

Response to Comments On the 2012 Stormwater Management Manual for Western Washington

Washington Department of Ecology
August 1, 2012

Stormwater Management Manual for Western Washington



Stormwater Management Manual for Western Washington



August 2012



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Introduction

The Washington Department of Ecology (Ecology) issues this Response to Comments (RTC) on the Draft 2012 Stormwater Management Manual for Western Washington (SWMWW or manual).

Ecology held a 90 day public comment period (November 4, 2011 – February 3, 2012) on the Draft 2012 SWMMWW. During the comment period Ecology gave five public workshops throughout Western Washington on the Draft 2012 SWMMWW. At the workshops, Ecology explained the proposed changes to the manual and answered questions.

Ecology considered the comments received during the 90-day comment period and issued the final 2012 SWMMWW on August 1, 2012. The 2012 Stormwater Management Manual for Western Washington can be downloaded at Ecology's website:

<https://fortress.wa.gov/ecy/publications/summarypages/1210030.html>.

To find more information about the 2012 SWMMWW, to view comment letters on the Draft 2012 SWMMWW, or to learn more information on the public process that went in to the 2012 SWMMWW please visit this website:

<http://www.ecy.wa.gov/programs/wq/stormwater/wwstormwatermanual/2012draft/2012draftSWMMWW.html>.

To help reviewers understand the changes between the 2005 SWMMWW and the 2012 SWMMWW, Ecology compiled a table listing the location, description of changes, and reasons for the changes, available here:

www.ecy.wa.gov/programs/wq/stormwater/manual/changechart.pdf.

Please note that Ecology received some comments that were on both the Municipal Stormwater Permits and on the SWMMWW. These comments were considered under the Municipal Stormwater Permits; please refer to this website to view those comments and a response to them from Ecology:

<http://www.ecy.wa.gov/programs/wq/stormwater/municipal/2012Reissuance.html>

Commenter Index

Ecology received numerous comments and has grouped them and assigned each topic an issue number. Below is the Commenter Index that lists the name of each commenter and the issue numbers associated with their comments. The index includes the name of the person who signed each comment letter (or email). Where appropriate, Ecology lists an acronym or shortened name to identify the commenter.

Commenter Name	Signatory	Issue Number	Name Used in Response
2020 Engineering	Mark S. Buehrer, PE	1.20, 3.21	
AKS Engineering & Forestry	John M. Meier, PE	1.30	
AMEC Environment & Infrastructure	Patrick Hsieh, PE	4.6	AMEC
Aspect Consulting LLC	J. Scott Kindred, PE	1.43, 3.17, 3.19, 3.20, 3.21, 3.22, 3.23, 3.33	Aspect Consulting
Associated Earth Sciences, Inc.	David J Baumgarten	1.46, 3.2	
Ballard Stormwater Consortium	Kim McDonald & Liz Tennant	G.6, 3.26, 3.1	
Baseline Engineering Inc.	Jerry Waldron, PE	G.2, G.3, 1.25, 1.20	Baseline Engineering
Bob Jacobs	Bob Jacobs	G.6, 1.9	
Browne Engineering, Inc.	Adam Wheeler, P.E.	1.12	Browne Engineering
Cathy Backlund	Cathy Backlund	G.6	
City of Arlington	Bill Blake	2.4, 2.5, 2.6	
City of Battle Ground	Bryan Kast	1.2	
City of Bellevue	Nav Otal	G.2, 1.9, 1.11, 1.12, 1.20, 1.36, 1.37, 1.40, 1.45, 2.2, 3.1, 3.2, 3.19, 3.21, 3.23, 3.26, 3.33, 5.1, 5.11, 5.20, 5.23, 5.29, 5.37, 5.42	
City of Bellingham	William M. Reilly	1.10, 1.18, 1.21, 1.43, 3.17, 3.20, 3.21, 3.26, 3.33	
City of Fife	Ken Gill, PE	1.18	
City of Kelso	Van McKay, PE	1.34, 2.1, 2.4, 3.20	

Commenter Name	Signatory	Issue Number	Name Used in Response
City of Kent	Tim LaPorte, PE	G.2, G.4, 1.2, 1.10, 1.11, 1.12, 1.14, 1.18, 1.19, 1.22, 1.27, 1.29, 1.43, 2.2, 3.17, 5.23	
City of Kirkland	Kelli Jones (Yamamoto)	1.1, 5.16, 5.34, 5.40	
City of Lakewood	Greg Vigoren, PE	3.2	
City of Longview	Steve Warner	G.2, 2.1, 2.4, 3.20	
City of Marysville	Kevin M. Nielsen	2.6	
City of Mukilteo	R. James Niggemyer, PE	G.1, G.2, G.4,	
City of Oak Harbor	Brad Gluth	1.21, 1.43	
City of Olympia	Andy Haub, P.E.	1.18, 1.45, 2.2, 2.6	
City of Port Orchard	Andrea Archer, P.E.	G.1, G.4,	
City of Redmond	Peter Holte & William J. Campbell, P.E.	G.1, G.2, 1.3, 1.7, 1.9, 1.11, 1.12, 1.20, 1.31, 1.43, 2.6, 3.8, 3.19, 3.22, 3.23, 3.26, 3.27, 3.33, 4.1, 4.2, 5.9, 5.10, 5.16, 5.21, 5.43	
City of Renton	Ronald J. Straka, PE	G.1, G.2, G.4, 1.11, 1.12, 1.18, 1.22, 1.23, 1.31, 1.43, 2.2, 3.33	
City of SeaTac	Donald Robinett	G.1, G.4,	
City of Seattle	Ray Hoffman, Peter Hahn, Diane Sugimura, Bruce Bachen	1.11, 1.15, 1.16, 1.18, 1.20, 1.23, 1.25, 1.34, 2.1, 2.4, 2.6, 3.13, 3.17, 3.20, 3.21, 3.22, 3.26, 3.33, 4.1, 4.2, 4.3, 4.4, 4.5, 4.6, 4.7, 4.8, 5.1, 5.2, 5.3, 5.4, 5.6, 5.8, 5.9, 5.10, 5.12, 5.14, 5.16, 5.17, 5.18, 5.22, 5.23, 5.24, 5.29, 5.30, 5.31, 5.32, 5.37, 5.39, 5.41, 5.43, 5.46, 5.47, 5.48, 5.50, 5.51	
City of Shoreline	Mark Relph	1.9	
City of Tacoma	Geoffrey Smyth, P.E.	G.3, 1.2, 1.8, 1.9, 1.10, 1.11, 1.14, 1.20, 1.23, 1.25, 1.26, 1.27, 1.28, 1.29, 1.30, 1.31, 1.33, 1.34, 1.35, 1.39, 1.40, 1.41, 1.42, 1.43, 2.4, 2.5, 2.6, 3.1, 3.2, 3.6, 3.8, 3.9, 3.12, 3.13, 3.14, 3.15, 3.18, 3.19, 3.20, 3.21, 3.22, 3.23, 3.24, 3.26, 3.32, 3.33, 4.1, 4.3, 5.1, 5.3, 5.6, 5.10, 5.14, 5.15, 5.18, 5.20, 5.22, 5.23, 5.24, 5.25, 5.26, 5.28, 5.29, 5.30, 5.32, 5.37, 5.38, 5.41, 5.43, 5.48, 5.52	
Clark County	Rod Swanson	G.2, 1.10, 1.11, 1.12, 1.19, 1.23, 1.25, 1.32, 1.36, 1.37, 1.43, 1.46, 3.17, 3.19, 3.24, 3.25, 3.32, 5.24	

Commenter Name	Signatory	Issue Number	Name Used in Response
Cowlitz County	Patrick N. Harbison	G.1, G.3, 1.2, 1.4, 1.8, 1.11, 1.21, 1.27, 1.30, 1.31, 1.34, 1.35, 1.41, 2.5, 3.5, 3.23, 3.24, 3.26, 3.31, 3.33, 4.1, 5.1, 5.5, 5.6, 5.9, 5.10, 5.12, 5.23, 5.28, 5.43	
Cowlitz County Soil and Water Conservation District	Russell Kastberg	1.11	
D.R. Horton	Jennifer Reiner, PE	1.18	
DeepRoot Green Infrastructure, LLC	Brenda Guglielmina	3.30, 3.32, 3.33	
ECO 3	Phil Fortunato	2.1, 2.4	
Forest Concepts, LLC	Michael C. Perry	2.1	
Harmsen & Associates, Inc.	David Harmsen, PE & Michael E. Ryan, PE	G.4, 1.23, 1.30, 3.17	
Harry Branch	Harry Branch	G.6, 1.46	
Hart Crowser, Inc	Roy E. Jensen	G.2, 3.17, 3.19, 3.20, 3.21, 3.22, 3.23	Hart Crowser
King County	Curt W. Crawford, PE	G.2, G.3, G.6, 1.1, 1.2, 1.3, 1.6, 1.7, 1.8, 1.9, 1.16, 1.20, 1.23, 1.31, 1.46, 2.1, 2.3, 3.1, 3.3, 3.18, 3.20, 3.21, 3.22, 3.23, 3.26, 3.33, 4.1, 4.4, 4.5, 4.6, 4.8, 5.5, 5.9, 5.10, 5.11, 5.15, 5.17, 5.19, 5.23, 5.29, 5.34, 5.35, 5.36, 5.37, 5.38, 5.43, 5.44, 5.45, 5.46, 5.51	
Kitsap County Public Works	David A. Tucker, P.E.	3.24, 5.22, 5.25, 5.29	Kitsap County
Land Technologies, Inc.	Merle Ash	G.2, 1.43	Land Technologies
LDC, Inc	Mark Villwock, PE	G.2, G.4, 1.18, 1.27, 3.19	LDC Inc.
Nathan Holloway	Nathan Holloway	2.1	
Parsons Brinckerhoff	Carmen O. Vanier, PE	1.12	
Pete Haase	Pete Haase	1.18	
Pierce County	Jeff Rudolph	1.10, 1.11, 3.1, 3.21, 5.23, 5.49	

Commenter Name	Signatory	Issue Number	Name Used in Response
Port of Seattle	Marilyn Guthrie	G.2, 1.18, 1.28, 1.30, 1.42, 1.43, 3.21	
Port of Seattle-Tacoma International Airport	Bob Duffner	1.18, 1.20, 1.21, 3.20	
Port of Vancouver	Matt Graves	1.9, 1.11, 1.18, 1.30, 1.43, 1.44, 1.45, 1.46, 3.17, 3.20, 3.21, 3.33, 4.1, 4.3, 4.6, 5.43	
Puget Sound Partnership	Gerry O'Keefe	2.6	
Richard Paulen	Richard Paulen	G.4	
SGA Engineering, PLLC	Eric E. Golemo, PE	1.23, 1.43, 3.17, 3.21, 3.23	SGA Engineering
Skagit County Administrative Services	Tim Holloran	1.14, 1.15, 1.22	Skagit County
Snohomish County	Bree Urban	G.1, 1.1, 1.2, 1.4, 1.6, 1.8, 1.10, 1.11, 1.12, 1.13, 1.14, 1.17, 1.20, 1.21, 1.22, 1.23, 1.30, 1.31, 1.36, 2.1, 2.2, 2.4, 2.5, 2.6, 3.1, 3.3, 3.7, 3.12, 3.13, 3.14, 3.15, 3.16, 3.19, 3.20, 3.21, 3.23, 3.24, 3.26, 3.33, 4.3, 4.4, 4.6, 5.2, 5.3, 5.6, 5.9, 5.10, 5.11, 5.17, 5.23, 5.24, 5.29, 5.32, 5.33, 5.38, 5.39, 5.40, 5.41, 5.43, 5.46, 5.47,	
Squeaky Wheels Bicycle Advocacy Group	Ross Hathaway	3.33	
SvR Design Company	Kathryn Gwilym, PE	3.32, 3.33, 5.2, 5.10, 5.12, 5.34, 5.37, 5.38, 5.41,	
Thomas W. Holz	Thomas W. Holz	3.1	
Thurston County	Jim Bachmeier & Dale Rancour	1.6, 1.8, 1.10, 1.11, 1.12, 1.17, 1.20, 1.21, 1.23, 1.24, 1.27, 1.29, 1.30, 1.31, 1.35, 1.42, 1.46, 2.1, 2.2, 2.4, 2.5, 2.6, 3.1, 3.2, 3.4, 3.5, 3.10, 3.13, 3.14, 3.15, 3.16, 3.17, 3.18, 3.19, 3.20, 3.22, 3.23, 3.24, 3.26, 3.29, 3.31, 3.32, 3.33, 4.1, 4.2, 4.6, 5.2, 5.4, 5.6, 5.7, 5.9, 5.10, 5.12, 5.23, 5.25, 5.27, 5.35, 5.37, 5.41, 5.42, 5.43, 5.44, 5.51	
Tupper, Mack, Wells PLLC	Sue Barragan	G.5, 1.5, 1.8, 1.11	Tupper et al

Commenter Name	Signatory	Issue Number	Name Used in Response
United States Department of the Interior Fish and Wildlife Service	Ken S. Berg	1.6, 1.13, 1.22, 1.26, 1.28	US Fish and Wildlife
Washington Department of Fish and Wildlife	George Fornes	1.12, 1.32, 1.37, 1.38	WA Fish & Wildlife
Washington State Department of Natural Resources	Shayne Cothorn	1.8	WSDNR
Washington State Department of Transportation	Megan White, PE & Mark Maurer, PE	1.8, 1.11, 1.24, 2.6, 3.2, 3.5, 3.11, 3.17, 3.26, 3.33, 5.6, 5.7, 5.13, 5.23, 5.28, 5.47	WSDOT
WSU Puyallup Green Stormwater	Curtis Hinman	1.15, 1.20, 1.44, 2.4, 3.20, 3.21, 3.22, 3.23, 3.24, 3.26, 3.33	WSU Puyallup

General Comments

RTC G.1: Legality of Manual as a Guidance Document

Commenters: City of Mukilteo, City of SeaTac, City of Port Orchard, City of Renton, City of Redmond, Clark County, Snohomish County

Summary of range of comments:

- The SWMMWW should go through the appropriate review processes, including SEPA review, economic impact assessment, and be adopted in accordance with the state's Administrative Procedures Act for rulemaking.
- Previous stormwater design manuals have followed the rulemaking process during review. Use the rulemaking process for future stormwater manual updates.
- If the manual is considered as a means to prove out new approaches and technology, it should not be adopted by reference in an NPDES permit where it has the force of law.
- The manual needs to have clear language to support its use as a regulatory tool, but still provide flexibility in planning and designing stormwater controls.

- Delete all references to the LID Technical Guidance Manual from the Stormwater Manual. Or, if Ecology chooses to retain the LID Technical Guidance Manual as a part of the Stormwater Manual, the LID Technical Guidance Manual must undergo the same type of public review and comment process as did the Stormwater Manual and the Permit.

Response to the range of comments:

Ecology followed the same review process for the 2012 *Stormwater Management Manual for Western Washington* update as followed during the review of the 2005 *Stormwater Management Manual for Western Washington*. Previous Manuals did not go through the formal rulemaking process.

Ecology stormwater manuals are not rules. The manuals have no independent authority and as such, are not the underlying basis for permit requirements. The underlying basis for the Permits and other Regulatory Actions is the federal Clean Water Act and/or State Water Pollution Control Act. The manuals represent an acceptable way to comply with existing state and federal regulatory requirements for managing stormwater runoff from construction sites, and post-construction stormwater runoff associated with new development and redevelopment.

The use and reference to the stormwater manuals is consistent with Ecology’s policy on the use of such manuals. The Policy Statement published in the Washington State Register (WSR 03-15-091) stated:

“Federal, state, and local permits may refer to this Manual or the BMPs contained in this manual. In most cases, elements of the Manual or the Manual itself may become permit requirements only if the authorities and standards under which the permit is issued support such a requirement. It is not permissible or appropriate to include the minimum requirements, thresholds, definitions, BMP selection processes, and BMP design criteria of this Manual as permit conditions or use the Manual as a review standard solely because they are published in the Manual or part of the Manual.”

It is appropriate, even expected, that Ecology require use of its best available guidance in a permit that must satisfy federal and state statutory requirements (MEP and AKART, respectively).

Ecology is no longer relying on the new Low Impact Development (LID) Technical Guidance Manual for permit requirements because it was not completed at the date of permit reissuance. The final LID requirements are contained in documents available during the appeal period.

RTC G.2: Comment Period

Commenters: City of Mukilteo, City of Bellevue, City of Longview, City of Kent, Clark County, City of Redmond, City of Renton, Hart Crower, King County, Land Technologies, Port of Seattle, Baseline Engineering Inc., LDC Inc.

Summary of range of comments:

- Ecology should have a longer comment period.
- Multiple sections of the manual (see sections 3.1.1, 3.1.2, 3.3.8, 3.4.2, 7.1, 7.9, 9.4, etc.) contain language that reads: "this section will be updated to be complementary with chapter# in the updated Low Impact Development Technical Guidance Manual for Puget Sound". Cross-review between documents when neither is complete severely limits our ability to provide complete review of either document.
- The Draft LID Manual should have been released concurrently with the Draft SWMMWW.
- Review process ESHB 1478 (WA State Legislature 2011) Comment - This bill was overwhelmingly passed by the State Legislature during the 2011 session. We believe Ecology should factor in the overarching intent of ESHB 1478 and provide adequate time to review all documents.
- Ecology should defer the adoption of the 2012 Stormwater Manual and not be a requirement for the 2013-2018 NPDES Phase II Permit until all language and guidelines are included in the manual itself, comments from jurisdictions are addressed, the Low Impact Development Technical Guidance for Puget Sound is adopted, and a new WWHM model that will allow for the modeling of LIDs and the LID performance standards is developed and available to the general public. Then, the manual should go through a second review process that will allow a complete review of the proposed requirements and comply with the state's Administrative Procedures Act for rulemaking.
- Ecology should synchronize the timing and sequence of permits and manuals in a manner that provides the reviewer the ability to focus on documents individually and provide substantial, productive comments related to the permit and its associated documents.
- My comments are taken under advisement but the language of the manual does not change. I would be interested to see if there is log or minutes on how comments have either been incorporated or rejected within the SWMMWW.

Response to the range of comments:

Ecology provided a 90 day public comment period, even though it was not required. Ecology believes that, given the LID advisory process and the 2011 preliminary draft informal comment period of Appendix 1 which corresponds to Chapter 2 of Volume I, the formal comment period materials and timeframes were sufficient.

Ecology acknowledges that the package of LID documents to review was substantial, and for this reason provided a 90 day public comment period. The majority of LID requirements, including thresholds, minimum requirements, and feasibility criteria were in Appendix 1 of the Western Washington permits published on October 19, 2011. Two weeks later, Ecology

released the draft SWMMWW with a table detailing each proposed change and allowed for a three-month comment period.

The Puget Sound Partnership (PSP) released the final draft of the LID guidebook for Integrating LID into Local Codes in November 2011. PSP published the first draft for comment in June 2011 and held three public workshops, with Ecology holding a fourth workshop in Vancouver. PSP incorporated the comments into the version issued in November, 2011 and made it available for over two months during Ecology's public comment period.

Ecology acknowledges the delay in the PSP's release of the draft LID Technical Guidance Manual, which was issued in early January for a separate comment period conducted by the PSP.

Ecology chose to provide all the documents for concurrent review in response to requests made during the May-June 2011 informal LID review, and also in order to meet the reissuance schedule in RCW 90.48.260.

Ecology has provided this response to comments on the manual so that commenters can understand how their comments have been incorporated, or not, into the final document.

RTC G.3: Manual Format

Commenters: Baseline Engineering Inc., King County, City of Tacoma, Cowlitz County

Summary of range of comments:

- Combine all volumes and reduce the redundancy between Volume I and the other volumes.
- In addition to hard-copy, publish the SWMMWW in an electronic version with hyperlinks between all table of contents, index entries, figures, tables, text references, and citations.
- All referenced external documents should be included with the Manual as Appendixes, and cross-referenced and hyperlinked in the electronic (PDF) version.
- Ecology has singled out some redundancies between Volume I and Volume V for elimination. We agree with this and encourage that effort to expand.
- There appears to be an effort to include some citations for updated material but existing text is short on citations, and there are citations in the main body of text that do not appear in the Reference section.
- The Manual should provide to the greatest extent possible, the intent and basis for each section and design.
- Ecology should consider working with WSDOT or using WSDOT standard specification format to develop standard specifications or provide template Special Provisions for stormwater facilities.

- Throughout the manual, a variety of words are used including, shall, should, must, may, recommended, suggested. The use of these words is unclear at times. All requirements should use the verb shall. A number of instances throughout the manual items are indicted and/or implied as mandatory and then a verb other than shall is used. It is important that requirements are clearly indicated for consistent enforcement by all permittees.
- The Stormwater Management Manual for Western Washington has multiple acronyms within the manual and the permit (SWMMWW, SMMWW, etc). We recommend the acronym for the manual be 'SMMWW' as used throughout the permit and in places within the Manual itself.

Response to the range of comments:

Ecology prefers to maintain the separation of volumes to address separate Minimum Requirements in separate volumes (Vol. II, Minimum Requirement #2; Vol. III, Minimum Requirement #7; Vol IV, Minimum Requirement #4; and Vol. V, Minimum Requirement #6). Both Volumes 3 and 5 cover Minimum Requirement #5, depending on the size of the project.

The 2012 Stormwater Management Manual for Western Washington will be primarily digital. Ecology agrees that the manual should have hyperlinks between chapters, sections, BMPs, tables, figures, etc. and has made a substantial effort to make this possible in the 2012 version. Ecology has decided to make the manual available as a combined PDF file and as individual volume PDF files.

If you want a hard copy of the Manual, you can obtain a copy through <https://prtonline.myprintdesk.net/DSF/storefront.aspx?6xni2of2cF1OAY5jHVVIUrUsqozrCjF3xgL/DdBBf+Sre9e470j4aMR+LcLIWmKS> . There is a cost for the printing.

Ecology worked hard to eliminate redundancies, add appropriate citations, limit the use of confusing words, and minimize acronyms.

The acronym for the *Stormwater Management Manual for Western Washington* is SWMMWW. Ecology chose to use this acronym universally throughout the manual and permit.

RTC G.4: Cost

Commenters: City of Kent, City of Mukilteo, City of SeaTac, City of Port Orchard, City of Renton, Harmsen & Associates, LDC Inc., Richard Paulen

Summary of range of comments:

- The proposed requirements will have significant economic impacts on small businesses and developers. Therefore, a small business economic impact statement should be completed.

- It seems that much of this draft was worked together with no consideration of economic means.
- Municipalities are already reeling from loss of income. The general population has shown an unwillingness to be taxed further to support government programs. Where once development provided funding for review staff, the general economy has dried up that source of funding and it likely will not be coming back soon.
- Radical increase in LID practices, compliance with mandatory lists and performance standards will have a significant cost impact to jurisdictions and the benefit of implementing these is unknown. Compliance with new LID practices will require retraining of engineers, developers, builders and City staff which will result in an immeasurable increase in training cost, construction cost and City staff time.
- DOE should provide information regarding increased cost to development by following this manual, as well as the increased cost to cities in implementing the additional inspection and project review that is required in conjunction with the manual and new permit. The public needs to be aware of the cost of implementation of this new manual so that they can provide informed feedback.
- We are very concerned that the proposed changes will have a very large, unintended impact to affordable housing.

Response to the range of comments:

Ecology acknowledges and is aware of the challenges of local governments to meet expanded requirements in the permit and SWMMWW during a time of shrinking revenue. This was addressed in 2012 legislation amending RCW 90.48.260 to direct Ecology to reissue the existing Phase I and Western Washington Phase II permits unmodified for one year, prior to making effective the updated five-year permits. The implementation delay also pertains to the requirement to follow the guidance in the SWMMWW. The hiatus in new requirements will provide time for economic recovery, and give permittees time to prepare and pass budgets, adjust utility rates, and plan to meet new requirements.

Changes in the SWMMWW are a direct result of changes in the permits. The manual does not add any new requirements or costs beyond those resulting from the permits.

Ecology disagrees that the changes to the Stormwater Management Manual for Western Washington require a small business economic impact statement.

The state has supported LID training and education for over 10 years. New training opportunities should be forthcoming as a result of legislation passed in the last session. Ecology has begun the process of seeking advice and professional assistance in developing a comprehensive, coordinated training plan on LID for the State.

RTC G.5: Timing of Changes

Commenters: Tupper et al

Summary of range of comments:

- The SWMM Does Not Yet Apply to Permittees Under the CSWGP or ISGP. Ecology should add language to the SWMMWW clarifying that the SWMMWW does not apply to permittees until those permits that explicitly incorporate the SWMMWW through a permit modification, including an opportunity for public notice and comment.
- The CSWGP is ambiguous as to whether permittees must alter their BMPs for consistency with revisions to the SWMMWW. The Ecology website states CSWGP Permittees have the option to continue using the 2005 SWMMWW or the final 2012 SWMMWW. The revised SWMMWW states that BMPs must be drawn from stormwater management manuals published or approved by Ecology, or BMPs that are demonstrably equivalent. The CSWGP, in contrast, states BMPs must be consistent with the “most recent edition” of the applicable SWMM. The current SWMMWW states that dischargers must select BMPs from the SWMM if that Manual was available 120 days before the BMP was chosen. The revised SWMMWW in Volume I, section 1.6.9 appears to require dischargers under the existing CSWGP to immediately comply with BMPs contained in any revised edition of the SWMM."

Response to the range of comments:

The appropriate version of the Stormwater Management Manual for Western Washington for permittees to use is defined in each NPDES Permit. The ISWGP states that “BMPs shall be consistent with Stormwater Management Manual for Western Washington (2005 edition) or revisions to the manual” (S3.A.3.a). Ecology interprets the term “revisions” to be direct edits to the 2005 Manual. Ecology considers development of the 2012 a reissuance.

For the CSWGP, the permit states that “BMPs must be consistent with Stormwater Management Manual for Western Washington (most recent edition) (S9.C.1). Ecology interprets the term “most recent edition” as the edition in effect at the effective date of the permit. For the current CSWGP, that would be the 2005 edition.

Ecology has edited the SWMMWW webpage to reflect the current interpretation of the appropriate version of the SWMMWW used for the ISWGP and the CSWGP.

Ecology provided language in the Volume II discussion of the SWPPP and the Elements within the SWPPP to address whether the text in the 2012 SWMMWW applies to the CSWGP, the Municipal permits, or both.

RTC G.6: Other

Commenters: Bob Jacobs, Harry Branch, King County, Cathy Backlund, Ballard Stormwater Consortium

Summary of range of comments:

- Ecology's task here is to put in place regulations which scientific research says are necessary to protect our streams and Puget Sound. This requires getting into land use regulation. But Ecology officials have said publicly that they refuse to do this. Which means that state officials are refusing to do the job they are paid to do. This is simply not justifiable. Let the legislature play politics. Administrative agencies should not do so. By refusing to do what is needed here, you are assuring the death of Puget Sound. If you even outlined the needed steps publicly it would help. The public could act. But by representing that your proposal will take care of the problem, you are keeping the public in the dark, thus becoming part of the problem.
- Go Above and Beyond Language encouraging action should be replaced with clear requirements. From experience, we can say with a high degree of certainty that if something is not required unequivocally, and implementation would cost more than the minimum requirements (using the term broadly here), few if any applicants will opt for the more protective more expensive option.
- I briefly looked over this Stormwater Management Manual and want to request that a similar manual be created for lake care. Many issues in this manual can be used for a lake care Manual which would provide guidance and clarify State Standards for lake water care. I would also request that this lake care Manual be required to be used with chemical discharge permits. This would help direct all involved to be concerned about all aspects of meeting the requirements of CWA & ESA and keeping our lake water clean.
- Thank you for creating this Stormwater Management Manual--very helpful to understand the impact of stormwater to our waterways!"

