

Chapter 1 Design Policy

1-1 Introduction

This *Hydraulics Manual* provides policy for designing hydraulic features related to Washington State Department of Transportation (WSDOT) roadways including hydrology, culverts, open-channel flow, drainage collection and conveyance systems, water crossings, and pipe materials. These hydraulic features maintain safe driving conditions and protect the roadway from surface and subsurface water. The chapters contained in the *Hydraulics Manual* are also based on the Federal Highway Administration's (FHWA's) [Hydraulic Engineering Circulars](#) (HECs) and the American Association of State Highway and Transportation Officials (AASHTO) [Drainage Manual](#).

The *Hydraulics Manual* makes frequent references to WSDOT's [Highway Runoff Manual](#), which provides WSDOT's requirements for managing stormwater discharges to protect water quality, beneficial uses of the state's waters, and the aquatic environment in general. The intent is to use the two manuals in tandem for complete analysis and design of stormwater facilities for roadway and other transportation infrastructure projects. Projects should consult WSDOT's [Design Manual](#) for general hydraulic design guidance. Design-build projects should also consult the [Design Manual](#) and the [Design-Build Manual](#).

In addition to the guidance in the *Hydraulics Manual*, the designer should use good engineering judgment and be mindful of WSDOT's legal and ethical obligations concerning hydraulic issues. Drainage facilities must be designed to convey water across, along, or away from the highway in the most economical, efficient, and safe manner possible without damaging the highway or adjacent properties and without causing permit violations. Furthermore, care must be taken so that highway construction does not interfere with or damage any of these facilities.

This chapter explains WSDOT policy regarding hydraulic design and hydraulic reports. In [Section 1-2](#), the roles and responsibilities of the Project Engineer's Office (PEO), Region Hydraulics Engineer (RHE), and WSDOT Headquarters (HQ) Hydraulics Section are defined. WSDOT has specific documentation requirements for a hydraulic report, which are specified in [Section 1-3](#). Each hydraulic feature is designed based on specific design frequencies and, in some cases, a specific design tool or software. A summary of the design frequency and design tools or software for most hydraulic features contained in the *Hydraulics Manual* is provided in [Section 1-4](#). [Section 1-5](#) defines the process for reviewing and issuing concurrence of a hydraulic report.

1-2 Responsibility

The PEO is responsible for the preparation of correct and adequate drainage design. All drainage structure types, culverts, storm sewer, drainage, general pipe connections, and pipe locations must be verified and annotated by the PEO. Actual design work may be performed by the PEO, by another WSDOT office, or by a private consulting engineer;

however, in all cases, it is the PEO's responsibility to complete the design work and verify that a hydraulic report is prepared as described in [Section 1-3](#). In addition, the hydraulic report shall follow the review process outlined in [Section 1-5](#). The PEO is also responsible for initiating the application for hydraulic-related permits required by various local, state, and federal agencies.

While the PEO is responsible for preparation of hydraulic reports and plans, specifications, and estimates (PS&E) for all drainage facilities, assistance from the RHE and the State Hydraulics Office may be requested for any drainage facility design. The RHE and State Hydraulics Office offer technical assistance to PEOs and local programs for the items listed below:

1. Hydraulic design of drainage facilities (culverts, storm sewers, stormwater best management practices [BMPs], siphons, channel changes, etc.).
2. Hydraulic design of structures (culverts, headwalls, etc.).
3. Analysis of closed drainage basins and unusual or unique drainage conditions.
4. Downstream analysis to identify and evaluate potential impacts from the project on the hydraulic conveyance system downstream of the project site. The analysis shall be divided into three sections:
 - a. Review of resources
 - b. Inspection of drainage conveyance systems in the site area
 - c. Analysis of downstream effects

The roles and responsibilities of the RHE and State Hydraulics Office are outlined in [Table 1-1](#). The State Hydraulics Office also takes primary responsibility for the following:

