

## Implementing the Flow Control Standard in Ecology's Western Washington Municipal Stormwater Permits

The Washington Department of Ecology (Ecology) prepared this guidance to answer questions from local governments about the stormwater flow control standard required under NPDES municipal stormwater permits in Western Washington. Stormwater flow control measures protect aquatic resources from high flows that erode and scour stream channels.

### Q: What is the Western Washington flow control standard?

**A:** The flow control standard for Western Washington is primarily found in Appendix 1 of the Western Washington Phase II Municipal Stormwater Permit (Phase II permit) and Volume I of Ecology's *Stormwater Management Manual for Western Washington*, February 2005 (SWMMWW).

The standard flow control requirement in the Phase II permit is based on flow durations:

*Flow durations on developed and redeveloped land must match pre-developed discharge rates from 50 percent of the 2-year peak flow to the full 50-year peak flow. Pre-developed land cover is assumed to be forested except where reasonable, historic information indicates the land cover was prairie prior to development.*

Design engineers and others use the "flow duration" standard to design detention or retention facilities on a development site. It differs from flow control standards that match pre-development and post-development peak stormwater flow rates produced by idealized rainstorms of certain recurrence intervals. Instead, the flow duration standard requires that predevelopment and post-

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development conditions match the amount of time (the duration) that specific flow rates are exceeded over a given period of time (usually 50 years). The standard is intended to prevent high flows in stream channels from lasting more hours-per-year than they have through most of their history.

Local governments are required to apply the flow control standard at specific thresholds for new development and redevelopment. Appendix 1 of the Phase II permit outlines and provides flow charts with the threshold conditions for applying the standard.

### **Q: What exceptions and alternatives exist to applying the standard flow control requirement on a site-specific basis?**

**A:** In the pages that follow, this guidance provides additional detail on options 1 through 7, below:

1. Ecology exempts direct discharges to salt water and many large receiving water bodies from the flow-control standard. See Ecology's SWMMWW Appendix 1-E for a list of Ecology-approved flow control exempt waterbodies.
2. Local governments may designate other waters as flow control exempt based upon a very flat stream gradient.
3. Discharges to stream reaches heavily influenced by tides or backwater conditions can also be candidates for a flow control exemption.
4. Local governments may establish a different flow control requirement for highly urbanized basins. Where the drainage area of a stream and all downstream basins have had at least 40 percent total impervious area since 1985, projects discharging to that stream need only match flow durations produced by the existing land cover condition. Once adopted, this requirement results in maintaining flows at durations existing at the date of adoption.
5. Local governments can undertake basin planning to establish an alternative flow control standard and/or a flow control strategy tailored to the flow regime of a specific basin.
6. Local governments may provide necessary flow control at regional stormwater facilities constructed at a down gradient site rather than at the development site itself. These regional facilities may be designed to meet the standard flow control requirement or may be designed to meet a tailored flow control requirement established through basin planning.
7. Local governments that have adopted a plan and schedule to fulfill flow control requirements in a downstream regional facility may exempt or institute a stop-loss provision for redevelopment

projects from compliance with the standard flow control requirement as applied to replaced impervious surfaces.

8. A local government may grant an “exception/variance” to the flow control requirement for instances of severe and unexpected economic hardship based on site-specific conditions. Specific criteria for making such a decision are listed in Appendix 1 of the Phase I and II Municipal Stormwater Permits.

### **1. Surface waters exempt from flow control**

#### **Q: How did Ecology determine which surface waters are flow control exempt, as listed in Appendix 1-E of the 2005 Stormwater Management Manual for Western Washington?**

**A:** Ecology based its decisions on the analysis presented in Washington Department of Transportation’s [\*Discharge of Stormwater to High Order Streams – Determining Exempt Reaches\*](#) (April 2004). The stream reaches that qualify for this exemption must be sufficiently large watercourses to accept a limited amount of un-detained stormwater discharge without sustaining significant environmental damage. The one-time analysis will not be repeated in the near future.