Response to the range of comments:

Please also refer to the [*Response to Comments on the Municipal Stormwater Permits Part V – Comments on Western Washington Appendix I, Low Impact Development \(LID\) and Watershed-based Stormwater Planning.*](#)

Ecology has not represented that the updated manual will “take care of the problem.” Please read Section 1.7.5 of Chapter 1 of Volume 1. Because the prescriptions in the manual will not likely fully address the impacts of development on the surface waters, Ecology has added additional requirements into the Municipal Stormwater Permits. Special Condition S5.C.5.b. of the Phase I municipal stormwater permit for western Washington, and special condition S5.C.4.f of the Phase II municipal stormwater permit for western Washington require municipalities to update their local land development codes to incorporate LID principles.

In addition, special condition S5.C.5.c of the Phase I permit and special condition S5.C.4.g of the Phase II permit require watershed planning in selected basins. The intent of the planning is to have local governments investigate the likely cumulative impact of their current (or proposed) land use plans on the surface water resources. Where those projections indicate impacts that would be counter to the requirements and goals of the Clean Water Act, the local governments are to investigate alternative strategies to avoid those impacts. This type of watershed planning is a new subject area that Ecology hopes will become a commonly-used tool to

influence land use planning decisions. Because it is a new tool, Ecology is not yet prepared to require it of all local governments.

Ecology stormwater manuals are not rules. The manuals have no independent authority and as such, are not the underlying basis for permit requirements. Ecology encourages permittees to install the highest possible level of treatment, but cannot require that a permittee install an increased level of treatment.

Thank you for your comments on lake care. For Ecology to develop a lake management manual similar to the Stormwater Management Manual, a fully funded lakes program is needed. At this time, a lakes program at Ecology is not funded outside of permitting and grants. Funding for such a program is something that the Legislature must provide to Ecology.

In order for Ecology to be able to require following a lake management manual the Legislature must also clarify its intent. Currently, it has stated under RCW 90.48.447: *"The legislature finds that the environmental, recreational, and aesthetic values of many of the state's lakes are threatened by the invasion of nuisance and noxious aquatic weeds. Once established, these nuisance and noxious aquatic weeds can colonize the shallow shorelines and other areas of lakes with dense surface vegetation mats that degrade water quality, pose a threat to swimmers, and restrict use of lakes. Algae can generate health and safety conditions dangerous to fish, wildlife, and humans. The current environmental impact statement is causing difficulty in responding to environmentally damaging weed and algae problems. Many commercially available herbicides have been demonstrated to be effective in controlling nuisance and noxious aquatic weeds and algae and do not pose a risk to the environment or public health. The purpose of this act is to allow the use of commercially available herbicides that have been approved by the environmental protection agency and the department of agriculture and subject to rigorous evaluation by the department of ecology through an environmental impact statement for the aquatic plant management program."* [1999 c 255 § 1.]

Volume I Response to Comments

Chapter 1

RTC 1.1: Use of Equivalent Manuals

Commenters: King County, Snohomish County, City of Kirkland

Summary of range of comments:

- Clarify that the Permittee may choose to use the Manual or an equivalent manual approved by Ecology, make the language more consistent with the Municipals Stormwater Permits.

- Add language regarding the use of manuals approved as equivalent to the 2005 SWMMWW until the timelines in the Municipal Stormwater Permit require the use of the 2012 SWMMWW.
- Why was the Alternative Technical Manuals section in Section 1.6.4 deleted when these directives are still in effect?
- Maintain the option of using equivalent alternative technical manuals.

Response to the range of comments:

Ecology's various NPDES Permits (Municipal, Industrial, Construction, etc.) have different timelines and requirements regarding the use of Ecology approved equivalent manuals. Operators and Permittees may use Ecology approved equivalent manuals according to the requirements and timelines detailed in the permits appropriate to their facility.

Ecology deleted the Alternative Technical Manuals section in Section 1.6.4 because it is superseded by the relevant special conditions in the Phase I (S5.C.5.a. i. and ii) and Phase II (S5.C.4.a.i and ii) Western Washington Municipal Stormwater Permits. Ecology has not added any new language in the 2012 SWMMWW regarding the use of Ecology approved equivalent manuals. Operators and Permittees should refer to their permit(s) for information.

Ecology has not yet approved any manuals as equivalent to the 2012 SWMMWW. Ecology anticipates approving equivalent manuals in the future and plans to modify Appendix 10, Part 2, of the Municipal Stormwater Phase I Permit accordingly. Ecology plans to list manuals approved as equivalent at this web address:

<http://www.ecy.wa.gov/programs/wq/stormwater/municipal/Phase1equivalentstormwatermanualsWestern.html>.

RTC 1.2: Section 1.6.15 Underground Injection Control (UIC) Authorizations

Commenters: City of Kent, City of Tacoma, Cowlitz County, King County, Snohomish County

Summary of range of comments:

- Provide a brief discussion on Ecology's UIC program that directs readers where to find more information on Ecology's website.
- The list of UIC examples is misleading. It would be better to refer readers to Ecology's guidance on this issue than to provide examples.
- Add the definition of a UIC.
- UIC requirements offered by Ecology in Guidance for UIC Wells that Manage Stormwater (2006) are different than this manual's requirements for infiltration, and requirements for LID BMPs.
- Are rain gardens with perforated pipes or infiltration PIT test facilities that are deeper than they are wide will require a separate UIC permit or authorization from Ecology?

Response to the range of comments:

Ecology has removed the list of UIC examples and has provided the definition of a UIC Well. Ecology has added a link to a Memorandum from EPA that provides guidance on stormwater infiltration practices/technologies that have the potential to be a regulated under the UIC program. Ecology has also added a link to the home page for Ecology's UIC program.

Ecology will consider updates to the 2006 UIC guidance document to address conflicts with guidance in the 2012 Stormwater Management Manual for Western Washington.

Rain gardens that install perforated underdrain pipes to facilitate infiltration would generally be considered as needing UIC permit authorization. However, in most situations, underdrain piping is intended to move stormwater from under the bioretention or rain garden toward a surface discharge. These designs do not need UIC permit authorization. An alternative rain garden design involves construction of a dry well to move stormwater, that has passed through a bioretention soil mix, into a deeper underground layer. These dry wells will need a UIC permit authorization.

Infiltration PIT test facilities are used to determine soil properties, are temporary in nature, and are not used to discharge stormwater into the ground. Infiltration PIT test facilities are not covered under the UIC permit.

RTC 1.3: Phase I & Phase II Municipal Stormwater Permit, and the Relationship between the Municipal Stormwater Permits to other Ecology NPDES Permits

Commenters: City of Redmond, King County

Summary of range of comments:

- In Section 1.6.5 and 1.6.6 the word "must" seems out of place in what Ecology states is a strictly technical guidance manual. It is also quite convoluted to say 'don't use a specific part of this manual, use a Permit Appendix instead.
- Please verify that all of the deleted text just prior to section 1.6.6 is no longer applicable. Please provide guidance defining how the Industrial Permit relates to the MS4 Permit. Please also address sand and gravel permits, boat yard permits, and individual industrial permits.
- Please provide guidance as to how the SWMMWW, the NPDES Municipal Permit, and non-municipal State Waste Discharge Stormwater permits relate to one another.
- Create a table or flowchart showing the relationship for different users of the manual.

Response to the range of comments:

The use of “must” is appropriate in Section 1.6.5 and 1.6.6 because the Municipal Stormwater General Permits require Permittees to refer to Appendix 1 of their permit. These sections in the SWMMWW provide a reminder to Municipal Stormwater Permittees of their duty under their permit to refer to Appendix 1 and are not requirements on their own.

All of the deleted information in Section 1.6.6 is outdated or inaccurate. Ecology has decided to remove this language as opposed to updating it.

Local jurisdictions (cities, counties, tribes, etc.) have review authority over the development of sites in their jurisdiction regardless of NPDES permits. The relationship between the Municipal Stormwater Permits, Industrial Permit, and other NPDES Permits issued by Ecology is dependent on site location.

Ecology’s NPDES permits are state waste discharge permits. Washington Administrative Code (WAC) [173-216-140](#) defines the typical relationship between state waste discharge permits and NPDES permits.

It is out of the scope of this edit of the SWMMWW to detail the relationships between all of Ecology’s NPDES permits, State waste discharge permits, and local jurisdictions. Refer to local jurisdictions for more information on the relationship between multiple permits and local regulations.

RTC 1.4: On-site Stormwater Management BMPs

Commenters: Cowlitz County, Snohomish County

Summary of range of comments:

- In Section 1.5.1 remove on-site stormwater management as a BMP Type because it is not a separate BMP classification.
- Move the discussion on On-Site Stormwater Management BMPs under Treatment BMPs.

- The language in Section 1.5.5 that refers to certain types of BMPs not generally viewed as LID practices is confusing.

Response to the range of comments:

Ecology removed on-site stormwater management as a BMP Type from Section 1.5.1. Ecology has revised Section 1.5.5 to clarify that on-site stormwater management BMPs can be flow control or treatment BMPs and that these BMPs are located in Volume III and V of the manual. Section 1.5.5 also now clarifies that construction BMPs can be source control, flow control, or treatment BMPs and they are listed in Volume II of the manual.

RTC 1.5: Section 1.6.8 Industrial Stormwater General Permit

Commenters: Tupper et al

Summary of range of comments:

- The Draft SWMMWW is not consistent with ecology's frequently asked questions for the ISGP. Ecology's discussion of the ISGP in Volume I, section 1.6.8 does not make any reference to the obligation to submit an engineering justification. Likewise, there is no reference to this obligation in the SWMMWW's discussion of the presumptive approach to protecting water quality in Volume I, section 1.6.3. Ecology should explain the significance, if any, of the omission of this requirement from the ISGP FAQ document.
- Section 1.6.8 of the Draft SWMMWW is not consistent with the proposed revisions to the ISGP and RCW 90.48.555. According to Vol. I, section 1.6.8, ISGP permittees must meet benchmarks, and to meet benchmarks facilities should consider BMPs that are demonstrably equivalent, as defined by the ISGP. This expectation is not consistent with the presumption of compliance in RCW 90.48.555.

Response to the range of comments:

Ecology has considered these comments and has decided that this section must be limited to a general overview of the ISGP framework, rather than a comprehensive list of the specific ISGP requirements for corrective actions and compliance with water quality standards. The ISGP FAQ is outside the scope of this edit to the SWMMWW. The SWMMWW is consistent with the ISGP and Revised Code of Washington (RCW) [90.48.555](#). Ecology has not revised Section 1.6.8 based on these comments.

RTC 1.6: Comments on Chapter I, that Ecology considered but didn't result in a change.

Commenters: King County, Thurston County, Snohomish County, US Fish and Wildlife

Summary of range of comments:

- Implementing the SWMMWW is the starting point for development throughout the Western Washington watershed and by allowing local jurisdictions to only implement more stringent, not less stringent requirements, a level playing field is provided for developers.

- Revise the language in Section 1.5.2 for source control BMPs and in Section 1.5.4 for flow control BMPs and wetlands to be more specific and complete, example language provided.
- A technology-based stormwater requirement (AKART) will only be effective where facilities and BMPs are properly sited and designed, and then maintained over time to preserve their intended design function and performance (Section 1.6.3).
- Commenter agrees with the Action Agenda Priorities in Section 1.6.4.
- Flexibility in regards to retrofits (Section 1.6.2) is important, and will be essential to improve controls for discharges from some MS4s.
- Meeting the Puget Sound Partnership's Action Agenda will be difficult for a variety of reasons.

Response to the range of comments:

Ecology carefully considered the comments above but they did not result in a specific change to the SWMMWW.

RTC 1.7: Comments that are beyond the scope of work for this edit to the SWMMWW.

Commenters: City of Redmond, King County

Summary of range of comments:

- Reorganize and align Volume V - Chapter 2 and Appendix I-F so that the information is combined and organized in a manner similar to that found in Appendix 1 of the Draft Phase II Permit.
- The Puget Sound Action agenda is currently out for review. Update language concerning the objectives of the Puget Sound Agenda.
- We strongly encourage Ecology to revisit the appropriateness of allowing UIC for stormwater infiltration. Ecology needs to:
 - Revisit if surfaces classified as non-pollution generating may be infiltrated without treatment.
 - Evaluate a wider range of chemicals.
 - Consider that mechanisms for organic pollutant treatment.
 - Consider that if UIC infiltrate travels laterally to a surface water body, then surface water quality standards are also a concern.

Response to the range of comments:

Ecology carefully considered the comments above but found them to be beyond the scope of this edit.

RTC 1.8: Corrections, Typos, and Minor Changes in Chapter I

Commenters: Cowlitz County, King County, Snohomish County, City of Tacoma, Thurston County, Tupper et al, WSDNR, WSDOT

Summary of range of comments:

- In Section 1.1.1, second paragraph, revise the first sentence because “establishes” implies regulation and the manual is a guidance document.
- Remove the word “Expanded” from the title of Section 1.2.
- In Section 1.5.3 add more examples of treatment BMPs.
- In Section 1.5.4 revise the language to be more complete.
- In Section 1.6.2 add a link to Section 1.6.4 regarding the retrofit objectives in the Puget Sound Action Plan.
- In Section 1.6.3 remove the reference to Section 1.6.4.
- In Section 1.6.7 add a reference for areas “identified as a limiting factor to salmon recovery,” or describe how a municipality can determine if this applies.
- In Section 1.6.9 Ecology should clarify the activities that trigger coverage under the CSWGP.
- Correct the reference in Section 1.6.13 for the Department of Natural Resource’s use authorizations.
- In Section 1.7.5 correct the reference from Figure 1.3 to Figure 1.7.3.

Response to the range of comments:

Ecology made these suggested changes.

Ecology corrected Section 1.6.9 to clarify and match the language in the CSWGP for activities that trigger coverage under the CSWGP. However, please note that Section 1.6.9 is a general overview of the CSWGP framework, rather than a comprehensive list of the specific CSWGP requirements. Operators and permittees should always refer to the language in the CSWGP for determination of coverage.

Chapter 2

RTC 1.9: General Comments

Commenters: King County, City of Redmond, City of Shoreline, Port of Vancouver, Bob Jacobs, City of Bellevue, City of Tacoma

Summary of range of comments:

- Incorporate applicable statements from Appendix 1.
- Use correct names for municipal permits.

- Is there something new in the 2012 Manual that allows for connections from crawl space pumps to MS4s, or is Ecology referring to overland discharges?
- Provide project examples concerning how to decide if Minimum Requirements apply to a project.
- Proposal inadequate because it doesn't require preservation of 70% or more of native vegetation.
- First paragraph of 2.1 tells permittees to use Appendix 1, not bold font statements. Yet Section 2.5 indicates use of bold font statements.
- Update appropriate sections of Chapters 2 and 3 to correspond with the new LID requirements and the guidance in the LID manual.

Response to the range of comments:

Ecology has placed statements in Appendix 1 that are applicable to municipal stormwater permittees, but are not applicable to other municipalities. It would confuse those other municipalities to insert those statements within Volume 1.

Ecology plans to provide project examples to demonstrate the proper use of the thresholds during trainings on the revised manual.

Ecology considers it inappropriate to place specific native vegetation retention requirements and impervious surface limits for development within a stormwater manual intended for use on a site basis. Such requirements and limits are more appropriately placed within site development codes adopted by the local governments. Ecology has a separate requirement within the Municipal Stormwater Permits for local governments to consider establishing such limits and requirements within updates to their development codes. In addition, Ecology has established a pilot watershed planning requirement for the Phase I counties in which cumulative impacts of impervious surfaces and native vegetation loss will have to be considered.

Ecology and WSU Puyallup have coordinated development of this stormwater manual and the LID manual. Ecology has tried to eliminate conflicting provisions and to have similar provisions where the documents have overlapping guidance.

RTC 1.10: Requests for modifications to the Exemptions Section 2.2

Commenters: Clark County, Snohomish County, City of Tacoma, City of Bellingham, Thurston County, City of Kent, Pierce County

Summary of range of comments:

- Exempt public road projects from Minimum (Min.) Requirement #5 if additional right-of-way purchase is necessary.
- Expand references to roads so that it applies to other paved surfaces too, such as parking lots.

- Road projects would now be subject to Min. Requirement #5 when replacing road surfaces. This will escalate costs and delay projects.
- Add subtitle for forest practices.
- Add an exemption for recreational trail maintenance
- Exempt road maintenance operations

Response to the range of comments:

Ecology has added an infeasibility criterion for permeable pavement where existing impervious surface is being replaced. However, where the county is installing a new road or widening a road, Ecology considers it appropriate that at least the new surfaces be installed with the latest stormwater requirements where it is feasible to do so.

The exemptions section has been re-worded so that it applies to other pavement surfaces too. A subtitle for forest practices is added.

Ecology has not written a blanket exemption from application of Minimum Requirements #1 through #5 to road projects that are replacing road surfaces. Ecology has recommended an infeasibility criteria for permeable pavement when replacing impervious surfaces. This means that projects replacing road surfaces or other surfaces are still appropriately subject to Minimum Requirements #1 through #4, and still have to consider whether other LID BMPs are feasible for the project.

Ecology is reluctant to establish a blanket exemption for recreational trail maintenance and construction. Where a new trail would concentrate runoff and send it offsite, it should meet new stormwater requirements. Most recreational trail construction should be able to “fully disperse stormwater runoff” with practices that are in-scale with that construction. Trail maintenance activities (filling of ruts, cutting back vegetation, etc) should not trigger the thresholds for new or redevelopment.

Road maintenance operations, as defined in the manual, are already exempted.

RTC 1.11: Change, add, or modify definitions in Section 2.3

Commenters: Snohomish County, Thurston County, Cowlitz County, Cowlitz County Soil and Water Conservation District, City of Seattle, Pierce County, Tupper et al, City of Tacoma, WSDOT, City of Renton, City of Kent, City of Bellevue, Port of Vancouver, City of Redmond

Summary of range of comments:

- Delete concept of hard surface, or eliminate permeable pavement from hard surfaces; change thresholds that apply to permeable pavements.
- Eliminate hard surfaces and add permeable pavement under the definition of impervious.
- Eliminate LID principles.

- Change definitions for arterials, commercial agriculture, converted pervious, hard surface, LID, maintenance, native vegetation, land disturbing activity, receiving waters, effective impervious surface, Certified erosion and sediment control lead, bioretention, rain gardens, replaced impervious surface, erodible or leachable materials, pollution-generating pervious surfaces, pollution-generating hard surface.
- Define vegetation change that triggers requirements.
- Add definition for effective hard surface, vehicle equipment storage yards, basin planning, watershed planning, stormwater treatment and flow control BMP/facility, administrator.
- Change “vehicular use” definition.
- Distinguish “normal maintenance” and “normal repair.”
- Distinguish permeable pavement facility from permeable pavement surface.
- Update definitions in the Volume 1 glossary.
- Clarify if synthetic turf fields are PGPS.
- Add definitions for project and project site.
- All roofs should be considered pollution-generating surfaces.
- Any permeable pavement subjected to pesticides/herbicides is pollution-generating.
- Don’t consider replacement of road surfaces as replaced impervious surface unless there is a grade change exceeding 0.25 feet.

Response to the range of comments:

Ecology has changed a number of definitions from what was in the proposed draft. Please also refer to the [Response to Comments on the Municipal Stormwater Permits Part V – Comments on Western Washington Appendix I, Low Impact Development \(LID\) and Watershed-based Stormwater Planning](#) to see reasons for those individual changes. Additional explanations are provided below for some of the above comments.

In regard to the terms LID, LID BMPs, and LID Principles, the proposed definitions were changed only marginally. Generally, the use of underdrains results in no to very little hydrologic benefit and therefore does not meet the definition of LID. The LID definition was agreed upon by the LID Advisory Committees. It was crafted to express the goal of LID. Any performance standards for new and redevelopment needed to be based upon helping to achieve the goal. The term, “pre-disturbance” is intended to mean before commencement of historical land clearing practices by European settlers. The term, “pre-developed” means a land cover condition prior to the proposed project. A pre-developed condition to be used in a particular regulatory requirement must be specified.

Ecology has dropped the term converted pervious surface and has added a definition for converted vegetation. The definition does not refer to a drainage system. The definition does reference the downspout infiltration systems specified in Volume III.

Ecology has added a definition for administrator. A definition already exists in the Glossary of Volume I for the terms: basin plan, project, and project site. Ecology has updated definitions within the glossary.

The term, “stormwater treatment and flow control BMP/Facilities” has a specific meaning within the context of the municipal stormwater permits. Check the permit.

Ecology has chosen not to distinguish between normal maintenance and normal repair.

RTC 1.12: Section 2.4.1: Thresholds in regard to New Development

Commenters: Snohomish County, Clark County, Parsons Brinckerhoff, Thurston County, City of Renton, City of Redmond, City of Bellevue, City of Kent, WA Fish & Wildlife, Browne Engineering

Summary of range of comments:

- Land conversion triggers don't make sense, as pasture to lawn may be an improvement if BMP T5.13 used.
- Some thresholds continue use of impervious instead of hard surface. What is intended? Use impervious surfaces? Use hard surfaces?
- Using the same thresholds for hard surfaces discourages the use of permeable pavements.
- MR #2 should not apply to all projects. Should apply to projects that need a permit.
- Replaced surfaces should not trigger requirements in new development
- Stormwater shouldn't be triggered for creation of rural plats with large lots that are just land subdivisions with no planned improvements.
- Why deletion of term “native”?
- Add an explanation regarding how regional facilities are an option to the site default requirements.
- Extend LID requirements to projects of all sizes.

Response to the range of comments:

Please also refer to the [Response to Comments on the Municipal Stormwater Permits Part V – Comments on Western Washington Appendix I, Low Impact Development \(LID\) and Watershed-based Stormwater Planning](#) for more detailed responses to these and other comments.

Ecology has added statements in the supplemental guidelines in Volume I concerning the use of regional facilities to meet these minimum requirements.

Ecology has checked its use of terms hard surfaces and impervious surfaces, and believes it uses those terms purposefully and correctly. The concept of hard surfaces is used in the initial threshold decisions so that the same amount of surface whether impervious or permeable pavement triggers the same requirements. Whether using permeable or impervious

pavements, Ecology wants the stormwater to be managed to prevent surface water and groundwater pollution.

The term native is deleted because Ecology wants stormwater requirements to apply when projects are converting the existing vegetation, whether native or not, to a lawn or landscaped situation.

An explanation for how regional facilities are an option is included in the supplemental guidelines.

Min. Requirement #2 must apply to all projects. However, not all projects need submit a Construction Stormwater Pollution Prevention Plan (SWPPP) – just those exceeding the 2,000 sq. ft./7,000 sq. ft. thresholds. Ecology recommends local governments provide a single sheet of instructions and diagrams of simple methods to prevent construction site erosion on small sites.

Ecology does not concur in the extension of LID requirements to projects smaller than the thresholds in the manual. Ecology encourages use of LID principles and BMPs for those small projects.

RTC 1.13: Section 2.4.2 Thresholds in regard to Redevelopment

Commenters: US Fish and Wildlife, Snohomish County

Summary of range of comments:

- Replaced surfaces should have upgraded stormwater management on any project exceeding 5,000 sq. ft. of new surface.
- Some thresholds continue use of impervious instead of hard surface. What is intended?
- Are all “public roads” projects able to use equivalent areas outside of project limits, or just roads built by public agencies?
- Please provide guidance concerning how to determine if areas have similar “pollution-generating potential”

Response to the range of comments

Ecology did not propose to change the area or cost triggers for application of treatment and flow control requirements to replaced impervious surfaces on redevelopment projects.

The draft text erroneously referred to impervious surfaces in some text locations where it should have been replaced with hard surfaces.

The intent is that one public entity be responsible for all stormwater runoff from the road – inside and outside of the project limits. So providing flow control and treatment for an

equivalent area involves solving an existing stormwater problem while adding a new problem – without transferring any responsibility to another entity.

Similar pollutant-generating potential is indicated by their use. For instance, road segments that have the same annual average traffic would have the same pollutant generating potential. Parking lots serving employees at commercial businesses have similar potential. A parking lot with high stall turnover (e.g., a fast food business) has higher potential than a commercial business lot primarily serving employees.

RTC 1.14: Minimum Requirement #1

Commenters: Snohomish County, City of Kent, Skagit County, City of Tacoma

Summary of range of comments:

- The requirement is vague, ambiguous.
- Too much discretion re what is feasible. Provide guidance.
- Eliminate “feasible.” Requires professional services and subjective opinions.
- Not appropriate for stormwater site plan. Already part of M.R. #5.

Response to the range of comments:

Ecology acknowledges it is ambiguous. Ecology does not intend it to add any additional requirement than what will be required when the local government’s development codes are updated to include LID principles. So, if a designer follows local site development codes, they should be in compliance with Minimum Requirement #1.

This concept is not already part of Minimum Requirement #5.

RTC 1.15: Minimum Requirement #2

Commenters: City of Seattle, Skagit County, WSU Puyallup

Summary of range of comments:

- Require dewatering discharge to get local government approval for discharge to a drainage system, and require checking for flooding or erosion impacts in receiving water.
- Too much knowledge expected of homeowners for erosion control threats and BMPs for small sites.
- New Element for LID should reference guidance in LID Manual

Response to the range of comments

Text prohibits flooding and erosion impacts in receiving water. Volume II guidance references the LID Manual for additional guidance.

Small projects can create big water quality problems. So, it is not appropriate to ignore them. The regulatory strategy is set up to be easier for small projects. If a homeowner has a project that does not exceed the 2,000 sq. ft. of hard surface or 7,000 sq. ft. of land disturbed thresholds, they do not have to prepare a Construction SWPPP. The local codes must still require the homeowner to prevent erosion and the discharge of sediments and other pollutants from the construction site. We encourage local governments to distribute a one page instructional sheet about construction site erosion control with all of their building permits. If the homeowner's project exceeds the 2,000/7,000 sq. ft. thresholds indicated above, a construction site SWPPP is necessary. Local government can develop standard Construction SWPPP forms that homeowners can complete and submit as their Construction SWPPP.

RTC 1.16: Minimum Requirement #3 Source Control

Commenters: City of Seattle, King County

Summary of range of comments:

- Does text mean comply with Volume IV?
- Structural source control BMPs should be included in Permanent Stormwater Plan and building plans.

Response to the range of comments:

The statement means that projects should use the information in Volume IV to develop their source control strategy.

Ecology added a statement within Chapter 4 of Volume 1 concerning inclusion of structural source control BMPs.

RTC 1.17: Minimum Requirement #4 Preservation of Natural Drainage Systems and Outfalls

Commenters: Snohomish County, Thurston County

Summary of range of comments:

- What is the basis for the recommendations? Which is preferred?
- The referenced flow rates are for 1 hour time steps. What are the rates for 15-minute time steps.

Response to the range of comments:

These recommendations are unchanged since the 2001 edition of the SWMMWW. Ecology used recommendations in the King County Surface Water Drainage Manual in effect at that time. As these recommendations are in the supplemental guidelines within Volume I local governments have complete discretion whether to use them. However, local governments must adopt something to meet the intent of the minimum requirement.

Designers could increase the referenced flow rates by a factor of 1.5 when using the results from an approved continuous runoff model that provides 15-minute flow rates.