1. Hydraulic analysis (one-dimensional [1D] and two-dimensional [2D]) and support for scour of water crossings.
2. Analysis of streambank erosion along roadways and river lateral migration, and the design of channel instability countermeasures and environmental mitigation.
3. Floodplain studies, flood predictions, and special hydrological analysis (snowmelt estimates, storm frequency predictions, etc.).
4. Wind and wave analysis.
5. Technical support to local programs for hydraulic or bridge-related needs.
6. Providing the Washington State Attorney General's Office with technical assistance on hydraulic issues.
7. Updating information in the *Hydraulics Manual* periodically.
8. Providing technical information for the [Highway Runoff Manual](#) updates.
9. Maintaining WSDOT's Standard Plans; *Standard Specifications for Road, Bridge, and Municipal Construction* (Standard Specifications); and General Special Provisions involving drainage-related items.

10. Designing water supply and sewage disposal systems for safety rest areas. The PEO is responsible for contacting individual fire districts to collect local standards and forward the information to the State Hydraulics Office.
11. Reviewing and concurring with Type A hydraulic reports, unless otherwise delegated to the RHE by the State Hydraulics Office.
12. Providing the regions with technical assistance on hydraulic issues that are the primary responsibility of the PEO.
13. Providing basic hydrology and hydraulics training material to the regions. Either region or HQ personnel can perform the actual training. (See the State Hydraulics Office on the WSDOT Hydraulics Training web page for information on course availability.)

1-3 Hydraulic Reports

The hydraulic report is intended to serve as a complete documented record containing the engineering justification for all drainage and stormwater installations and modifications that occur as a result of the project. The primary use of a hydraulic report is to facilitate design review and to assist in PS&E preparation. The hydraulic report should be well written, show conditions before and after construction, and be defensible in a court of law. This section contains specific guidance for developing, submitting, and archiving a hydraulic report.

A *Fish Passage and Stream Restoration Design (FPSRD)* certificate number is required for all authors of any portion of a specialty report. See [Table 1-1](#) for a list of specialty reports. An FPSRD certificate number is given to those who have viewed all of the training modules and successfully passed the comprehensive exam. Additional information, training resources, and the point of contact for this training can be found on the [WSDOT Hydraulics Training web page](#). As WSDOT updates the Fish Passage and Stream Restoration Design Training modules a re-certification number is also required. Any updates to this training will be posted on the [WSDOT Hydraulics Training web page](#).

A *Highway Runoff Manual* certificate number is required for the stormwater designer who designs a new stormwater BMP on WSDOT right-of-way (ROW) or modifies an existing stormwater BMP on WSDOT ROW, or where a stormwater BMP is designed or modified and will be turned back to WSDOT ownership. The *Highway Runoff Manual* certificate number is given to those who have successfully passed the *Highway Runoff Manual* training course. See training information on the [WSDOT Hydraulics Training web page](#).

The [FHWA Bridge Scour Workshop Recordings](#) are required prior to completing a scour analysis specialty report for WSDOT infrastructure. Please contact the State Hydraulics Office to obtain links to the recorded sessions or look for the links on the [FWHA Hydraulics web page](#).

WSDOT is developing a mandatory scour certification program that will be required for

authors of scour analysis for WSDOT projects or WSDOT managed infrastructure. Please contact the State Hydraulics Office for additional information. It can be anticipated that the following training courses will be required to obtain a scour analysis certification:

- The [FHWA Bridge Scour Workshop Recordings](#)
- [NHI Course 135046 Stream Stability and Scour at Highway Bridges](#)
- [NHI Course 135048 Countermeasures Design for Bridge Scour and Stream instability](#)
- [WSDOT Scour Training Workshop](#)

1-3.1 *Hydraulic Report Types*

There are three types of hydraulic reports: specialty report, Type A, and Type B. [Table 1-1](#) provides guidance for selecting the report type; however, consult the RHE for final selection.

