered. The Standard Specifications, Section 8-01, provides guidance on the installation, inspection, and maintenance of physical BMPs. More detailed information on physical BMPs is provided in Appendix 6A and in the *Construction Site Erosion and Sediment Control Certification Course Manual.*

2. TESC Elements

The 12 TESC Elements are described below. All Elements must be considered and included in the TESC plan, unless site conditions render an Element unnecessary and the exemption is clearly justified in the narrative of the TESC plan. Common design and procedural BMPs are described for each Element, followed by a list of physical BMPs, if applicable.

- ***TESC Element 1: Mark Clearing Limits***

  Prior to land-clearing activities, mark all clearing limits on the plan and in the field with high visibility fences, to protect sensitive areas and their buffers (including vegetation to preserve), as well as adjacent properties. Retain duff layer, native topsoil, and existing vegetation in an undisturbed state to the maximum extent practicable.

  PHYSICAL BMPS

  - Preserving natural vegetation
  - Buffer zones
  - High visibility fence

- ***TESC Element 2: Establish Construction Access***

  Install stabilized construction access points prior to major grading operations. Limit access points to the fewest number possible—only one, whenever feasible. Whenever possible, slope entrances downward into the site to reduce track-out of sediments onto the roadway. If sediment is tracked off-site, roads are to be cleaned thoroughly at the end of each day, or more frequently if necessary. Sediment should be removed from roads by shoveling or sweeping, and removed sediment should be transported to a controlled disposal area. When applicable, a tire wash should be used and the wash-water should be treated separately on-site, or discharged to a sanitary sewer (if allowed by permit). Street washing is only allowed after sediment is removed from the street. If streets are washed with water, wash-water must be treated prior to discharge.

PHYSICAL BMPS

- Stabilized construction entrance
- Construction road stabilization
- Tire wash
- Street cleaning

☐ ***TESC Element 3: Control Flow Rates***

Protect downstream properties and waterways from erosion by preventing increases in the volume, velocity, and peak flow rate of stormwater runoff from the site during construction. Install the permanent sediment control facilities to provide flow control as early in the construction process as feasible.

Install retention/detention facilities as one of the first steps in grading, for use as infiltration or sedimentation facilities prior to mass grading and the construction of site improvements. Design drainages to account for both on- and off-site water sources. Use vegetated areas that are not identified as wetlands or other sensitive features to infiltrate and dispose of water whenever possible, and mark those areas on the TESC plan sheets.

Nonstormwater (i.e., dewatering, line flushing) discharges must also be controlled to protect downstream properties. When nonstormwater discharges are routed through separate storm sewer systems, the flow rate must be controlled to minimize scouring and flushing of sediment trapped in the system.

PHYSICAL BMPS

- Temporary sediment pond
- Sediment trap
- Stormwater infiltration

☐ ***TESC Element 4: Install Sediment Controls***

Install sediment control BMPs prior to soil-disturbing activities, whenever feasible. Prior to leaving a construction site or discharging to an infiltration facility, concentrated stormwater runoff from disturbed areas must pass through sediment ponds or traps. Sheet flow runoff must pass through sediment control BMPs specifically designed to remove sediment from sheet flows, such as filter berms, vegetated filter strips, or silt fencing. As maintaining sheet flows greatly reduces the potential for erosion, runoff should be maintained and treated as sheet flow whenever possible.

PHYSICAL BMPS

- Silt fence
- Check dam
- Straw bale barrier
- Surface roughening
- Inlet protection
- Preserving natural vegetation
- Vegetated filter strip
- Filter berm (gravel, wood chip, or compost)
- Wattle
- Temporary sediment pond or trap
- Street cleaning
- Level spreader
- Outlet protection
- Stormwater chemical treatment*
- Construction stormwater filtration*
- Portable water storage tanks

*All TESC plans, including stormwater chemical treatment, whether originally planned or added after construction begins, must notify both region and HQ water quality programs.

☐ ***TESC Element 5: Stabilize Soils***

Stabilize all exposed and unworked soils by applying effective BMPs that protect the soil from wind, raindrops, and flowing water. Selected soil stabilization measures must be appropriate for the time of year, site conditions, estimated duration of use, and the water quality impacts that stabilization agents may have on downstream waters or groundwater.

Construction activity, including equipment staging areas, material storage areas, and borrow areas that are included in WSDOT's NPDES permit for the project, must be stabilized and addressed in the TESC plan as well.

Soil stockpiles are especially vulnerable to slumping when saturated and must be stabilized and protected with sediment-trapping measures. Plastic may be necessary on silty stockpiles, as it is the only BMP that can prevent soil saturation. Stockpiles should be located away from storm drain inlets, waterways, and drainage channels where possible.

In western Washington, cover erodible soil that is not being worked (whether at final grade or not) within the following time limits, using approved soil cover practices, unless authorized otherwise by the Engineer:

October 1 through April 30	**2 days maximum**
May 1 through September 30	**7 days maximum**

In eastern Washington, erodible soil that is not being worked (whether at final grade or not) must be covered within the following time limits, using approved soil cover practices, unless authorized otherwise by the Engineer:

July 1 through September 30	**10 days**
October 1 through June 30	**5 days**

In the Central Basin region of eastern Washington (areas receiving 12 inches or less of annual rainfall), erodible soil that is not being worked (whether at final grade or not) must be covered within the following time limits, using approved soil cover practices, unless authorized otherwise by the Engineer. (For precipitation maps, see http://www.wsdot.wa.gov/eesc/design/hydraulics/pdf/EastWAIso.pdf.)

If any portion of the project lies in areas that receive more than 12 inches of annual precipitation, follow the soil coverage time limits for eastern Washington, not for the Central Basin. (Contact the region's hydraulics staff to confirm average annual rainfall.)

July 1 through September 30	**30 days**
October 1 through June 30	**15 days**

Expose no more soil than can be covered within the above time limits. Construction activities should never expose more erodible earth than the amounts shown below for the specified locations.

Area	Date	Location
17 Acres	April 1 – October 31 May 1 – September 30	East of the Summit of the Cascade Range West of the Summit of the Cascade Range
5 Acres	November 1 – March 31 October 1 – April 30	East of the Summit of the Cascade Range West of the Summit of the Cascade Range

PHYSICAL BMPS

- Preserving vegetation
- Temporary mulching
- Soil binding using polyacrylamide*
- Placing erosion control blanket
- Placing compost blanket
- Placing plastic covering
- Seeding and planting
- Gravel base
- Mechanically Bonded Fiber Matrix
- Sodding
- Check dam**
- Wattle**
- Surface roughening***
- Stabilized construction entrance
- Construction road stabilization
- Dust control BMPs
- Bonded Fiber Matrix

*While polyacrylamide alone does help stabilize soils, using it in conjunction with mulch provides more protection for disturbed soil.

**Check dams and wattles alone do not stabilize soils. These BMPs should be used in conjunction with other soil stabilization BMPs.

***Surface roughening alone does not provide soil stabilization. Another BMP should be used in conjunction with surface roughening to protect the soil from raindrop impacts. It must be performed prior to seeding, per the Standard Specifications.

□ ***TESC Element 6: Protect Slopes***

Design and construct cut-and-fill slopes in a manner that will minimize erosion by (1) reducing continuous length and steepness of slopes with terracing and diversions, (2) reducing slope steepness, and (3) roughening slope surfaces, considering soil type and its potential for erosion (e.g., track walking). In addition, all soil must be protected from concentrated flows through temporary conveyances, such as diversions and pipe slope drains. Best professional judgment should be used when sizing the conveyance, so consult the Region Materials Engineer (RME) for guidance when runoff or groundwater is intercepted. Conveyances exceeding a 10% slope should have a solid lining.

To capture sediment and runoff when cutting trenches, place excavated soil on the uphill side of the trench (when consistent with safety and space considerations).

PHYSICAL BMPS

- Channel lining (riprap, grass, etc.)
- Temporary pipe slope drain
- Temporary curb
- Interceptor dike and swale
- Subsurface drains
- Level spreader
- Live fascines
- Gradient terraces
- Physical BMPs listed under TESC Element 5 (with the exception of stabilized entrance and road stabilization)

□ ***TESC Element 7: Protect Drain Inlets***

Protect all operable storm drain inlets from sediment with approved inlet BMPs.

PHYSICAL BMPS

- Inlet protection (above/below grate and grate covers)
- Check dam

□ ***TESC Element 8: Stabilize Channels and Outlets***

Design, construct, and stabilize all temporary conveyance channels to withstand the 2-year, 24-hour frequency storm for the developed condition. The outlets of all conveyance systems must be adequately armored to prevent erosion around the outfall structure, adjacent slopes, streambanks, and downstream reaches.

PHYSICAL BMPS

- Channel lining (riprap, grass, etc.)
- Level spreader
- Check dam
- Temporary seeding and planting
- Erosion control blanket
- Sodding
- Outlet protection

☐ ***TESC Element 9: Control Pollutants***

All pollutants, including construction materials, waste materials, and demolition debris, must be handled and disposed of in a manner that does not cause contamination of stormwater. Methods for controlling nonhazardous pollutants must be described in the TESC plan. Wood debris may be chopped and spread on-site.

Methods for controlling pollutants that can be considered hazardous materials, such as hydrocarbons and pH-modifying substances, must be described in the contractor's SPCC plan. The SPCC plan must be prepared to meet Standard Specification 1.07.15(1) and the Washington State Department of Ecology's (Ecology's) standards as described in WSDOT SPCC Plan Preparation Instructions and Spill Plan Reviewers Protocols located at:
http://www.wsdot.wa.gov/Environment/HazMat/SpillPrevention.htm

Stormwater or groundwater that has come into contact with curing concrete must be sampled to ensure water quality standards are not violated. (See water quality monitoring protocols in Section 6-8 for sampling information). Process water (concrete washout, slurry water, hydrodemolition, etc.) must be contained and cannot be discharged to waters of the state under the NPDES General Construction Permit. Contact the region's environmental staff and the HQ Environmental Services Office for more information on disposing of high pH water. WSDOT Headquarters has created a specific GSP, Treatment of pH for Concrete Work, which can be found at:
http://www.wsdot.wa.gov/eesc/design/projectdev/GSPS/egsp8.htm

☐ ***TESC Element 10: Control Dewatering***

When groundwater is encountered in an excavation or other area, control, treat, and discharge it as described in Standard Specification 8-01.3(1)C.