RTC 1.18: Minimum Requirement #5, General comments

Commenters: D.R. Horton, LDC, Inc., Pete Haase, Port of Seattle, Port of Seattle-Tacoma International Airport, City of Bellingham, City of Fife, City of Seattle, City of Renton, Port of Vancouver, City of Olympia, City of Kent

Summary of range of comments:

- LID should have a cost feasibility evaluation. Should not exceed 5% of cost without LID.
- AKART analysis should be done and an economic impact analysis.
- LID should not reduce the developable area by more than 5%.
- There should be an applicability section and an exemption section in the requirement.
- LID should not apply to flow control exempt waters.
- LID should not apply to industrial stormwater permittees.
- Stormwater manual should only contain requirements. Leave details to LID Manual.
- Will have undesired results where using permeable pavement and bioretention/rain gardens.
- Put all treatment, on-site, and flow control BMPs into one volume.
- Remove requirement to revise local codes to minimize impervious and preserve vegetation.
- Don't require LID because of cost and liability reasons.
- Use a flow chart to display decision points.
- MR #5 will increase design and construction costs, complicate review.
- Remove MR #5. LID not ready for widespread use – maintenance, longevity, inspection, cost issues. Make it optional.
- References to outside UGA geared only to Phase 1 communities.
- MR #5 should not apply to flow exempt surface waters.

Response to the range of comments:

Please also refer to the [*Response to Comments on the Municipal Stormwater Permits Part V – Comments on Western Washington Appendix I, Low Impact Development \(LID\) and Watershed-based Stormwater Planning*](#) for a more detailed responses to these and other comments.

Ecology will provide updated cost examples of developments with and without LID features. However, cost is not the over-riding factor in this decision. Though it could be cheaper to stick strictly with conventional stormwater management BMPs, we know that approach does not always protect water quality and the beneficial uses of fresh water or marine systems. The flow reduction and pollutant control benefits that LID BMPs and principles (as required and defined in the permit) provide, may still not be adequate to protect the aquatic natural resources

either. However, until we learn how to make better land use decisions using more accurate predictive tools concerning impacts to the aquatic resources, we are obligated to make use of the best available methods.

The only LID options that require space dedicated just for the purpose of stormwater management are bioretention and rain gardens. The list option requires those facilities, if used, to be at least 5% of the area draining to them.

Ecology has included an applicability section, as well as infeasibility statements, within the description of most of the LID BMP options. There is a separate “exemption” section in the manual that applies to the application of stormwater requirements. Ecology does not concur that there should be an exemptions section that just applies to Minimum Requirement #5.

Ecology does not concur with the suggestion to exempt industrial facilities from local stormwater code requirements. The industrial stormwater permit requirements will drive what happens for pollution control at existing industrial facilities. In addition, most industrial facilities in western Washington are located in areas exempted from LID requirements. New industrial facilities should be required to consider ways in which their site may be developed in ways that reduce the generation of pollutants by the activities planned for the site.

The manual does not have a requirement to revise local codes to minimize impervious surfaces and retain native vegetation. The benefits of those actions are mentioned and encouraged in the supplemental guidelines for Minimum Requirement #5. Supplemental guidelines are not requirements. Ecology has placed the requirement to review local codes with the goals of minimizing impervious surfaces and retaining native vegetation into the Municipal Stormwater Permits for Western Washington. Please refer to those permits and to the guidance document prepared by the Puget Sound Partnership entitled: “Integrating LID into Local Codes: A Guidebook for Local Governments.”

References to requirements outside of UGA’s primarily affect all counties in Western Washington, not just Phase I counties.

Ecology has continued to organize the manual along the subject areas established twenty years ago. The manual includes critical design criteria for proper design of LID BMPs, just as it does for treatment, flow control, erosion and sediment control, and source control BMPs. Ecology has chosen not to include design criteria for LID BMPs where those design features do not affect the minimum functionality of the BMP. For instance, Ecology is not specifying the various ways in which permeable pavements may be constructed.

RTC 1.19: Minimum Requirement #5, Performance Standard

Commenters: Clark County, City of Kent

Summary of range of comments:

- What level of protection are we trying to achieve in matching 8% of the 2-year flow?
- WWHM unreliable at 8% of 2-year flow. Test WWHM for range of project types.
- Standard not adequately developed, tested, and used.

Response to the range of comments:

The standard has a more sound science basis than the federal LID standard and any other LID performance standard that has been adopted by a water quality regulatory agency. The flow duration matching requirement will result in matching more of the flow duration curve produced by natural conditions. Based on computer modeling matching this portion of the flow duration curve will also result in matching or nearly matching the annual total of interflow and surface runoff produced by a natural land cover situation.

Watershed modeling work accomplished by King County estimated that retrofitting 80% of the existing impervious surfaces in the Juanita Creek Basin so that they met the combined Flow Control and LID Performance Standard would result in improving hydrologic conditions in the basin to a level correlated with a probable B-IBI score that is associated with maintaining conditions suitable for salmonids.

Ecology ran a number of trial runs of different development types on different soil types to determine what would need to be done to achieve the LID performance standard. Ecology ran these tests using the existing, publicly available WWHM. The standard is sufficiently developed and tested. The standard is not utilized by the industry only because it has never been proposed before. In terms of the current computer modeling methods, it will utilize the same flow duration matching procedures as have been used for the flow control standard. The extent of the duration curve to be matched will just be larger. This standard was chosen because it would be easier to implement than the other similar (e.g., annual runoff volume) options considered.

RTC 1.20: Minimum Requirement #5, Feasibility-related comments

Commenters: 2020 Engineering, Baseline Engineering, City of Battle Ground, City of Seattle, Snohomish County, City of Tacoma, Port of Seattle-Tacoma International Airport, King County, Thurston County, WSU Puyallup, City of Bellevue, City of Redmond

Summary of range of comments:

- Feasibility criteria should be in SWMMWW or in Section 8 of Appendix 1 of permit
- Criteria with “cannot reasonably be” is ambiguous.
- For small projects, it will be hard to get reliable information regarding infiltration rates.
- Add where bioretention would threaten pre-existing road surfaces.
- How does municipality decide if a utility or road is threatened?
- How does municipality confirm lack of space for bioretention at redevelopment?
- Include a monetary value on extent feasible.

- Infeasibility for drive aisles of lots is a design option. Delete.
- Placement of a sand treatment layer is a feasibility criteria?
- Need explicit criteria for where sanding roads makes permeable pavement infeasible.
- Clarify that BMP T5.13 is always feasible.
- Require to extent feasible without causing flooding, erosion, or groundwater impacts
- Identify where to find feasibility criteria.
- 0.3 in/hr eliminates bioretention in too many areas. Use lower rate and require more detailed site analysis for low infiltration rate sites; or no minimum rate and require design options like storage and orifices.
- Feasibility due to low infiltration should be based on long-term rates.

Response to the range of comments:

Please also refer to the [Response to Comments on the Municipal Stormwater Permits Part V – Comments on Western Washington Appendix I, Low Impact Development \(LID\) and Watershed-based Stormwater Planning](#) for more detailed responses to these and other comments.

Ecology has been specific where it can be specific. There is a necessity to leave room for the site professional to make judgment calls based on site-specific knowledge. The site professional must document and submit the basis for their feasibility decisions to the local government who also must make a judgment call.

Ecology cannot prevent a “gaming” of this system. There will be situations in which professional judgment is invoked without a sound basis to forego LID BMPs. To some extent, there must be a buy-in from all parties: designers, site professionals, local governments, and the public that LID is a desirable feature and is a tool that should be used to help protect the aquatic natural resources.

Ecology concurs that infeasibility criteria belong in the stormwater manual. Ecology has inserted them into BMP descriptions in Volumes III and V.

Ecology has provided its recommendations concerning the field testing needed to design LID BMPs into a development. Local governments can adopt those procedures or develop alternative procedures that they consider appropriate for their area and design needs.

BMP T5.13 feasible everywhere except steep slopes.

It is true that virtually any amount of infiltration on a site is a plus. However, the slower the infiltration rate, the more likely that the design will not function as desired, or that there will be other consequences, such as prolonged ponding and resurfacing. Ecology has recommended a 0.3 in/hr initial infiltration rate for the soils beneath the facility based on local experiences, the need to prevent ponding for 72 consecutive hours (mosquito breeding), and the general classification of soil capabilities.

Seattle's experience in the much-publicized Ballard rain gardens design was that they had compromised designs where the initial infiltration rate was below about 0.3 inches per hour. That rate is also published by the NRCS as a rate which classifies soils as Type A. Type A soils are supposed to have little runoff potential.

There also is a need to prevent prolonged ponding. Prolonged ponding reduces the ability of oxygen to penetrate the soils. This reduces the rate at which soil organisms can breakdown organic pollutants. Prolonged ponding also provides conditions more suitable for successful mosquito larvae hatching. A number of species types require 72 hours of ponded water. The *LID Technical Guidance Manual for the Puget Sound Basin* recommends designs that will eliminate surface ponding in 24 hours. At a minimum initial rate of 0.3 inches per hour, 7 inches of water can infiltrate in a 24-hour period. However, the designer must also consider a correction factor based on variability of soils at the site and the number of locations tested. See Section 3.4 of Volume III. So, at these low rates, the designer may want to restrict the total maximum depth of ponded water.

Ecology considers the initial, field verified infiltration rate to be the best basis for deciding feasibility. Long-term rates are determined through use of correction factors that are assigned – within limits - based upon professional opinion. That unnecessarily introduces a subjective factor into the feasibility decision.

The use of underdrains minimizes the hydrologic benefit of LID techniques. The hydrologic benefit is the primary reason for use of LID techniques. Requiring sites with extremely low infiltration rates to use underdrains and orifices still has significantly reduced benefits as the runoff volume is not significantly reduced. Consequently, Ecology chooses not to mandate use of LID techniques where they must be underdrained in order to be functional.

In regard to the infeasibility of permeable pavements on frequently sanded roads, Ecology has added a statement that it does not consider most Puget Sound lowland roads to meet this criterion. During the course of a winter season, some roads are sanded during infrequent, extreme storm events. That is not a basis for disqualifying the road for use of permeable pavement.

RTC 1.21: Use of Permeable pavements

Commenter: Cowlitz County, Port of Seattle-Tacoma International Airport, Snohomish County, City of Bellingham, Thurston County, City of Oak Harbor

Summary of range of comments:

- Long-term maintenance costs are a concern. Do not support permeable pavement for replaced road surfaces. Can't chip seal permeable pavement. Cleaning requirements adds costs.
- For small projects, how can you make feasibility decision if no infiltration testing?

- Need more information on life expectancy, resurfacing issues, design issues, costs.
- Need more guidance re under-storage base course needs or failures will result.

Response to the range of comments:

Please also refer to the [Response to Comments on the Municipal Stormwater Permits Part V – Comments on Western Washington Appendix I, Low Impact Development \(LID\) and Watershed-based Stormwater Planning](#) for more detailed responses to these and other comments.

Proper long-term maintenance of permeable pavements will require investment in equipment that can clear plugged voids. Local governments will likely have to purchase new types of equipment. The need to do so is a few years off. And, the number of pieces of equipment needed will start out small.

Ecology would point out that the limited benefits of mechanical street sweepers have been known for years. And the benefits of other designs using vacuum and sprays in reducing pollutant loading has been well-demonstrated. The use of permeable pavements is another reason to switch to more efficient street cleaning systems.

Ecology is aware of various cost estimates for use of permeable pavements. There are studies through the literature that document overall project capital cost decreases due to stormwater benefits. And there are projects where the costs will be higher than using impervious products. There likely will be higher long-term costs due to equipment purchase for maintenance.

Car-related impervious surfaces are estimated to comprise about two-thirds of the impervious surfaces created in urban areas. If measures are not taken to reduce the hydrologic disruption and pollutant discharge that they cause, we may not be able to maintain the beneficial uses and meet water quality standards in areas of new development that drain to lowland streams in western Washington.

Ecology disagrees that permeable pavements will necessarily have reduced life spans. The literature seems to report significant progress in improving asphalt and concrete mixes such that their lifetimes can match impervious pavements.

Ecology has written an infeasibility criterion for the use of permeable pavements when replacing road surfaces. See the infeasibility criteria for permeable pavements in Chapter 5 of Volume V.

Ecology has revised the site planning guidance (Chapter 3 of Volume I), and the design guidance in Section 3.4 of Volume III to require infiltration testing for small projects.

Base course depth recommendations are easily available. The local government has discretion concerning whether it wants to specify base course depths that result in substantial storage of water. It can choose to require minimum depths for structural needs as long as the base course

can overflow without raising to the level of the wearing course. Designers can then choose to install more base course depth if they want more flow reduction benefits.

RTC 1.22: Minimum Requirement #5, for small projects

Commenters: US Fish and Wildlife, Snohomish County, City of Kent, Skagit County, City of Renton

Summary of range of comments:

- The requirements are appropriate.
- The requirements are too stringent because they will require professional services that will increase costs.
- Performance standard requires an engineer. Feasibility decisions require engineer. Can decisions be made without an engineer?
- The LID requirement will create long-term maintenance and compliance issues. No standards.
- Don't reference Rain Garden Handbook. Homeowners not qualified to install. Require engineer.
- LID approach not geared to small, in-fill projects.

Response to the range of comments:

Professional services are necessary to evaluate the feasibility for certain LID BMPs and to establish a design basis. Smaller projects may be able to use professionals other than engineers to meet requirements. There is no doubt that the proper design and use of LID BMPs requires more upfront planning costs for most projects.

The draft 2012 *Stormwater Management Manual for Western Washington* did not include an expanded Maintenance Standards Table within Section 4.6 of Volume V to include LID BMPs that will require ongoing maintenance. There are recommendations concerning maintenance from multiple sources for all types of LID BMPs. Ecology has procured consultant services to develop recommended maintenance standards and methods. The consultant will survey various sources, take recommendations to technical advisory committees and develop its final recommendations. Ecology intends to incorporate these directly into the maintenance table. In addition, the consultant will develop guidance concerning the types of equipment and expected levels of effort and actions needed to maintain BMPs. This will give local governments more direction concerning establishing both their own maintenance programs and providing direction to private parties.

Chapter 3 of Volume I, and Section 3.4 of Volume III also includes guidance in regard to documenting the location of and requirements for maintenance of LID facilities in legal documents.

Engineers are not necessary for the installation of rain gardens. Ecology does not require, but recommends use of experienced landscaping professionals for their installation.

Ecology acknowledges that there can be difficulties in incorporating LID BMPs into small, in-fill projects. Ecology has established infeasibility criteria to help identify situations where use of a particular LID BMP is not advisable.

RTC 1.23: Minimum Requirement #5, Use of Lists

Commenters: Harmsen & Associates, Clark County, Snohomish County, City of Seattle, City of Tacoma, Thurston County, King County, SGA Engineering, City of Renton

Summary of range of comments:

- Bioretention/rain gardens, and permeable pavement should be same priority. Use same design criteria.
- Consider potential maintenance issues and risk of failure in creating priorities.
- No sound basis for priorities. Put BMP T5.13 on top of list, permeable pavement on bottom.
- Don't use priorities for lists. Allow choices and use of combinations.
- Dispersion options probably more sustainable than rain gardens.
- Commercial buildings can also infiltrate below impermeable pavement.
- Infiltration below permeable pavement increases risk of failure.
- Add tree plantings to lists.
- A number of other LID options should be added to the lists; or, make designers aware of those options.
- Better identify use of BMP T5.13.
- Identify cost criteria for vegetated roof feasibility.
- Clarify that if using lists, but everything is infeasible, achieving the performance standard is not necessary.
- Clarify if PGIS roofs are to use bioretention with underdrains in low infiltration areas.
- Allow projects on large parcels outside UGA to use lists too; but if all options infeasible, meet performance standard using other methods.
- Consider roofs PGIS, and re-consider lists accordingly.
- Should allow roads to fully infiltrate if permeable pavement not desired.
- Remove vegetated roof cost analysis.
- Eliminate 5% minimum size requirement from list #2. It is arbitrary.
- Allow rain gardens for projects choosing the performance standard.

Response to the range of comments:

Please also refer to the [Response to Comments on the Municipal Stormwater Permits Part V – Comments on Western Washington Appendix I, Low Impact Development \(LID\) and Watershed-based Stormwater Planning](#) for more detailed responses to these and other comments.

Bioretention, rain gardens, and permeable pavement are given the same priority for the “other hard surfaces” list #1 for smaller projects. This allows more flexibility for smaller projects. For larger projects using list #2, permeable pavement is ranked ahead of bioretention because it has much greater potential for infiltration of stormwater. A number of infeasibility criteria are similar for bioretention/rain gardens and permeable pavement.

Ecology could not distinguish a priority system based in part on maintenance or risk of failure categories. Bioretention and permeable pavement both have maintenance and risk issues. The best basis for establishing a priority ranking, is the ability of a BMP to reduce stormwater runoff.

BMP T5.13 is required for all lawn and landscaped areas unless it is infeasible due to a steep slope.

Choices are allowed under the Performance Standard option. If permeable pavements are not desired, one solution is to meet the performance standard by other means. Infiltrating road runoff through infiltration basins or trenches is an example of other means. However, road runoff is pollution-generating. So, there are requirements in regard to treatment that must be met too.

If using the performance standard option, a broader range of choices is available to the designer. Designers using the list option can employ additional LID BMPs than those on the lists. Achievement of the performance standard is not a requirement if using the list option.

In our computer modeling, it became evident that projects in urban-zoned areas could frequently have trouble meeting the performance standard because of site limitations. Ecology considered universal application of the performance standard to be unreasonable, or at least extremely difficult to meet in a number of typical urban situations. Therefore, Ecology elected to require a technology-based approach for those areas. The lists include those LID BMPs that Ecology considers available and reasonable in most urban situations unless there are site limitations that make their use infeasible. So, we are requiring projects to do the best they reasonably can do reduce hydrologic disruptions and control pollutants in those areas already designated for urban use.

In rural areas on large lots, the performance standard is the regulatory target because there is more ability to achieve it, more options to achieve it, and it is necessary to prevent degradation of the aquatic resources. Rural areas generally have higher quality stream resources that Ecology is trying to maintain.

Vegetated roofs were eliminated from List #2. Infiltration of commercial roof runoff below pavement was also removed.

Projects using list #2 or the LID Performance Standard option cannot use rain gardens because we cannot estimate the flow reduction benefits.

Some minimum sizing limitation is necessary for bioretention or rain gardens in the list options to ensure a reasonable hydrologic benefit. The 5% minimum size criterion was established after reviewing minimum sizing criteria used locally and in other areas of the nation.

RTC 1.24: Minimum Requirement #6: Treatment Thresholds

Commenters: Thurston County, WSDOT

Summary of range of comments:

- Better define when treatment is not necessary because runoff is not in a natural or man-made conveyance
- Retain concept of “effective” hard surfaces because runoff may be handled in full dispersion and therefore not need treatment

Response to the range of comments:

The qualifier for runoff to be in a natural or man-made conveyance exists because Ecology does not necessarily want to mandate that runoff must be collected. But where runoff is sufficiently constrained or conveyed, treatment BMPs can be applied.

Ecology removed the word “effective” from the threshold because it wants to capture projects that exceed the 5,000 sq. ft. threshold regardless of whether the water is being directed into the ground or to surface waters. If Ecology allowed permeable pavement with adequate storage and infiltration capability to be considered ineffective, and the threshold only required treatment for effective hard surfaces, then the threshold for treatment wouldn’t be triggered and there would be no requirement for treatment and no review of whether the soil was adequate to provide that treatment for the infiltrating stormwater.

RTC 1.25: Minimum Requirement #7, Thresholds for flow control

Commenters: Baseline Engineering, Clark County, City of Seattle, City of Tacoma

Summary of range of comments:

- Clarify that the 0.1 cfs threshold compares existing conditions to proposed conditions.
- For 0.1 cfs threshold, better to use single event modeling.
- Explain waiver of requirement if all runoff is reliably infiltrated
- For direct discharges to exempt waters, be more specific concerning hydraulic capacity requirements.
- Change impervious to hard; delete native; define effective pervious.

Response to the range of comments:

Ecology has added a footnote to clarify use of the 0.1 cfs threshold.

The 0.1 cfs threshold was developed specifically for use with continuous runoff modeling.

Ecology did not specify hydraulic capacity requirements for conveyance systems. Ecology prefers to leave that to the discretion of the local government.

Ecology intended the first threshold to read 10,000 sq. ft. of impervious area. Ecology has deleted “native” and used the “converted vegetation” terminology. Ecology deleted the adjective “effective,” so a definition is not necessary.

RTC 1.26: Minimum Requirement #7, Reduced Standard for Highly Urbanized Basins

Commenters: US Fish and Wildlife, City of Tacoma

Summary of range of comments:

- The reduced standard for basins over 40% needs explanation and will perpetrate ongoing degradation
- Use 1985 land cover as the existing condition, not today’s land cover

Response to the range of comments:

The 2005 update of the stormwater manual provided background for the rationale for establishing a reduced flow control requirement for basins that have been over 40% total impervious area since 1985. Ecology did not propose a change in that requirement in this update. In summary, Ecology does not consider it a wise use of resources, nor an effective rehabilitation strategy, to require redevelopment projects or the few new development sites remaining in such basins to control runoff flows to an historic condition. Basins over 40% TIA have multiple problems – in addition to high flow rates - that must be addressed in a coordinated fashion if they are to be rehabilitated to a condition associated with some desirable value.

RTC 1.27: Minimum Requirement #8

Commenters: LID, Inc., Cowlitz County, Thurston County, City of Kent, City of Tacoma

Summary of range of comments:

- If Min. Req. #7 & # 8 are both applicable, just require compliance with M.R. #7.
- Change “within drainage area of a wetland” to “ discharge to a wetland.”
- Guidesheets 2 and 3c conflict
- Please explain why the guidance is changing.
- Confusion about applicability of guidesheet 3, and when it is OK to modify wetlands.
- New requirements not industry standard and will be burdensome for all. Can’t require trespassing

- Allow dispersion BMPs to be used in buffers

Response to the range of comments:

Ecology has required that if both requirements apply, both must be complied with. That will likely require two separate hydrologic analyses.

Ecology adopted the “discharge to a wetland” phrase.

Guidesheets 2 and 3c in the final document should not be in conflict. If you perceive that they are, call Ecology for clarification. The applicability of guidesheet 3 should be clear. If you have confusion, call Ecology.

The guidance is changing because of severe, insurmountable problems in many cases with complying with the previous guidance. It will no longer require monitoring of the wetland to establish the hydroperiod conditions. It will give designers achievable targets to match and the tools to do it. Those tools do not require trespassing.

Most stormwater BMPs are inappropriate within wetland buffers. Stormwater treatment and flow control facilities do not include the partial dispersion techniques described in the manual for roofs and driveways. Local governments will have to decide whether to allow them in buffer areas. If allowed, the dispersion should be through the native vegetation and soils, not through lawn and landscaped area.

RTC 1.28: Minimum Requirement #9 Operation and Maintenance

Commenters: US Fish and Wildlife, Port of Seattle, City of Tacoma

Summary of range of comments:

- Agree with need for manuals and a log for maintenance
- Operation and maintenance standards for LID not provided.
- O&M manuals should be required for all facilities/BMPs used to meet any minimum requirement

Response to the range of comments:

Ecology intends to publish updated operation and maintenance standards for many LID BMPs next year. There are existing maintenance recommendations for some LID BMPs in the stormwater manual now, and within the *LID Technical Guidance Manual for the Puget Sound Basin*. Local governments may use those while waiting for the updated guidance.

Ecology does not concur that O&M manuals should be required for all LID BMPs that are used to help meet minimum requirements. For instance, an O&M manual, including the requirement for a log of maintenance activities, seems unnecessary for roof downspout dispersion and for BMP T5.13. Ecology agrees that there should be maintenance directions to

homeowners concerning the need for and directions for how to conduct maintenance for LID BMPs on their property. Ecology has included recommendations that such instructions be included in legal documents for the property as well as a declaration of covenant and grant of easement for the local government.

RTC 1.29: Exceptions/Variations

Commenters: Thurston County, City of Kent, City of Tacoma

Summary of range of comments:

- Should be an allowance for variances for reasons other than financial hardship. Site conditions should also be taken into account.
- The public sector can't meet the economic hardship criteria. So, the conclusion is that stormwater management supersedes any other public interest. This should not be.
- Clarify that the administrator can find economic hardship in regard to long-term operation and maintenance.

Response to the range of comments:

The exceptions/variance requirements were updated in the manual to be the equivalent of those contained within the municipal stormwater permits since 2007.

Ecology does not concur that there should be any variance from the requirement for stormwater BMPs or facilities due to economic hardship in regard to operation and maintenance.

Chapter 3

RTC 1.30: Site Planning

Commenters: Port of Seattle, Snohomish County, City of Tacoma, Cowlitz County, Port of Vancouver, Thurston County, AKS Engineering & Forestry, Harmsen & Associates,

Summary of range of comments:

- Should not have to do detailed site analyses on sites where LID obviously not feasible.
- Guidance should be compatible with LID Manual
- Use term "On-site Stormwater Management BMP" consistent with Chapter 1
- Guidance re surveys is too loose in some instances and too tight in others.
- Soils report should be OK to be done by an on-site designer.
- Allow alternative, cost saving measures to ID soils and groundwater elevations
- Professional services to ID native vegetation for small projects is overkill. Require only where trees over 8 inches diameter, or where local government deems it necessary.

- Don't agree with the level of detail or formats for vicinity maps, site maps, existing conditions maps. Don't agree with identifying ownership.
- Sites subject to M.R. #1 - #5 should not have to hire an engineer to do computer modeling.
- Infiltration testing on small projects will be difficult to do properly. Unreliable results.
- Should have less rigorous requirements for small projects. Too many professionals required.
- Add a step to check for contaminated site issues.
- Use full title of LID Performance Standard in references for clarity.
- Require dispersion BMPs and their supporting areas to be shown on drawings
- Require O&M manual for all distributed facilities.
- Shouldn't need a minimum depth to perched groundwater.
- Number of pilot infiltration tests too large. Let geotechnical engineer determine based on site conditions.

Response to the range of comments:

Ecology has recommended site assessment procedures in Chapter 3 of Volume 1 and more specific site procedures for bioretention and permeable pavement in Section 3.4 of Volume III. More analysis of site soils and knowledge of subsurface restrictive layers is necessary to properly implement LID, regardless of the size of the project. Ecology has recommended procedures that it thinks can provide the most valuable and accurate information. Local governments can develop similar assessment procedures, authorize different testing techniques, and specify alternative submittal formats that it thinks provides a similar level of information and reliability.

A soils report by an on-site designer is acceptable for projects that are only subject to Minimum Requirements #1 - #5. An on-site designer is not listed as an acceptable professional for sites that have triggered Minimum Requirements #1 - #9.

Sites subject to Minimum Requirements #1 - #5 do not necessarily have to hire an engineer to do computer modeling. Computer modeling is only necessary for such projects if they choose to, or have to meet the LID performance standard. Projects outside the urban growth area on lots of 5 acres or larger have to meet the LID performance standard. Using the full dispersion option does not require computer modeling.

Chapter 4

RTC 1.31: Comments on BMP and Facility Selection Process

Commenters: Snohomish County, Cowlitz County, City of Renton, King County, Thurston County, City of Redmond, City of Tacoma

Summary of range of comments:

- Include a reference to Volume V
- M.R. #5 should be triggered by threshold discharge areas too.
- Section 4.2 should include guidance concerning WWHM credits for all types of LID BMPs.
- Encourage reduction in redundancy. Encourage hyperlinks in electronic version.
- Encourage an overview of the treatment selection process here with reference to Volume V.
- Keep all directions for treatment selection in this text.
- All LID “Elements” should be available in the free version of WWHM.
- Include an LID selection step.

Response to the range of comments:

Ecology referenced Chapter 2 of Volume V for the step-by-step guidance for selection of treatment facilities. Selection of LID facilities is covered in the broader site planning guidance in Chapter 3.