Table 1-1 Hydraulic Report Documentation

Report Type ^(g)	Description	Concurrence ^a		PE Stamp
		RHE	HQ Hydraulics Section	
Specialty report ^b	Projects with any of the following components: <ul style="list-style-type: none"> • Culverts greater than 48 inches in diameter or large-span culverts^b • Bridge drainage • Fish passage • Bank protection • Large woody material • River structures (e.g., barbs, engineered log jams, levees) • Channel realignment/modifications or restoration • Any fills in floodplain or floodway • Pump stations • Hydraulic connectivity zones • Siphons 		✓	✓ ^c
A ^b	Projects with any of the following components: <ul style="list-style-type: none"> • Water quality treatment facility • Flow control facility • Storm sewer systems that discharge into a stormwater treatment or flow control facility • Create, modify, or remove any existing or new BMP (full or partial treatment BMP) • Fish passage stormwater treatment assessment for full or partial treatment^f • Region facilities projects^e 	✓ ^{d,e}		✓
B ^{b, a}	Projects without Type A components and with any of the following components: <ul style="list-style-type: none"> • Stormwater and non-fish passage Culverts up to 48 inches in diameter^b • Storm sewer systems that do not discharge into a stormwater treatment or flow control facility • Paving/Safety Restoration and Preservation Projects 	✓		✓

Notes:

HQ = Washington State Department of Transportation Headquarters.

PE = Professional Engineer.

RHE = Region Hydraulics Engineer.

a. In no case may the PEO provide concurrence on its own design.

b. For design-build projects, the identified concurring RHE or State Hydraulics Office engineer shall be involved in developing the scope and the Request for Proposal. The identified concurring hydraulics engineer shall verify that the Final Hydraulic Report and Stormwater BMP Maintenance Plans meet the Mandator Standards per the Request for Proposal 2.14.

c. The PE stamp shall be either by the State Hydraulics Office or by a licensed engineer approved by the State Hydraulics Office.

d. The State Hydraulics Office is delegating final review authority and concurrence for all Type A hydraulic reports to a person designated by the assistant regional administrator for development in each region.

e. Facilities designed by the RHE will have concurrence from the State Hydraulics Office.

f. All fish passage projects shall complete a stormwater assessment for the feasibility of full or partial stormwater treatment BMPs. See [Highway Runoff Manual](#) for more information.

g. During scoping, all projects shall conduct a stormwater and hydraulic assessment per [Design Manual, Chapter 800](#).

1-3.2 Preparing a Hydraulic Report

This section provides guidance for developing a hydraulic report.

1-3.2.1 Hydraulic Report Content and Outline

The [hydraulic report checklist](#) identifies the required subject matter that the hydraulic report should contain. PEOs shall provide a well-organized report such that an engineer with no prior knowledge of the project could read and fully understand the hydraulic/hydrologic design decisions made for the design of the project. The report shall contain enough information to allow reproduction of the design in its entirety, but at the same time PEOs should be concise and avoid duplicate information that could create confusion. Because the software used for analysis will change over time, all assumptions and input parameters shall be clearly documented to allow the analysis to be reproduced in other software in the future, if needed.

In addition, a [Type A hydraulic report outline](#) has been developed as a starting point. Although use of the outline is not mandatory, organizing reports in the outline format may expedite the review process. Because some regions have modified the outline to meet specific regional needs or requirements, PEOs should contact their RHE to determine the correct outline before starting a report. Once the relevant outline is selected, PEOs shall read through the outline, determine which sections are applicable to the project, and delete those that are not. Either the RHE or the State Hydraulics Office can be contacted for assistance in preparing a Type A hydraulic report and for current updates to the hydraulic report outline.

The author should not copy sections of the *Hydraulics Manual* into the hydraulic report because it would add redundant information to the report. Instead, authors should reference the relevant section in the hydraulic report narrative.

1-3.2.2 Deviations from the *Hydraulics Manual*

An author who deviates from the requirements in the *Hydraulics Manual* must clearly state why a deviation is necessary and document all the steps used in the analysis in the written portion of the hydraulic report. Deviations from this manual require approval prior to submitting a hydraulic report for review. Requests for a deviation shall go through the RHE to the State Hydraulics Office engineering staff.