☐ ***TESC Element 11: Maintain BMPs***

Inspect BMPs per Standard Specification 8-01.3(1)B to ensure they perform their intended function properly until the Project Engineer determines that final stabilization is achieved. Final stabilization means completion of all soil-disturbing activities, and establishment of a permanent vegetative cover, or permanent stabilization measures (such as riprap) to prevent erosion.

Maintain BMPs in accordance with Standard Specification 8-01.3(15). When the depth of accumulated sediment and debris reaches approximately one-third the height of the device, the contractor must remove the deposits. BMP implementation and maintenance should be documented in the Site Log Book. Clean sediments may be stabilized on-site if the Project Engineer approves.

- ☐ ***TESC Element 12: Manage the Project***

To the maximum extent possible, apply the following actions on all projects.

1) Preserve vegetation and minimize disturbance and compaction of native soil, except as needed for building purposes.

2) Where feasible, phase development projects to minimize the amount of soil exposed at any one time and prevent the transport of sediment from the site during construction.

3) Time sediment control BMP installation in accordance with TESC Element 4.

4) To minimize erosion, follow soil cover timing requirements and exposure limits in TESC Element 5 and Standard Specification 8-01.3(1). Projects that infiltrate all runoff are exempt from the above restrictions. Individual contract special provisions and project engineer directives may be more stringent, based on specific location characteristics or changing site and weather conditions.

5) The work of utility contractors and subcontractors is coordinated to meet requirements of both the TESC and SPCC plans.

6) All BMPs are inspected, monitored, and maintained in accordance with TESC Element 11. Sampling will be conducted to ensure compliance (see Section 6-4 for details).

7) <u>The WSDOT Erosion Control</u> Lead is on-site or on-call at all times.

8) The TESC and SPCC plans are kept on-site or within reasonable access to the site. Due to the unpredictable nature of weather and construction conditions, the TESC plan is a flexible document that should be modified whenever field conditions change. Whenever

inspections and/or monitoring reveal that the BMPs identified in the TESC plan are inadequate due to the actual discharge of or potential to discharge pollutants, the plan must be modified (as appropriate) within 10 days. Most of these updates can be drawn onto the plans sheets. The plan must also be updated whenever there are changes in the project design or in construction methods that could affect the potential for erosion or spills.

6-2.1.3 Schedule

A construction schedule must be provided by the contractor per Standard Specification 8-01.3(1)A. The schedule should specify TESC plan implementation to effectively reduce erosion risks. Include the following in the schedule:

- Installation of perimeter control and detention BMPs prior to soil-disturbing activities.
- Phasing and timing of clearing, grubbing, and grading. Where feasible, work must be phased and timed to minimize the amount of exposed soil at any one time and prevent transport of sediment from the site during construction.
- Application of interim BMP strategies when construction activities interfere with the placement of final-grade BMPs.
- Discussion of how temporary BMPs are to be transitioned into permanent BMPs.
- Implementation of an erosion control inspection and maintenance schedule.

The following is a general schedule guideline for implementing TESC BMPs during construction of a project:

1. Prior to any work on-site, WSDOT verifies:
   - ☐ The contractor has obtained permits for off-site staging/storage/borrow areas (per NPDES permit requirement S1.C.2). Staging/storage/borrow areas within WSDOT ROW must be included in the TESC plan for the project.
   - ☐ The point(s) at which concentrated site runoff leaves the project boundary and/or enters surface water resources (NPDES permitted projects).
   - ☐ Background conditions of water quality for in-water work projects (see Section 6-9.2 for more information).
   - ☐ Locations where off-site stormwater can enter the project so that it can be diverted around the site (if applicable).
   - ☐ Clearing limits.

- Possible infiltration areas within the right-of-way (nonsensitive areas) or on neighboring properties, with written permission. These areas should be labeled on the TESC plan sheets as dispersion/infiltration areas.

2. Prior to any soil-disturbing activities, the contractor installs:
   - Storm drain inlet protection BMPs.
   - Perimeter control BMPs (construction entrances, silt fences, clearing limit fences, straw bale barriers, etc.).
   - Diversion measures for off-site water (if applicable).
3. Prior to any other grading activities, temporary sediment/detention ponds are excavated, and pond embankments are stabilized or otherwise protected against erosion. Site clearing and grading are phased so that runoff from exposed areas flows through stabilized conveyances to functioning sediment control BMPs.
4. Major construction excavation begins only after TESC measures for each phase of construction are in place.
5. Additional erosion and sedimentation control facilities are installed, as needed, throughout construction. These additions must be drawn onto the TESC plan sheets to reflect actual field conditions.
6. BMPs are maintained, as necessary.
7. Temporary BMPs are replaced with permanent BMPs, as construction allows.
8. Once all permanent construction is completed and permanent BMPs are functioning properly, the remaining temporary BMPs are removed in accordance with Standard Specification 8-01.3(16).

6-2.1.4 Narrative and Plan Sheets

The physical BMPs specified in the narrative section of the TESC plan are shown on the plan sheets. The plan sheets should also show clearing and grubbing limits, cut-and-fill slope lines, topography, impervious surfaces, sensitive areas, receiving waters, and stormwater treatment areas. The narrative section must include provisions for interim project conditions, not just the final configuration as shown on the plan sheets. The HQ Design Office's *Plans Preparation Manual* provides more information on plan sheet preparation.

1. **Scoping and Budgeting**

   The scope of a TESC plan includes all phases of construction. Each phase of a construction project needs to be included in the risk analysis and evaluation effort. Intermediate site configurations should be accounted for in the TESC scope because the process of staging requires multiple applications of BMPs. For example, a short duration project may be scheduled and completed during the dry season, whereas a multiyear project may need soil cover BMPs for each wet season encountered. Inspection and maintenance of BMPs should also be considered in scoping and budgeting, as should the repair or replacement of inadequate or malfunctioning BMPs.

Even with the best planning and risk assessment, there is still an inherent risk associated with each project. For example, groundwater may be encountered where it is not expected, soil conditions are often worse than anticipated, and construction is sometimes delayed into the wet season in western Washington. In addition, low-probability storm events, such as high-intensity rainfall in mid-August, sometimes cannot be avoided. Even after completing a thorough risk assessment, scheduling a project to take advantage of optimum conditions, and incorporating a full range of BMPs, include extra materials and funds in the budget to provide for contingency work.

Budgeting methods for erosion control are not as well developed as for more predictable construction activities. Additionally, erosion control overlaps with numerous other construction activities. The budgeting tools described below are intended to help when calculating the cost to install and maintain physical BMPs. Possibly the most accurate method for calculating a TESC budget is to consult with technical personnel and specialists. Consultation with WSDOT personnel having experience on similar projects in the same area is recommended to confirm cost estimates for anticipated/selected BMPs.

2. **Cost-Based Estimate**

Costs can be calculated from the labor and materials costs for individual items. This method can be time consuming; however, it is the only method available for many of the newer TESC products.

3. **Bid-Based Estimate**

The HQ Design Office has some very useful tools for making bid-based estimates. The UnitBid Analysis and Standard Item Table (www.wsdot.wa.gov/biz/contaa) can be used to view per-unit costs for specific standard bid items on past WSDOT projects. This method can quickly provide a price range for most common erosion control bid items.

4. **Construction Contract Information System**

The HQ Construction Office maintains the Construction Contract Information System (CCIS), which contains cost information from past projects. This database can be used to estimate future erosion control costs. If a project is being built in an area with a history of erosion challenges, the designer can query the database to view how much was estimated under the line item Water Pollution Prevention/Erosion Control, versus how much was actually spent. For instance, on some state routes and on some project types, WSDOT consistently pays more than it estimates for erosion control. If the erosion control costs in an area are consistently greater than the estimates, consult the construction offices that experienced the cost overruns. Ask what factors caused the overruns, and incorporate extra measures into the erosion budget and the TESC plan to address problems and prevent or reduce such overruns on the upcoming project. WSDOT staff should contact their local help desk or workstation support personnel to obtain access to CCIS.

6-2.2 Contracting

The ability to enforce provisions in the TESC plan is directly tied to the contract. Contracts must be written to ensure that all 12 TESC Elements are addressed throughout construction. The contractual tools for ensuring that the plan is properly enforced include the *Standard Specifications for Road, Bridge, and Municipal Construction* (Standard Specifications), statewide and region-specific GSPs, special provisions, and erosion control *Standard Plans for Road, Bridge, and Municipal Construction* (Standard Plans).

Revisions are regularly made to the erosion control specifications in the Standard Specifications, to do a better job of meeting the 12 Elements within a TESC plan. However, in some cases, they must be supplemented with GSPs or special provisions to ensure that issues concerning erosion control are addressed in the contract language.

GSPs or special provisions should be prepared whenever the Standard Specifications do not address the specific needs of a project. Such provisions may involve limiting earthwork in the wet season, timing of pond installation, requiring specific products, etc. GSPs and special provisions have been written for many common erosion problems and can be pulled from existing libraries. The statewide library for GSPs and special provisions is provided on the HQ Design Office web site (http://www.wsdot.wa.gov/eesc/design/default.htm).

Some regions also have their own libraries of regional GSPs that can be accessed by contacting the region's Plans Office. If there is no suitable provision, one must be written. Staff within design, construction, and environmental offices can often help and should be consulted.

6-3 Spill Prevention Control and Countermeasures Plan

A Spill Prevention Control and Countermeasures (SPCC) plan is required on all projects, since all projects involve either vehicles or construction materials with potential for spills to contaminate soil or nearby waters. The plan is prepared by the contractor as a contract requirement and is submitted to the Project Engineer prior to the commencement of any on-site construction activities. For further information, refer to Standard Specification 1-07.15(1).

The Hazardous Materials Program provides guidance on SPCC plan preparation to contractors, and provides training to WSDOT staff on reviewing an SPCC plan that addresses all SPCC Elements**.** An SPCC plan addresses the following:

- Site information and project description
- Spill prevention and containment
- Spill response
- Standby, on-site material and equipment requirements
- Reporting information
- Program management
- Plans to contain preexisting contamination (if necessary)
- Equipment for work below the ordinary high water line
- Attachments including a site plan and Spill and Incident Report Forms (if needed)

SPCC plans ensure that:

- All pollutants are handled in a manner that does not cause contamination of stormwater.
- Cover, containment, and protection from vandalism is provided for all materials that, if spilled, would pose an immediate risk to surface waters or groundwater.
- Maintenance and repair of heavy equipment is conducted using spill prevention measures such as drip pans and, if necessary, cover.
- Contractors follow manufacturers' recommendations for applying fertilizers and herbicides, to protect runoff water quality.
- Materials that modify pH, such as cement, concrete, kiln dust, fly ash, cement grindings, and cement wash-water be managed to prevent contamination of runoff.