Threshold discharge areas are not used in determining the application of LID BMPs under Minimum Requirement #5. LID requirements are based on whether the entire project has triggered Minimum Requirements #1 through #5, or #1 through #9. Projects (not including those that must meet the LID performance standard) that have triggered Minimum Requirements #1 through #9 by use of the thresholds in Figure 2.2 or 2.3, must use List #2 or meet the LID performance standard regardless of the results of threshold discharge area analyses for determining requirements under Minimum Requirements #6 and #7.

An additional statement was added to the end of Step III in Section 4.2 directing the reader to sources of information for modeling of all types of LID BMPs.

Appendix I-A: Basin Planning

RTC 1.32: Appendix I-A Basin Planning

Commenters: Clark County, WA Fish & Wildlife

Summary of range of comments:

- Quality of basin planning guidance from Ecology will determine whether locally derived requirements will be effective.

Response to the range of comments:

Ecology does not have a one size fits all basin planning guidance document. A basin planning effort can focus on one aspect of water quality, e.g., an appropriate high flow control standard, or it can tackle a broad range of topics that are concerned with creating a healthy stream

ecosystem amenable to maintaining or restoring the beneficial uses of the basin. There are examples of basin planning studies that Ecology can make available to those interested in developing a specific basin plan.

Appendix I-B: Rainfall Amount and Statistics

RTC 1.33: Appendix I-B Rainfall Amount and Statistics

Commenters: City of Tacoma

Summary of range of comments:

- Delete and tell municipalities to develop their own rainfall amounts.

Response to the range of comments:

Ecology has established a definition for water quality design flow rate and water quality design volumes. This is to set a common base line for how much runoff must be treated.

In Appendix 1-B Ecology lists a specific rainfall amount for various locations for those who elect to use the 6-month, 24-hour rainfall amount as the water quality design volume. For other locations, interpolation of adjacent isopluvials for 2-year, 24 –hour amounts and multiplying that estimate by 72% is the recommended guidance for determining the 6-month, 24-hour volume. Local governments can choose to use the amounts identified by these methods, or they can use updated rainfall data and/or a different analysis approach to estimate the 6-month, 24-hour rainfall amount. Those alternative techniques should produce a rainfall amount not too different from those volumes and methods identified by Ecology. Local governments must be prepared to explain and defend the basis for their estimates.

Appendix I-D

RTC 1.34: Clarify the use of the term Pre-development and Post-development in Appendix I-D and throughout Volume I of the SWMMWW

Commenters: Cowlitz County, City of Kelso, City of Seattle, City of Tacoma

Summary of range of comments:

- In the overall SMMWW, pre-developed typically has the definition of a forested condition. The definition of pre-developed in the wetland guidance describes pre-developed as more of the existing condition prior to the proposed action. It is confusing to define the same word in different ways.

- There are conflicts in Sections 1.5.4, 2.5.6, 2.5.8, and Appendix I-D regarding the use of “match the pre-developed conditions”, “maintain the natural hydroperiod”, and “preserve pre-project wetland hydrologic conditions”.
- The definitions in Appendix I-D should be consistent with the definitions for the entire SWMMWW and combined into one section for the entire document.
- Clarify the definitions section in Appendix D with a brief sentence at the beginning that these definitions relate to Appendix D only.
- It appears Ecology’s intent is to require existing conditions to be matched; revise the language in Section 1.5.4 and elsewhere to reflect Ecology’s intent to use existing conditions.
- Modeling the pre-development discharges as forested land cover may not be appropriate and may have unintended consequences for some wetlands. Using the wetland’s current condition as a baseline would be a better standard.
- Revise the definition in Appendix I-D to be consistent with the pre-treatment definition within the entire SMMWW.

Response to the range of comments:

The definitions in Appendix I-D only apply to Appendix I-D and are not an appropriate reference for the rest of Volume I, or for the rest of the SWMMWW. Ecology added a sentence at the beginning of the definitions section in Appendix I-D clarifying this.

In the draft Appendix I-D Ecology defined Pre-development and Post-development in Appendix I-D differently than in the rest of Volume I. Ecology’s intent in both the draft and final version of Appendix I-D was to use the wetland’s existing condition (before any project development occurs) as a baseline. In order to clarify this intent Ecology modified the language in Appendix I-D to refer to pre- and post- project instead of pre- and post- development.

Ecology removed the term pre-treatment from Appendix I-D since it was not used within Appendix I-D.

RTC 1.35: Comments requesting clarification of the Guide Sheets in Appendix I-D

Commenters: Cowlitz County, City of Tacoma, Thurston County

Summary of range of comments:

General

- The effort to modify the wetland guide sheets are good, but need to go further to be clear exactly when the flow standards are required to be met and when and what improvements can be made to impaired wetlands.
- Guide Sheet 3C conflicts with Guide Sheet 2 in that it does not classify its guidelines depending on the value of the wetland. The third guideline in Guide Sheet 3C supersedes Guide Sheet 2 and creates a conflict.

- Clarify if wetlands not classified by Guide Sheet 1 and not proposed for use as a flow control or treatment facility require compliance Guide Sheet 3.

Guide Sheet 1

- It is unclear if wetlands that will receive flows from an upgradient stormwater system are required to comply with Guide Sheets 3B and 3C. If they are not, is the jurisdiction required to provide guidance for these types of wetlands? Is the “should” in this paragraph intended to be “shall.”
- In the special conditions in Guide Sheet 1 include listed plant species.
- Quantify “large storms” and clarify what design criteria are being referred to.
- Why and how should one characterize the changes to water quality coming from the development?

Guide Sheet 3

- Please add that alteration of a wetland would likely require federal, state and local permits to Guide Sheet 3A, #7.
- Clarify the type of treatment or the process to determine the type of treatment for urban runoff into the wetland. Why is only urban runoff treated? Define urban.
- Clarify the nutrients to be controlled or the process to determine the type of nutrient control.

Guide Sheet 4

- Remove the last sentence of Comprehensive Planning Step 3a in Guide Sheet 4. The requirement to control flows to pre-european flow rates requires development to construct stormwater facilities similar to facilities that would need to be constructed if the development was replacing a fully forested site. This makes the cost related to stormwater for development on deforested land equal to the cost to stormwater for development on forested land.
- Explain the rationale behind the order of preference and the reasons why certain facilities are preferred on-site are different from those for regional facilities.

Response to the range of comments:

General

- Ecology has made several revisions in order to clarify the requirements in Appendix I-D.
- Flow standards for wetlands that meet the criteria in Guide Sheet #1 are specified in Guide Sheet #3. The improvements that can be made to impaired wetlands that meet the criteria in Guide Sheet #2 are not specified because they will depend on the needs of the stormwater controls for a project.
- Wetlands not classified by Guide Sheet 1 and not proposed for use as a flow control or treatment facility do not require compliance with Guide Sheet 3.
- Ecology intended Guide Sheet 3C to apply to the wetlands meeting the criteria in Guide Sheet 1. The third guideline in Guide Sheet 3C does not supersede Guide Sheet 2. Ecology added clarifying language in Guide Sheet 3C.

Guide Sheet 1

- Wetlands that receive uncontrolled discharges or flows from a stormwater systems are required to comply with Guide Sheets 3B and 3C. Ecology has revised “should” to “shall” and has removed the term upgradient in this paragraph in Guide Sheet 1.
- Listed plant species are covered under the Natural Heritage special condition.
- Ecology removed the requirements, in Guide Sheet 1, to use Guide Sheet 3B and 3C to characterize potential effects from large storms.

Guide Sheet 3

- Ecology did not add a reference to Guide Sheet 3A regarding the permit requirements for alterations of a wetland because this information is already covered in the Regulatory Requirements Section of Appendix I-D.
- Ecology has removed the word “urban” from Guide Sheet 3C to clarify that for wetlands meeting the criteria in Guide Sheet 1 a water quality control facility should be provided for runoff entering the wetland, regardless of if that runoff is considered urban.
- Ecology considers nutrient control in Guide Sheet 3c to be nitrogen, phosphorous, and any other nutrients that the local jurisdiction determines appropriate.

Guide Sheet 4

- Ecology did not revise Comprehensive Planning Step 3a. Stormwater management costs for development on deforested land and for development on forested land are likely equivalent (although their impacts are not equivalent). However, costs for a site that maintains some forest cover should be lower than that of a completely cleared site – the last sentence refers to this condition.
- Ecology has provided the listings of on-site facilities in Guide Sheet only for guidance. The on-site facilities are listed in order of their effectiveness in reducing changes to the natural hydrology. Local jurisdictions may set their own order of preference for these facilities.

RTC 1.36: Regulatory shift from explicitly regulating wetland hydroperiods to regulating stormwater inputs to wetlands.

Commenters: City of Bellevue, Clark County, Snohomish County

Summary of range of comments:

- What is the scientific basis for the wholesale change of the prior Appendix I-D methodology and statistical analysis of every storm event over a 50 year period on a particular day?
- The wetland guidance needs better supporting documentation based in science and the application of the WWHM.
- Snohomish County commends Ecology's proposed shift from explicitly regulating wetland hydroperiods to regulating stormwater inputs to wetlands as a surrogate for hydroperiod. The County agrees that it is not feasible to regulate hydroperiod.

- Guide sheet 1: Includes criteria that excludes wetlands from serving as a treatment or flow control BMP/Facility. These regulations are a substantial change from the 2005 SWMMWW and could impact a large portion of the redevelopment opportunities in Bellevue.
- Many of the methods in Guide sheet 3A are very effective in reducing impacts to wetlands, especially maintaining required buffers, limiting compaction, retaining connecting areas of vegetation.
- Considerable uncertainty exists in the proposed criteria for showing protection of wetland hydroperiods within riverine, slope, and lake-fringe wetlands and this places an unreasonable burden on public and private developments for demonstrating compliance with the manual.

Response to the range of comments:

When Ecology tested the hydrologic models available Ecology found that the models could not adequately predict the water level fluctuations in a depressional wetland and were not designed to model anything but a “bathtub” type wetland (no riverine or slope wetlands).

The Washington State Department of Transportation had their consultants attempt to model a wetland for which a University of Washington had data from their wetlands stormwater study. The model could not be calibrated so its results matched the data on water level fluctuations monitored in the UW study. Thus, the model could not be used to determine if a project was meeting the specific limits in the 2005 SWMMWW.

The model however, was able to predict the influent volumes to a wetland in a reasonable way. Ecology staff analyzed the data from the model to come up with the 15% and 20% volume limits. A statistical analysis of the 50 year record of flows into the wetland showed that the standard deviation of the daily and monthly inflows for the pre-development scenario was about 1/3 of the mean. For this estimate Ecology modeled the watershed of the wetland as being completely undeveloped. Ecology set the limits so the increase or decrease in volume would be less than this standard deviation. Ecology assumed that a wetland could absorb additional flows on a daily or monthly basis that fell within the statistical range of its natural variation. Based on this analysis Ecology revised the requirements for wetlands in Appendix I-D in the 2012 SWMMWW.

RTC 1.37: Guide Sheet 1, Provide Wetlands with a breeding population of native amphibian species the maximum protection from urban impacts.

Commenters: City of Bellevue, Clark County, WA Fish & Wildlife

Summary of range of comments:

- In Appendix I-D, Page D-3 describes habitat while page D-16 describes an actual breeding population.

- Placing restrictions from development of all treatment or flow control BMPs/facilities from all wetlands with known breeding populations of native amphibian species is overly burdensome. Native amphibian species will likely colonize a majority of new flow control and treatment BMPs/facilities regardless of whether or not the BMPs/facilities are constructed in wetlands or uplands.
- Excluding all wetlands from use as a treatment or flow control BMPs/facility due to the presence of habitat for a breeding population of a native amphibian species is contrary to existing science on the population dynamics of native amphibian species in Southwest Washington and Northwest Oregon.
- Specify accepted methodologies for amphibian surveys in order to avoid potential conflicts between the timing of permitting activity and the timing of ideal amphibian detection. Absent direction, there will likely significant disparity across western Washington in how this will be handled.
- We understand the intent behind ruling out amphibian habitat as treatment or flow control BMP/facility. It is related to the thresholds for acceptable variance in daily (20%) and monthly (15%) influent volume to the wetland compared to pre-development volumes. To be extra cautious wetlands with amphibians are ruled out.
- In King County, Klaus Richter reported that water level fluctuation >0.2 meters was significantly correlated with decreasing amphibian species richness, but existing models cannot predict whether this would occur.

Response to the range of comments:

In Guide Sheet I, Ecology has removed the fourth criterion: “provide habitat for a breeding population of native amphibian species.” Ecology has determined that protecting wetlands that provide habitat for threatened or endangered species is also adequate to protect many native amphibian species. The Washington Department of Fish and Wildlife (WDFW) list many native amphibian species in their databases as threatened and endangered. Since the absence of threatened and endangered species in a wetland has to be confirmed to meet the third criterion in Guide Sheet 1, Ecology removed the fourth criterion that focused on amphibians.

RTC 1.38: Comments that are beyond the scope of work for this edit to the SWMMWW.

Commenters: WA Fish & Wildlife

Summary of range of comments:

- Changes in wetland hydrology have potential to impact habitats and species other than amphibians. Forest birds, wetland obligate birds, fish, and native plants are a few examples of wetland-dependent species that could benefit from hydrologic policy guidance.
- WDFW recommends monitoring water levels within wetlands before and after having changed influent volumes in order to test the assumptions that the proposed daily (20%) and monthly (15%) thresholds do not significantly affect water level fluctuation or native amphibians.

Response to the range of comments:

Ecology carefully considered the comments above but found them to be beyond the scope of this edit. At present Ecology does not have the scientific tools necessary to support any specific policies for limiting the impacts from changes in water regimes. Ecology will try to consider them in future versions of the SWMMWW as new methods and data become available.

Testing the assumptions used is a scientific experiment that should be done, but Ecology cannot require project proponents to carry it out. It will require several years and at least \$200,000 to test the assumption.

RTC 1.39: Use of the Western Washington Hydrology Model (WWHM) for Wetlands

Commenters: City of Tacoma

Summary of range of comments:

- It is unclear if the use of WWHM, or another model, is required to determine if the criteria are met. If the applicant is not required to use a WWHM, is there a particular source that is required for obtaining precipitation data.
- Under Data Needed for Guide Sheet 3B, Ensure that all required modeling elements are included in the free version of WWHM prior to SMMWW implementation dates.
- Clarify how groundwater flows are determined in accordance with Guide Sheet 3B. If the designer selects the groundwater button in WWHM, will that be sufficient for estimating groundwater flows?
- Is the modeling meant to apply to the entire basin upstream or solely to the project site?

Response to the range of comments:

The Western Washington Hydrology Model (WWHM), or other models approved by Ecology, shall be used to determine the compliance with the criterion in Guide Sheet 3B. Ecology has added clarifying statements in Guide Sheet 3B to refer readers to WWHM.

WWHM is currently being updated. The new version of WWHM (WWHM 2012) will have the capability to compare the modeling of wetlands with the criterion in Guide Sheet 3B. Flows to a wetland include surface flow, inter-flow, and groundwater flow. WWHM 2012 will add contributions from these three flow components, which include the ground water flow and any time delays, in determining compliance with the flow criteria in Guide Sheet 3B.

RTC 1.40: Guide Sheet 4 Monitoring

Commenters: City of Bellevue, City of Tacoma

Summary of range of comments:

- In Guide Sheet 3B only very general methodology is included that specifies how monitoring of alterations of water flows is to occur. This lack of specificity may lead to grossly differing results between communities.
- In Guide Sheet 3B provide requirements for monitoring and methodology.
- Pre-development monitoring should be conducted to establish existing hydroperiods.
- In Guide Sheet 4 are there standard methods to be used for sample analysis?
- Clarify how are the goals for sampling established in the last paragraph of the monitoring section in Guide Sheet 4?
- In the fourth bullet, under #2, in Guide Sheet 4 the parenthetical phrase is very open. Are there criteria for when the sample should be rescheduled? Does the parenthetical phrase apply to all the bullets?

Response to the range of comments:

Ecology has significantly revised the monitoring section in Guide Sheet 3B and now refers to monitoring requirements that may be required within local, state, and federal permits for modifications that alter the structure of a wetland or its soils. Monitoring should be tailored to the specific goals and objectives of a project and cannot be specified in advance. Refer to local, state, and federal permits for the monitoring and methodology requirements.

Since the model cannot be used to predict hydroperiods post-development there is no need to monitor the existing hydroperiod for comparison. Ecology may consider revising the monitoring sections in Appendix I-D once new models are developed that can accurately predict changes to hydroperiods.

Ecology has not specified standard methods for monitoring in Guide Sheet 4 because local jurisdictions may set their own standards. Ecology will provide examples of monitoring standards by request. Local jurisdictions should determine their water quality goals based per Guide Sheet 4 through a public process, technical advisory board, or however the jurisdiction wishes.

Ecology modified the monitoring section of Guide Sheet 4 to clarify that sampling during dry periods.

RTC 1.41: Corrections, Typos, and Minor Changes in Appendix I-D - Volume I

Commenters: Cowlitz County, City of Tacoma

Summary of range of comments:

- Volume I, Appendix I-D, Page D-11; extra 'to' in the first sentence.
- In Guide Sheet 3A provide a reference page for design of a spreader swale.

Response to the range of comments:

Ecology made these suggested changes.

Appendix I-C and Appendix I-E

RTC 1.42: Appendix I-C and Appendix I-E

Commenters: Port of Seattle, Thurston County, City of Tacoma

Summary of range of comments:

- Add Duwamish to Basic Treatment waters or explain that it is included under Green River
- Add Montlake Cut.
- In fifth bullet, change “water line” to “water mark.”
- Change reference to “T-Street Gulch” to “First Creek.”

Response to the range of comments:

The Duwamish is included in the Basic Treatment waters list by virtue of the listing of the Green River and Elliott Bay.

Ecology intends to exempt Lake Washington and all downstream waters to Puget Sound.

Incorporated suggested change from line to mark.

Request to change name accomplished.

Engineering and Competing Needs Feasibility Criteria

RTC 1.43: Engineering Feasibility Criteria (Appendix I-F in the Draft 2012 SWMMWW)

Commenters: Land Technologies, Clark County, City of Kent, City of Oak Harbor, City of Tacoma, City of Renton, Port of Seattle, Port of Vancouver, City of Bellingham, City of Redmond, Aspect Consulting, SGA Engineering

Summary of range of comments:

- Government system too complex; will just claim infeasibility
- Distance to groundwater should be standardized.
- Allow/require perched groundwater to be drained away similar to allowed for siting onsite sewage systems.
- Slope setbacks should be determined by geotechnical analysis
- “If reasonable” caveats too vague and open to opinion
- Drive aisle comment is not a feasibility criterion but a design option. Move to the BMP description
- “Reasonably designed” difficult to implement. Criteria will make it too easy to reject LID.

- Define “excessively steep slopes.”
- Each jurisdiction should decide whether to allow LID within building setbacks
- One foot of vertical separation is not enough. Three feet minimum should be used.
- 5 feet separation for larger projects, 3 feet for small projects
- Within 10 feet of on-site system is too close. Use 30 feet.
- Need infeasibility criteria for driveway runoff to a rain garden whenever it would require a retaining wall.
- 0.5 in/hr as measured in the field should be the minimum rate for bioretention
- Allow construction of deep drains to bypass shallow groundwater or impermeable layers.
- More closely define heavy applications of sanding.
- Lack of usable space in redevelopment is too subjective.
- PIT tests too invasive in many situations. Rely on borings to adjust # of PIT tests.
- Justify groundwater mounding analysis for all large projects
- Full wet season monitoring of groundwater can unnecessarily delay projects.
- Guidance needed for post-construction testing
- Infeasible within 10 feet of underground utilities
- Should be infeasible within aquifer protection areas.
- Should allow LID implementation based on a basin approach
- Need flexibility for industrial sites
- Geotechnical opinion should not be restricted to erosion, slope failure, and flooding.
- Should be infeasible upgradient of any known or suspected contaminated site
- Requiring permeable pavement, infiltration testing, and wet season monitoring will delay and increase street construction costs. Special maintenance machinery will increase costs.
- Exclude bioretention in wellhead protection areas.
- Exclude bioretention and green roofs where they would drain into phosphorus sensitive basins
- Clarify that exclusion of permeable pavement in arterials and collectors does not extend to non-pollution generating surfaces such as sidewalks.
- Use of a treatment layer should not be in feasibility criteria. If it’s a treatment option, provide guidance in treatment section of manual.
- Differentiate setbacks for PGIS versus non-pgis in some feasibility criteria.
- Do pavement slope restrictions apply to surface slopes or excavated slopes?
- Criteria for threatening basements should apply to all infiltrating BMPs
- Permeable pavements will not always threaten adjacent impermeable pavements.
- A blanket criterion for areas with heavy loads is too restrictive.
- Fill material compacted to 95% density should be an infeasibility criterion.
- Allow for use in industrial facilities with underdrains and liners.
- Revise exempted roads to a criterion based on ADT
- Asphalt industry indicates feasibility up to 9% slope.
- Add to “or to a manufacturer’s recommendation.”

Response to Summary of range of comments:

Ecology has chosen to not create a separate appendix in Volume 1 for feasibility criteria. Instead, Ecology has placed subsections for infeasibility criteria, applications and limitations within the descriptions for each LID BMP in Chapter 5 of Volume V, and Chapter 3 of Volume III.

Please also refer to the [Response to Comments on the Municipal Stormwater Permits Part V – Comments on Western Washington Appendix I, Low Impact Development \(LID\) and Watershed-based Stormwater Planning](#) for detailed responses to most of these comments. The following responses cover those comments not addressed in the document reference above.

Ecology has tried to identify where a criterion only applies to pollution generating surfaces.

There is an infeasibility criterion for threatening existing structures under bioretention.

Slope restrictions apply to the final grade of the surface slope.

Ecology does not mean to imply that permeable pavements will always threaten adjacent impermeable pavements. In many smaller situations, such as patios, walks, plazas, permeable pavement provides no more risk than landscaping. However in situations such as sloped roads or parking lots, an upgradient area of permeable pavement could compromise downgradient impermeable pavement by saturating the sub-grade below the impervious surface.

In regard to fill material, it is difficult to know what the in-place infiltration rate will be. If the fill material has a soil specification and a compaction requirement for which an infiltration rate can be estimated or is known to be high (e.g., local sandy soils whose infiltration rate remains high (e.g, 1 in/hr) even with compaction), permeable pavement can still be feasible. Failing that information, permeable pavement over fill seems logistically difficult to implement.

Lining bioretention facilities and installing underdrains means that they will have little hydrologic benefit. This can be done at the owner/installer's option. But Ecology does not want to mandate LID when it will only achieve a treatment benefit.

The permeable pavement slope criteria are based on manufacturer's recommendations. If those change over time, local governments have a basis for using those updates.

RTC 1.44: Competing Needs Criteria

Commenters: WSU Puyallup, Port of Vancouver

Summary of range of comments:

- Difficult to find LID practices that would conflict with public safety and health standards.

- Transportation requirements to maintain options doesn't apply any more to LID methods as conventional methods. Calling this out as a criterion creates an unnecessary barrier.
- "High Land value" should be a competing need.

Response to the range of comments:

Please also refer to the [Response to Comments on the Municipal Stormwater Permits Part V – Comments on Western Washington Appendix I, Low Impact Development \(LID\) and Watershed-based Stormwater Planning](#) for detailed responses to most of these comments. The following responses cover those comments not addressed in the document reference above.

Ecology agrees that there should be few situations where safety and health standards conflict. But if a conflict did exist, it is appropriate to defer to them. Ecology does not agree that transportation requirements do not apply to LID methods as they do to conventional methods. Conventional methods call for putting all the runoff in a pipe and sending it to a large facility that could be located not adjacent to the right-of-way. LID methods involve using the right-of-way to manage stormwater. Where the transportation plans call for conversion of part of the right-of-way to meet existing or future transportation needs, it may not be available for long-term stormwater management.

High land value is not a competing need that merits an infeasibility criterion designation.

Appendix I-F Basins with 40% or more total impervious area as of 1985

RTC 1.45: Appendix I-F Basins over 40% total impervious area

Commenters: City of Bellevue, City of Olympia, Port of Vancouver

Summary of range of comments:

- Maps weren't included in draft. Give time for comment.
- Portions of Olympia meet the criterion. Please include

Response to the range of comments:

The map is the same as has been published at Ecology's website for a number of years. Ecology is not proposing any changes.

By use of satellite imaging data, and applying the analyses methods described at the website, no areas of Olympia qualify that don't already qualify because of the direct discharge to salt waters exemption.

Glossary

RTC 1.46: Glossary

Commenters: Associated Earth Sciences, Harry Branch, Thurston County, Port of Vancouver, Clark County, King County

Summary of range of comments:

- Define permeable pavement facilities as pavement that accepts flows from other areas. Facilitates additional requirements.
- Re-define rip-rap.
- Topsoil definition is a specification. Replace with general definition.
- Gravel roads and packed earthen materials can be pervious
- Include roofs that vent manufacturing, commercial, or other indoor pollutants into the definition of PGIS.
- Clarify the term stormwater and estuary.
- Change definition of compost to agree with WAC.
- Definition of common plan of development or sale should not include public, long-range transportation plans.
- Definition of Cation Exchange Capacity could use better identification of the role of pH.
- Consider changing definition of BMPs or create another term.
- We have found metals in runoff from roofs in industrial areas.
- Consider a definition for “seasonal high groundwater” that includes a methodology and frequency of testing. Frequency of testing can greatly impact estimated water level.

Response to the range of comments:

Ecology has not distinguished between permeable pavements that simply infiltrate rain that falls directly on its surface and pavements that accept run-on from adjacent areas. Both are acceptable strategies. Ecology understands that some municipalities may want to make the distinction for long-term maintenance reasons.

There needs to be caution around accepting run-on. It will likely result in the need for more frequent maintenance of the permeable pavement surface. Also, designers should confirm how the additional run-on will be managed by the pavement and its underlying materials.

Ecology has changed the definitions of topsoil and compost, and added roofs that vent to the definition of PGIS. Ecology did not make the other adjustments suggested above.

Volume II Response to Comments

RTC 2.1: Modifications to Construction BMPs

Commenters: ECO 3, Forest Concepts, City of Kelso, King County, City of Longview, Nathan Holloway, City of Seattle, Snohomish County, Thurston County

Summary of range of comments:

- Commenters were concerned with modifications to construction BMPs currently listed in Volume II.
- Comments were made on a total of seven separate Source Control BMPs and 15 Runoff Conveyance and Treatment BMPs.
- Specific comments concern:
 - Concern over the elimination of the use of straw bales
 - Mulch thickness determinations
 - Change in allowable uses for plastic coverings
 - Wattles
 - Use of polyacrylamide as a tackifier
 - Rip rap installation
 - Spray Fields
 - Sizing guidance

Response to the range of comments:

Ecology considered the comments submitted and many are included in the edits of the BMPs in Volume II.

RTC 2.2: References to the CSWGP Concerns

Commenters: City of Bellevue, City of Kent, City of Olympia, City of Renton, Snohomish County, Thurston County

Summary of range of comments:

- Commenters were concerned with the Construction Stormwater General Permit (CSWGP) and how the SWMMWW references the permit. Comments include elimination of specific permit language or references to the permit, clarification of the requirement for a SWPPP on smaller projects, and the need for increased discussion on the Erosivity Waiver.

Response to the range of comments:

Ecology considered the comments submitted and many are included in the edits of Volume II.

RTC 2.3: Measuring Turbidity

Commenters: King County

Summary of range of comments:

- This comment discusses the ability to measure turbidity in the receiving water a distance downstream to allow mixing when determining if the turbidity of water discharged off-site meets the requirements of the CSWGP.