1-3.2.3 Design Tools and Software

The design tools and programs described in the *Hydraulics Manual* and in the [Highway Runoff Manual](#) shall be used whenever possible. To determine if software and/or a design tool is required, PEOs shall review [Section 1-4](#) or check the expanded list on the [State Hydraulics Office web page](#). If a PEO wishes to use a design tool or software other than those required, it must request concurrence by the 10 percent milestone for the hydraulic report through the RHE.

1-3.2.4 Contract or Scope of Work

PEOs should use caution when referencing the hydraulic report outline in contracts or scopes of work for consultants. Never contract or scope a consultant to only finish or complete the hydraulic report outline. The consultant should use the hydraulic report

outline to develop the report in accordance with the *Hydraulics Manual*; the hydraulic report shall address all of the applicable minimum requirements in the *Highway Runoff Manual*. Contact the RHE and/or State Hydraulics Office to review the contract or scope prior to hiring a consultant.

1-3.3 Hydraulic Report Submittal and Archiving

Hydraulic reports shall be submitted to the following offices.

1-3.3.1 Review Copies

PEOs shall submit a complete searchable electronic copy of the hydraulic report to the appropriate concurring authority (RHE and/or State Hydraulics Office; see [Table 1-1](#)) for review. To allow the most efficient hydraulic report review, PEOs shall follow the hydraulic review process outlined in [Section 1-5](#) and shown in [Figure 1-1](#). Final concurrence of the hydraulic report will be issued once the report complies with the *Hydraulics Manual* and the *Highway Runoff Manual* and all reviewer comments are satisfactorily addressed.