6-4 Water Quality Sampling and Reporting Procedures

The following procedures have been developed to document compliance with local, state, and federal permit conditions; and conditions of the *Implementing Agreement Between the Washington State Department of Ecology and the Washington State Department of Transportation Regarding Compliance with the State of Washington Surface Water Quality Standards* (Implementing Agreement). These procedures are also used to evaluate the effectiveness of BMPs.

All projects with greater than 1 acre of soil disturbance (except federal and tribal land) that may discharge construction stormwater to waters of the state are required to seek coverage under the National Pollutant Discharge Elimination System (NPDES) Construction Stormwater General Permit. Sampling guidance for meeting permit requirements can be found in Section 6-8.

Sampling guidance for in-water work projects that are issued a 401 Certification can be found in Section 6-9.

Projects that require additional permit conditions should contact region environmental and HQ Environmental Services Office staff to incorporate additional sampling parameters into these protocols.

6-5 Standard Sampling Procedures

1. **Sampling Equipment**

   All regions use the following water quality sampling equipment. This equipment was selected for the purpose of legal compliance and should be maintained to document the project conditions and legal records of WSDOT construction activities.

Conditions/Procedures	Sampling Equipment
Turbidity	Hach Model 2100 p portable turbidimeter with sampling bottles
pH and temperature	Hach Model SensION portable pH meter or HQ11D pH meter
Water sampling	Rod & cup (12-foot extendable)
Rain measurement	Gage – Tru-Check brand or equivalent installed on-site
Field observations	Field notebook/recording equipment

Company	Product	Approximate Cost
Hach Company* (970) 669-3050 www.hach.com	2100 p Turbidimeter SensION1 pH Meter or HQ11D pH Meter with pHC301 Liquid filled pH electrode	$850 $500 $500

(*or any major scientific supply distributor)

2. **Equipment Calibration**

   Calibrate equipment according to manufacturers' recommendations and specified schedules. Calibration frequency must follow the manufacturers' recommendations, at a minimum, for data to be legally defensible. Additional calibrations should be performed immediately if data appear suspect.

3. **Field Equipment Checklist**

   - ☐ Sampling cup/rod or hip waders
   - ☐ Turbidity equipment (check batteries and sampling supplies)

- ◻ pH equipment (check batteries and sampling supplies)
- ◻ Distilled water for rinsing equipment
- ◻ Long survey stakes, hammer, and marking pen (initial set-up only)
- ◻ Rain gauge
- ◻ WSDOT-approved safety vest and hardhat
- ◻ Camera
- ◻ Field notebook or data sheets for recording sampling data and field conditions. Data sheets are available at: http://www.wsdot.wa.gov/Environment/WaterQuality/ErosionControl.htm
- ◻ Cellular phone and contact phone numbers

4. **Sampling Station Setup**

When setting up sampling stations:

- ◻ Mark all sampling station locations with clearly labeled survey stakes.
- ◻ Photograph each sampling station for future reference and reporting. Picture(s) should show a good relationship between the project, the sampling station, and the surrounding environment.
- ◻ If sampling outside WSDOT right-of-way, survey stake locations should be within WSDOT right-of-way with direction and distance labels to the exact sampling point locations. Record the exact sampling point location in the field notebook and in the TESC plan.

5. **Create Base/Site Map**

Develop a relatively small-scale map depicting the project, sampling locations, and major water, land, and road characteristics. Keep the map in the Site Log Book so that other staff can understand the locations and access the sampling stations. Monitoring locations should also be drawn onto the TESC plan sheets.

6. **Sampling Information**

The following information is recorded in the field notebook (or on the data recording sheets) for each sampling event:

- Date, time, and location of the sample
- Project name and contract number

- Name(s) of personnel who collected the sample
- Amount of rainfall in the last 24 hours
- Field conditions (weather, temperature, pertinent construction activities, any prior disturbance of the water body, etc.)
- Testing results for measured parameters
- Date and time of the last calibration of sampling equipment
- Notes summarizing critical activities, unusual conditions, corrective actions, whether or not photographs were taken as supporting documentation, etc.

7. **Sampling Procedures**

The following sampling procedures must be used:

- In-water work: Sampling begins at the downstream station first followed by the upstream location, to avoid contamination. Testing of samples should occur at the designated sampling station whenever possible.
- Collect samples that are representative of the flow and characteristic of the discharge. Use the sampling rod if necessary.
- Fill the sampling bottle (downstream) at least once prior to collecting the sample, to remove possible contaminants. Invert the sample bottle to re-suspend particulates prior to turbidity testing.
- pH sampling should occur prior to turbidity testing, as temperature affects pH.
- Follow the manufacturers' recommendations for equipment operations.

6-6 Office Data Recording and Analysis

WSDOT has developed a Water Quality Monitoring Database (see Section 2-3.2.1) that all projects must use to input water quality data. For in-water work projects and other non-NPDES General Construction permitted projects, the database automatically calculates water quality standards based on the receiving water body and noncomplying events are flagged, prompting the user to initiate Environmental Compliance Assurance Procedures (ECAP). For projects with NPDES General Construction permits, the database automatically flags benchmark non-compliance and prompts the user to follow the corrective action steps identified in the NPDES permit. For a brief training, contact region environmental personnel or the Statewide Erosion Control Coordinator at the Environmental Services Office, 360-570-6649.

6-7 Reporting Sampling Results and Compliance Issues

The NPDES Construction Stormwater General Permit requires that data be submitted monthly for all projects with greater than 5 acres of soil disturbance after October 1, 2006. The HQ Environmental Services Office will batch send data to Ecology monthly via the Water Quality Monitoring Database. Therefore, all projects with NPDES General Construction Permits must enter water quality data into the database as data is collected.

Data collected during in-water work projects must also be reported to resource agencies per the 401 Certification. The Water Quality Monitoring database can generate graphs of water quality data showing both upstream and downstream data, along with the state standard. These graphs can be sent via e-mail to the person at Ecology designated in the permit.

If a turbidity or pH sample is out of compliance with water quality standards (in-water work) or exceeds the benchmark values (NPDES monitoring), ECAP should be filed as soon as possible. Once the data is entered into the Water Quality Monitoring Database, it will prompt the filing of ECAP, if it has not been already filed.

Additional Project Water Quality Sampling

If construction stormwater will be discharging to a 303(d) or a TMDL-listed water body, or if there is an NPDES Individual Stormwater Permit that requires additional sampling, contact the region's environmental personnel and the HQ Environmental Services Office at 360-570-6649 or 360-570-6648 for guidance on implementation.

If a project chooses to monitor any pollutants more frequently than required by these protocols, the data must be reported to Ecology per a requirement of the NPDES Construction Stormwater General Permit. Section 6-8 of WSDOT's water quality monitoring protocols is designed to meet the NPDES permit requirements, and region environmental and HQ Environmental Services Office staff should be contacted if additional sampling will be performed.

6-8 NPDES General Construction Permit Sampling Procedures

All project water quality monitoring forms, maps, and pictures of sampling stations must be kept in the Site Log Book, along with copies of the contractors' inspection reports. The Site Log Book must be kept on-site to provide easy access for compliance inspections.

Prior to water quality sampling in the field, the responsible WSDOT personnel perform the following procedures:

1. **Review Important Project Information and Assess Risk**

Review project maps, project definition, and schedule to understand when and where construction activities have the greatest potential to impact specific water quality parameters.

Projects that require turbidity sampling are as follows:

- **Any WSDOT projects that disturb 5 acres or more of soil** when runoff from construction activities discharges to surface waters of the state or to a storm sewer system that drains to surface waters of the state.

Standard activities and project conditions that require pH sampling are as follows:

- **Any WSDOT project that disturbs 1 acre or more and involves**: (1) greater than 1000 cubic yards of poured concrete curing simultaneously during a 30-day period, (2) greater than 1000 cubic yards of recycled concrete are crushed on-site, or (3) the use of soils that are amended with cement or kiln dust where stormwater from the affected area drains to surface waters of the state or to a storm sewer system that drains to surface waters of the state.

2. **Establish Sampling Locations**

Establish sampling locations to determine construction stormwater outfall water quality conditions. Sites with multiple outfalls or stream crossings may require numerous sampling stations. Sampling is required at all discharge points where stormwater is discharged off-site. Locate and clearly mark in the field sampling points according to the following criteria:

- **Discharge water quality**. Locate the sampling point at the outfall to the receiving water. The sample should be collected before the construction stormwater enters the receiving water body. This sample should be evaluated for possible turbidity benchmark value exceedances, and steps identified in Procedure 3 below should be followed if benchmark value is exceeded. In cases where water directly discharges from the site through a traditional stormwater treatment BMP like a pond, sampling will occur at the outlet of the BMP. In cases where WSDOT provides additional treatment via dispersion within adjacent properties, discharges will be sampled after the additional treatment is provided.

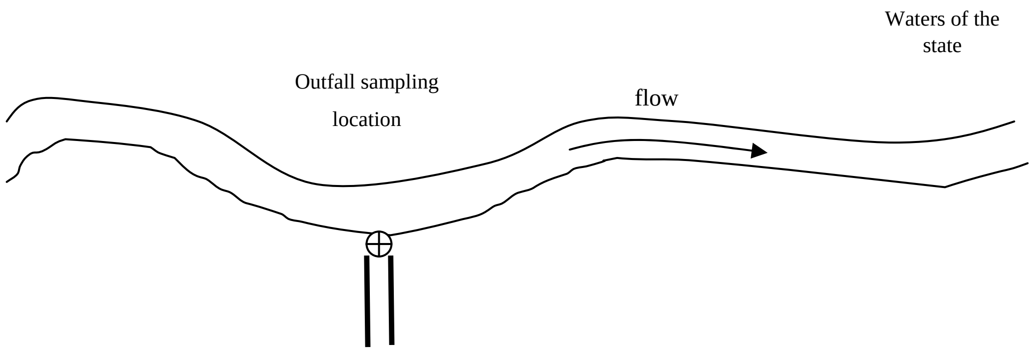

Figure 6-5.1. General layout of NPDES General Construction Permit water quality sampling location.

3. Establish Turbidity Sampling Schedule

Establish a sampling schedule to ensure that monitoring is conducted during the high-risk periods.

Follow the schedule for turbidity sampling.