Response to the range of comments:

The CWSP does not allow the use of a mixing zone when determining compliance with turbidity requirements. Ecology made no change to the text based on this comment.

RTC 2.4: Construction SWPPP Elements

Commenters: City of Arlington, ECO3, City of Kelso, City of Longview, City of Seattle, Snohomish County, City of Tacoma, Thurston County, WSU Puyallup

Summary of range of comments:

- Commenters were concerned with the 13 individual elements of the construction SWPPP along with general SWPPP guidance.
- Elements commented on include 1, 3, 4, 5, 6, 7, 8, 10, 12, and 13.

Response to the range of comments:

Ecology considered the comments submitted and many are included in the edits of the SWPPP guidance in Volume II.

RTC 2.5: Volume II Typos

Commenters: City of Arlington, Cowlitz County, Snohomish County, City of Tacoma, Thurston County

Summary of range of comments:

- Commenters were concerned with typos and grammar.
- Commenters identified necessary modifications to figures.

Response to the range of comments:

Ecology corrected typos, grammar, and figures.

RTC 2.6: Appendix 1 and Volume II

Commenters: City of Arlington, City of Marysville, City of Olympia, Puget Sound Partnership, City of Redmond, City of Seattle, Snohomish County, City of Tacoma, Thurston County, WSDOT

Summary of range of comments:

- Commenters were concerned with how Appendix 1 in the Phase II permits interacted with Volume II of the Manual.

Response to the range of comments:

Ecology considered the comments submitted and most required edits to Appendix 1 but not to text in Volume II.

Volume III Response to Comments

Chapter 2

RTC 3.1: WWHM Model Update in Section 2.2

Commenters: Ballard Stormwater Consortium, Pierce County, King County, City of Tacoma, City of Bellevue, Thurston County, Thomas W. Holz, Snohomish County

Summary of range of comments:

- An updated WWHM model and information on how it will be used to design LIDs and determine compliance with the LID standard were not available. Therefore it is difficult to review functionality of the model and the corresponding guidance in SMMWW.
- Compliance with LID standard is not possible without an updated model. The permit should not require compliance with the LID standard before the modeling tool and guidance become available.
- Modeling algorithms in the updated WWHM should go through peer review.
- Will there be training on the updated model?
- Capabilities to modeling LIDs with and without underdrain hydraulic system.

Response to the range of comments:

The existing, publicly available WWHM can be used to demonstrate compliance with the LID Performance Standard. This is done by adjusting the lower boundary for compliance to 8% of the 2-year flow. However, Ecology is developing updating the Western Washington Hydrology Model (WWHM) to make it easier to demonstrate compliance.

Ecology expects to release the new version of the Western Washington Hydrology Model, WWHM 2012, in the fall of 2012. Mathematical algorithms will be incorporated to represent LID techniques in WWHM. Four LID techniques will be incorporated in WWHM, these are: bioretention cells, porous pavements, green roofs, and road embankment using compost amended vegetative filter strip (CAVFS). The modeling algorithms are developed based on input and review by a committee of modelers.

WWHM 2012 will also address the Windows 7 (and 8) compatibility issues. Currently, the hourly precipitation data in WWHM cover a period of about 40-50 years within the 1948 - 1998 time period. WWHM 2012, will include precipitation data, in 15-minute time step, from the more recent years.

Ecology plans to provide training on both the 2012 Stormwater Management Manual and WWHM 2012 concurrently, after the release of WWHM 2012.

RTC 3.2: Wetland flow criteria and modeling guidance in Section 2.2

Commenters: City of Tacoma, City of Bellevue, WSDOT, Thurston County

Summary of range of comments:

- More clarity is needed on the new wetland flow criteria.
- Modeling guidance is needed for the new wetland flow criteria.
- Implementation of the new wetland flow criteria should be delayed until WWHM is available and can be used to evaluate compliance with the criteria.
- Does the update to WWHM allow wetland hydroperiod analysis on existing wetlands?

Response to the range of comments:

Wetlands are impacted by flows originating from surface, interflow, and ground. Typically, ground water flow movement is relatively slow with delayed impacts. The wetland flow criteria accounts for all the 3 flow components ranging from the faster surface flows to the slower groundwater flows with delayed impacts. The new wetland flow criteria replaces the wetland hydroperiod fluctuation criteria primarily because it makes compliance determination easier. The new wetland flow criteria includes 2 criteria:

- **Criterion 1:** Total volume of water into a wetland during a 24-hour period should not be more than 20% higher or lower than the pre-development volumes.
- **Criterion 2:** Total volume of water into a wetland on a monthly basis should not be more than 15% higher or lower than the pre-development volumes.

WWHM is being updated to enable it to calculate flows to a wetland and make compliance determination. The WWHM 2012 users manual will include wetland modeling guidance for assessing wetland flow impacts from developments. Ecology plans to release WWHM 2012 in the Fall of 2012, well before the Western Washington Municipal Stormwater Permits require the implementation of the revised wetland requirements.

RTC 3.3: LID modeling in Section 2.2

Commenters: Snohomish County, King County

Summary of range of comments:

- Provide more information the scientific basis of the LID standard.

- Guidance in Appendix C is outdated and LID modeling guidance for WWHM is needed.
- Address LID modeling features and flow control credits.

Response to the range of comments:

The LID Performance Standard aims at keeping the pre-development hydrology unchanged. The standard is not intended to increase detention volume; the standard is generally achieved through a combination of infiltration and site development.

Updated LID modeling guidance is included in Appendix C. The updated guidance includes: methods to use with the current publicly available WWHM3; and methods to use with the yet-to-be-released WWHM2012. WWHM2012 will include new ways to model bioretention cells, porous pavements, green roofs, and road embankment. WWHM determines compliance with the LID standard which is that the post development flow duration values must be below any of the Pre-development flow duration values between 8% and 50% of the 2-year pre-development peak flow value. For projects choosing the “List” option for compliance with Minimum Requirement #5, the WWHM estimates the flow reduction benefits of the On-site BMPs that will be implemented.

There is no specific "credit" number/value given to a particular LID practice in WWHM. WWHM models the hydraulic behavior of the various LIDs in response to precipitation, incoming runoff, and evapo-transpiration. Any water quality or flow control benefits associated with LIDs will depend on the algorithms used to model each LID. Currently, there is no algorithm included that models the hydraulic behavior of different urban trees.

RTC 3.4: Incorporating local precipitation in WWHM (Section 2.2)

Commenters: Thurston County

Summary of range of comments:

- Are there instructions for local jurisdictions to incorporate local precipitation in WWHM?

Response to the range of comments:

WWHM programmers’ assistance is needed for incorporating local precipitation data for use in a jurisdiction.

RTC 3.5: Grammatical errors and clarifications

Commenters: Cowlitz County, Thurston County, WSDOT

Summary of range of comments:

- A number of grammatical corrections and alternative clarifying wording have been suggested.

Response to the range of comments:

Ecology incorporated suggested corrections and clarifications as appropriate.

Chapter 3

RTC 3.6: Figure 3.6 Material for Support Post

Commenters: City of Tacoma

Summary of range of comments:

- Consider revising the figure 3.6 to allow additional materials for the support post.

Response to the range of comments:

Language was added clarifying/allowing local governments to approve other materials for support posts.

RTC 3.7: Figures in Chapter 3

Commenters: Snohomish County

Summary of range of comments:

- Snohomish County uses its own details in its Engineering Design & Development Standards. Some are different than the King County drawings that Ecology has used in development of this Volume.

Response to the range of comments:

Phase I permittees can use their own drawing details as long as those do not compromise the function that the facility or device is expected to provide as designated in Ecology's permits and manual.

RTC 3.8: Section 3.1 Roof Downspout Controls

Commenters: City of Tacoma, City of Redmond

Summary of range of comments:

- Revise the flowchart to include new Minimum Requirement #5 requirements, including order of preference.

Response to the range of comments:

Ecology has revised the flowchart to be consistent with the priority order in Min. Requirement #5 for roof downspout controls.

RTC 3.9: Embankments

Commenters: City of Tacoma

Summary of range of comments:

- It is unclear why a professional engineer with geotechnical expertise and geotechnical engineer are used differently when designing pond embankments. Ensure consistency between the statements.

Response to the range of comments:

Embankments higher than 6 feet require structural consideration.

RTC 3.10: Detention Ponds

Commenters: Thurston County

Summary of range of comments:

- Clarify "steep" slopes.

Response to the range of comments:

Requirements for steep slopes vary based on the stormwater facility. Ponds, infiltration trenches, and dry wells have different requirements. In general, a geotechnical analysis and report may be required on slopes over 15% or if the stormwater facility will be located within 200 feet of the top of a slope steeper than 40%, or in a landslide hazard area.

RTC 3.11: Landscaping in Section 3.2.1 – General comment on readability and clarity

Commenters: WSDOT

Summary of range of comments:

- Consider performing a word search for "that" and delete when appropriate to improve readability.

Response to the range of comments:

Suggestion has been incorporated.

RTC 3.12: Section 3.1.1 Downspout Full Infiltration Systems

Commenters: City of Tacoma, Snohomish County

Summary of range of comments:

- Ensure consistency between downspout feasibility criteria and LID feasibility criteria.

- A soils report required for infiltration. So, same soils report should be required for rain gardens. Ensure consistency with Vol. 1, Ch. 3 re required professional and other requirements.
- Necessary depth of soil log should depend on depth of facility and that required to verify needed separation to groundwater.
- Delete 22,000 sq. ft. threshold.
- Table of needed trench length should be revised because Ecology no longer proposing to use USDA soil types.
- Define steep slopes.

Response to the range of comments:

Ecology has placed pertinent (in)feasibility criteria, as well as statements about applications and limitations, within the text of each On-site Stormwater Management BMP.

A single soils report should address soil types and depth to groundwater or other hydraulic restriction layer. This report helps determine which, if any, on-site stormwater management BMPs are feasible.

The soil log depth does depend on the depth of the facility, and should be deep enough to verify needed separation. Separation requirements are stated in terms of depth to groundwater or restrictive layer, and from depth from final grade (assuming the facility is constructed as in the drawings).

The 22,000 sq. ft. threshold is eliminated.

Use of the USDA soil type classification is still acceptable for setting the length of the infiltration trench.

Requirements for steep slopes vary based on the stormwater facility. Ponds, infiltration trenches, and dry wells may have different requirements. In general, a geotechnical analysis and report may be required on slopes over 15 percent or if the stormwater facility will be located within 200 feet of the top of a slope steeper than 40%, or in a landslide hazard area.

RTC 3.13: Section 3.1.2 Downspout Dispersion Systems

Commenters: City of Seattle, City of Tacoma, Snohomish County, Thurston County

Summary of range of comments:

- Why can flowpaths from non-native impervious surfaces overlap?
- Consider revising figure. Treated grade board longevity questioned.
- Will perforated connections be an option under MR #5.

Response to the range of comments:

The criteria should have indicated that flow paths from non-native pervious surfaces can overlap with roof dispersion. The text allows overlap with sheet flow from the lawn/landscape area because that is the area being used for dispersion. It cannot be avoided.

Ecology did not update the figure. Local governments can require other methods for dispersion that they have a basis for believing can function better.

Ecology added perforated connections as a last option for downspouts.

RTC 3.14: Section 3.2.1 Detention Ponds

Commenters: City of Tacoma, Snohomish County, Thurston County

Summary of range of comments:

- Include reference to WAC or RCW for dams regulated for safety.
- Don't require a sign.
- Address how to determine if mulch doesn't contain excessive resin, tannin, or other materials. Add that it shouldn't be detrimental to receiving waters. Add caution concerning use of mulch from construction & demo sites. It may have CCA-treated wood.
- Restrict trees on berms higher than 4 feet.
- Revise paragraphs regarding discharge of standing water and sediments for maintenance for consistency with policy in Vol. IV.
- Reference to engineering types should be consistent.
- Emergency overflow and spillway guidance should apply to other BMPs too, e.g., bioretention
- Ecology should develop guidance for homeowners associations to understand their stormwater responsibilities.

Response to the range of comments:

The section includes the WAC reference for dam safety.

A sign is not required. It is recommended.

Guidance for avoiding mulches with excessive resins and tannins is not yet provided. We have added a statement to not use construction materials wood debris or wood treated with preservatives.

Ecology added restrictions for trees on berms higher than 4 feet and added a reference to the street waste guidance in volume IV for handling sediments and water during maintenance. Bioretention has its own guidance in regard to overflows.

The legislature has directed Ecology to develop a training plan for stormwater. Ecology will add homeowners associations to the list of possible training audiences.

RTC 3.15: Section 3.2.3 Detention Vaults

Commenters: City of Tacoma, Snohomish County, Thurston County

Summary of range of comments:

- The control structure should be outside the vault in a separate control manhole.
- Expand to include tanks and Stormtech chambers.

Response to the range of comments:

Ecology did not change the detention vault figure to designate a separate control manhole. However, the “Control Structure” section indicates that such structures are in catch basins or manholes. The detailed figures also show examples of flow control structures in separate structures. Local governments may add a provision to their standard specifications that mandate placement of control devices in structures outside of detention vaults or tanks.

RTC 3.16: Section 3.2.4

Commenters: Snohomish County, Thurston County

Summary of range of comments:

- Minimum orifice diameter not consistent with bioretention. Provide more information on flow throttling devices.
- Add additional information, standards, and a figure for use of notched weirs as flow control structures.
- Delete requirement for an information plate.

Response to the range of comments:

The minimum orifice diameter for bioretention was changed to be consistent with this text. However, Ecology notes that underdrains for bioretention should not be exposed to solids that could plug a one-quarter inch orifice. So, there is an adequate basis for local governments to specify smaller minimum orifices if they want to allow them.

Ecology has not yet added a standard figure for notched weirs. Ecology agrees with the usefulness of providing such a figure and may add a figure as an addendum.

Note that the text indicates that the information plate is recommended. It is not required. Local governments can choose to not specify an information plate.

Section 3.3

RTC 3.17: Section 3.3 Infiltration Facilities for Flow Control and Treatment

Commenters: Aspect Consulting, City of Bellingham, City of Kent, City of Seattle, Clark County, Harmesen & Associates, Hart Crowser, Port of Vancouver, SGA Engineering, WSDOT, Thurston County

Summary of range of comments:

- Improve infiltration performance with dug or drilled drains.
- Allow stand-alone dry wells as under UIC rules.
- Increased infiltration through LID can have unintended negative consequences. Municipalities should evaluate and mitigate or at least monitor groundwater.
- Shift away from traditional road infrastructure will have profound consequences for public works departments. Information on capital, maintenance, and replacement costs should be provided.
- Use “infiltration rate” instead of “saturated hydraulic conductivity.” Also avoid use of “short-term” and “long-term.” Use “field rate” and “design rate.” Use “drop rate in PIT.
- Abbreviation of SHC for saturated hydraulic conductivity not consistent with use of Ksat in LID manual.
- Pre-treatment in a pre-settling basin should be required for all infiltration facilities.
- Should be a tiered screening process. Initial steps to screen out sites not favorable for infiltration using grain size, soil structure and stratification. Field data collected for other sites & to locate facilities. Infiltration tests on all sites not necessary.
- Substantial changes in design approach will require training for designers and reviewers. Ecology should analyze economic impacts and allow more thorough analysis.
- Should be separate guidance for analysis of infiltration at possible constructed wetlands.
- What kind of historical data are acceptable? Are data from old methods acceptable?
- Unclear how much of Section 3.3 applies to bioretention.
- Minimum pretreatment of TSS removal may not protect groundwater. Disconnect between infiltration for treatment and flow control.
- Why must infiltration facility meet LID performance standard? Overkill.
- Re-organize the chapter.
- Expand goal statement and add an applicability section.
- Re-write for clarity.
- Specify post-construction testing and monitoring methods.
- Provide guidance describing heavy compaction, what to do with Ksat estimate, and what to do in the field. More research is necessary.

Response to the range of comments:

Ecology incorporated an expanded purpose statement. This section was originally written for infiltration facilities serving an entire development project. That remains the primary focus of

the chapter. However, the advent of bioretention facilities, rain gardens, and permeable pavements that are essentially small infiltration facilities placed within a development rather than just at the downstream end, required a reassessment of this guidance. Ecology decided to create a new section 3.4 to specifically address field procedures and design criteria for distributed bioretention and permeable pavements. That section, as well as the detailed BMP descriptions for permeable pavement and bioretention in Volume V, include references to specific subsections of Section 3.3 that also apply to those facilities.

Dry wells are an allowed infiltration system but must have appropriate pretreatment as indicated in this section. A possible design that may become more frequently used is construction of a dug or drilled drain (essentially a dry well) to take the stormwater from beneath a bioretention facility into a deeper geologic layer. Ecology will pursue addition of a figure by addendum to illustrate this.

Ecology has chosen to use saturated hydraulic conductivity in most locations of this chapter when it is using the results from a field test or a grain size analysis that are intended to identify a value for that characteristic. Ecology has also used the abbreviation of Ksat rather than SHC to represent saturated hydraulic conductivity.

Ecology concurs that a tiered screening process should be used to firstly evaluate the feasibility of using infiltration-based LID methods on a site, and subsequently to establish design conditions for such methods. Ecology has made its recommendations for such a tiered screening system in Chapter 3 of Volume I – Site Planning, and in Section 3.4 of Volume III. Ecology realizes its recommendations in these sections aren't the only possible way to go about the evaluation and decision process. Local governments can provide their own site planning processes that intends to take a similar tiered approach to design.

The requirement to use LID methods, particularly permeable pavements and bioretention/rain gardens where feasible, represents a significant shift in the infrastructure created to manage stormwater. There will be more distributed infrastructure features that will require periodic maintenance and sometimes replacement. Ecology considers this shift a necessary step to do a better job in protecting the surface and groundwater resources and their designated beneficial uses. There have been various cost analyses done and maintenance recommendations made for various types of LID features. To put a better focus on those aspects, Ecology has two active contracts. One will result in an update to the construction and operation and maintenance costs for the development examples that it used for the 1992 and 2001 stormwater manuals. The other contract will identify recommended maintenance triggers and procedures, and estimate maintenance costs. The results of those contracts will be shared with the municipalities and the public. Training sessions for maintenance will also be held.

Ecology is also tasked by the legislature to create a training plan and create training opportunities for the development community and municipalities. As a first step, Ecology has contracted for a full assessment of all the possible audiences needing training, and development of a proposal to best address those needs.

Historical data that was collected using procedures still recognized as providing useful information can be used.

Infiltration facilities, by themselves, do not necessarily have to meet the LID performance standard. If a designer chooses or must meet the LID performance standard, they have to demonstrate compliance downgradient of all BMPs used on the site.

The minimum pretreatment requirement for TSS removal may not provide adequate protection of groundwater resources that are overlain with soils that do not have much capacity for pollutant removal. In such cases, dissolved pollutants in stormwater could degrade an aquifer if enough stormwater recharges that aquifer. The stormwater pollutants of highest concern would be various dissolved organics, bacteria, and virus.

An analysis for infiltration at proposed constructed wetlands sites does not fit within the guidance of this section. Constructed wetlands are intended to provide treatment by detention settling, and by plant and soil uptake. Soils analyses to determine the acceptability of a site for a constructed wetland belongs in Volume V, Chapter 10.

Ecology considered options for chapter reorganization and changes for clarity.

See responses to comments concerning post-construction testing and construction impacts on design in subsequent subsections.

RTC 3.18: Section 3.3.2 Description

Commenters: City of Tacoma, King County, Thurston County

Summary of range of comments:

- Is TSS reduction before infiltration always necessary? If runoff not from PGIS, pretreatment should not be necessary.
- Does “advisable” mean suggested?
- Are bacteria a problem?

Response to the range of comments:

Runoff from a non-pollution generating surface, by definition, does not need pretreatment prior to infiltration. The common situation where that could occur is infiltration of runoff from an outdoor plaza area subject only to pedestrian traffic. The other common PGIS, many roof surfaces, should be fitted with catch basins prior to infiltrating as indicated in BMP T5.10A. Those catch basins will remove heavier solids and floating materials.

“Advisable” indicates a recommendation.

RTC 3.19: Section 3.3.4 Steps for Design of Infiltration Facilities – Simplified Approach

Commenters: Aspect Consulting, City of Bellevue, City of Redmond, City of Tacoma, Clark County, Hart Crowser, King County, LDC Inc., Snohomish County, Thurston County

Summary of range of comments:

- Apply the same feasibility and design criteria to on-site/LID systems as are used for infiltration facilities to protect groundwater.
- Need guidance concerning when to use simple versus detailed method.
- Minimum distances to groundwater make mounding likely. Simple software modeling capability is needed, preferably in WWHM.
- Given the uncertainties in infiltration design, a number of facilities could fail a performance test. It is very difficult to expand a facility at that point, and enforcement would be problematic. Highlights need for redundancy in design.
- Performance testing needs additional information. Required or recommended?
- Performance testing should be done immediately after construction and observation ports constructed.
- Does this section apply to permeable pavement and bioretention?
- Clarify if simple method is for projects less than an acre or facilities with drainage areas less than an acre?
- Is mounding analysis required for projects over an acre, or just for projects where the drainage area to the facility is over an acre?
- Be consistent in mounding analysis triggers. This section not consistent.
- Exempt road projects from mounding studies if local agency knows where high groundwater does or doesn't exist.
- Mounding analysis should be recommended for small sites with high groundwater or a low permeability layer (less than 0.1 in/hr) within 10 feet of base.
- Is mounding analysis necessary for a rural site clearing 1 acre?
- Not clear if infiltration testing and soils investigation necessary in all cases.
- Clarify if PI test is used to try to locate an infiltration facility.
Allow flexibility in number of borings and test pits.

Response to the range of comments:

Ecology has applied similar and complementary, but not exactly the same, feasibility and design criteria for LID methods that involve infiltration as compared to criteria developed for centralized infiltration facilities. Where bioretention facilities serve larger drainage areas that trigger treatment and/or flow control requirements, their minimum distance to groundwater is similar. A minimum of three feet to groundwater is specified, rather than a default of 5 feet, because bioretention systems, if LID concepts are properly applied, should serve drainage areas not much larger than the treatment and flow control thresholds. Bioretention and rain gardens serving areas under the treatment and flow control thresholds need less clearance to groundwater to function properly because they have lower amounts of stormwater to manage. In addition the bioretention soil mix should provide the needed pollutant removal prior to water passing into the soil profile. For permeable pavements, the underlying soil must meet the soil suitability criteria and provide a 1 foot clearance to the seasonal high groundwater or hydraulic restrictive layer. The low clearance should be adequate for pavements not managing stormwater run-on.

Ecology has provided general guidance for when to use the simple versus detailed methods. The simple method applies where the drainage area to the facility is less than 1 acre. Ecology revised the text to indicate this.

Ecology does not have simple methods to do groundwater mounding analysis. The MODRET model is cited in the text because it represents a simplified version of a more complicated model – MODFLOW. Local governments can allow other methods that they think adequately address the issue. This section retains the 2005 manual recommendation to perform a mounding analysis when the drainage area to the facility exceeds 1 acre and the depth to groundwater is less than 15 feet.

Ecology is recommending post-construction performance testing using the same methods used for design. Ecology has modified the requirement that the project must be modified or expanded if it does not perform as designed. Many commented that it would likely be impractical to expand a facility because of a lack of available space. Ecology concurs and has rewritten the requirement that the applicant is to seek solutions within the existing facility footprint.

This section does not apply to bioretention and permeable pavement.

Methods to determine the measured (initial) infiltration rate and to characterize the soils on-site are necessary in all cases. Ecology has made its recommendations in regard to the types of analyses and methods necessary to adequately site and design an infiltration facility. Local governments can use their discretion in establishing alternative, phased, site analysis procedures.

A Pilot Infiltration test (PI test) can be used as a preliminary screening tool and as a design tool at the selected infiltration site.

RTC 3.20: Section 3.3.5 Site Characterization Criteria

Commenters: Associated Earth Sciences, Aspect Consulting, Thurston County, City of Bellingham, City of Seattle, Port of Vancouver, Port of Seattle-Tacoma International Airport, City of Tacoma, King County, Snohomish County, Hart Crowser, City of Lakewood, City of Kelso, City of Longview, WSU Puyallup

Summary of range of comments:

- Allow driven well points for determining seasonal groundwater elevation.
- Add visual grain size classification. What is basis for using CEC for treatment performance?
- A qualitative description of clay content more realistic than estimating clay versus silt content.
- Level of site characterization depends upon site size and other factors.
- Number of monitoring wells should depend upon project type and size.

- Eliminate groundwater monitoring wells or leave it local discretion.
- Monitoring through one wet season will delay projects and add costs.
- Allow use of soil strata information re groundwater elevation.
- Number of test pits or test holes per infiltration trench length is excessive.
- Require winter observation for seeps and springs.
- Extent of subsurface monitoring not necessary on every project.
- Define saturation zone.
- Allow more discretion on number of monitoring wells.
- Require monitoring wells only if can't confirm 5 feet of separation to groundwater.
- Wells not necessary for small sites, unless necessary to determine depth to groundwater.
- Depth to groundwater not necessary for small sites if you can determine at least 10 feet of clearance.
- Depth to groundwater not necessary for large sites if at least 50 feet of clearance.
- Three monitoring wells only necessary to document variability or assess groundwater impacts.
- The 50 foot depth exempting investigation of groundwater regime should only apply to the confining layer.
- Delete reference to using textural analysis for preliminary infiltration rate estimate.
- Restrict information regarding clay content to sites using grain size analysis.
- Does subsurface exploration need to be so deep?
- This section requires mounding analysis when the drainage area is greater than 1 acre and there is less than 15 feet to groundwater. This conflicts with another section.
- Remove infiltration rate determination from the Site Characterization section.
- Delete repetition of well requirement. Consider conditions under which groundwater wells aren't required.
- Provide guidance concerning appropriate historical data
- If depth to groundwater more than 50 feet, don't require receptor characterization either.
- Depth of explorations should not be based on planned depth of ponded water. Recommend 10 feet for small sites, and 50 feet (or no more than 10 feet below water table) for large sites.
- Clarify requirements for estimating volumetric holding capacity.
- Delete estimation of volumetric holding capacity.
- Estimating capacity of infiltration receptor is important.
- Groundwater monitoring and mounding analysis should be based on risk of failure and scale of facility.
- Allow homeowners to use textural analysis.
- Reduce number of explorations needed.
- This section should discuss potential for perching and potential mitigation (e.g., deep drains).
- Should only have to show time of travel zones if available.

- How can a homeowner determine how deep soil testing must be performed?

Response to the Range of Comments

Driven well points can be used for determining groundwater elevation.

Visual grain size classification and a qualitative description of clay content can be useful. However, if using grain size to estimate infiltration rates, a detailed classification must be done. CEC represents potential sites for pollutant adsorption.

The larger the project site and the infiltration facility, the greater the risks and therefore the greater the certainty in field information to establish design.

Ecology has included recommendations for groundwater monitoring wells as a general requirement. If local governments consider other information sources as adequate for providing information about groundwater elevations and direction, such as soil strata information, they can so designate.

Ecology has reduced the number of test pits or holes per infiltration trench length.

Ecology recommends monitoring groundwater elevations through a wet season if reliable information concerning groundwater elevations at the site aren't otherwise available or can't be ascertained. For infiltration facilities serving drainage areas less than an acre, some method must be used to ascertain whether 10 feet to groundwater from the base of the facility can be achieved. For infiltration facilities serving drainage areas more than an acre, some method must be used to ascertain whether 15 feet to groundwater from the estimated base of the facility can be achieved.

The exemption from investigating the groundwater regime applies to any groundwater layer, perched or confining.