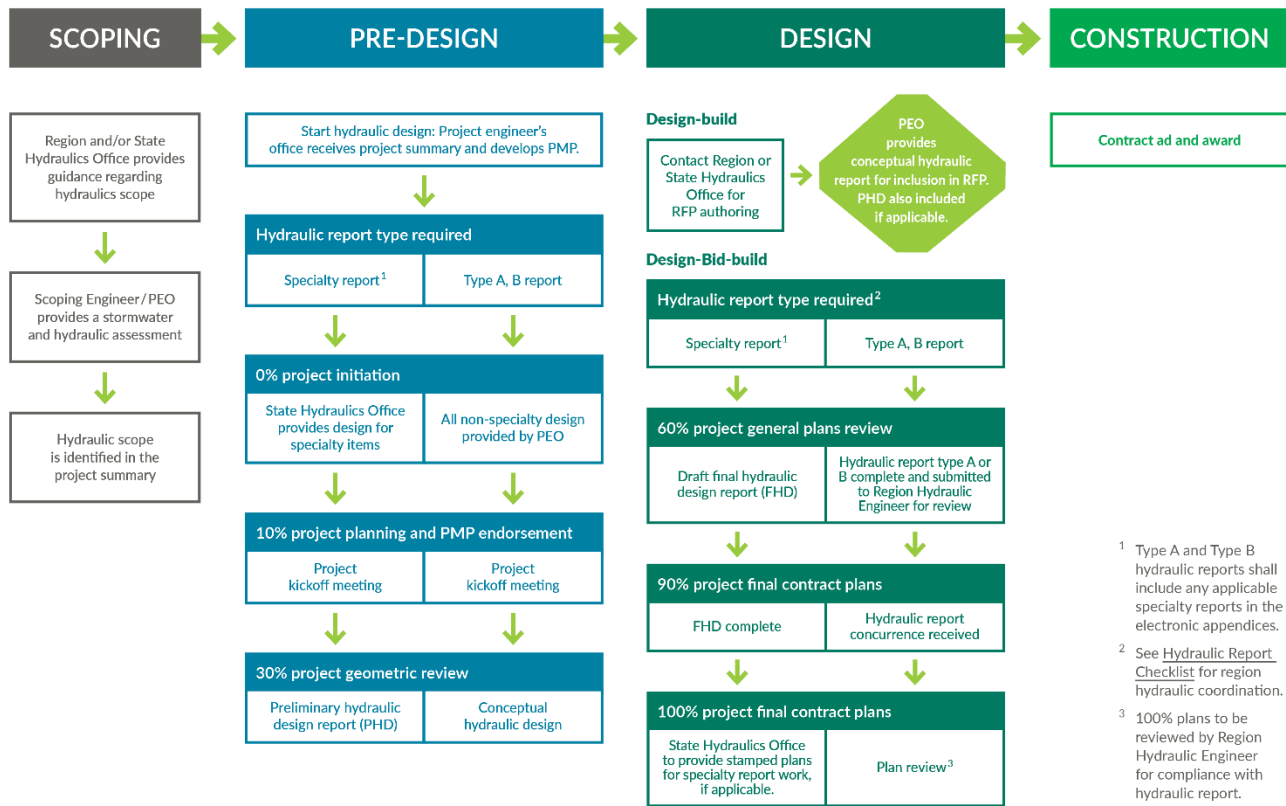
1-3.3.2 Final Copies

Upon concurrence, PEOs shall submit a searchable electronic copy of the hydraulic report and the original concurrence letter shall be sent to the offices noted below. Electronic copies shall include the entire contents of the hydraulic report (including the appendices files) in a Portable Document Format (PDF) file.

1. Send one PDF to the Construction Office for reference during construction.
2. Send one PDF to the RHE to be kept in a secure location as the record of copy for 10 years and then follow the state retention schedule. For design-bid-build projects, if any stormwater or hydraulic changes are made during construction to the approved hydraulic report design, the final hydraulic report shall be updated to include all stormwater and hydraulic change orders per [Section 1-3.4](#).
3. Send one PDF to the State Hydraulics Office. The State Hydraulics Office will retain this copy for at least 10 years and then follow the state retention schedule. For design-bid-build projects, if any stormwater or hydraulic changes are made during construction to the approved hydraulic report design, the final hydraulic report shall be updated to include all stormwater and hydraulic change orders per [Section 1-3.4](#).
4. Archive the original concurrence letter and original hydraulic report with the design documentation package. Any changes that occur during construction that affect a hydraulic feature's intended function will require a revision or a supplement to the original hydraulic report. Coordinate with the RHE for the extent and format of the revision or supplement, which must be completed prior to the construction project closeout. Changes require approval from either the State Hydraulics Office or RHE depending on the report type per [Table 1-1](#).

The 10-year report retention period begins after construction is complete. However, WSDOT employees are directed to preserve electronic, paper, and other evidence as soon as they are aware of an incident that may reasonably result in an injury, claim, or legal action involving WSDOT per WSDOT Secretary's Executive Order E 1041. In some instances, this may extend beyond the 10-year retention period.

Figure 1-1 Hydraulic Design Process



1-3.4 Hydraulic Report Revisions and Supplements

An approved hydraulic report may need to be revised because of design changes during the design phase or construction phase of the project. There are two ways to submit a change:

- 1. Revision:** A revision is a correction to the existing report because of either an error or omitted design documentation. The PEO shall submit the revision along with a new title page that is stamped and signed by the PE with the same date as the revision or later.
- 2. Supplement:** A supplement is a change that was not part of the original scope of work. The same approval process is required as with the original report; however, the supplement shall be a standalone document that references the original report. The supplement shall indicate what the existing design was and how the existing design has changed as well as describe why the change was necessary.

Either type of change shall be included in a submittal package with the changes clearly documented as well as supporting analysis and data including any revised plans, calculations, and other updates, as warranted, to support the change. The package shall be submitted to the concurring authority following the guidance in [Section 1-3.3](#) and as shown on [Table 1-1](#).

1-3.5 *Hydraulic Reports and Design-Build Projects*

Design-build projects present design and schedule challenges so PEOs should coordinate the hydraulic design with both the RHE and State Hydraulics Office throughout the project. In addition to the guidance in the *Hydraulics Manual* and the *Highway Runoff Manual*, PEOs shall consult the *Design-Build Manual*.

Prior to the Request for Proposal phase of the project, a conceptual design hydraulic report(s) is prepared that serves as the basis of a bid and further development by the selected design-build contractor. Refer to the design-build Request for Proposal template for more information on required reporting.