- **All WSDOT projects that disturb 5 acres or more of soil.** At a minimum, sample at least once every calendar week when there is a discharge of stormwater from the site to satisfy NPDES stormwater permit requirements. If the sample or visual observations indicate the potential for a water quality violation, perform contingency sampling (see section on contingency sampling). Samples must be representative of the flow and characteristics of the discharge. When there is no discharge during a calendar week, sampling is not required. Sampling is not required outside of normal working hours or during unsafe conditions (a note should be made with a brief description of why a sample was not collected). Discharges to surface waters include (but are not limited to) draining of ponds, vaults, or footings, and flushing of water lines. During temporary suspension of construction, monitoring is also suspended if samples from three consecutive storm events each fall below 25 NTU.

Turbidity Benchmark Values

Benchmark values were created as indicators of properly functioning BMPs and are not discharge limitations. Discharges from construction sites less than 25 NTU are considered not likely to cause an exceedance of water quality standards under most conditions, and BMPs are thought to be functioning well. Construction site discharges between 26 and 249 NTU may cause an exceedance of water quality standards, and either the TESC plan has not been well implemented or BMPs are not functioning properly. A discharge greater than 250

NTU is likely to cause an exceedance of water quality standards under most conditions, and the TESC plan has not been well implemented and BMPs are not functioning properly. Therefore:

a. If an outfall sample has a value greater than 25 NTU, but less than 250 NTU:

   i. Review the TESC plan and make appropriate revisions within 7 days of the discharge that exceeded the benchmark; and

   ii. Fully implement and maintain the BMPs as soon as possible, but within 10 days of the discharge that exceeded the benchmark, and document in the Site Log Book.

b. If an outfall sample has a value greater than 250 NTU:

   i. Notify Ecology by phone within 24 hours;

   ii. Review the TESC plan and make appropriate revisions within 7 days of the discharge that exceeded the benchmark; and

   iii. Fully implement and maintain the BMPs as soon as possible, but within 10 days of the discharge that exceeded the benchmark, and document in the Site Log Book.

   iv. Continue to sample discharges daily until:

      1. Turbidity is 25 NTU or lower; or

      2. Compliance with water quality standards is achieved; or

      3. The discharge stops or is eliminated.

4. **Establish pH Sampling Schedule**

Follow the schedules for the following project types if conducting pH sampling:

- **Sites with more than 1000 cubic yards of poured concrete curing simultaneously during a 30-day period, or greater than 1000 cubic yards of recycled concrete are crushed on-site.** pH monitoring should begin when the poured or recycled concrete is first exposed to precipitation and should continue at least once per week until stormwater pH is 8.5 or less.

- **Sites with soils amended with cement or kiln dust.** pH monitoring should begin when the soil amendments are first exposed to precipitation and should continue at least once per week until runoff from the area of amended soils complies with the pH benchmark (between 6.5 and 8.5) or the area is covered.

At least once per week, pH samples should be collected prior to discharge to surface waters from sediment traps or ponds storing runoff from the two areas described above. If the HQ "GSP for Treatment of pH for Concrete Work" is included in the contract, the contractor will be responsible for this monitoring.

Process water or wastewater (nonstormwater) that is generated on-site, including water generated during concrete grinding, rubblizing, washout, and hydrodemolition activities, cannot be discharged to waters of the state under the NPDES General Construction Permit. Off-site disposal of concrete process water must be in accordance with Standard Specification 5-01.3(11). Under limited circumstances, infiltration of process water may be acceptable. As standards for dealing with process water are still evolving, contact the region's environmental personnel and the HQ Water Quality Program to determine if infiltration is an acceptable option.

pH Benchmark Values

a. The benchmark value for pH is 8.5 standard units. Any time sampling indicates that pH is 8.5 or greater:

   i. Prevent the high pH water (8.5 or above) from entering storm sewer systems or surface waters; and

   ii. If necessary, adjust or neutralize the high pH in accordance with the HQ GSP for Treatment of pH for Concrete Work (http://www.wsdot.wa.gov/eesc/design/projectdev/GSPS/egsp8.htm).

   In situations where the GSP does not appear adequate, contact the region's environmental staff and the HQ Environmental Services Office for more information. These offices can provide additional guidance for extreme situations where neutralizing the high pH water with dry ice or CO_2 sparging may be necessary.

5. **Contingency Sampling**

Contingency sampling is required if visual observations suggest that turbidity or pH benchmark values may be exceeded. If monitoring confirms that water quality is out of compliance with benchmark values, then additional samples should be taken to determine the duration and magnitude of the event. High pH water (over 8.5) should not be allowed to discharge. Once compliance with benchmark values is achieved (turbidity less than 25 NTU, pH between 6.5 and 8.5), the project shall return to its standard sampling schedule. If more than ten contingency samples are collected in one day, contact the HQ Environmental Services Office, Water Quality Program.

6-9 In-Water Work Monitoring

WSDOT monitors water quality on 20% of in-water work projects and those required by permit conditions. Water quality monitoring must be done in accordance with these protocols and other project permits. If permit requirements vary from these protocols, contact the region's environmental staff or the HQ Environmental Services Office. Reporting of data must be in accordance with Sections 6-6 and 6-7 of these protocols, along with reporting required by permit conditions.

- **In-water work.** Such projects require work below the ordinary high water mark of state water bodies.

1. **Verify Classification and Water Quality Standards**

   Verify the classification and water quality standards for potentially impacted water bodies according to state of Washington surface water quality standards (WAC 173-201A). Region environmental personnel should be contacted for assistance if necessary.

2. **Preconstruction Baseline Sampling**

   Prior to beginning compliance monitoring, baseline water sampling is required to establish background water quality characteristics. It is important to show the existing water quality conditions both above and below the site prior to construction, as natural streambank erosion or preexisting stormwater outfalls from adjacent properties may cause differences between proposed monitoring points. Whenever possible, baseline monitoring should be performed during a rainstorm no more than one month prior to the start of construction.

   One sampling event is adequate (unless conditions are variable), in which up to three samples can be collected.

3. **Establish Sampling Locations**

   Establish sampling locations to determine background and downstream water quality conditions. Locate and clearly mark in the field sampling points according to the following criteria:

   - **Background condition.** Locate background sampling locations where water bodies enter the right-of-way, or 100 feet upstream of construction activities, whichever is closer.

   - **Downstream impacts.** Sample 100 feet downstream of the construction activity or at the edge of the right-of-way, whichever is closer. If a mixing zone is allowed per Ecology's permit, and if the sample collected 100 feet downstream of construction activities is out of compliance with water quality standards, sample at the mixing zone compliance point designated by Ecology. If out of compliance with water quality standards, file ECAP.

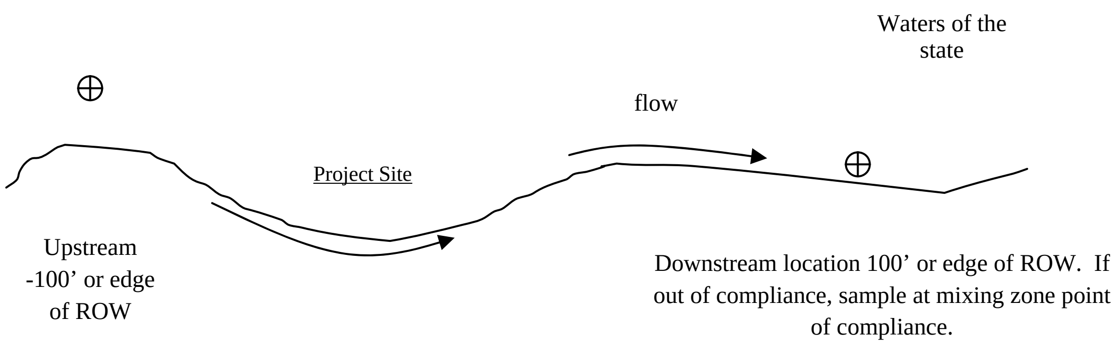

Figure 6-5.2. General layout of typical in-water work sampling locations.

4. Establish Sampling Schedule

Establish a sampling schedule to ensure that monitoring is conducted when necessary.

Follow the schedule for conducting turbidity sampling.

- **In-water work.** Sample daily during in-water work activities. One upstream/downstream sample should be collected after work begins each day. If that sample meets standards and visual inspections reveal no change in water quality throughout the day, no further sampling is required. If work activities change during the day (removing piles in the morning and driving piles in the afternoon), another upstream/downstream sample should be collected after work activities change. If standards are met and visual inspections reveal no change in water quality, then no further sampling is required. If visual inspection reveals a change in water quality, then contingency sampling should occur.

Follow the schedule for conducting pH sampling.

- Whenever water comes in contact with curing concrete, a pH sample must be taken prior to discharge. If the pH is less than 8.5 pH units, the water can be discharged, followed by an upstream and downstream sample to verify that water quality standards are achieved. If water quality standards are not achieved, file ECAP. If the water to be discharged has a pH greater than 8.5 pH units, the water cannot be discharged to waters of the state. This water must be treated, infiltrated, or sent to a sanitary sewer system. Contact the region's environmental personnel or the HQ Environmental Services Office for more information.

5. Contingency Sampling

If there is a visual change in receiving water turbidity due to work activities or a potential increase in pH, contingency sampling is required. If monitoring confirms that water quality is out of compliance with water quality standards, then additional samples should be taken to determine the duration and magnitude of the event. Once compliance with water quality standards is achieved, the project shall return to its standard sampling schedule. If more than ten contingency samples are collected in one day, contact region environmental personnel or the HQ Environmental Services Office, Water Quality Program.

Chapter 2. Table of Contents

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Chapter 2. Stormwater Planning and Design Integration

2-1 Introduction

This chapter provides guidance for integrating the planning and design of stormwater-related project elements into the context of the Washington State Department of Transportation (WSDOT) project development process. How the process applies to a specific project depends on the type, size, and complexity of the project and individual WSDOT regional business practices.

2-2 Stormwater Management Objectives

Originally, the only function of highway stormwater management was to maintain safe driving conditions, using engineering techniques designed to prevent stormwater from ponding on road surfaces. While maintaining safe driving conditions continues to be essential for any functional highway drainage system, WSDOT also acknowledges the state's vital interest in protecting and preserving natural resources and other environmental assets, as well as its citizens' health and safety. These interests have become integrated with other vital interests committed to the department, including the cost-effective delivery and operation of transportation systems and services that meet public needs. Thus, stormwater management for WSDOT transportation facilities has two main objectives: (1) protect the functions of the transportation facility, and (2) protect ecosystem functions and the beneficial uses of receiving waters.