Although textural analysis is deleted from the options for estimating design infiltration rates, it can still be used for estimating a preliminary rate. However, it should not be used to claim infeasibility. The comments in regard to home owners use of textural analysis or soil testing are out of place. Home owners should not be designing infiltration facilities and should not be using this section for rain gardens. Home owners who are building a rain garden should use the guidance in the rain garden handbook published by the Puget Sound Partnership.

The infiltration rate determination details were removed from this section as they are covered in Section 3.3.6.

Ecology received a range of comments – delete, important to retain, restrict the application - regarding estimation of the volumetric holding capacity below the facility. Ecology decided to leave it unchanged.

Time of travel to wells is qualified by “if available.”

RTC 3.21: Section 3.3.6 Design Saturated Hydraulic Conductivity – Guidelines and Criteria

Commenters: City of Bellingham, Hart Crowser, Port of Vancouver, SGA Engineering, City of Tacoma, Thurston County, Port of Seattle, Pierce County, City of Seattle, King County, WSDOT, Aspect Consulting, Snohomish County, City of Bellevue

Summary of range of comments

- Allowing only Pilot Infiltration tests (PI tests) in consolidated soils will increase project costs, planning time, and disturb nearby developed areas.
- What is basis for modified infiltration testing? Were correction factors inadequate?
- Allow other infiltration testing methods, especially in areas which have spent time agreeing on standard methods to use.
- A hierarchy of test methods should be specified, from which designer can choose best fit for the site.
- Do not use grain size analysis for estimating infiltration rates.
- Support PI tests. It should be scalable as appropriate for size of facility and site. Move details to appendix. Detailed comments on the procedures provided.
- Give designer flexibility to use something other than a PI test. Require documentation for the alternative method.
- Clarify if “short-term” refers to actual test result prior to applying correction factors. What about for grain size method?
- Allow grain size method in more areas than those with unconsolidated soils.
- PI test not practical where difficult to get access with the equipment needed to run the test.
- PI test not practical in road development.
- Must professional run PI test? If so, give qualifications.
- Grain size tests useful for preliminary rate estimation, and to ID sites not suitable for infiltration. 2 samples or one from each soil stratum per test hole for grain size analysis.
- If the frequency of testing remains, no correction factor necessary for site variability.
- PI test can be too difficult and unnecessary for road projects. Retain ASTM 422.
- PI test too much for small projects.
- Too much variability in use of terms around saturated hydraulic conductivity and infiltration rate.
- Need wording clarification concerning derivation of design rates from initial rates.
- PI test protocol too complex.
- Put PI test protocol in appendix.
- A number of comments concerned with the details of the PI test.
- Allow smaller PI test footprints.
- Remove discussion concerning compaction.
- Many comments about the basis for correction factors including the total range.

- Top of range indicated for site variability and number of tests should be 1, i.e., no correction.
- The total correction factor for the grain size method should not be less than for the field testing methods.
- Total range of correction should be 0.25 to 0.5 rather than 0.1 to 0.27, and should be based on factors determined by professional, including site variability, test method & frequency, potential for perching layers, and degree of maintenance.
- Correction factors should account for inevitable decrease due to solids loading over time.
- Correction factor for test method seems unsupportable.
- How will plans examiners evaluate proper use of correction factors? How can they assess uncertainty of a method?
- Some equations are hard to find. Please number all equations and place them near to text references.
- Provide worked examples of all equations.
- Not likely that performance will be affected by soil 100 feet below facility.
- Maintenance at 90% of design rate is unreasonable and is not monitored.

Response to the range of comments

Ecology has specified infiltration testing procedures that it considers the best available for estimating saturated hydraulic conductivity. The Pilot Infiltration tests (PI tests), even on a small scale, would seem to provide more reliable information than the other small-scale tests that have been used in western Washington. However, the comments received on the draft indicate a wide range of opinions across the professional community concerning the acceptability of different methods for estimating infiltration rates. Ecology finds such a wide range of opinions disconcerting.

Ecology has decided to retain its fundamental recommendations to delete the USDA textural analysis and the partial soil analysis ASTM method. These simply do not have sufficient engineering rigor for designing infiltration facilities. Ecology will continue to allow local governments to establish their own recommendations concerning what field methods they will allow to be used within their jurisdiction.

Ecology has reduced the use of alternative terms to describe the same test result. But for the record, the “measured,” “initial” and “short-term” saturated hydraulic conductivity all refer to the immediate results of the PI test or the grain size analysis estimate. The “design” and “long-term” saturated hydraulic conductivity refer to the rate estimated after the application of correction factors, and which is used for sizing the facility or estimating its hydraulic performance.

A number of comments concerned the practicality of the large-scale PI test for roads or other sites where nearby improvements could be adversely affected. A few comments also noted implementation problems where it would be difficult to supply sufficient water to conduct the

test. In those situations, Ecology recommends the use of the small-scale PI test. Ecology has recommended an infiltration area as small as 12 square feet. If local governments want to specify a smaller test footprint for use in tight areas, e.g. small sites that are determining feasibility of bioretention or permeable pavement, they may do so. The large-scale PI test will give the best indication of performance and is recommended where it can be implemented without inordinate issues for larger-scale, planned infiltration facilities.

Ecology received a number of wide-ranging comments on the grain size analysis method. The consensus of a number of geotechnical experts consulted prior to the draft proposal was that the grain size analysis method was simply unreliable on consolidated soils. The '05 stormwater manual also indicates this with its recommendation for use of large correction factors for such soils. Some commenters thought grain size analysis should not be accepted for estimating saturated hydraulic conductivity. Because that was not a common comment, Ecology is retaining that option.

Ecology received a number of comments on the details of the PI test. Ecology incorporated a number of recommendations but did not make all of the recommended suggestions.

Ecology received a wide range of comments in regard to the use of correction factors for estimating the design saturated hydraulic conductivity. The '05 manual recommends three factors be added together to arrive at a total correction factor range of 5.5 to 18. The measured saturated hydraulic conductivity is divided by this correction factor to arrive at a design rate. That is a wide range of values whose final determination depends upon the professional judgment of the designer. For this manual update, Ecology's goal was to try to reduce this wide range. The draft manual included three factors that multiplied to a total correction factor range of 3.7 to 11. Commenters in general thought this range was still too expansive and encouraged a reduction in the minimum allowed correction factor. Ecology decided upon a total range of 1.5 to 8.5. The least correction factor would apply to sites where field tests confirm very little chance for site soils variability; and use of a large-scale PI test at the projected infiltration site. The largest correction factor would be used at a site where field tests indicate a site soils variability that cannot be pinpointed without an unreasonable number of soil borings or pits and saturated hydraulic conductivity tests; and use of small-scale methods for hydraulic conductivity rate testing. Note that the correction factors in the manual are actually represented as fractions rather than multiples of 1. The hydrology models are programmed to use fractions. So, a fraction range of 0.67 to 0.12 replaces the 1.5 to 8.5 range indicated above. This range seems to be consistent with the anecdotal experiences of municipalities in reporting the operating success of infiltration facilities. The range, and the basis for it, gives designers some options in deciding the methods and the amount of field tests performed in establishing a design basis.

Some comments were directed at the categories of the factors. A correction factor for site variability seems widely accepted, although there is disagreement about an appropriate range to assign to it. There was not agreement on the assignment of a correction factor for the type

of test method used. Ecology considers this a reasonable factor. The larger the scale of the test method, the more it will represent the actual soil /water interactions of the full scale system. In accordance with the decision to allow local governments to use other small-scale tests, if they consider them appropriate for their area, Ecology has recommended use of a correction factor that provides 20% more correction than use of the Ecology recommended small-scale PI test.

In regard to the correction factor for influent control to prevent siltation, Ecology decided to use a slight correction factor of 0.9 to account for the practical issue that the facility will operate most often in a condition with some amount of solids build-up that will reduce its capacity.

Ecology understands that the assignment of correction factors for site variability will involve some professional judgment. And, that municipal reviewers will also have to evaluate whether a proper site variability factor has been assigned by the designer. Ecology cannot provide a canned solution to that issue. Ecology has described the basis for the site variability factor and provided a description of the extreme ranges of situations that warrant assignment of factors on the limits of the range.

In regard to the comment about maintenance at 90% of design rate as unreasonable and not monitored, Ecology recommends periodic evaluations of these facilities to estimate when maintenance is needed.

RTC 3.22: Section 3.3.7 Site Suitability Criteria

Commenters: Aspect Consulting, City of Redmond, City of Seattle, City of Tacoma, Hart Crowser, King County, Thurston County, WSU Puyallup

Summary of range of comments:

- Delete post-construction performance monitoring. Retain current manual statement. It is not a site suitability factor.
- Exclude infiltration systems over sole source aquifers and within xx feet of a contaminated site.
- Reduce 12 in/hr maximum rate and set infiltration rates and drawdown times for infiltration for flow control.
- Clarify bioretention separation to groundwater to be 1 or 3 feet depending upon drainage area.
- Setback criteria inconsistent with bioretention and downspout infiltration.
- If using PI test, you can't verify infiltration rate for different depths.
- Site suitability criteria should reference UIC guidance; agree with feasibility criteria and organic content for bioretention.
- Treatment not related to infiltration rate.
- SSC-6 criteria should be reconsidered based on latest science. Treatment provided by biofilms that can form even on gravelly soils.

Responses to the range of comments:

Ecology deleted SSC-9 performance testing because it is not a site suitability criterion. Performance testing is listed at the end of the simplified and detailed approaches for design.

Ecology will not exclude use of infiltration facilities over sole source aquifers. The Spokane area is an example of stormwater management that primarily involves recharging the local aquifer with treated urban stormwater.

The maximum infiltration rate for treatment was raised from 2.4 inches per hour to 9 inches per hour. A higher rate seemed practical because: 1) the results of testing the infiltration rate of engineered soils that should have a high capacity for suspended and dissolved pollutant removal generally came in at lower than 13 inches per hour; 2) the soils in Spokane County that are used for pollutant removal over the Rathdrum Prairie Aquifer infiltrate at much higher than the 2.4 in/hr limit; 3) the 2.4 in/hr limit was not achievable by soil types that could otherwise meet the other soil suitability criteria; and 4) the 2.4 in/hr limit seemed to severely restrict the opportunities to use infiltration for treatment. The maximum infiltration rate is intended to ensure adequate contact time of the water with materials that could physically or chemically remove pollutants. Ecology is assuming that contact time plays a role in the potential for pollutant removal.

Twelve inches per hour was a rate achieved by most soils created to meet the bioretention soil mix specification in Chapter 7 of Volume V. However, the bioretention soil mix also has significantly higher cation exchange capacity and organic content than the minima proposed for those parameters in the soil suitability criteria that is applied for use of native soils for treatment. To offset that, Ecology reduced the maximum allowable infiltration rate to 9 inches per hour for the use of native soils that meet the other site suitability criteria.

Ecology is not going to rely on the creation of biofilms to create a treatment media in soils. Studies of infiltrating sewage show the growth of biofilms influences treatment. Such growth is the basis for various fixed media filters. However, stormwater is not as rich in organics and nutrients that sewage is. Ecology is not aware of studies showing reliable growth of pollutant-removing biofilms in stormwater studies. So, Ecology is maintaining minimum criteria for soil characteristics.

The bioretention requirements are in Section 3.4. Do not use Section 3.3 for bioretention design unless section 3.4 refers you to a specific subsection.

Ecology concurs that it is not reasonable to site an infiltration rate to be confirmed at various depths within the same test hole. So the references to soil depth for compliance with an infiltration rate have been removed. The designer still needs to have an indication from soil testing of an adequate depth of soils meeting the other suitability criteria (CEC, organic content).

RTC 3.23: Section 3.3.8 Steps for Design of Infiltration Facilities - Detailed Approach

Commenters: Cowlitz County, Hart Crowser, City of Tacoma, Thurston County, King County, SGA Engineering, WSDOT, Aspect Consulting, City of Redmond, City of Bellevue, Snohomish County

Summary of range of comments:

- Combine 3.3.4 and 3.3.8 into one section.
- Update and relocate figures to be closer to text.
- Conflict in guidance concerning drawdown times for water quality volume and maximum pond volume.
- MODRET should not be only program used for mounding analysis.
- Mounding analysis should only be required where higher groundwater potentially exists and where there are potential risks to downstream areas.
- Blanket threshold for mounding analysis overly restrictive. Let the jurisdiction decide based on the soils information.
- More guidance needed concerning how to do the mounding analysis.
- Is performance testing required or recommended?
- Roadside bioretention should be exempt from mounding analysis except in high ground water areas.
- Rewrite all equations using a uniform set of units.
- State that Dpond should use 0.25 of max. depth.
- Threshold for groundwater mounding analysis is unclear. Does it apply to bioretention and permeable pavement? Does the project size have to exceed 1 acre, or the drainage area to the infiltration facility?
- Mounding analysis trigger should not be based on project type, but on a combination of factors including depth to groundwater, soil type/infiltration capacity, risk of mounding to adjacent facilities/properties. Mounding analysis purpose should be for determining impacts, not for adjusting infiltration rate.
- Mounding analysis should only be done when determined necessary by a soils professional.
- At what depth should the pond aspect ratio be determined?
- Move BMP design criteria to the BMP description section. Does 24-hr drawdown apply to simple method too?
- Mounding analysis should be not necessary: at the recommendation of a geologic professional; or, when borings show consistent soils for 10 ft. below facility; or for permeable pavement receiving no run-on.
- Groundwater mounding analysis using a groundwater modeling program is complex. Most local governments don't have expertise. The detailed method is more conservative than a program like MODRET. Reconsider need for this requirement. Not necessary where infiltration rate greater than precipitation rate.

- Equation for determining hydraulic gradient not necessary as the Pilot Infiltration test (PI test) at steady state already accounts for the hydraulic gradient.

Response to the range of comments:

Ecology decided to retain the current format of sections but to eliminate some duplicative material.

The drawdown time requirement is now restricted to the guidance for checking the water quality volume.

Ecology does not have simple methods to do groundwater mounding analysis. The MODRET model is cited in the text because it represents a simplified version of a more complicated model – MODFLOW. Local governments can allow other methods that they think adequately address the issue. This section retains the 2005 manual recommendation to perform a mounding analysis when the drainage area to the facility exceeds 1 acre and the depth to groundwater is less than 15 feet.

Groundwater mounding analysis would apply to bioretention facilities that meet the threshold criteria. Permeable pavements that do not accept run-on from other areas should generally not have to perform a mounding analysis.

Performance testing is required. The text is changed to consistently indicate that.

Ecology has not rewritten the equations to indicate consistent units. This admittedly can be a source for designer error. If Ecology becomes aware of a frequent problem with the use of different units, it will consider an addendum.

The aspect ratio is the length to width of the bottom area of the infiltration facility.

A clarification on the calculation of the pond parameter was added directly below the equation.

RTC 3.24: Section 3.3.9 General Design, Maintenance, and Construction Criteria for Infiltration Facilities

Commenters: Kitsap County, Clark County, WSDOT, City of Tacoma, Thurston County, Cowlitz County, Snohomish County

Summary of range of comments:

- Update section to properly reference use of infiltration to meet minimum requirement #5
- Do not use impervious liners on side slopes. Allow use of a treatment layer.
- Reference O&M manual for a maximum time for water to remain in the trench or basin. A blanket drawdown of 24 hours is not appropriate because some basins have a long time of concentration.
- It is not clear when different types of infiltration rate testing are acceptable.

- Criteria for all types of infiltration facilities, including LID, should be the same.
- For clarity, revise wording concerning depths.
- Conflict in drawdown time between maximum depth and Water Quality Volume.
- Ensure consistency in pretreatment recommendations.
- Figure and text do not agree concerning when to use MODRET.
- 1 acre trigger for groundwater model too broad. Perhaps require analysis only where the local jurisdiction is aware of groundwater problems.
- List steps to protect LID BMPs too.

Response to the range of comments:

The section was updated to properly reference updated requirements.

The recommendation for use of impermeable liners on side slopes is deleted.

The general statement concerning indications for needed maintenance is changed to indicate observation of ponded water longer than 24 hours after runoff ends.

Criteria for all types of infiltration facilities should not be the same because of variations in how they are used. See responses to similar comments in previous sections.

Ecology resolved the drawdown time conflict, and text and figure conflict, regarding the use of MODRET.

See responses to previous sections concerning groundwater modeling. In summary groundwater mounding analysis is recommended where a facility serves more than an acre of drainage and there is less than 15 feet to seasonal high groundwater or other hydraulic restriction layer.

Steps to protect LID BMPs are included in minimum requirement #2 concerning construction controls.

RTC 3.25: Section 3.3.10

Commenters: Clark County

Summary of range of comments:

- Trigger for mounding analysis should be at 2.5 to 3 acres with high groundwater conditions.

Response to the range of comments:

Ecology received a range of suggestions for groundwater mounding analysis triggers. Some recommended smaller drainage areas. Others recommended larger drainage areas. Many recommended use of some consideration for depth to groundwater.

Ecology decided to keep the guidance in the '05 manual. A groundwater mounding analysis should be conducted where the depth to seasonal groundwater table or low permeability statum is less than 15 feet and the runoff to the infiltration facility is from more than one acre.

RTC 3.26: Section 3.4 Stormwater-related Site Procedures and Design Guidance for Bioretention and Permeable Pavement

Commenters: Ballard Stormwater Consortium, City of Bellingham, King County, City of Seattle, City of Tacoma, Thurston County, City of Redmond, Cowlitz County, WSU Puyallup, Snohomish County, WSDOT, City of Bellevue

Summary of range of comments:

- Minimum Requirement #5 will trigger more upfront planning and analysis with increased cost. This will raise the cost of homes and other small projects.
- The criteria for compost in the WAC allow too high of concentrations of metals and other pollutants. Restrict concentrations using MTCA standards. In long run, establish lower criteria for the compost.
- How would anyone ascertain whether mulch contained excessive resin, tannin or other materials detrimental to plant growth? Also, caution users about mulch from construction debris because of danger of chemically treated wood.
- Too much emphasis on restoring hydrogeology. Should also emphasize restoring water quality.
- Recommend guidance require checking groundwater elevations at end of winter.
- Recommend that projects triggering minimum requirements #1 - #5 be required to use the small-scale PI test. Rain garden handbook methods not acceptable.
- Reduce frequency of testing for roadside bioretention from every 50 feet to every 150 feet. Or, 250 feet.
- An infiltration test is recommended for every lot. Is this regardless of lot size?
- Infiltration tests for permeable pavement should be less frequent than every 2500 square feet. Use same as for infiltration facilities – 5,000 sq. ft. or greater if no run-on.
- Clarify that a reduction in testing frequency should be a judgment call by a geotechnical professional.
- Clarify use of section 3.3.5 for bioretention and permeable pavement.
- Clarify how section 3.4 works with Chapters 5 and 7 in Volume V. Combine into one volume.
- Require groundwater mounding analysis at a drainage area of 10,000 sq. ft.
- Exempt permeable pavement from Pilot Infiltration test (PI test) if it only infiltrates direct rainfall.
- Make guidance concerning correction factors consistent with bioretention in Chapter 7 of Volume V.
- Don't require computer modeling of permeable pavement on small sites.
- Require a PE to evaluate hydrologic connectivity of channels to reduce flood risk.

- Guidance inconsistent concerning infiltration testing for infiltration trenches and bioretention.
- Designing permeable pavement using an average of infiltration rates on-site is inappropriate when a large disparity in rates.
- Allow modeling as one facility only where infiltration rates and groundwater elevations are similar.
- Disagree with modeling all facilities on a project site as one large facility.
- Clarify how/whether portions of section 3.3 apply to design of bioretention and permeable pavement.
- Require only small scale PI tests for bioretention and permeable pavement.
- Frequency of PI tests should be reduced if consistent soil characteristics. Require tests where subsurface characterization changes.
- If an infiltration test done at the bioretention site, there should be no correction for site variability.
- Make correction factor guidance the same as in LID Manual.
- Is overexcavating an infiltration test site to view soils and any hydraulic restriction layers a requirement or a recommendation?
- Better to simply observe soil profile for mottling than to overexcavate an infiltration test site. If any question, monitor over the winter.
- Clarify if groundwater mounding analysis required for bioretention serving over 1 acre.
- Make comments concerning priority use of permeable pavements and bioretention consistent with minimum requirement #5.
- Setbacks for permeable pavement should be similar to other BMPs.
- Add a checklist of concerns to the site planning guidance for considering possible travel routes of infiltrated water.
- Delete reference to tests in the Rain Garden Handbook for Western Washington Homeowners.
- On projects subject to M.R. #1 - #9, require a hydrogeologist report assessing potential impacts on downgradient properties and structures.
- P.E. should certify as-builts. Handle LID BMPs like infiltration facilities to reduce chance for interflow issues.
- Should do more testing of permeable pavement before requiring their use.

Response to the range of comments:

To implement LID properly requires more upfront planning and site analysis than is commonly practiced. The use of LID may or may not result in an overall increase in project design and construction costs. The cost of more upfront field work and planning can be offset by savings in stormwater infrastructure.

Ecology concurs that the amount of pollutants allowed by the state's compost regulation is more than should be present in compost that is used to create soils through which large amounts of stormwater will be purposefully directed. In the long run, Ecology may pursue

more restrictions in the quality of compost for this purpose. In the meantime, Ecology has specified compost destined for use in bioretention must be created from yard waste and food waste feedstocks. This excludes other sources that are more likely to contain higher concentrations of metals, e.g., biosolids.

Ecology has included a statement about not using mulch from construction debris. Ecology does not know how one would avoid mulch containing excessive resins, tannin or other materials detrimental to plant growth. But we retained the provision as a warning of the potential issue.

Ecology has not reduced any emphasis on water quality. Ecology has increased emphasis on water quantity issues. It is interesting to note that Ecology received criticism in the 1990's for too much emphasis on water quality while ignoring water quantity.

Projects that trigger minimum requirements #1 - #5 will not be allowed to use the rather qualitative analysis methods that were described in the existing rain garden handbook. This manual and the updated rain garden handbook will direct those projects to the use of more technical methods. The rain garden handbook will allow less technically demanding methods for projects not triggering minimum requirements #1 - #5, and for retrofit projects that are not new or redevelopment.

Recommended frequency of saturated hydraulic conductivity testing has generally been reduced to be consistent with other guidance in the manual. The manual contains statements regarding judgment to be exercised by the site professional in regard to the amount of testing.

Section 3.4 applies to bioretention and permeable pavement, and references specific subsections of section 3.3 for pertinent detailed information or guidance.

Section 3.4 includes general guidance on field testing and some basic design procedures associated with them. Pertinent design criteria for bioretention and permeable pavement are described in Chapters 7 and 5, respectively, of Volume V. Chapter 3 of Volume I has general site planning procedures.

Ecology does not think it is appropriate to exempt permeable pavement from small scale PI testing. There should be a test to determine whether the water will infiltrate or not. Water which will not infiltrate will either flow into areas that were not specifically designed to receive it, or will remain ponded and potentially create hazardous or structure damaging situations.

Computer modeling of permeable pavement is not required on sites that do not have to demonstrate compliance with the LID performance standard, the treatment standard, or the flow control standard.

A professional engineer is necessary to approve the overall stormwater site plan for a development.

The guidance for infiltration testing for infiltration trenches assumes a facility that is being designed to meet treatment and/or flow control requirements. Infiltration testing for small areas, such as roof runoff, should refer to the more simple procedures under BMP 5.10A in Section 3.1.

Ecology has changed the information in regard to modeling multiple facilities as one facility. Certainly some commonality and restrictions on variation in infiltration rates should be applied to any roll-up methods for modeling. This issue will probably be revisited in the development of more detailed modeling guidance.

Small scale PI tests are appropriate for bioretention and permeable pavements that do not serve very large drainage areas.

The correction factor range for site variability for bioretention and permeable pavement has changed to allow for no correction for some situations where testing occurs at the planned location for the LID BMP. This would be appropriate for a small-scale bioretention (e.g., serving one or two houses) or a small-scale permeable pavement (e.g., a driveway) where the soils are not highly variable. This guidance should be consistent with guidance in the LID manual.

Ecology would recommend groundwater mounding analysis for a bioretention cell serving over an acre where there is less than 15 feet to groundwater. Ecology would not recommend a groundwater mounding analysis for a roadside bioretention swale that runs along the length of the road (with the exceptions of cross streets and driveways) it serves if the depth to groundwater is over 5 feet.

The text has been changed to read more accurately with what is required within minimum requirement #5.

Please see the infeasibility criteria for permeable pavement in Chapter 5 of Volume V for setbacks. Remember that permeable pavement is merely passing incident rainfall through its surface. It is not concentrating and infiltrating water from other areas. So, some setback requirements do not need to be as stringent.

Ecology has not created a checklist of concerns for site planning. That could be a more detailed guidance document developed at a future time if experience indicates it as a priority need.

See Chapter 3 of Volume I for Ecology's guidance concerning the scope of reports to be submitted with project plans. A report from a qualified professional would be needed to justify a decision to claim infeasibility based on potential impacts to downgradient properties or structures.

A P.E. should certify record drawings for any stormwater facilities that assist in meeting treatment, flow control, and LID performance standard requirements. For subdivisions where the developer is only installing the access road, utilities, and driveway entrances in the right of way, the engineer should provide record drawings for the stormwater facilities serving those improvements. LID facilities to be located on individual lots should be called out on legal

documents for those lots. They should be installed as part of the development of those lots. Any engineered LID BMPs (e.g., bioretention, permeable pavement with a specified base layer for storage), should have record drawings certified by a P.E. LID BMPs for which standard designs from the local code or stormwater manual are followed (e.g., roof full infiltration or downspout dispersion, permeable pavement without storage) do not seem to require a PE certification.

Please also refer to the [Response to Comments on the Municipal Stormwater Permits Part V – Comments on Western Washington Appendix I, Low Impact Development \(LID\) and Watershed-based Stormwater Planning.](#)

Appendix III-A

RTC 3.27: Isopluvial Maps for Design Storms

Commenter: City of Redmond

Summary of range of Comments:

- Note that NOAA Atlas 2 available on-line in GIS compatible formats.

Response to the Range of Comments:

Ecology added a link to the NOAA maps.

Appendix III-B Western Washington Hydrology Model

RTC 3.28: WWHM Model Update

Refer to RTC 3.1: WWHM Model Update in Section 2.2.

RTC 3.29: Wetland Modeling

Commenter: Thurston County

Summary of Range of comments:

- For compliance with Minimum Requirement #8, surface flow modification should be taken into account.

Response to the range of comments:

Wetlands are impacted by flows originating from surface, interflow, and ground. Since the ground water movement is relatively slow, it has a delayed impact on wetlands. The wetland flow criteria accounts for all the 3 flow components not just the surface flow.

RTC 3.30: LID Modeling

Commenters: DeepRoot Green Structure LLC

Summary of range of comments:

- Consider adding an “Element” (i.e., button) specific to urban trees in the updated version of the model, so that the flow control and water quality treatment benefits can be accurately applied by designers and understood by development reviewers.

Response to the range of comments:

There is no specific "credit" number/value given to a particular LID practice in WWHM. WWHM models the hydraulic behavior of the various LIDs in response to precipitation, incoming runoff, and evapo-transpiration. Any water quality or flow control benefits associated with LIDs will depend on the algorithms being used to model each LID. Currently, there is no algorithm included that models the hydraulic behavior of different urban trees.

RTC 3.31: Clarification and typos

Commenters: Cowlitz County, Thurston County

Summary of range of comments:

- A number of grammatical correction and clarification have been suggested.

Response to the range of comments:

The suggested correction and clarification have been incorporated.