1-3.6 *Developers and Utility Agreements*

Developers, state and local agencies, utilities, and others designing stormwater facilities within the WSDOT ROW shall assume the same responsibility as the PEO and prepare hydraulic reports in compliance with the policy outlined in [Chapter 1](#). Developers, state and local agencies, utilities, and others discharging stormwater to the WSDOT ROW may need a permit. For more information on requirements and permits for discharging to the WSDOT ROW and/or building on the WSDOT ROW, consult the *Design Manual*, *Utilities Manual*, and *Local Agency Guidelines* manual.

1-3.7 *Downstream Analysis*

A downstream analysis identifies and evaluates the impacts and risks, if any, that a project will have on the drainage conveyance system, properties, and sensitive areas that are downstream of the project site. All projects that propose to discharge stormwater from WSDOT ROW and meet the requirements below are required to provide a downstream analysis as part of the hydraulic report; see the [hydraulic report outline](#) for more information.

- Projects that add 5,000 square feet or more of new, impervious surface area
- Projects where known drainage or erosion problems indicate there may be impacts on the downstream conveyance system, properties, or sensitive areas
- Projects that add less than 5,000 square feet of new, impervious surface and where the project is within 300 feet of a stream or if the project's stormwater discharges into a stream within 0.25 mile downstream of WSDOT's ROW
- Projects that alter existing hydrology or drainage

1-3.7.1 *Downstream Analysis Reports*

At a minimum, the analysis must include the area of the project site to a point 0.25 mile downstream of the site and upstream to a point where any backwater conditions cease. The results of the analysis must be documented in the project hydraulic report. Potential impacts to be assessed in the report also include but are not limited to changes in flows for extreme events, changes in flood duration, water surface elevations (WSELs), bank erosion, channel erosion, and nutrient loading changes from the project site. The analysis

is divided into three steps that follow sequentially:

1. Review of resources
2. Inspection of drainage conveyance systems in the site area
3. Analysis of downstream effects

1-3.7.2 Review of Resources

The PEO reviews available resources to assess the existing conditions of the drainage conveyance systems in the project vicinity. Resource data commonly include aerial photographs, area maps, floodplain maps, wetland inventories, stream surveys, habitat surveys, engineering reports concerning the entire drainage basin, the [Climate Impacts Vulnerability Assessment statewide map](#), geographic information system (GIS) and light detecting and ranging (LiDAR) information, and any previously completed downstream analyses. All of this information shall encompass an area 0.25 mile downstream of the project site's discharge point from WSDOT's ROW.

The background information is used to review and establish the existing conditions of the drainage conveyance system. This baseline information is used to determine whether the project will improve upon existing conditions, have no impact, or degrade existing conditions if no mitigating measures are implemented. The RHE and HQ Environmental Services Office staff will be able to provide most of this information. Other resource information sources include the Washington State Department of Ecology (Ecology), the Washington Department of Fish and Wildlife (WDFW), and local agencies.

1-3.7.3 Inspection of Drainage Conveyance System

The PEO must inspect the downstream conveyance system and identify any existing problems that might relate to stormwater runoff. The PEO will physically inspect (if possible) the drainage conveyance system at the project site and downstream from the WSDOT ROW for a distance of at least 0.25 mile. The inspection shall include any problems or areas of concern that were noted during the resource review process or in conversations with local residents and the WSDOT Maintenance Office. The PEO shall also identify existing or potential conveyance capacity problems in the drainage system, existing or potential areas where flooding may occur, existing or potential areas of extensive channel destruction or erosion, and existing or potential areas of significant destruction of aquatic habitat (runoff treatment or flow control) that can be related to stormwater runoff. If areas of potential and existing impacts related to project site runoff are established, actions must be taken to minimize impacts to downstream resources.

1-3.7.4 Analysis of Downstream Effects

This final step analyzes information gathered in the first two steps of the downstream analysis. It is necessary to determine if the project will create any drainage conveyance problems downstream or make any existing problems worse. The PEO must analyze downstream effects to determine corrective or preventive actions that may be necessary. If the project is within a medium- or high-vulnerability location according to the [Climate Impacts Vulnerability Assessment](#) statewide map, the PEO must run extreme

events (for example, the 100-year storm event) and evaluate the impacts and stability of the conveyance system. The PEO shall perform a risk assessment based on the extreme events showing impacts to the conveyance system and to downstream properties and sensitive areas.