The analysis referenced above considered the following factors:

- Water bodies with at least 100-square miles of drainage area. The study found that most, but not all, river segments that drain more than 100 square miles qualify as exempt reaches.
- Modeling of flows at maximum build-out scenarios for impervious area and forest conversions based on local Comprehensive Plans, zoning, upstream land uses and ownership.
- Land cover criterion equations developed to predict stream stability.
- Presence of unconfined receiving channels.

In addition to stream size and future land cover conditions, the study identified methods for determining proximity requirements to limit the exemption area in order to protect small streams from excessive diversion. The two methods identified included (1) within a specified distance from the ordinary high water of a stream or other water body and (2) a more complex analysis to determine potential impacts on adjacent land uses and smaller water bodies in the floodplain.

#### **Q: How can local governments add surface waters to this list?**

**A:** Local governments seeking exemptions for additional surface waters may refer to the above study for methodologies to use. A study to satisfy the criteria for the flow control exempt reaches (including those discussed in #2 and #3 below) require the services of a qualified hydrogeologist

or hydrologic engineer. The local study must demonstrate how the proposed water body meets the study objectives using the factors above, and how the stormwater discharge meets the proximity requirements outlined in the study. Proponents are encouraged to contact their regional permit specialist to explore this option before undertaking such an analysis.

Ecology will review all exemption analyses and approve any qualifying surface waters for addition to the list in Appendix 1-E. Appendix 1-E will then be updated as the SWMMWW is revised.

## **2. Flow control exemptions for streams with a low gradient**

### **Q: How can local governments designate streams with a low gradient as flow control exempt?**

**A:** Local governments may designate waters as flow control exempt based upon a very flat stream gradient. Because prevention of stream erosion is part of the intent of the flow control standard, to obtain an exemption the local government must demonstrate that a stream with a very flat gradient will not be destabilized by flows produced when the drainage area is fully developed.

A professional hydrogeologist must estimate the maximum possible velocity in the channel (based upon build-out conditions in the drainage area) versus the likely velocity necessary to initiate significant bed load movement. Streams that have qualified as flow control exempt have typically been located in a broad, lowland floodplain of a large river and have rather cemented banks that do not show signs of recent destabilization (e.g., downed trees). The study referenced in #1 above provides an example of such an analysis.

Exemptions should not extend to discharges into the upper reaches of such creeks that may have higher gradients and different bed and bank material.

## **3. Flow control exemption for stream reaches with tidal or backwater conditions**

### **Q: How can local governments designate stream reaches with tidal or backwater conditions as flow control exempt?**

**A:** Discharges to stream reaches heavily influenced by tides or backwater conditions can also be candidates for a flow control exemption. In some tidally influenced reaches with low gradients, increases in discharge may not have a significant effect on the processes that control channel morphology. The combination of a low gradient and the possible effects of tidal backwater may dominate the channel forming processes to a far greater extent than potential stormwater discharges.

A local government can establish the flow control exemption by conducting hydrogeologic studies using hydrologic data and stream geometry to numerically model the discharge thresholds to demonstrate that the effects would be negligible. However, stream channels periodically exposed to higher velocities under some hydrologic conditions (e.g. low tide), probably do not warrant an exemption. Also, discharges are still subject to Minimum Requirement #4 of Appendix 1, which requires energy dissipation at the outfall site. An example of an analysis for a tidal prism is included in the study referenced in #1, above. Local governments interested in exploring this approach should contact their regional permit specialist prior to beginning such a study.

#### **4. Alternative flow control standard for highly urbanized basins**

##### **Q: What information is needed to demonstrate that a basin within my jurisdiction meets the 40 percent total impervious area threshold?**

**A:** The map below shows those basins that qualify for use of a flow duration standard that would require matching high flow durations of a project to the durations produced by the existing land cover condition. To qualify, a basin must have been at or above 40 percent total impervious area (TIA) since 1985. **The map depicts basins that exceeded 40 percent total impervious area as of 1986.** The Department of Ecology has used 1986 land covers as estimated from satellite images as the best available information upon which to make these designations.