2-3 Project Development Overview

The integration of stormwater planning and design into WSDOT's project development process is shown in Table 2-1. While the process consists of the distinct phases described below, in practice, the phases actually overlap.

- The preliminary scope, schedule, and cost estimates for a project are generated during the *definition phase* (referred to as *scoping*). The product of the definition phase is the Project Summary, which is used to program the project.
- After the project is programmed, it is further developed through the *design phase*. The Design Documentation Package (DDP) produced during the design phase is submitted for design approval.
- The process continues through the development of project Plans, Specifications, and Estimates—the *PS&E phase*—which leads to production of contract documents for construction.

The level of effort invested during each phase of development and the extent to which the phases overlap for a specific project varies depending on the type, size, and complexity of that project. The project's design may also undergo modifications during the construction process.

Table 2-1. Stormwater Planning and Design in the Project Development Process.

Scoping ➔ ⬇	***Design Approval/ Environmental Documentation*** ➔ ⬇	***PS&E*** ⬇
Identification of water quality and hydrologic impacts and potential mitigation BMPs ⬇	Selection of stormwater mitigation BMPs—type, size, and location ⬇	Final design of stormwater BMPs—working plans ⬇
Project Summary supported by design file documentation: ▪ Stormwater scoping package ▪ Environmental Review Summary ⬇	Design report supported by design file documentation: ▪ Hydraulic Report ▪ Required environmental documentation ⬇	Plans, Specifications, and Estimates package: ▪ TESC plan ▪ Provisions for SPCC plan ▪ Stormwater-related plans; general and special provisions ⬇
BMP cost allocation	Preliminary BMP cost estimate	BMP cost estimate

2-3.1 Development Team

Assessment and documentation of stormwater impacts and mitigation measures begin during project scoping. The scoping and design team should involve appropriate participants (listed in Table 2-2) as part of the scoping process. Project type, size, and complexity are key factors in determining who should be consulted for development of the stormwater strategy for a project.

Table 2-2. Key Contacts for Development of Project Stormwater Strategy.

Contact	Roles	Activities
Project Design Office	Project management.	Participates in all aspects of project management and design.
Program Management (including program development)	Manages current biennial program; develops future biennial programs.	Manages set-up design and construction funding, and assists with below-the-line costs; manages project definition process.
Survey	Collects survey information.	Compiles field data; performs surveys; stakes right-of-way; verifies existing conditions.
Consultant Liaison	Consultant administration.	Issues request for proposal; assists in development of scopes of work; selects consultant; manages contract.
Developer Services	Coordinates development activity.	Provides information and contacts for other development activity in the area.

Contact	Roles	Activities
Planning Office	Determines future plans for route location.	Determines route development plans; develops proposals.
Geotechnical and Materials Laboratory	Determines geotechnical requirements; obtains data; provides analysis.	Provides scope and cost estimate of geotechnical work; reviews existing records and maps; performs soil borings; installs piezometers; conducts pH and resistivity testing. Assesses sources of materials and makes surfacing recommendations.
State Design Engineer	Approves design.	Reviews and approves overall design.
Right-of-Way Research and HQ Photogrammetry	Maintains as-built and right-of-way/access records.	Provides information regarding project location for inclusion in plans; provides aerial photos, survey, and photogrammetry development.
Maintenance	Provides recommendations.	Provides information on existing conditions; gives input on maintenance requirements of completed project.
Region and Headquarters Hydraulics	Provides assistance with hydraulic elements of design; provides approval or concurrence.	Determines hydraulic requirements; manages design, review, and approval of hydraulic and TESC design elements; assists with construction monitoring.
Region Environmental/ HQ Environmental Services	Performs analysis of environmental impacts and alternatives, and assures compliance with environmental laws and regulations.	Prepares environmental (NEPA/SEPA) documents; coordinates with resource and permitting agencies; assists with public involvement; obtains environmental permits.
Resource Agency (various)	Reviews reports; issues permits.	Provides endangered species list; approves biological assessments; issues permits that establish conditions for design and construction.
Roadside & Site Development Unit	Provides landscape design plans.	Prepares landscaping plans, specifications, and estimates, including planting and irrigation work; inspects construction; manages plant establishment period until sign-off by regulators.
Biologist	Performs biological analyses.	Delineates wetlands; prepares wetland reports, biological assessments, and mitigation recommendations.
Air and Noise	Performs air quality and noise analyses.	Conducts air and noise testing; determines wall locations.
Local Programs Office and Local Agencies	Various	Provides funding and design criteria; develops maintenance agreements.
Tribal Organizations	Various	May provide funding and comments on project.
Regional Transit Authorities	Various	Coordinates regional issues, basin plans, construction projects, and route development.
Railroads	Manages design conflicts.	Identifies facilities, relocation requirements, and design considerations.
Plan Review Office	Ensures compliance with plan standards.	Assists with preparation of special provisions and plans; provides final plan reviews.
Real Estate Services	Real estate management.	Determines ownership; estimates property costs; procures rights-of-way, easements, rights of entry, and access management.

Contact	Roles	Activities
Bridge and Structures Office	Structural design.	Assesses condition of existing structures; designs new structures; prepares PS&E for structures; coordinates backwater studies and pier placement.
Traffic	Traffic analysis and design.	Collects traffic data; develops traffic models; reviews channelization plans and work zone traffic control plans.
Safety Office	Applies safety standards.	Assists with design and provisions for stormwater features to meet regulations and codes.
Utilities	Manages existing and new utilities.	Determines utility requirements; prepares franchise inventory listing; reviews clear zone inventory; obtains utility as-built plans for inclusion on plan sheets; prepares relocation plan and utility agreements.
Construction Offices	Manages project construction.	Contributes to design considerations; provides constructibility reviews.

2-3.2 Site Assessment

Stormwater facility design is a major element for many projects, which requires significant advance data gathering and assessment to identify alternatives and develop accurate schedules and cost estimates. Data are needed to assess the project site in order to (1) determine project alignment alternatives, (2) assess impacts, (3) determine minimum requirements, and (4) develop conceptual stormwater management alternatives.

Characterizing the site and adjacent areas allows for a determination of the limiting factors controlling local hydrology. These limiting factors can then become the focus of the project's stormwater treatment strategies.

A three-dimensional picture of site hydrology should emerge during the site assessment. This picture should include natural and altered flow paths to the site from upstream areas, and from the site to downstream areas. Natural drainage must be preserved (see Minimum Requirement 4, Section 3-3.4). The design team must identify all off-site flows coming to the site, including streams, seeps, and stormwater discharges. The transportation facility must allow for passage of all off-site flows; however, every effort should be made to keep off-site flows separate (via bypass) from the highway runoff. This may not be possible for flows that are currently permitted to discharge to WSDOT conveyance and treatment facilities.

Runoff from WSDOT rights-of-way must not adversely affect downstream receiving waters and properties. Existing drainage impacts on downstream waters and properties must be identified during scoping, and must be either corrected as part of the project or recommended for a later retrofit. Drainage impacts are identified using multiple sources of information (see Section 2-3.2.1) and site visits during storms. Section 4-7 in the WSDOT *Hydraulics Manual* provides guidance on performing and documenting a downstream analysis. The preliminary downstream analysis is used for scoping purposes; however, a more detailed analysis may be needed during the project design phase. The final downstream analysis is included in the Hydraulic Report.

The scoping phase is the time to begin identifying natural areas within or adjacent to the project boundary that can be conserved. Conserving these areas helps to minimize project impacts. Some of these areas may be used as part of the project's stormwater management approach if they are appropriate areas for dispersion and infiltration. (See Chapters 4 and 5 for information regarding dispersion and infiltration.)

Conservation areas and their functions must be permanently protected under conservation easements or other locally acceptable means. If the conservation area falls within the right-of-way, it needs to be appropriately labeled on the right-of-way plan. If the conservation area is outside the right-of-way, then WSDOT needs to purchase a conservation easement or obtain another similar real estate protection instrument.

2-3.2.1 Information Sources

As a starting point, the following data and resources are generally necessary for this task:

- Project vicinity map and site map
- Land cover types and areas (aerial photographs)
- Topography (USGS quadrangle maps and other survey maps)
- Watershed or drainage basin boundaries
- Receiving waters
- Wetlands
- Stream flow data
- Ditches and open-channel drainage
- Enclosed drainage
- Floodplains
- Utilities
- Total maximum daily loads (TMDLs)
- Water cleanup plans
- Clean Water Act Section 303(d) list of impaired waters
- Drainage patterns and drainage areas
- Basin plan data (basin-specific needs)

- Soil types, depth, and slope (Natural Resources Conservation Service soil surveys)
- Existing stormwater outfalls (outfall inventory and site reconnaissance)
- Land use types and associated pollutants
- Groundwater data, including depth to seasonal high water table
- Soil infiltration rates
- Vegetation surveys
- Land surveys
- Hazardous materials or wastes
- Average daily traffic (ADT)
- Roadway geometry (profiles/super-elevations)
- Geotechnical evaluation (see Section 2-3.2.2)

The contacts in Table 2-2 can help in collecting this information. In addition, WSDOT's *GIS Workbench* (an ArcView geographic information system tool to provide staff with access to comprehensive, current, and detailed environmental and natural resource management data) can be used to gather some of these data and can provide maps to help with project assessment, selection of stormwater management alternatives, and maintenance applications.

WSDOT's *Stormwater Management Facility Inventory Database* is another information resource. The database includes information generated from both office research and in-field site review for inventoried outfall locations. Data gathered includes information on the outfall location, watershed hydrology, and receiving water body water quality impairments and beneficial uses. The research portion also involves gathering data on the known external influences (e.g., legislative activities, the activities of other departments within state government, or the activities of local cities, communities, and tribal organizations) that may affect planning and scoping relative to the outfall location.

Data gathered in the field includes geographic and photographic information, adjacent land uses, receiving water body type, distance of outfall to receiving water body, and description of the outfall and conveyance system(s). The description of the outfall and conveyance system includes information on catchment size, percent contribution of highway runoff to watershed, conveyance system type, and other observations. Another portion of the in-field collection effort involves gathering data on aspects of the right-of-way (including right-of-way land classification) and existing BMPs and their condition. Furthermore, during dry weather, field visits assess whether any illicit discharges are present in the WSDOT drainage system.

In addition to the data used to derive retrofit priorities for each outfall, several hundred complete records contain best management practice (BMP) retrofit recommendations, conceptual design information, BMP cost estimates, drainage basin characteristics, conveyance system information, photographs, field sketches, and preliminary facility sizing calculations. Where available, that information can be used to reduce the research needs of designers for a particular project. It is important to check the date of a retrofit recommendation; older recommendations may not meet current standards and will require modification.