PEOs shall consult the [Highway Runoff Manual](#) for further guidance on the design flow for runoff treatment and flow control BMP design. In some cases, analysis of downstream effects may indicate that no corrective or preventive actions are necessary. If corrective or preventive actions are necessary, the following options must be considered:

- Design the on-site treatment and/or flow control facilities to provide a greater level of runoff control than stipulated in the minimum requirements in Chapter 3 of the [Highway Runoff Manual](#).
- Take a protective action separate from meeting Minimum Requirements 5 and 6 in the [Highway Runoff Manual](#) for runoff treatment and flow control. In some situations, a project will have negative impacts even when the minimum requirements are met. Below are two examples:
 - Roadway runoff in a project's threshold discharge area (TDA) was sheet-flowing to the roadway side slopes in the pre-developed condition but is now being collected and conveyed to a stormwater detention pond in the post-developed condition. The detention pond's emergency overflow usually discharges to the same location as the riser structure and overflow structure but sometimes discharges to a different location. In both scenarios, even though the detention pond will provide flow control for more frequent storm events (up to the 25-year for eastern Washington or 50-year for western Washington), the larger, less frequent storm events (100-year) may not have flow control. These scenarios need to be analyzed as part of the downstream analysis. Because the stormwater is now collected and conveyed to one or two discharge locations, there may be more flow at those discharge locations than in the pre-developed condition. If a situation is encountered where downstream impacts will result from the project, the corrective action must be applied to the project based on a practicability analysis.
 - If a project is flow control exempt, the conveyance system downstream of the project site shall be inspected to ensure adequate capacity. The PEO shall also analyze and document any changes to the downstream conveyance system, properties, and sensitive areas. If there are any negative impacts, the PEO shall perform a risk analysis showing what would happen if no actions were taken to minimize the negative impacts.

1-3.8 Existing Stormwater Drainage Conveyance System

During the scoping phase, a stormwater and hydraulic assessment is done for the project. If the assessment identified any parts of the existing stormwater drainage conveyance system (culverts, storm sewers, catch basins, manholes, inlets, grates, and ditches) to be repaired or replaced by the project, a physical inspection of the entire

existing stormwater drainage conveyance system within the project limits is required. There may be condition ratings for some of these existing stormwater features in Highway Activities Tracking System (HATS) or the Stormwater Features Inventory that may aid in determining the physical inspection requirements. Contact the State Hydraulics Office for culvert Level 1 and Level 2 inspection requirements and guidelines. See the 2020 AASHTO Culvert and Storm Drain System Inspection Guide for guidance on inspecting storm sewer, catch basins, manholes, inlets, grates, and ditches.

1-4 Storm Frequency Policy and Software/Design Tools

It is not practical to design hydraulic structures for the largest possible flow because this would result in unreasonably large and costly structures. Therefore, specific storm frequencies have been selected for various types of hydraulic structures. Selected storm frequencies for design purposes have considered the potential degree of damage to the roadway and adjacent property, potential hazard and inconvenience to the public, the number of users on the roadway, and the initial construction cost of the hydraulic structure.

The way in which these factors interrelate can be quite complex. WSDOT policy regarding design storm frequency for hydraulic structures has been established so the PEO does not have to perform a risk analysis for each structure on each project. The design storm frequency is referred to in terms of mean recurrence interval (MRI) of precipitation. A more detailed discussion of MRI can be found in [Chapter 2](#). New hydraulic structures shall also consider climate resilience for final design size.

Occasionally, the cost of damages may be so great or the need to preserve the level of services using the roadway during higher storm events may be so important that a higher MRI is appropriate. As this is a departure from conventional design, it must go to the RHE and the State Hydraulics Office early for discussion and concurrence. Good engineering judgment must be used to recognize these instances, and the design should be modified accordingly. In high-risk areas, a statistical risk analysis (benefit/cost) may be needed to arrive at the most suitable frequency. This must go to the RHE and the State Hydraulics Office early for discussion and concurrence.