Appendix III-C**RTC 3.32: Updating WWHM for Modeling LIDs**

Commenters: Thurston County, DeepRoot Green Structure LLC, SVR Design Company, City of Tacoma, Clark County

Summary of range of comments:

- LID techniques in WWHM
- Guidance in Appendix C is outdated and LID modeling guidance for WWHM is needed

Response to the range of comments:

Updated LID modeling guidance is included in Appendix C. WWHM is being updated to include the capability to model bioretention cells, porous pavements, green roofs, and road embankment. WWHM determines compliance with the LID standard which is that the post development flow duration values must be below any of the Pre-development flow duration values between 8% and 50% of the 2-year pre-development peak flow value.

The updated WWHM will be free and the features will be available for all Western Washington counties.

RTC 3.33: Appendix III-C Flow Modeling Guidance

Commenters: Cowlitz County, Port of Vancouver, Snohomish County, Squeaky Wheels Bicycle Advocacy Group, City of Seattle, City of Redmond, Thurston County, WSU Puyallup, SvR Design Co., Aspect Consulting, City of Bellevue, WSDOT, City of Tacoma, Deep Root Green Infrastructure, City of Renton, City of Bellingham, King County

Summary of range of comments:

- This section should be moved into Volume V. Flow modeling and design criteria should be part of each BMP description in Chapter 5 of Volume V.
- Text of BMP T5.30 and Roadway full dispersion in this appendix are not consistent. Consolidate.
- Groundwater not necessarily protected where full dispersion in outwash soil.
- Bioretention infiltration rates are too conservative. Ecology has approved media attaining Enhanced Treatment at 100 inches per hour.
- Pavements for bicycles should be exempt from treatment and flow requirements.
- Need additional guidance for cisterns and rainwater harvesting.
- Define planter boxes more explicitly.
- Add guidance for tree planting and add trees to the List option of M.R. #5.
- Clarify that 100% reuse of harvested rainwater is preferable but compliance with LID performance standard is the requirement.
- Restriction of rainwater harvesting to 4 homes/acre and less densities when water is used strictly outdoors is too restrictive and not clear.
- Cite guidelines in LID manual for growing urban trees.
- Tree planting is not an enforceable requirement. For roads, the clear zone takes precedence.
- Clarify how tree canopy measurement is made.
- In areas with good native soils, add a provision that allows just hydroseeding in roadside areas cleared for sight distance, clear zone, and other safety measures.
- Should be reference to setbacks from utilities, poles, structures, etc.
- Minimum depth of 18 inches only necessary for treatment not flow control.
- Provide bioretention mix specifications consistent with LID manual.
- Change bioretention soil specification to (more than one option suggested).
- Provide references that support the adequacy of the bioretention soil mix specifications in protecting groundwater.
- Mulch thickness should be 2 – 3 inches.
- Mulch should vary with plant type. So, give a range of 2 – 4 inches.
- Various recommendations regarding modeling of permeable pavements.
- Correction factors for infiltration rates should range from 0.25 to 0.5.
- Will publicly available version of WWHM have Elements for bioretention?
- Why different correction factors for different drainage areas?

- Use of correction factors should be tied to consequences of failure at a specific site.
- Bioretention will be too costly along roads if an infiltration test is necessary every 50 feet and a large correction factor must be used. Allow for engineering judgment.
- Require one infiltration test per soil type for bioretention along roadside, and model each bioretention that has a different soil type separately.
- For multiple infiltration rate tests that are weighted by area, no variability correction factor is needed.
- Construction guidance should be consistent with LID manual.
- Refer reader to LID manual for various specifications for base aggregate material below permeable pavement.
- Base materials used for water storage should be in addition to base depth necessary for pavement support.
- List soils for which geotextile is recommended for permeable pavements.
- Minimum new rate for permeable pavement should be 200 in/hr.
- Delete void space specification for pervious concrete.
- Recommend allowing ASTM C1701/C 1701 – 09 to test infiltration rate of permeable pavements.
- Rather than a set cleaning frequency, set a minimum infiltration rate for permeable pavement that must be maintained. 20 in/hr? 10 in/hr?
- Infiltration requirements should be the same for all infiltration devices.
- Revise tree credit guidance. The credit should not be linear. Credit should increase non-linearly as a function of tree size.
- All guidance documents and modeling tools, including this Appendix, should be complete and subject to public review before making them an NPDES requirement.
- Replace tree credit equations so that results are in square feet, not a percentage.
- Don't allow areas meeting BMP T5.13 to be modeled as pasture. Some mixtures don't infiltrate well. Consider a more prescriptive requirement such as the bioretention mix.
- Allow deeper ponding depths for bioretention.
- Bioretention design doesn't consider the infiltrate rate of the native soils below.
- Instructions for modeling storage in below grade base materials of pavement are suspect.
- Run-on to permeable pavement from adjacent areas should be allowed and modeled accordingly. Where run-on from PGIS, maintenance plan should address preservation of infiltration rates.

Response to the range of comments:

Ecology implemented the suggestion of a number of commenters to move all design criteria for LID BMPs into the sections of the manual where those BMPs are described. Most of the LID BMPs are described in Chapter 5 of Volume V. Roof downspout controls are described in Section 3.1 of Volume III. Brief descriptions of computer modeling methods were also included within those BMP descriptions. Ecology retained computer modeling guidance within this Appendix III-C so that it serves a convenient summary for all LID BMPs.

The appendix contains two summaries of guidance. The first summary applies to the publicly available version of the WWHM (WWHM3) that can be used immediately to model LID BMPs. The second summary provides a general description of updated methods that are being incorporated into an updated version of WWHM (referred to as WWHM 2012) that will be available later this year.

BMP T5.30 has been expanded to include all detailed BMP guidance in regard to full dispersion options for developments and public roads. Where full dispersion occurs on outwash soils, it is assumed that in most cases, those outwash soils are overlain with soils that have characteristics that will suffice for pollutant removal.

Ecology has provided a specification for bioretention soils that should have strong capabilities to remove a range of pollutants associated with sediments and pollutants in the dissolved phase. Ecology understands that the specified soil mix can actually contribute dissolved forms of nutrients – phosphorus and nitrogen – to stormwater. So, Ecology does not recommend bioretention use where the bioretention will be underdrained and discharge to fresh water.

Ecology has a specification with minimum criteria for custom soil mixes that can also be used in bioretention. The specification has a restriction on saturated hydraulic conductivity. That restriction will not allow use of media that has otherwise been approved for use within specified containers for meeting enhanced treatment requirements. Those media were approved as meeting a minimum level of dissolved metals removal and were not tested for other pollutants. Ecology does not expect that those media will perform nearly as well at total pollutant removal as the soils in the bioretention soil specifications.

Pavements for bicycling only will not be exempted from stormwater requirements. Those pavements are classified as non-pollutant generating if they are separated from road surfaces for cars. But on a square foot basis, they create just as much of a change in natural hydrology as pavements for cars do.

Guidance for cisterns can be found in the LID manual. Typical small cisterns (e.g., 55 gallon containers) do not provide sufficient flow reduction benefits that make it worthwhile to acknowledge in runoff modeling. Large cisterns can be modeled as storage devices. Ecology is not prepared to offer detailed guidance in regard to rainwater harvesting designs. Ecology has taken a simplistic approach that indicates that allows the impervious area used for collection to be removed from computer modeling if the design demonstrates a monthly water balance that does not result in an overflow to surface discharge. Theoretically, rainwater harvest designs that demonstrate compliance with the LID performance standard would be acceptable also. Projects using such designs still have to demonstrate compliance with Minimum Requirement #7 – flow control – if it is applicable to the project.

Ecology decided not to include tree retention and/or planting within the List option of Minimum Requirement #5. Trees can be used as an additional method to reduce runoff in projects using the list option of minimum requirement #5, or in projects choosing the LID performance standard. Ecology agrees that tree retention and additional planting are desirable

features not only from a stormwater perspective but for other environmental benefits too. However, a state mandate to retain or plant a certain number of trees within different development types would put Ecology further into site development standards than it thinks is appropriate for a technology-based approach (i.e., the list option). Ecology has supported the development of the Puget Sound Partnership guidance document, “Integrating LID into Local Coes: A Guidebook for Local Governments.” Ecology cited that document in an updated Municipal Stormwater Permit requirement for local governments to review and update their site development codes to incorporate LID principles and BMPs. That guidance document identifies the option of a local ordinance to mandate tree retention and planting. Ecology encourages local governments to include tree retention and planting requirements in their development code update.

Ecology reviewed the tree planting draft and finds the guidance sufficient for directing how tree canopy measurements are made and how much impervious surface reduction credit can be taken. Ecology has been contacted concerning a more rigorous science basis for assigning tree credits. Ecology will proceed with the tree credits as proposed in the draft, but will pursue further evaluation of tree credits. If Ecology considers an adjustment to be prudent, it will recommend an adjustment in an addendum.

Ecology has incorporated setbacks for LID facilities within the BMP descriptions for each. If a local government has a need for an additional feasibility criterion, or a different setback, it can establish the criterion or setback but must be prepared to defend the technical basis for it.

Ecology has settled on an 18-inch depth of soil for all bioretention facilities in order to promote healthy plantings within the facility and significant soil moisture holding capacity.

Ecology cannot cite a listing of studies that demonstrate that the specified bioretention soil mix will provide a certain anticipated infiltrate quality that will protect groundwater from all potential pollutant sources. Ecology has relied on the general principle that soils with high CEC and organic capacity have the potential to capture a wide range of pollutants. Ecology has provided funding to the WSU Puyallup research station to investigate the ability of various soil mixes to achieve pollutant removal. Those results could influence changes in the soil specification. But those results are not yet available.

A mulch thickness is specified in chapter 7 of Volume V.

Ecology has a general recommendation in regard to correction factors for use with the assumed initial infiltration rate of 6 inches per hour for the default bioretention soil mix. A factor of 0.25 is used for bioretention facilities that serve a drainage area exceeding 5,000 sq. ft. of pollution-generating impervious surface; or 10,000 square feet of impervious surface; or $\frac{3}{4}$ acre of lawn and landscape. A factor of 0.5 is used as the infiltration rate correction factor, if the contributing area is less than all of the above areas. The larger correction factor (0.25) is a relatively conservative (i.e., projecting lower infiltration rates) correction for infiltration facility design. The range of correction for infiltration facilities is 0.67 to 0.12. The smaller correction

factor (0.5) for smaller drainage areas is an acknowledgement that they serve small drainage areas and their footprint is less of a scale-up from the small scale test pit.

Note that there is a separate discussion in Section 3.4 concerning whether a site variability correction factor should be used for the underlying native soil below a bioretention facility.

The correction factor guidance in this manual is intended to be consistent with the guidance in the Low Impact Technical Guidance Manual for the Puget Sound Basin.

Ecology worked with an advisory committee and its WWHM modeling consultant, Clear Creek Solutions, to develop a modeling method to represent bioretention. The result of the discussion is the bioretention “element” in the runoff model. The element take into consideration the properties of the bioretention soil mix and the native soil underlying the bioretention mix (if the bioretention exfiltrate is allowed to soak into the ground below the facility).

Ecology also used the same administrative process to agree upon a method for modeling permeable pavements. The result of those discussions is the development of an “element” in the model that incorporates various features of permeable pavements. However, a more simplified approach of modeling the pavement as a grassed surface is also available and is appropriate for installations that do not have any appreciable storage volume in the base gravel course below the pavement.

Ecology did not incorporate a lot of detailed specifications for permeable pavement into Volume V of the stormwater manual. Ecology does not have expertise in road construction, and there are multiple variations that local governments can adopt for permeable pavement standard details. Local governments can use suggested details in the LID Technical Guidance Manual for the Puget Sound Basin to develop their own specifications. As long as the specifications do not compromise a basic assumption of the computer modeling approach, they should be acceptable.

The specification for BMP T5.13 is to simply add compost to the soil profile on the construction site. Ecology has not recommended use of the bioretention soil mix or other mixes of compost with other materials. If just compost is used, the instructions for BMP T5.13 are followed, and the correct choice of background soils is selected (e.g., outwash or till), Ecology is comfortable with allowing such areas to be modeled as pasture.

Local governments may choose to allow deeper pooling depths for bioretention.

Local governments may also allow run-on to permeable pavements from adjacent areas. Ecology has recommendations for restricting the amount of run-on. Wherever run-on is allowed there is the need for more frequent inspection to make sure infiltration rates through the pavement are maintained above minimum acceptable rates.

Ecology has incorporated reference to ASTM C1701 as an infiltration rate acceptance test, and has increased the minimum acceptable rate to 20 inches per hour.

Volume IV Response to Comments

RTC 4.1: The use of “applicable”, typos, and minor edits

Commenters: Cowlitz County, King County, Port of Vancouver, City of Redmond, City of Seattle, City of Tacoma, Thurston County

Summary of range of comments:

- The use of the “applicable” is confusing, since it is to be interpreted as “mandatory”.
- Typographical, grammatical, spelling and formatting errors
- Unclear wording

Response to the range of comments:

Ecology left the term “applicable” within this volume since it is consistent with the current Industrial Stormwater General Permit and Boatyard General Permit. In an attempt to clarify the meaning of “applicable”, Ecology uses “applicable (mandatory)”. Ecology felt it was important to have consistent language between the permits and the manual.

Ecology revised the text for clarity and corrected errors. In some instances, the proposed changes altered the intent of the statement. In these cases, Ecology inserted other wording that clarified the meaning. In some instances, the original wording remains because Ecology determined it was the best phrasing available to convey the meaning.

RTC 4.2: Permit References

Commenters: City of Redmond, City of Seattle, Thurston County

Summary of range of comments:

- The Industrial Stormwater General Permit seems to be referenced heavily in the volume, there are other applications for this volume that should be considered.
- Some of the guidance seems directed at Individual Permits, which the commenter did not think was appropriate.
- References to the Sand and Gravel and Boatyard Permits appeared unclear.

Response to the range of comments:

Volume IV is particularly directed to the Industrial, Boatyard, and Sand and Gravel Permits, to help the facilities covered by these permits meet their Stormwater Pollution Prevention Plan requirements. Ecology maintained the emphasis on these permits throughout the volume. Ecology also added new language to Chapter 1 of Volume IV to clarify the relationship between this manual and the various NPDES permits and individual NPDES permits. Ecology added additional references to the Sand and Gravel General Permit, and Boatyard General Permit where appropriate. Ecology includes permit requirement in individual permits to protect receiving waters at least to the level of protection as provided by the General Permits referenced by this volume.

RTC 4.3: Vacuum Sweepers

Commenters: Port of Vancouver, City of Seattle, Snohomish County, City of Tacoma

Summary of range of comments:

- Consider allowing sweeping and not requiring vacuum sweeping.
- There is confusion as to where vacuum sweepers are required or not.

Response to the range of comments:

Ecology has determined that Vacuum Sweeping is AKART. Guidance continues to recommend where this is required. Ecology edited Volume IV to clarify where vacuum sweepers are required.

RTC 4.4: Other permits, regulatory and standards references

Commenters: King County, City of Seattle, Snohomish County

Summary of range of comments:

- The commenters requested Volume IV to provide a more detailed description of the regulation or standard referenced.
- Most jurisdictions have adopted the International Fire Code instead of the Uniform Fire Code.

Response to the range of comments:

Ecology attempted to minimize repeating information within regulations or standards outside of Ecology's control. When Ecology referenced a permit, there was a conscious effort to not duplicate or usurp the information contained within that reference.

Ecology has edited Volume IV to refer to the International Fire Code where applicable.

RTC 4.5: BMPs suited for other volumes

Commenters: King County, City of Seattle

Summary of range of comments:

- More discussion should be provided for Erosion and Sediment Control in the BMPs for Dust Control.

Response to the range of comments:

Erosion and Sediment Control is discussed most extensively in Volume II.

RTC 4.6: Modification to BMPs

Commenters: AMEC, King County, Port of Vancouver, City of Seattle, Snohomish County, Thurston County

Summary of range of comments:

- Some of the “recommended” BMPs should be reclassified as “applicable (mandatory)”
- The “recommended” BMPs are too protective and should not be included
- Some BMPs should be eliminated entirely since there are similar BMPs or more general criteria that cover those BMPs
- Some BMPs should be added to address some more specific concerns
- Source control BMPs should have an ecology sponsored evaluation such as TAPE so that the end users will be able to find the products that they need
- Cost should be an explicit consideration in the decision criteria of BMPs
- The range of comments above applies to the following sections:
 - 2.1 Applicable (Mandatory) Operational Source Control BMPs
 - 2.2 Pollutant Source-Specific BMPs
 - S401 BMPs for the Building, Repair, and Maintenance of Boats and Ships
 - S404 BMPs for Commercial Printing Operations
 - S406 BMPs for Streets/ Highways
 - S407 BMPs for Dust Control at Disturbed Land Areas and Unpaved Roadways and Parking Lots
 - S410 BMPs for Illicit Connections to Storm Drains
 - S411 BMPs for Landscaping and Lawn/ Vegetation Management
 - S413 BMPs for Log Sorting and Handling
 - S414 BMPs for Maintenance and Repair of Vehicles and Equipment
 - S417 BMPs for Maintenance of Stormwater Drainage and Treatment Systems
 - S419 BMPs for Mobile Fueling of Vehicles and Heavy Equipment
 - S420 BMPs for Painting/ Finishing /Coating of Vehicles/Boats/ Buildings/ Equipment
 - S423 BMPs for Recyclers and Scrap Yards
 - S424 BMPs for Roof/ Building Drains at Manufacturing and Commercial Buildings
 - S427 BMPs for Storage of Liquid, Food Waste, or Dangerous Waste Containers
 - S428 BMPs for Storage of Liquids in Permanent Aboveground Tanks
 - S429 BMPs for Storage or Transfer (Outside) of Solid Raw Materials, Byproducts, or Finished Products
 - S431 BMPs for Washing and Steam Cleaning Vehicles/ Equipment/ Building Structures

Response to the range of comments:

Ecology reviewed the “recommended” BMPs and did not make them more protective. The level of emphasis was appropriate for the BMPs. Leaving the BMPs as recommended allows some

flexibility, particularly when ISGP users need to address benchmark exceedences that trigger corrective action.

One notable exception to reconsidering the emphasis from “recommended” to “applicable(mandatory)” is the BMP for the removal of liquids from vehicles retired for scrap. This BMP was moved from a recommended BMP to an “applicable(mandatory)” BMP. This move aligns the treatment of scrap vehicles in Volume IV with the ISGP.

No BMPs were eliminated even though some of the information can be found in other locations. A few new BMPs were added and other existing BMPs were expanded to address some of the issues raised. See the Chart of Changes for a full list of those changes and additions.

Administering a separate TAPE-like program for source control devices is not feasible at this time. Some of the emerging technology devices may have the option of placing their device in the TAPE program for evaluation. The Washington Storm Center has been designated by Ecology to collect manufacturer’s information regarding their emerging technology. This information is collected and disseminated to the public by the Washington Storm Center without endorsement. This is intended to help facility operators locate the products that they need.

Costs are not explicitly separated and considered by Ecology in the design criteria. Cost is considered in the overall feasibility of a proposed BMP. Ecology acknowledges that cost is a factor that users will need to consider.

RTC 4.7: Volume IV Figures

Commenters: City of Seattle

Summary of range of comments:

- Commenters indicated that several figures were unclear.

Response to the range of comments:

Ecology added clarifying notes to some figures and removed some that were unclear and did not represent the text referred to.

RTC 4.8: Street Waste and Ditch Cleanings

Commenters: King County, City of Seattle

Summary of range of comments:

- The proposed language to handle street waste and ditch cleanings is onerous and will be challenging to implement.
- There is more recent data that should be incorporated within Appendix G regarding the characterization of street waste

Response to the range of comments:

Ecology reworded some of the guidance to allow more flexibility. The operator is requested to consider screening the wastes. The intent is that there is an effort to screen and separate street wastes so that they can be treated in the most effective and efficient manner. Some wording remains to encourage this type of screening.

Ecology reworded some passages to refer to “proper disposal” instead of “off-site” disposal since there are sometimes options to properly dispose of street wastes on site.

Ecology added the new data to the existing tables in Appendix G.

Volume V Response to Comments

Text Organization

RTC 5.1: Text Organization - Definitions

Commenters: City of Bellevue, Cowlitz County, City of Seattle, City of Tacoma

Summary of range of comments:

- Why is Bioretention not on the list of on-site BMPs?
- Ecology left Emerging Technologies off Table 4.1 describing the relationship of treatment with detention.
- There is a need for further definition of “free water”, “sediment zone”, “BSM”, “utilities”, and “bioinfiltration”.

Response to the range of comments:

Ecology included Emerging Technologies and their relationship with detention in a note to Table 4.1 (now Table 4.2.1). Bioretention is included in the list of on-site BMPs and additional definitions are included for words in addition to those listed above.

RTC 5.2: Text Organization – Add/Delete Text/Tables

Commenters: City of Seattle, Snohomish County, SvR Design Company, Thurston County

Summary of range of comments:

- Don’t remove Tables 2.2 and 2.3.
- How should Permittees interpret the text in “design Guidelines”?
- There is need for additional text for dispersion criteria relative to soil types.

Response to the range of comments:

Ecology removed Table 2.2 because it was not helpful to the reader in selecting a treatment option. Ecology has retained Table 2.3 (now Table 2.2.1), though in a slightly modified form.

RTC 5.3: Text Organization – Inappropriate Location for Text

Commenters: City of Seattle, Snohomish County, City of Tacoma

Summary of range of comments:

- Some items in Volume V should be in Volume III.
- Some BMPs in Volume III should be in Volume V.

Response to the range of comments:

Ecology listed all On-site Stormwater Management BMPs in Chapter 5, of Volume V. The details of options for roof dispersion and infiltration are solely in Volume III because engineers generally classify roofs as non-pollution generating surfaces. The roof dispersion and infiltration BMPs are focused on flow reduction not pollution control. Ecology has added design criteria for bioretention to Chapter 7 of Volume V because Ecology considers it a treatment BMP option. However, field procedures and some design procedures for determining feasibility and infiltration rates are located in Section 3.4 of Volume III. Those procedures are similar to, and sometimes reference procedures in Section 3.3 of Volume III in regard to design of infiltration facilities.

RTC 5.4: Text Organization – Combining Volumes III and V

Commenters: City of Seattle, Thurston County

Summary of range of comments:

- There should only be one volume with combined information from Volume III and Volume V.

Response to the range of comments:

Ecology wants to continue with the separation of Volumes III and V. Volume III deals primarily with flow control (Minimum Requirement #7) and Volume V deals with Water Quality treatment (Minimum Requirement #6). Ecology lists all On-site Stormwater Management BMPs in Chapter 5, of Volume V. The details of options for roof dispersion and infiltration are solely in Volume III because engineers generally classify roofs as non-pollution generating surfaces. Ecology focuses the roof dispersion and infiltration BMPs on flow reduction, not pollution control. Ecology has added design criteria for bioretention to Chapter 7 of Volume V because Ecology considers it a treatment BMP option. However, field procedures and some design procedures for determining feasibility and infiltration rates are located in Section 3.4 of Volume III. Those procedures are similar to, and sometimes reference procedures in Section 3.3 of Volume III in regard to design of infiltration facilities.

References and Citations

RTC 5.5: References/Citations in Manual

Commenters: Cowlitz County, King County

Summary of range of comments:

- Citations were not included in the reference section.
- The text contains out of date references.

Response to the range of comments:

Ecology modified text to include references where appropriate and corrected out of date references.

RTC 5.6: Text Organization – References/Hyperlinks

Commenters: Cowlitz County, City of Seattle, Snohomish County, City of Tacoma, Thurston County, WSDOT

Summary of range of comments:

- References to outside documents are not appropriate text should be included in the SWMMWW.
- Permittees won't have an opportunity to review outside documents that the manual references.
- There are broken links to webpages.
- Some references to sections in the manual, table, or documents don't exist anymore.
- There are locations where references would assist in understanding and improve usage of the manual.
- There may be confusion between criteria in the SWMMWW and other guidance manuals.
- There are places where references are to old documents.

Response to the range of comments:

Ecology corrected any incorrect references and fixed broken hyperlinks. References to outside documents are limited to those where Ecology felt it was too difficult or unnecessary to bring the text into the SWMMWW. There should not be many conflicts between the SWMMWW and referenced texts. Where a conflict exists, municipal stormwater permittees should give preference to statements within the SWMMWW when weighing whether a local code provides equivalent pollution control.

RTC 5.7: LID General

Commenters: Thurston County, WSDOT

Summary of range of comments:

- There is a potential for duplication or confusion between the SWMMWW and the *Low Impact Development Technical Guidance Manual* (LID Manual).
- Permittees may not have sufficient time to review the information from the LID Manual that is included in the SWMMWW.

Response to the range of comments:

Ecology has inserted those criteria into the SWMMWW from the LID Manual that it considers critical to a treatment or pollutant control function. So, there is repetition by design. There should not be substantial conflict or confusion between the documents. Where there is conflict, permittees should use the guidance in the SWMMWW as the yardstick against which they would measure their local criteria for providing equivalent pollution control.

Confusing Text/Grammer/Typos

RTC 5.8: Thresholds – Minimum Requirements

Commenters: City of Seattle

Summary of range of comments:

- There is confusion between full dispersion and the requirements in Minimum Requirements #6 and #7.

Response to the range of comments:

Use of the full dispersion option is one method to meet Minimum Requirements #6 and #7. Projects that correctly use that option do not need to use an approved continuous runoff model to verify performance.

RTC 5.9: Typos/Grammar - Typos

Commenters: Cowlitz County, King County, City of Redmond, City of Seattle, Snohomish County, Thurston County

Summary of range of comments:

- There are a number of grammatical errors and typos.

Response to the range of comments:

Ecology corrected grammar and typos as required.

RTC 5.10: Typos/Grammar – Confusing Language

Commenters: Cowlitz County, King County, City of Redmond, City of Seattle, Snohomish County, SvR Design Company, City of Tacoma, Thurston County

Summary of range of comments:

- Ecology did not fully define the term “Timber Harvest Activities”.
- When does Ecology use “will” and “shall”, and how do they differ.
- There was not adequate review between Volume V and volume III.
- The use of “Enhanced” as a term for dissolved metals treatment and/or improved treatment is confusing.
- There are specific locations of confusing text.
- Ecology has not adequately explained the TAPE criteria.
- There are differences between text, tables, and figures.
- Using the term “see below” does not adequately address where the additional information was located.
- Ecology inserted extraneous text into the document.

Response to the range of comments:

Ecology corrected the confusing language where possible. Ecology tries to use “shall” to indicate that the statement is critical to a properly designed system. Ecology does not define the terms “will” and “should” as critical to design, but are recommendations.

RTC 5.11: Typos/Grammar – Missing Figures/Tables

Commenters: City of Bellevue, King County, Snohomish County

Summary of range of comments:

- Some referenced figures and tables are not included in the manual.
- There is an issue with the relative locations of figures and text for some BMPs.

Response to the range of comments:

Ecology added the referenced figures.

RTC 5.12: Typos/Grammar - Redundancy

Commenters: Cowlitz County, City of Seattle, SvR Design Company, Thurston County

Summary of range of comments:

- There are locations of duplicate text.

Response to the range of comments:

Ecology cleaned up the text to eliminate the duplication.

RTC 5.13: WSDOT

Commenters: WSDOT

Summary of range of comments:

- There is a lack of information on how to size an underdrain.
- There are places where the SWMMWW and the HRM do not agree.

Response to the range of comments:

Ecology updated the text in the SWMMWW to match that of the HRM where WSDOT created the BMP.

Chapter 2 – Treatment Facility Selection Process

RTC 5.14: BMP Criteria – Catch Basin Inserts

Commenters: City of Seattle, City of Tacoma

Summary of range of comments:

- Catch basin inserts (not approved for pretreatment) are still included in the text.