Ecology published a 2004 discussion paper that explains the basis for the less stringent flow control standard for basins meeting the criteria. The implementation section at the end of the paper no longer applies to the updated (2010) map, but the background and rationale for the exemption does.

The map in GIS format and all associated metadata are available to local governments from Ecology's GIS Web site: [Western Washington Land Cover Change](#).

Permit holders interested in using alternative data or methods to demonstrate that a basin meets this criterion for a highly urbanized basin prior to 1985 should contact their Regional Permit Specialist prior to beginning such a study.



## 5. Alternative flow control standards using basin plans

### Q: How does a local government conduct a basin plan to establish a basin-specific flow control standard?

**A:** Through basin planning, local governments can change the default flow control standard based on analyses to determine the measures necessary to protect a stream channel from accelerated erosion.

Basin planning that intends to adjust the default flow control standard or propose an alternative high flow control strategy will require the use of computer models and field work to verify and support the models. The US Geological Survey has developed software called “GenScn” (Generation and Analysis of Model Simulation Scenarios) that can facilitate basin planning. This Windows-based application of Hydrological Simulation Program Fortran (HSPF) predicts water quality and quantity changes for multiple scenarios of land use and water management within a basin. Permit holders considering the use of basin/watershed plans to adjust the default flow control standard or strategy are encouraged to contact their regional permit specialist in the planning stage.

For a basin plan to serve as a means of modifying the flow control standard or strategy, the following conditions must be met:

- The plan must be formally adopted by all jurisdictions with responsibilities under the plan; and
- All ordinances or regulations called for by the plan must be in effect; and
- The basin plan must be reviewed and approved by Ecology.

Ecology’s flow duration standard is based upon a generalization that the threshold of significant bed load movement in western Washington streams occurs at 50 percent of the 2-year return stream flow. Through field observations and measurements, a local government may estimate a more appropriate threshold – higher or lower - for a specific stream. The alternative threshold can become the lower limit for the range of flows over which the duration standard applies. For instance, if the threshold is established at 70 percent of a 2-year return flow, the alternative standard must match the discharge durations of flows from the developed site to the range of pre-developed discharge rates from 70 percent of the 2-year peak flow up to the full 50-year peak flow.

Ecology cautions local governments seeking to determine a threshold of bed load movement for a stream whose channel has been significantly altered from its historic condition by stormwater flows. Alternative flow control standards and control strategies must be compatible with the restoration and maintenance of the designated beneficial uses of the stream. If the current

threshold of bed load movement is not compatible with creating and sustaining channel conditions for the beneficial uses, it is not an acceptable regulatory target.

Ecology has not published definitive guidance regarding the scope of work for basin planning. Ecology hopes to have such guidance available for urbanized basins in the future after assessing the procedures and experiences of some test cases. We encourage you to contact your regional permit specialist if you interested in conducting a basin plan.

### **Q: How does a local government implement an alternative flow control standard or strategy through basin planning?**

**A:** In order to implement the alternative flow control standard developed through a basin plan, all of the affected jurisdictions must adopt the appropriate elements of the basin plan into local codes and other documents as appropriate. Local governments must train engineers, inspectors, and planners to inform developers of the plan requirements and to review site plans for consistency with the elements of the basin plan that apply to the project.

If the basin plan includes additional local government responsibilities for regional facilities or other measures, the obligations must be met according to the timing and sequence outlined in the approved plan. Construction of regional facilities or other actions may be required prior to approving projects using the alternative flow control standard.

### **Q: Can local governments use stream protection and restoration measures to help meet flow control standards?**

**A:** Basin planning is well-suited to control stream channel erosion for both existing and future conditions. Flow control standards developed from a basin plan may include a combination of on-site, regional, and stream protection and rehabilitation measures. On-site standards are usually the primary mechanism to protect streams from the impacts of increased high flows in future conditions. Regional flow control facilities are used primarily to correct existing stream erosion problems. Basin plans can evaluate retrofitting opportunities, such as modified outlets for existing stormwater detention facilities.