For design of hydraulic features contact the RHE for approved software or application.

Any hydraulics software that has not been approved by the State Hydraulics Office will require a side-by-side comparison submitted for review. This should be done early in the schedule. Contact the RHE for additional guidance.

Table 1-2 presents a design reference chart and preapproved software.

Table 1-2 Design Reference

Type of Structure	MRI Chapter Reference	Preapproved Software
Gutters	5	Inlet spreadsheet
Storm sewer inlets on longitudinal slope	6 (MRI based on farthest downstream BMP or 10, whichever is greater)	Inlet spreadsheet
Storm sewer inlets on vertical curve sag/closed contour location	6 (MRI based on farthest downstream BMP or 50, whichever is greater)	Sag spreadsheet
Storm sewers	6 ^b (MRI based on farthest downstream BMP or 25)	StormShed3G
Ditches	4	StormShed3G or FHWA Hydraulic Toolbox
Non-fish passage culverts ^a	3	HY-8, HEC-RAS, SRH-2D
Temporary diversions ^a	3	StormShed3G, HY-8, HEC-RAS, SRH-2D
Water crossings	7 (Table 7-1)	SRH-2D
Stormwater BMP	See the Highway Runoff Manual	

Notes:

a = Coordinate with the Region Hydraulics Engineer to determine the appropriate software to use and potential reports required.

b = When tying into existing systems, the hydrologic methods used shall be the rational method

1-5 Hydraulic Report Review Schedule

Hydraulic reports developed for WSDOT must be reviewed and receive concurrence by the State Hydraulics Office or RHE (per [Table 1-1](#)) prior to the project advertisement date. The State Hydraulics Office has delegated concurrence authority to all State Hydraulics Office engineers and to some RHEs. PEOs shall contact the RHE to verify the hydraulic report review process.

To help facilitate an efficient design and review process, a hydraulic report review process has been developed. The review will consist of several checkpoints or milestones of the design as it is being developed, followed by a complete review of the report. The purpose of the milestones is to establish communication among the PEO, the RHE, and/or the State Hydraulics Office, and other internal and external stakeholders during the hydraulic design. Each prescribed milestone is considered complete when the [corresponding checklist](#) is completed, along with deliverables, and submitted to the RHE reviewer(s).

1-5.1 Milestones and Scheduling

WSDOT has developed the Project Management and Reporting System to track and manage projects. This system uses a master deliverable list (MDL) to identify major elements that occur during most projects. The MDL is intended to be a starting point for creating a work breakdown structure and identifies specific offices with which the PEO should communicate during project schedule development. The current MDL identifies

three options for hydraulics (see [Section 1-3](#)):

4. Type A report
 5. Type B report
 6. Specialty report

Regardless of the type of report, the milestones identified in [Table 1-3](#) apply. At the 10 percent milestone, all projects with hydraulic features shall develop an approved hydraulic schedule. At a minimum, the schedule shall include the milestones with agreed-upon dates by the PEO, the RHE, and the State Hydraulics Office. Additional guidance will be provided in future revisions to the *Hydraulics Manual*.

Table 1-3 Hydraulic Report Review Schedule

Percentage	Milestone	Project Alignment	Estimated Task Durations ^a	Date of Completion
0	Define project	Project definition complete MDL 320	TBD	TBD
10	Develop approved schedule	TBD	TBD	TBD
30	Design planning checklist complete	Design approved MDL 1685	TBD	TBD
60	Conceptual design complete	Complete prior to starting design	TBD	TBD
90	Draft hydraulic report submitted for review and concurrence	TBD	TBD	TBD
TBD	Revisions and supplements	Complete prior to hydraulic report archive	TBD	TBD
100	Hydraulic report concurrence	Complete prior to project design approval	TBD	TBD
CN	Hydraulic Report supplement	Complete prior to operationally complete	TBD	TBD

Notes:

MDL = master deliverable list.

PEO = Project Engineer's Office.

TBD = to be determined.

CN = construction phase of a project.

a. Allow additional time for projects submitted around major holidays.