This database will become an increasingly valuable tool for design engineers as more stormwater management facilities are inventoried. Future plans include enhancing the database to track stormwater facility operation and maintenance. Information on the project's stormwater facilities will be input into the database as part of the project closeout procedure. Even though these database functions are not currently available, the types of data needed to support these database functions should be documented in the project's Hydraulic Report. Furthermore, stormwater management deficiencies are also tracked through the Priority Array Tracking System (PATS) and the Capital Program Management System (CPMS). When deficiencies are addressed by means of a retrofit, this is tracked through the same systems.

To obtain available stormwater database information about specific outfalls, or outfalls within the limits of a project, contact the region's Hydraulics and Water Quality offices, or the Headquarters (HQ) Environmental Services Office, Water Quality Program.

2-3.2.2 Geotechnical Evaluations

Understanding the soils, geology, geologic hazards, and groundwater conditions at the project site is essential to optimizing stormwater design for a project. Contact the WSDOT Region Materials Engineer (RME) and staff from the HQ Geotechnical Division as early as possible in the scoping phase, for inclusion on the scoping and design team.

Infiltration is the preferred method for flow control of stormwater runoff. Chapters 4 and 5 provide direction on how to apply optimal infiltration for stormwater management on transportation projects. However, the extent to which infiltration can be used needs to be assessed during the scoping phase because of its direct impact on stormwater alternatives and costs. The degree to which runoff can be infiltrated depends on the project location and context. Limiting factors include soil characteristics, depth to groundwater, and designated aquifer protection areas.

The RME evaluates the geotechnical feasibility of stormwater facilities that may be needed for the project. With assistance from the HQ Geotechnical Engineer, as needed, the RME gathers all available geotechnical data pertinent to the assessment of the geotechnical feasibility of the proposed stormwater facilities. Some subsurface exploration may be required at this stage, depending on the adequacy of the geotechnical data available to assess feasibility. For additional details, see Section 510.04 of the WSDOT *Design Manual*.

The scoping office develops the stormwater facility conceptual design using input from the RME and the HQ Geotechnical Engineer. Based on this design and investigation effort, fatal flaws in the proposed stormwater plan are identified, along with potential design and construction problems that could affect project costs or the project schedule. Critical issues to be considered include:

- Depth to water table, including any seasonal variations.
- Presence of soft or otherwise unstable soils.
- Presence in soils of shallow bedrock or boulders that could adversely affect constructibility.
- Presence of existing adjacent facilities that could be adversely affected by construction of the stormwater facilities.
- Presence of geologic hazards such as earthquake faults, abandoned mines, landslides, steep slopes, or rockfall.
- Adequacy of drainage gradient to ensure functionality of the system.
- Potential effects of the proposed facilities on future corridor needs.
- Maintainability of the proposed facilities.
- Potential impacts on adjacent wetlands and impacts on other environmentally sensitive areas.
- Presence of hazardous materials in the area.
- Whether or not the proposed stormwater plan will meet the requirements of resource agencies.
- Infiltration capacity (infiltration and percolation rates for project sites).

To characterize the seasonal variation of the groundwater table, it may be desirable to install piezometers at potential infiltration sites during scoping. One year of monitoring is desirable. At a minimum, one full rainy season is necessary to acquire the data needed to make a determination of site suitability.

2-3.2.3 Right-of-Way

Once the stormwater requirements for the project are understood, the general hydrologic site characteristics are known (including approximate groundwater table elevations), and the stormwater design alternatives are determined, the area necessary for stormwater facilities can be estimated. Refer to Chapters 4 and 5 to estimate the required area for each facility. Examine the proposed layout of the project, and determine the most suitable locations available to locate the stormwater facilities. Determine where facilities are proposed outside existing right-of-way and establish estimates for right-of-way acquisition areas and costs.

2-3.2.4 Utilities

The project design office should contact the region's Utilities Office to obtain information about whether existing utilities have franchises or easements within the project limits. Whenever proposed stormwater facilities conflict with an existing utility's right-of-way and facilities, a utility agreement is required. WSDOT may be responsible for the relocation costs, the utility owner may be responsible for the costs, or the costs may be shared. More information regarding utility elements is available in the *Utilities Manual*.

2-3.3 Maintenance Review

Once a list of permanent stormwater BMPs is determined based on the site assessment, the designer shall contact the region's maintenance program to discuss treatment options available for use. Overall maintenance costs must be considered when selecting BMPs. The project design office shall consult with the region's maintenance staff regarding the proposed drainage alternatives and evaluate maintenance needs, including personnel, equipment, and long-term costs through the BMP's expected life cycle. Review the general maintenance requirements in Section 5-3.7.1 and the maintenance guidelines in Section 5.5. Maintenance concurrence shall be obtained prior to the final selection of the treatment BMP and documented in the Hydraulic Report.

2-3.4 Documentation

Thorough documentation and tracking of stormwater design commitments is often a required element of environmental permit applications.

2-3.4.1 Stormwater Scoping Package

Stormwater documentation during the scoping phase of project development is referred to here as the *stormwater scoping package*. This package contains the information used to determine project stormwater impacts and the selection of stormwater BMPs. It is the source of stormwater information needed to complete the project summary documents. This package should include a brief summary report that contains the following:

- Identification of the project program
- Brief project description
- Synopsis of data gathered during the site assessment
- Basin and subbasin identification
- Threshold discharge area delineations indicating flow paths and outfalls to receiving waters
- Area determinations

- Applicable minimum requirements
- Other applicable regulatory requirements related to stormwater (e.g., Endangered Species Act requirements)
- Design criteria required for flow control and runoff treatment
- Known problems and commitments
- Retrofit recommendations
- Design alternatives and assumptions for flow control and runoff treatment
- Cost estimates

The stormwater scoping package is critical to the efficient continuation of project development and must be retained and easily retrievable. Once the project is programmed and assigned to a project office, the file and report become the starting point for the design phase. The stormwater-scoping package should be kept and stored by the region program management or scoping office. The package should remain with the overall project scoping file to ensure that the project office to which the project is assigned for design receives the preliminary stormwater information.

2-3.4.2 Project Summary

As described in Section 2-3, the product of scoping is the *Project Summary*, which consists of the *Project Definition*, *Environmental Review Summary*, and *Design Decisions Summary*. All of these documents require stormwater-related information, as outlined in Table 2-3. Much of the stormwater-related information needed to complete permit applications can be obtained from the *Project Summary* documentation.

2-3.4.3 Hydraulic Report

The Hydraulic Report is intended to serve as a complete document record containing the engineering justification for all drainage modifications that occur as a result of project construction, including documentation of the analysis and design for the postconstruction stormwater management system. For additional details, see the WSDOT *Hydraulics Manual*.

Table 2-3. Stormwater-Related Information Needed for the Project Summary.

Project Definition (PD)	• Cost estimate and variance for preliminary engineering, right-of-way, and construction • Right-of-way needs for stormwater facilities • Preliminary environmental review: required environmental documentation, permits, and environmental commitments • Design decisions regarding stormwater • Public input regarding stormwater • Project commitments for stormwater made to others and by others • Potential impacts of stormwater facilities on utilities • Specialized workforce expertise required for geotechnical, biological, geomorphic, and other evaluations • Other stormwater-related issues
Environmental Review Summary (ERS) and Environmental Classification Summary (ECS)	• Required permits and approvals related to stormwater • Critical or sensitive areas as designated by Growth Management Act ordinances • Floodplains or floodways within (or affecting) the project site • Rivers and streams: crossing structures and types • Water quality/stormwater: impacts and mitigation • Previous environmental commitments made in project area related to stormwater • Long-term maintenance commitments related to stormwater and necessary for project
Design Decisions Summary (DDS)	• Roadway geometrics data affected by stormwater facilities • Roadside character classification and treatment level: effect on stormwater facility design (forest, open, rural, semiurban, urban) • Hydraulic decisions regarding stormwater facilities

2-3.4.4 Construction Planning

During the design phase, key stormwater documents are produced to meet stormwater site planning requirements associated with Minimum Requirement 1 (see Section 3-3-1).

All projects require spill prevention, control, and countermeasures (SPCC) plans, which are prepared by the contractor after the project contract is awarded. The WSDOT Hazardous Materials Program (🖰 http://www.wsdot.wa.gov/environment/hazmat/default.htm) and Section 1-07.15(1) within the *Standard Specifications* provide more information regarding SPCC plan expectations. Provisions of the SPCC plan should be developed during the PS&E phase to ensure plan implementation.

For soil-disturbing projects, WSDOT must also prepare temporary erosion and sediment control (TESC) plans (see Chapter 6).

2-3.4.5 Contract Plan Sheets

Infiltration, dispersion, and conservation areas need to be identified on the contract plan sheet, along with other drainage and environmental elements. Development of the contract plan sheets is defined in the WSDOT *Plans Preparation Manual*.

2-3.4.6 Plans, Specifications, and Estimates (PS&E)

For the PS&E phase of a project, a set of Plans, Specifications, and Estimates is prepared. These documents translate the stormwater management elements of the design into a contract document format for project advertisement, bidding, award, and construction.

2-3.4.7 Underground Injection Control Wells

Drywells and infiltration trenches that contain perforated pipe are considered injection wells and require registration per the Washington State Department of Ecology's (Ecology's) Underground Injection Control (UIC) Program. Registration information is available at:
http://www.ecy.wa.gov/programs/wq/grndwtr/uic/registration/reg_info.html

For further guidance, consult region environmental staff or HQ Environmental Services Office staff.

2-4 Developer Projects

WSDOT must provide for the passage of off-site flows through its right-of-way to maintain natural drainage paths. If a private developer's project discharges off-site flow to WSDOT right-of-way, the project must provide stormwater BMPs that will prevent any increase in flow rates or volumes and any degradation of water quality within the state right-of-way. WSDOT will not concur with designs or allow discharges that do not comply with these requirements. Once WSDOT accepts discharge of water onto its right-of-way, the state becomes liable for the quality and quantity of that discharge. For this reason, WSDOT requires the discharge water to be treated at a minimum in accordance with provisions of this *Highway Runoff Manual*, Ecology stormwater management manuals, or an Ecology-approved local equivalent manual used by the local government having primary jurisdiction over the project.

For details regarding the WSDOT requirements and the process for review and concurrence of private project drainage design, refer to WSDOT's *Development Services Manual* and *Utilities Manual*.