In-stream protection and rehabilitation measures may be applied where stream channel erosion problems exist that will not be corrected by on-site or regional facilities. However, Ecology urges caution in the application of such measures. If the causes of the stream channel erosion problems still exist, repairs to the physical expression of those problems may be short-lived. In some instances, it may be prudent to apply in-stream measures to reduce impacts until the basin hydrology improves.



## 6. Regional facilities for flow control

### **Q: How can local governments use regional facilities to help meet flow control standards?**

**A:** Rather than requiring each individual project to construct a flow control facility, a local government may locate a regional facility to serve future new and redevelopment in a drainage area. A regional facility may be sized to also serve existing development. Regional facilities that are designed to provide flow control sufficient to meet the standard flow control requirement need no additional review by Ecology.

Regional facilities designed to meet a flow control requirement other than matching durations produced by the historical condition must be approved by Ecology. An alternative requirement may apply to regional facilities based upon 1) the results of an approved basin plan, or 2) a strategy that uses a combination of onsite facilities and the regional facility to meet the standard flow control requirement at the discharge point. The local government must track the land areas draining to the facility to ensure that they do not at any time exceed the design capacity of the regional facility. Regional facilities intended to provide flow control for new development must be constructed and online before the new development occurs.

As noted above, it is possible to meet the default flow control standard, or a basin-specific flow control standard, through a combination of an on-site flow control requirement at project sites that drain to a regional facility providing additional flow attenuation. This option requires use of an HSPF-based watershed model (a continuous simulation model such as the Western Washington Hydrologic Model) to determine an acceptable combination of on-site project requirements and (a) regional facility design(s) that achieve the target flow control.

## 7. Using regional facilities for redevelopment

### **Q: How can local governments use regional facilities to help meet flow control standards for redevelopment?**

**A:** The local government can exempt or institute a stop-loss provision (cost limit) for the replaced impervious surfaces at a redevelopment project from flow control (or treatment) if it has a plan and a schedule for a regional facility whose tributary service area includes that redevelopment site. The “stop-loss” and exemption provisions only apply to the replaced impervious surfaces. It is acceptable to delay treatment and flow control of replaced impervious surfaces because impervious surfaces that will be replaced are already exerting impacts on the local receiving water. It is not against state law to delay treatment and flow control of those areas, especially if it can be done more cost-effectively in regional facilities.

The local government cannot apply a stop-loss provision to discharges from new impervious surfaces which would have the effect of allowing such discharges to be untreated or uncontrolled

for any significant length of time. Doing so would cause additional stress to the local receiving water and violate the AKART provision of state law.

Regional facilities must be functional before or nearly simultaneous with the completion of any new development or new impervious surfaces at redevelopment projects if the regional facilities are intended to meet the treatment or flow control requirements of those projects.

**Q: What steps are required for cities and counties to adopt a regional facilities approach for redevelopment?**

**A:** Cities and counties need to evaluate the feasibility of establishing regional facilities in terms of land available, staff resources to track and implement the program, and financial commitments. Regional facilities must be designed by a qualified hydrologic engineer using an appropriate hydrologic model to size the facility for the required flows.

The local government must establish a program with the following elements:

- A financial structure capable of supporting the program.
- Administrative procedures to track the total obligations to serve redevelopment projects that have been excused from applying flow control facilities on-site and to ensure that the regional facility capacity is not over-committed.

## **8. Flow control and wetlands**

**Q: How do I reconcile the standard flow control requirement with the requirement to maintain hydrologic wetland conditions?**

**A:** Appendix I of the municipal stormwater permit recognizes that there may be situations where meeting the standard flow control requirement for discharges to a stream would adversely impact the hydrologic conditions of a down gradient wetland (e.g., by “starving” the wetland of vital flows). As a result, the requirement to maintain the hydrologic conditions, hydrophilic vegetation, and substrate characteristics of the wetland becomes the overriding concern and a different flow control standard may be established. If this is the case, the discharge from the wetland to a down gradient stream may still need to be controlled to assure that the discharge from the MS4 to the wetland and then to the stream does not adversely impact stream flows or channel stability.