2-5 Stormwater Facility Design Approach

2-5.1 Context Sensitive Design

It is important to understand how transportation facilities, in combination with other development, can affect the natural hydrology of watersheds and the water quality of receiving waters; in other words, the watershed context of a project. This understanding can guide the planner and designer in choosing stormwater management solutions that more successfully achieve the objective of protecting ecosystems.

Context sensitive design (CSD), also known as *context sensitive solutions* and *thinking beyond the pavement*, is an approach to transportation planning that broadens the focus of the project development process to look beyond the basic transportation issues, and develop projects that are integrated with the unique context(s) within the project setting. This approach considers the elements of mobility, safety, environment, community, and aesthetics from the beginning to the end of the project development process. The CSD also involves a collaborative project development process that obligates participants to understand the impacts and trade-offs associated with project decisions. Further discussion of and guidance on the context sensitive design/context sensitive solutions approach can be found at the following web site:
http://www.wsdot.wa.gov/biz/csd/

2-5.2 Stormwater Facility Design Strategy

Stormwater management facilities (i.e., runoff treatment and flow control) can be utilized to mitigate both the hydrologic impacts and the water quality impacts of a development project by applying the following fundamental strategy:

> *Maintain the preproject*[1] *hydrologic and water quality functions of the project site as it undergoes development.*

This strategy is accomplished through the following steps:

Step 1 Avoid and minimize impacts on hydrology and water quality.

Step 2 Compensate for altered hydrology and water quality by mimicking natural processes.

Step 3 Compensate for altered hydrology and water quality by using end-of-pipe solutions.

Steps 1 and 2 can be achieved by minimizing impervious cover; conserving or restoring natural areas; mimicking natural drainage patterns (e.g., using sheet flow, dispersion, infiltration, or

[1] The term *preproject* refers to the actual conditions of the project site before the project is built.

open channels); disconnecting drainage structures to avoid concentrating runoff; and using many small redundant facilities to treat, detain, and infiltrate stormwater. This approach to site design reduces reliance on the use of structural management techniques. Step 3 refers to the use of traditional engineering structural approaches (e.g., detention ponds) to the extent that Steps 1 and 2 are not feasible.

The methods listed for achieving Steps 1 and 2 above are commonly referred to as low-impact development (LID) approaches. By using the project site's terrain, vegetation, and soil features to promote infiltration, the landscape can retain more of its natural hydrologic function. Low-impact development methods will not be feasible in all project settings, depending on the physical characteristics of the site, the adjacent development, and the availability and cost of additional right-of-way, if needed. However, the designer should always investigate the feasibility of using low-impact development methods. Since the use of low-impact development methods requires understanding of soil characteristics, infiltration rates, water tables, native vegetation, and other site features, it is important to gain the participation of design support services and others from the beginning through the end of the project development process.

2-6 Special Design Considerations

2-6.1 Critical and Sensitive Areas

The Washington Growth Management Act (RCW 36.70A), combined with Article 11 of the Washington State Constitution, requires local jurisdictions to adopt ordinances that classify, designate, and regulate land use in order to protect critical areas. *Critical areas* are defined as wetlands, floodplains, aquifer recharge areas, geologically hazardous areas, and those areas necessary for fish and wildlife conservation.

2-6.1.1 Wetlands

Altering land cover and natural drainage patterns may increase or decrease stormwater input into surrounding wetlands. Land use changes and stormwater management practices usually alter hydrology within a watershed. Hydrologic changes have more immediate and greater effects on the composition of vegetation and amphibian communities than do other environmental changes, including water quality degradation.

Wetland ecosystems can be highly effective managers of stormwater runoff; they can remove pollutants and also attenuate flows and recharge groundwater. Minimum Requirement 7 (see Section 3-3.7) addresses wetland protection. While natural wetlands for the most part may not be used as pollution control facilities in place of runoff treatment BMPs, Ecology's SMMEW allows the use of lower-quality wetlands as runoff treatment BMPs if requirements for hydrologic modification are met. For detailed guidance on this issue for eastern Washington projects, refer to *Use of Existing Wetlands to Provide Runoff Treatment* (in Section 2.2.5, page 2-26) and *Application to Wetlands and Lakes* (in Section 2.2.6, page 2-33) in Ecology's

SMMEW, and the *Eastern Washington Wetland Rating Form* at:
🖱 *http://www.wsdot.wa.gov/environment/biology/docs/WetlandRatingForm_EasternWA_050426.doc*

For western Washington projects that may potentially alter the wetland hydroperiod, refer to *Guide Sheet 1B* in Appendix I-D of Ecology's SMMWW. Additional information on wetland hydroperiods is provided in Section 4-6 of this manual.

Region or HQ hydraulics and environmental staff can provide further assistance on hydroperiod modeling. For guidance on wetland creation or restoration as mitigation for direct wetland impacts, contact the region's wetland biologist or consult the following web site:
🖱 http://www.wsdot.wa.gov/environment/biology/bio_wetlands.htm

2-6.1.2 Floodplains

Hydrologic storage that is displaced by roadway fill or other structures may result in increased stream flows, channel erosion, downstream flooding, and decreased infiltration and summer base flows. Projects may be required to mitigate loss of hydrologic storage by creating new hydrologic storage elsewhere in the watershed.

A decision to locate structural detention facilities in floodplains should depend on the flow control benefits that can be realized. If a detention facility can be placed so that it is functional through at least the 10-year flood elevation, it will accomplish most of its function by controlling peaks during smaller, more frequent events that cumulatively cause more damage. Stormwater facilities that are located outside the 2-year, 10-year, and 25-year flood elevations do not compromise any flood storage during those floods. If it is not possible to locate stormwater facilities anywhere but within the 100-year floodplain, and if flood storage is an issue, consult with the region's Hydraulics Office to identify alternative mitigation opportunities.

2-6.1.3 Aquifers and Wellhead Protection Areas

To ensure that highway improvement projects protect drinking water wells, WSDOT has entered into an agreement with the State Department of Health. (The agreement is posted at:
🖱 http://www.wsdot.wa.gov/NR/rdonlyres/426DEF64-3BE9-4965-8414-441B878F0D46/0/SCAScreeningCriteria.pdf.) This agreement includes the following screening criteria to determine the conditions under which a highway project will not be considered a potential source of contamination to drinking water wells according to the State Department of Health:

1) Road location and construction setbacks are maintained such that the drinking water source intake structure is not in danger of physical damage.

2) All concentrated flows of untreated roadway runoff are directed via impervious channel or pipe and discharged outside the *Sanitary Control Area*.

3) If roadside vegetation management practices are identified as a potential source of contamination, the water purveyor will provide the location of the SCA to the appropriate WSDOT maintenance office for inclusion in the *Integrated Vegetated Management Plan* for that section of highway, as necessary to protect the wellhead.

4) WSDOT complies with all National Pollutant Discharge Elimination System permits, as required per Section 402 of the federal *Water Pollution Control Act*.

5) WSDOT provides the well purveyor with contact information to be used in the event of any problems or questions that may arise.

The project design team shall gather and document information on all drinking water wells along the project corridor. Refer to the local critical areas ordinances for details on aquifer and wellhead protection areas applicable to the project area. To locate wells in the project area, check Ecology's web site for listed well logs at: http://apps.ecy.wa.gov/welllog/. This web site contains a database of wells constructed and registered since the 1930s, and wells managed by Ecology since 1971. The WSDOT *GIS Workbench* can also provide a preliminary assessment of wellhead and aquifer protection areas in the vicinity of a given project. Recognize that some wells may not be registered and can only be identified through field investigations. Contact region environmental staff early in the project design phase if there are wells located within the radius of concern.

County health departments set well protection buffers, called *Sanitary Control Areas* (SCAs), presuming that the well protection buffer width will adequately protect wells from contamination. When highway projects encroach into well SCAs, however, WSDOT must document how the project will avoid impacting the well and water supply.

When a road project is expected to intersect a public water supply well's SCA, contact the water purveyor to confirm the location of the well and its SCA. If the project intersects the SCA, a licensed professional engineer, using the screening criteria listed above, needs to establish the conditions under which a highway project will not be considered a potential source of contamination to drinking water wells. Then, the engineer needs to attest to the well purveyor in writing, on WSDOT letterhead, that the screening criteria's conditions are satisfied. It is expected that the purveyor will identify and sign SCA-restrictive covenants and/or WSDOT will check for such covenants filed with the County Auditor's office.

If a disagreement arises between the water purveyor and WSDOT region staff regarding the potential impacts of the project to a public water supply well that cannot be resolved, elevate the issue to the HQ Water Quality Program. Likewise, contact the HQ Water Quality Program to evaluate mitigation options if it is not possible to meet the screening criteria.

Projects that include large cuts or compaction of soil over shallow aquifers could potentially intercept groundwater flows and restrict the quantity of water reaching a well. Groundwater quantity issues are not covered by the State Department of Health agreement, thus potential groundwater quantity impacts must be analyzed as a hydrogeologic issue in consultation with the HQ Materials Laboratory and the HQ Hydraulics Office.

2-6.1.4 Streams and Riparian Areas

Avoiding encroachment into riparian areas is important to prevent direct impacts on stream channels and stream ecosystems. Removing riparian vegetation may directly result in channel instability and streambank erosion; loss of aquatic and wildlife habitat; loss of spawning gravels; increased sedimentation; increased water temperatures; decreased dissolved oxygen concentrations; and other water quality impacts. When a highway-widening project is located parallel to a stream, stormwater facility placement should occur away from the stream to the extent feasible and measures should be taken to preserve or enhance riparian buffers.

2-6.2 Endangered Species

Projects with a federal nexus (i.e., federal funding, permit, or approval) must go through consultation pursuant to Section 7 of the federal Endangered Species Act (ESA). A biological evaluation or biological assessment must be prepared whenever ESA-listed species are suspected to occur in the vicinity of a project.

The design team works with a WSDOT region biologist to develop the required documentation. The information needed to complete the biological evaluation or biological assessment can be obtained from existing documents and resources for the given conceptual project design alternatives. Ideally, the majority of the final information will be gathered during the scoping phase of project development. The scoping team should contact the biologist early in the scoping process to request assistance in determining ESA-related issues, and to determine how these issues and needs affect project design and cost considerations.

Information necessary to complete a biological evaluation or biological assessment for stormwater-related impacts is compiled in the ESA Stormwater Design Checklist included as Appendix 2B.

2-6.3 Contaminated and Hazardous Waste Sites

If a project contains a contaminated or hazardous waste site, or if such a site is suspected to exist within the project limits, contact WSDOT HQ hazardous materials staff for further direction. Also, see the WSDOT *Environmental Procedures Manual*, Section 447.05, Technical Guidance.

2-6.4 Airports

Special consideration must be given to the design of stormwater facilities for projects located near airports. Roadside features, including standing water (e.g., wet ponds) and certain types of vegetation, can attract birds both directly and indirectly. The presence of large numbers of birds near airports creates hazards for airport operations and must be avoided. Before planning and designing facilities for a project near an airport, contact WSDOT Aviation, the airport, and the Federal Aviation Administration for wildlife management manuals and other site-specific guidance.

2-6.5 Bridges

Because the over-water portion of the bridge surface captures only the portion of rainfall that otherwise would fall directly into the receiving water body, that portion of the bridge makes no contribution to the increased rate of discharge associated with surface runoff to the water body. This reasoning assumes that the conveyance system is constructed to prevent any localized erosion between the bridge surface and the outfall to the water body. While this fact may simplify needs for flow control, bridges present challenges associated with pollutant removal from runoff generated by their surfaces.

Bridges are typically so close to receiving waters that it is often difficult to find sufficient area in which to site a treatment solution. In the past, bridges have been constructed with small bridge drains that discharge the runoff directly into the receiving waters by way of downspouts. This practice is no longer allowed; thus creating the challenge of incorporating runoff collection, conveyance, and treatment facilities into the project design.

Use of suspended pipe systems to convey bridge runoff should be avoided whenever possible because these systems have a tendency to become plugged with debris and are difficult to clean. The preferred method of conveyance is to hold the runoff on the bridge surface and intercept it at the ends of the bridge with larger inlets. This method requires adequate shoulder width to accommodate flows so that they do not spread farther into the travel way than allowed (see Chapter 5 of the WSDOT *Hydraulics Manual* for allowable spread widths). In cases where a closed system must be used, it is recommended that bridge drain openings and pipe diameters be larger, and that 90º bends be avoided, to ensure the system's operational integrity. Early coordination with the HQ Bridge and Structures Office is essential if a closed system is being considered.

2-6.6 Ferry Terminals

A ferry dock consists of the bridge (trestle and span), piers, and some of the holding area (parking facility). The terminal is the dock and all associated upland facilities. Requirements and consideration for the terminal's upland facilities are the same as for park-and-ride lots, rest areas, and maintenance yards as describe in Section 2-6.7 (where similarities exist). Requirements and considerations that apply to bridges also apply to the trestle, span, and other over-water portions (see Section 2-6.5).

2-6.7 Maintenance Yards, Park-and-Ride Lots, and Rest Areas

The Ecology stormwater management manuals for western (SMMWW) and eastern (SMMEW) Washington provide more specific stormwater BMP information related to parking lots and commercial and industrial land uses. Stormwater facility design should give first consideration to the use of low-impact development methods such as permeable pavement and bioretention (see Chapter 5 for these and other applicable BMPs).

2-7 How Stormwater Management Applies to a Project

2-7.1 HRM Minimum Requirements and Exemptions

Chapter 3 contains the manual's minimum requirements for stormwater management. Section 3-2 aids in determining the minimum requirements that apply and Section 3-3 provides further detailed direction as to their application. Even when projects do not trigger a particular minimum requirement (e.g., flow control), the intent of the minimum requirement should still be considered in project design.

Section 3-2 provides information on projects that are exempt from the minimum requirements. Sections 3-3.5 and 3-3.6 provide specific information on limited exemptions from runoff treatment (Minimum Requirement 5) and flow control (Minimum Requirement 6), respectively.

2-7.2 Local Requirements

Section 1-1.5 explains the conditions under which local requirements apply to stormwater management on WSDOT projects. By state statute, WSDOT projects on state right-of-way are not subject to local permits, except for *shoreline* permits required by the local shoreline master program and permits required by *critical* or *sensitive areas* ordinances promulgated under the Growth Management Act (see Section 2-6.1).

Permitting staff in the region's Environmental Office should be consulted as to the individual permits required for a project. If the project will result in a new stormwater discharge to a municipal storm sewer system, a permit may be required by that jurisdiction's stormwater utility. Local agencies may have special design requirements for projects in which a portion of the local system will be replaced and turned over to the local jurisdiction for operation and maintenance.

The above information is intended to specify the local permits that may be applicable to WSDOT projects; it is not intended to preclude the need to work with local authorities to address concerns they may have regarding the potential impacts of a project. Additional information on applicable statutes, regulations, and environmental permitting can be found in WSDOT's *Environmental Procedures Manual*.

2-7.3 Watershed and Basin Plans

Incorporating watershed and basin planning, and local requirements into stormwater management is addressed in Minimum Requirement 8 (see Section 3-3.8). Project planners and designers need to familiarize themselves with the planning efforts for the watersheds and local jurisdictions in which the project is located, and identify any specific requirements, recommendations, and opportunities that relate to stormwater management. Watershed plans may also identify priority mitigation needs within the watershed that may present off-site opportunities to mitigate project impacts. Local plans may have identified specific stormwater-related needs and/or contain useful analyses.

Statewide-organized watershed planning efforts occur under two state laws: the Watershed Planning Act (2514 Planning) and the Salmon Recovery Act (2496 Planning). Each uses *water resource inventory areas* (WRIAs) as its basic geographic unit.

Basin planning conducted by local governments focuses on drainage basins at a local, sub-WRIA scale. Unfortunately, there are no uniform state standards defining an adequate basin plan. As stated in Minimum Requirement 8 (see Section 3-3.8), standards developed from basin plans cannot modify any minimum requirement until the basin plan is formally adopted and implemented by the local governments within the basin, and has received approval or concurrence from Ecology.

Entities with basin planning responsibilities for an area where transportation projects are planned should be contacted as early as possible in the project planning process. Such groups include *lead entities* under the Salmon Recovery Act and *watershed planning units* under the Watershed Planning Act, as well as city and county public works departments responsible for basin planning. There may be shared funding opportunities for local priority mitigation projects , which could significantly reduce project mitigation costs. Also, such entities may have data and analyses that can be used in the project planning process.

- More information on activities under the Watershed Planning Act, including a map of Washington's water resource inventory areas, can be found at:
  🖰 http://www.ecy.wa.gov/watershed/index.html
- More information on activities under the Salmon Recovery Act can be found at:
  🖰 http://wdfw.wa.gov/recovery.htm
- Watershed data, reports, and other related information can be found at:
  🖰 http://www.ecy.wa.gov/programs/eap/wrias/index.html

Also, the region's Environmental Office or the HQ Watershed Management Program Office can arrange meetings and help coordinate with watershed-related efforts.

The Watershed Program staff of the HQ Environmental Services Office has developed a project screening and watershed characterization process to identify alternatives to managing stormwater impacts within the right-of-way. The objectives in pursuing the watershed-based approach are to improve environmental benefits and reduce costs compared to standard runoff treatment and flow control facilities constructed within the right-of-way. Factors to consider with watershed-based options include:

1. *Have all source controls been included?* Source control may be the most cost-effective practice to control pollutants. This should be the first step in the investigation of alternative treatment options.
2. *What size watershed scale is appropriate for this alternative mitigation approach?* While the smallest subbasin may be appropriate for healthy watersheds, a larger watershed scale may be more appropriate in highly degraded watersheds depending on the nature of impairment(s).
3. *Can stormwater treatment be coordinated with habitat mitigation?* Stream restoration, floodplain restoration, riparian replanting, or other practices could provide both habitat mitigation and stormwater treatment.
4. *Has a regional facility been evaluated?* If on-site stormwater facilities are not feasible, combining several project stormwater treatment/control needs into one regional facility may be a more cost-effective option.
5. *Are there legal or regulatory constraints to off-site stormwater treatment?*

For more information on activities of WSDOT's Watershed Program, including the watershed-based mitigation method, see: 🖰 http://www.wsdot.wa.gov/environment/watershed/default.htm

2-7.4 Engineering and Economic Feasibility

For some projects, practical limitations may present obstacles to fully meeting certain requirements, particularly runoff treatment and flow control, within the project right-of-way. Limitations may be infrastructural, geographical, geotechnical, hydraulic, environmental, or benefit/cost-related. For these projects, the planning and design team must make a formal assessment of the project and identify constraints on meeting the minimum requirements. This assessment is referred to as *engineering and economic feasibility* (EEF).

The Engineering and Economic Feasibility Evaluation Checklist, included in Appendix 2A, is an evaluation based on 18 project- and site-specific criteria that assesses the practical limitations of constructing stormwater facilities within or adjacent to a project's right-of-way. The assessment should be performed as early as possible in project development. If the assessment reveals that stormwater requirements for a project cannot be met because it is not feasible to do so, an explanation must be provided in the project's Hydraulic Report. The explanation must include the reasons why the requirements cannot be met for the site and the amount of stormwater treatment/control that can be provided. Whenever an EEF assessment shows that meeting the HRM's minimum requirements for a project is not feasible within the project's right-of-way, in whole or in part, the project team should consult with the region's Environmental Office or the

HQ Watershed Management Program Office regarding whether alternative mitigation opportunities have been identified for the project area.

If on-site options are unavailable and opportunities to create off-site runoff treatment and/or flow control capacity cannot be identified or are not chosen, the project needs to pursue the *demonstrative approach* to propose a treatment option for the stormwater discharge (see Sections 1-1.3 and 5-3.6.3). The *demonstrative approach* requires demonstrating that the project will not adversely affect water quality by providing appropriate supporting data showing that the alternative approach satisfies state and federal water quality laws. The timeline and expectations for providing technical justification depend on the complexity of the individual project and the nature of the receiving water environment. Thus, this approach may be more cost effective for large, complex, or unusual types of projects. In developing alternate treatment and control options, it is important to consider and document the site limitations using the Engineering and Economic Feasibility Evaluation Checklist.

2-7.5 Stormwater Retrofit

Project-related stormwater retrofit provides stormwater improvements for existing impervious surfaces where treatment/controls are substandard. The decision to apply current standards for runoff treatment and flow control to existing impervious surfaces within the project limits should occur during project scoping. The guidelines for applying project-related retrofit actions are provided in Section 3-4.

Stormwater retrofit may also occur as a stand-alone programmed project. Those responsible for scoping a project should work closely with the region or HQ Program Management Office to learn if any such programmed retrofit actions apply to their project. The level of retrofit should be documented in the Hydraulic Report.