Response to the range of comments:

Ecology removed the text on catch basin inserts.

RTC 5.15: Types of Surfaces (PGHS, NPGHS)

Commenters: King County, City of Tacoma

Summary of range of comments:

- Why do vegetated areas of commercial/industrial sites require treatment?
- The current infiltration criteria may not be strict enough.
- Allowing BMPs with the potential to export phosphorus may increase Phosphorus in limited areas.
- Ecology should consider roofing as PGIS instead of NPGIS.
- Provide information on the status of synthetic sports fields with respect to pollution generation.
- Ecology removed a proprietary BMP from the text, is it no longer approved?

Response to the range of comments:

Ecology generally considers vegetated areas as pollution-generating pervious surfaces because of potential for loss of soil as well as discharge of fertilizers, pesticides, and herbicides.

Ecology has made its recommendations. Monitoring results would help inform where we need improvements.

Agreed. Ecology has recommendations against using underdrained bioretention facilities, or such facilities draining to the ground within ¼ mile of a phosphorus sensitive receiving water.

Ecology did not consider changing all roofs into the PGIS category. Ecology's standard designs for roof runoff should significantly reduce pollution coming from those surfaces. In addition, metal roofs and roofs exposed to significant amounts of dusts, mists, or fumes are considered pollution-generating.

RTC 5.16: Treatment Levels/Parameter Selection

Commenters: City of Kirkland, City of Redmond, City of Seattle

Summary of range of comments:

- Add multi-family projects to Industrial and Commercial sites for Enhanced Treatment.
- Language used is not enforceable.

Response to the range of comments:

Since 2001, Ecology has classified multi-family project sites as subject to Enhanced Treatment in certain discharge situations. Ecology changed the wording to multi-family residential project sites as a better descriptor.

Ecology considers the local jurisdiction as the best entity to determine if projects require higher levels of pollutant removal. The text is there to assist the jurisdiction in determining the need for higher levels of treatment, but the variability in projects makes it impossible for Ecology to make a blanket statement.

Chapter 3 – Treatment Facility Menus

RTC 5.17: General Editorial Comments – Performance Goals

Commenters: King County, City of Seattle, Snohomish County

Summary of range of comments:

- The performance standard for zinc removal may be too high.
- The performance goals for TSS removal were different in different areas of the text.
- It appears that it is necessary to prove that a treatment BMP was meeting higher levels of pollutant removal after building the facility.
- Re-examine the assumptions about “pollutant-trapping, treatment, and infiltration”.

Response to the range of comments:

Ecology corrected the text to reflect one set of performance goals and uses a presumptive approach to BMP design and there is no need to prove that a facility can remove a given level of

pollutant. Many treatment facilities can already meet the proposed percent removal standard for zinc. A review of assumptions is beyond the scope of this SWMMWW revision.

RTC 5.18: General Editorial Comments – Regulatory

Commenters: City of Seattle, City of Tacoma

Summary of range of comments:

- Don't place a blanket requirement for liners where concerns exist about soil contamination. Instead, apply the requirement on a case-by-case basis.
- Suggest use of operational BMPs instead of pre-treatment before infiltration.
- Clarify that runoff from PGHS must be treated

Response to the range of comments:

Ecology does not intend that engineers must use a liner wherever there are concerns about existing soil or groundwater contamination below a bioretention device. Certainly, there should be some confirmation of pre-existing contamination issues that make infiltration of stormwater unwise.

Ecology requires applicable operational BMPs for all new and redeveloped commercial and industrial sites. Yet that does not replace the need for pretreatment prior to infiltration.

Pollution-generating hard surfaces may be impervious or pervious pavements. Certainly impervious surfaces are going to have runoff that you must treat to meet certain thresholds. Pervious pavements may or may not have surface runoff. But, in any event, if they are pollution-generating surfaces, and size thresholds for treatment have been met, approved methods must be used to confirm whether treatment requirements are met. Those would include confirmation of whether the underlying soil meets the soil suitability criteria for treatment and computer modeling to estimate the volume of water that passes into that soil profile. You may take that volume as credit toward meeting the minimum criterion of treating 91% of stormwater.

RTC 5.19: New Pollutants to include in Manual

Commenters: King County

Summary of range of comments:

- There is a potential need to add bacteria as a pollutant of concern.
- Request that Ecology provide BMPs for bacteria removal.

Response to the range of comments:

Ecology would like to include bacteria and Nitrates as pollutants of concern. However, that issue requires significant evaluation and is not appropriate for the level of edits at this time.

Chapter 4 – General Requirements

RTC 5.20: BMP Criteria – Structural Issues

Commenters: City of Bellevue, City of Tacoma

Summary of range of comments:

- The thickness of concrete baffle walls (4”) is too large and unnecessary.
- Ecology’s requirement that side slopes for ponds can be no steeper than 3:1 (H:V) in all cases is too restrictive. Allow designers to reduce the slope to 2-1/2:1 on a case-by-case basis.

Response to the range of comments:

Ecology based the dimensions shown in the SWMMWW on experience of various jurisdictions. The pond side slopes with 3:1 (H:V) maximum have been established for safety and comply with the regulations from Ecology’s Dam Safety Section. In addition, mowing of grass on cross slopes steeper than 3:1 could be dangerous.

RTC 5.21: General Editorial Comments – New BMPs

Commenters: City of Redmond

Summary of range of comments:

- Don’t use a manufacturers name to identify a product.

Response to the range of comments:

Ecology removed the specific name from the text in Chapter 4. Ecology identifies emerging technologies by name only on Ecology’s web pages and not in the SWMMWW.

RTC 5.22: Water Quality Storm Sizing

Commenters: Kitsap County, City of Seattle, City of Tacoma

Summary of range of comments:

- Why can a designer use a single event model to calculate the volume of a design storm instead of continuous simulation.
- That Ecology didn’t identify any design storm for rain gardens.

Response to the range of comments:

Ecology believes that using the single storm event to size wetpool type BMPs will result in larger ponds than you would see if you used a continuous simulation. The runoff volume determined in the single storm event simulation is adequate to obtain the needed level of treatment.

Ecology allows Rain gardens only for projects that do not trigger treatment requirements. So, the concept of a design storm does not apply. However, Ecology would still prefer these

projects to accrue some significant reduction in surface runoff volume. So, for smaller projects (those subject only to Minimum Requirements #1 - #5) using the list approach to meet Minimum Requirement #5, rain gardens must have a minimum horizontal projected surface area below the overflow that is at least 5% of the area draining to it.

RTC 5.23: Maintenance

Commenters: City of Bellevue, Cowlitz County, City of Kent, King County, Pierce County, City of Seattle, Snohomish County, City of Tacoma, Thurston County, WSDOT

Summary of range of comments:

- Reference manufactured BMPs by a generic name instead of using the manufacturer's name.
- The new maintenance standards for LID features would not be available for public comment.
- No information on triggers for starting maintenance is included.
- Operation and maintenance information for some BMPs is missing (Bioretention, modified filter drains, CAVFS, Oil/water separators, catch basin inserts).
- Move the maintenance requirements to the sections with the BMPs instead of having all the standards in a single location.

Response to the range of comments:

Ecology has included maintenance requirements for most of the missing BMPs with the exception of LID BMPs (Bioretention, pervious pavement). Ecology has an active grant to develop maintenance standards for LID BMPs. The results of the grant project will be available for public review and eventual inclusion in the SWMMWW.

Chapter 5 – Full Dispersion

RTC 5.24: BMP Criteria – Full Dispersion

Commenters: Clark County, City of Seattle, Snohomish County, City of Tacoma

Summary of range of comments:

- Ecology has not provided a complete definition of “native conditions”.
- Ecology needs to define if developer can utilize previously cleared and replanted land as part of the 65% native conditions.
- The 65% native vegetation is too high a percentage.
- The definition of “preserved area” is too lax.
- Vegetated flow-paths for dispersion should also include vegetation where there is previously removed and replanted vegetation.
- Ecology has not provided sufficient detail for the design criteria for dispersion trenches.

Response to the range of comments:

In regard to full dispersion of residential projects, Ecology requires a forested or native condition. Ecology has provided a definition for native vegetation. Native condition includes native vegetation and a generally undisturbed soil profile. However, Ecology has added a section titled “native vegetation landscape specifications” for projects that wish to reclaim a previously disturbed area for use as a dispersion area. For road projects, Ecology has additional options in regard to the dispersion areas.

The 65% requirement is an estimate of the area needed to handle runoff from the developed area. To Ecology’s knowledge, it has not been field verified. Runoff modeling indicates that it can come close to meeting the hydrologic goals. Because the net result is preservation of a significant percentage of a parcel in a native condition, Ecology is willing to continue to risk allowing the 65/10 concept for stormwater management.

RTC 5.25: General Editorial Comments – Dispersion

Commenters: Kitsap County, City of Tacoma, Thurston County

Summary of range of comments:

- The percentage of development area set aside for existing vegetation may not be adequate.
- Can developers use sites previously cleared and restored as part of the 65% native vegetation?
- Geotechnical experts need to evaluate sheet flow over road fill.

Response to the range of comments:

Ecology had hoped to have performance monitoring done on sites that have been using full dispersion. That monitoring has not occurred. So, Ecology does not have field data that could be used to modify the design requirements for this BMP. On a theoretical basis, Ecology has run the full dispersion option on the WWHM. The outputs indicate significant flow reduction benefits.

Any remaining impervious areas and lawn/landscaped areas in a development in excess of these amounts must comply with applicable manual requirements.

Developers can use sites previously cleared and restored in accordance with the section entitled “Native Vegetation Landscape Specifications.”

When considering a full dispersion option a professional engineer should be involved.

Chapter 5 – Other On-site Stormwater Management Topics

RTC 5.26: Pervious Pavements

Commenters: City of Tacoma

Summary of range of comments:

- Will Ecology consider pervious pavement an approved pretreatment device?

Response to the range of comments:

Ecology believes porous pavement does not provide treatment by itself, but you could consider porous pavement a pretreatment facility if you infiltrate the runoff into native soils that meet Site Suitability Criteria or have materials that provide treatment located above the underdrains or native soils.

RTC 5.27: BMP Criteria – BMP T5.13

Commenters: Thurston County

Summary of range of comments:

- Infiltration rates through the specified soils listed in the SWMMWW are too specific and don't cover all cases.

Response to the range of comments:

Ecology cannot create a list that covers all cases, but has presented an example list of soils and infiltration rates as a starting point for use by developers and jurisdictions. BMP T5.13 recommends four options for meeting the specification of BMP T5.13. The first three options should result in soils that will always have a fair amount of capacity to hold water and pass some through the profile. Option 4 involves importing topsoil that can be a mix of compost and sand or sandy loam. It recommends tilling a portion of the imported soil into the native soil, and then placing three inches of imported soil on top of that. If the native soil has a high clay content tilling in a mix of compost and sand can create a soil that has a low infiltration capability. In this situation, it may be better to choose one of the other three options for creating the post-construction soils.

RTC 5.28: General Editorial Comments – On-site Stormwater Management

Commenters: Cowlitz County, City of Tacoma, WSDOT

Summary of range of comments:

- On-site stormwater management should have its own volume.

Response to the range of comments:

Ecology prefers to maintain the division of volumes as currently set up. The division puts Flow Control BMPs in Volume III and Water Quality Treatment BMPs in Volume V. On-site stormwater management BMPs are located in Volumes III and V as appropriate.

RTC 5.29: General Editorial Comments – Treatment

Commenters: City of Bellevue, King County, Kitsap County, City of Seattle, Snohomish County, City of Tacoma

Summary of range of comments:

- Text for portions of the document (Native Vegetation and Landscaped Areas) is not available for review.
- Suggest just using “filtration” and drop the term “sand”.
- Some text contradicts priority order set in MR #5-and may require a Professional Engineer where one wasn’t required under the 2005 Manual.

Response to the range of comments:

BMP T5.30 now contains a section on “Native Vegetation Landscape Specifications.” Ecology dropped “Sand” from the title in acknowledgement of other media.

Ecology changed text in the introduction to Chapter 5 to be more sensitive to when a professional engineer is required, and when you can use a standard design – not requiring an engineer’s involvement.

RTC 5.30: Rain Garden Guidance

Commenters: City of Seattle, City of Tacoma

Summary of range of comments:

- Provide an opportunity to review the new Rain Garden Manual prior to referencing it from the SWMMWW.

Response to the range of comments:

Ecology has an active grant to update the existing Rain Garden Manual. A task within the grant provides for public review and comment before the consultant finalized the document.

Chapter 6 – Pretreatment

RTC 5.31: BMP Criteria - Pretreatment

Commenters: City of Seattle

Summary of range of comments:

- The requirement for pretreatment upstream of some treatment BMPs is excessive.
- There are different criteria for pretreatment used with Bioretention within the SWMMWW.

Response to the range of comments:

Ecology has provided pretreatment requirements where it considers them necessary to ensure proper pollutant removal functioning. Engineers generally expect to use Bioretention facilities in a dispersed manner at project sites. In that type of use, it is difficult to install extensive pretreatment devices. It is also difficult to require any amount of pretreatment for long swale designs that take dispersed flow, for instance from a road, into the bioretention device. However, where engineers design bioretention facilities to take concentrated runoff from large drainage areas, it begins to be more practical and even necessary to install more pretreatment structures, just as is called for prior to infiltration basins.

Chapter 7 – Infiltration

RTC 5.32: BMP Criteria – Infiltration/Site Suitability Criteria

Commenters: City of Seattle, Snohomish County, City of Tacoma

Summary of range of comments:

- Ecology should reference the hydraulic restriction layer instead of the seasonal high ground water.
- Bioretention siting criteria doesn't include previously contaminated soils.
- Ecology requires too many small-scale PIT tests for roadway projects.
- Requirements for infiltration testing are not consistent throughout the various guidance manuals.
- Ecology is placing requirements on Bioretention that are not on other infiltration BMPs.
- Separation distances from hydraulic restriction layers are recommendations not requirements.

Response to the range of comments:

In most locations in the text, hydraulic restriction layer is the more appropriate term rather than seasonal high ground water table. However, there are places where reference to the seasonal high groundwater table is appropriate. Ecology has tried to check those references to be more accurate in their use. Ecology has added a subsection on infeasibility criteria for bioretention. The guidance concerning numbers of PIT tests for a site are generally within the Site Planning guidance in Chapter 3 of Volume I, and Section 3.4 of Volume III. For small projects, (e.g., a single commercial or residential building), engineers should run field tests in the planned location for the bioretention facility. Ecology has reviewed and updated guidance on design of infiltration facilities and bioretention. Design criteria and field procedures for centralized infiltration basins and trenches are within Section 3.3 of Volume III. Design criteria for bioretention are within Chapter 7 of Volume V. Field procedures and design methods

pertinent to bioretention and permeable pavement are within Section 3.4 of Volume III. Section 3.4 has references to specific subsections of Section 3.3 where those subsections are pertinent to bioretention or permeable pavements.

RTC 5.33: BMP Criteria – Post Construction Infiltration Testing

Commenters: Snohomish County

Summary of range of comments:

- Post construction testing for infiltration should not be included in the SWMMWW.

Response to the range of comments:

Ecology believes that post construction testing for infiltration facilities (where possible) is a necessary part of the construction process. Without the post construction testing it is unknown if the contractor maintained the original infiltration rate.

RTC 5.34: General Editorial Comments – Infiltration

Commenters: King County, City of Kirkland, SvR Design Company

Summary of range of comments:

- There is confusion about the differences between infiltration through native materials and infiltration through filter media.
- Ground water contamination should be of equal importance to infiltration rate.
- The existing soils may not be able to provide adequate treatment in perpetuity.

Response to the range of comments:

Ecology tries to identify “infiltration facilities” as those that discharge stormwater into the ground. Ecology considers media filters as filtration devices. You can discharge their output to surface water or to the ground if it meets pretreatment requirements.

Even if the native soils meet the soil suitability criteria for treatment, pretreatment is necessary to remove a portion of the influent solids content. The intent is to extend the operational time between maintenance activities to restore infiltration rates.

Ecology acknowledges that the soils in infiltration facilities may exhaust their capability to remove certain types of dissolved pollutants. Ecology has not established a standard periodic evaluation procedure for the quality of infiltrate below such facilities. Local governments may want to require installation of piezometers or other methods that would allow for future monitoring of infiltrate quality.

RTC 5.35: PIT Tests

Commenters: King County, Thurston County

Summary of range of comments:

- There are too many required PIT tests.

Response to the range of comments:

Ecology modified the number of PIT tests required. See Section 3.3 for recommendations in regards to centralized infiltration facilities. See Section 3.4 in Volume III for bioretention and permeable pavements.

RTC 5.36: Infiltration

Commenters: King County

Summary of range of comments:

- The Site Suitability Criteria (SSC) should be re-evaluated.

Response to the range of comments:

Ecology re-evaluated the site suitability criteria as part of this update. Ecology has recommended changes from the criteria in the '05 manual.

Chapter 7 – Bioretention Design

RTC 5.37: Bioretention - Design

Commenters: City of Bellevue, King County, City of Seattle, SvR Design Company, City of Tacoma, Thurston County

Summary of range of comments:

- The specifications for ponding depth, slopes, draw down time, use of filter fabric, side slopes, depth to ground water, and bottom width are not adequate.
- Is there adequate safety around deep Bioretention facilities?
- The level of treatment assumed for Bioretention is too high.
- Need additional clarification in the sizing of velocity dissipation rock and the forebay of the Bioretention facility.

Response to the range of comments:

- With the exception of the minimum depth to groundwater or a hydraulic restriction layer, local governments may adjust Ecology's design criteria for the categories listed above. These criteria are Ecology's recommendations. Most of the criteria do not impact treatment performance. Ecology would advise against a maximum drawdown time in excess of 48 hours as a safeguard against mosquito breeding.

- Ecology’s recommendation is to distribute Bioretention facilities within the development, and therefore have public access, is a maximum ponded depth of one foot. Bioretention facilities that have restricted public access, e.g., a centralized facility with a perimeter fence, can have deeper ponding depths.
- Because of their high organic content, cation exchange capacity, soil depth, and moderate infiltration rates, Ecology has anticipated that bioretention facilities should have the highest potential of all treatment systems to remove suspended particles and a broad range of dissolved pollutants. Ecology is not aware of an overwhelming amount of performance data on bioretention systems. Ecology has arranged for field-testing of the default mix and other bioretention mixes to more accurately define treatment capabilities.
- Ecology is relying on the judgments of Dr. Hinman regarding recommended criteria for velocity dissipation rock and forebay designs.

RTC 5.38: Bioretention - Underdrains

Commenters: King County, Snohomish County, SvR Design Company, City of Tacoma

Summary of range of comments:

- The conditions under which you can install underdrains are too limited.
- Underdrain pipe specifications are inadequate.

Response to the range of comments:

Ecology has indicated situations in which installation of underdrains is either advisable or necessary because of site conditions. But underdrains can be installed in all types of situations. Generally, the designer should not want to install underdrains unless necessary because underdrain designs don’t help meet the LID performance standard, nor provide any help in achieving the flow control standard (Min. Requirement #7).

Ecology has provided its recommendations re materials for underdrain pipes. The introductory paragraph for the “underdrain pipe” section of the bioretention criteria is general in nature expressing general design intentions and needs. There are more specific material recommendations in subsequent subsections. Local governments finding the specifications inadequate can supplement or modify Ecology’s criteria.

RTC 5.39: Bioretention - Inlets

Commenters: City of Seattle, Snohomish County

Summary of range of comments:

- Specified aggregate mulch may not provide adequate velocity dissipation.
- The SWMMWW needs additional text to complete the discussion of piped flow into the Bioretention facility.

Response to the range of comments:

Alternate aggregate mulch and more detailed piped inflow requirements can be specified by local governments or proposed by designers if they are concerned about the adequacy of Ecology's guidance.

RTC 5.40: Bioretention - Plants

Commenters: City of Kirkland, Thurston County

Summary of range of comments:

- The requirement that you provide irrigation following installation of plants should not be universal.
- Ecology should specify the number of plants that are required in a Bioretention facility.

Response to the range of comments:

Watering newly installed plants is a standard procedure for most landscaping situations. It also seems reasonable to advise that watering during prolonged dry periods may be necessary. These are not design criteria critical to the hydrologic and pollutant removal mechanisms. So, local governments may adjust this guidance. Please see the *Low Impact Design Technical Guidance Manual for the Puget Sound Basin* for more detailed guidance on planting. Density of planting is more of an aesthetic criterion than a pollutant control and hydrologic function. Local preference may adjust density of planting.

RTC 5.41: BMP Criteria – Curb Cuts/Orifices for Bioretention

Commenters: City of Seattle, Snohomish County, SvR Design Company, City of Tacoma, Thurston County

Summary of range of comments:

- Designers should not introduce water into the Bioretention cell before plants are established.
- The minimum orifice diameter is too small.
- There are several examples of curb cut spacing alternatives provided in response to Ecology's request.

Response to the range of comments:

The guidance allows contractors to use water to help settle the bioretention soil mix during construction. An orifice in the underdrain piping below a bioretention device should not be subject to large particles that could cause clogging. The overlying soil mix and the gravel within which the underdrain lies should prevent the introduction of large particles.

Ecology reviewed the general recommendations for curb cut spacing. Local governments can specify alternative designs intended to assure proper entry of water into the facility.

RTC 5.42: WWHM Elements

Commenters: City of Bellevue, Thurston County

Summary of range of comments:

- Permittees won't be able to review and test the new CAVFS element before release of the new version of WWHM.

Response to the range of comments:

Ecology will beta test the new WWHM before Ecology releases it for final use.

Chapter 7 – Bioretention Soils

RTC 5.43: Bioretention - Soils

Commenters: Cowlitz County, King County, Port of Vancouver, City of Redmond, City of Seattle, Snohomish County, City of Tacoma, Thurston County

Summary of range of comments:

- Concern expressed regarding the elimination of the use of on-site soils for Bioretention facilities.
- The allowable infiltration rate is too low.
- Correction factors of 2 and 4 for soil mix should not be based on drainage area
- The required minimum soil depth of 18-inches is too large.
- The text was vague on custom soil mixes.
- Ensure that the requirements in the Manual agree with those in the *Low Impact Development Technical Guidance Manual*.
- The definition of "mulch" is not adequate.
- The required soil mix might not be locally available.
- There is a lack of clarity in the term "initial saturated hydraulic conductivity".
- Allowing BMPs with the potential to export phosphorus may increase Phosphorus in limited areas.
- Methods of analyses need to be specified.

Response to the range of comments:

Ecology views Bioretention facilities as treatment facilities that also provide flow control benefits if you infiltrate stormwater into the soil profile below the facility. Ecology has explicit design criteria for bioretention facilities so that we can rely on their performance, and so the flow control benefits can be reasonably estimated. Ecology has relied in large extent on the research and background investigations by Dr. Curtis Hinman of Washington State University into creating a soil specification. Dr. Hinman is also the author of the *Low Impact Development Technical Guidance Manual for the Puget Sound Basin (LID Manual)*. Consequently, the *Stormwater Management Manual for Western Washington* and the LID Manual should have

very similar design criteria for bioretention facilities. With that as a background, here are responses to the above bulleted comments.

Contractors can use on-site soils only if they meet the default mineral aggregate or combined aggregate/compost soil specification, or if they meet the minimum specifications for custom soil mixes. In the latter case, you must complete soil testing and saturated hydraulic conductivity testing.

Soils that meet the mineral aggregate, compost, and combined mix specifications, and intend to follow the construction procedures, can use the default measured (initial) saturated hydraulic conductivity, K_{sat} of 6 inches per hour. This is the average rate for this material based on a number of soil tests. Custom soil mixes cannot have measured (initial) saturated hydraulic conductivities exceeding 12 inches per hour. Ecology established an upper limit to ensure adequate contact time.

Ecology requires that designers use a correction factor of 0.5 or 0.25 with the assumed K_{sat} or the K_{sat} determined for a custom soil mix. The correction factors are to account for the potential for long-term reduction in the initial rate based on accumulation of fine sediments on the surface of the bioretention soil mix. The 0.5 correction factor can be assigned to bioretention devices whose tributary area is less than 10,000 sq. ft. of impervious surface, less than 5,000 sq. ft. of pollution-generating impervious surface, and less than $\frac{3}{4}$ acres. Bioretention facilities with tributary drainage areas that exceed any of the above amounts are to use the 0.25 correction factor. The larger correction factor is in the middle of the range for the total correction factor applied to centralized infiltration facilities.

The 18-inches of soil depth allows for healthy plants and provides a large infiltration receptor capacity for long-term pollutant removal.

The text for custom soil mixes identifies minimum specifications and testing requirements.

The two texts should be in close agreement.

The text has specifics on mulch requirements, including some explicit “don’t use” provisions.

Because Ecology is mandating a particular soil aggregate specification, the demand will ensure its availability.

Ecology has modified the text to make sure that readers understand that the initial K_{sat} is synonymous with the K_{sat} measured in the field, or in the case of using the default bioretention soil mix, the assumed 6 inches per hour rate.

Recent monitoring has shown that the default soil mix can actually discharge higher concentrations of phosphorus for some amount of time. Therefore, Ecology has added statements to the Applications and Limitations section. Do not use bioretention where it will infiltrate through native soils not meeting the soil suitability criteria within ¼ mile of a phosphorus sensitive water. Do not use underdrains that will discharge to the surface anywhere within the basin of a phosphorus sensitive water.

The text includes references to specific test procedures.

RTC 5.44: BMP Criteria – Compost Amended Vegetated Filter Strips (CAVFS)

Commenters: King County, City of Tacoma

Summary of range of comments:

- There should be a requirement to test underlying infiltration rates for CAVFS.
- The specification of the quality of compost in CAVFS is not sufficiently detailed.

Response to the range of comments:

Information in the SWMMWW for BMPs created by WSDOT agrees with the language in the HRM. Ecology wants to cooperate with WSDOT for BMPs that work on linear projects.

RTC 5.45: General Editorial Comments – Compost

Commenters: King County

Summary of range of comments:

- The compost standard in WA may not be adequate for use with stormwater treatment.

Response to the range of comments:

Ecology shares concern about compost being a source for adding pollutants to stormwater. Ecology concurs that the general allowable pollutant concentrations in the WAC for compost are not necessarily appropriate to use in designs where water is concentrated and directed through the compost.

As a first step in reducing the chances of leaching significant quantities of metals and other man-made organics from the compost, Ecology has specified that compost produced for bioretention use must be made from a minimum of 65% of Type 1 (plant wastes) feedstocks, and a maximum of 35% Type III feedstocks (post-consumer food waste).

Chapter 8 – Filtration

RTC 5.46: BMP Criteria – Sand Filters

Commenters: King County, City of Seattle, Snohomish County

Summary of range of comments:

- Ecology should not remove Amended Sand Filters from the list of approved phosphorus BMPs.
- There are issues with the design criteria for the Linear Sand Filter.
- There is an issue with the relative locations of figures and text for some BMPs.

Response to the range of comments:

Ecology feels that the Amended Sand Filter is not a valid phosphorus treatment technology, and it thus removed from the Phosphorus treatment menu of the SWMMWW. The concept of amending sand filters to effect phosphorus removal is a valid concept. However, Ecology has not accomplished testing of specific amendments to the degree required by the TAP-E program.

RTC 5.47: BMP Criteria – Media Filter Drain

Commenters: City of Seattle, Snohomish County, WSDOT

Summary of range of comments:

- Ensure there is coordination between the HRM and the SWMMWW with respect to the Media Filter Drain.

Response to the range of comments:

Ecology inserted the text and figures from the HRM to ensure both documents would agree.

Chapter 9 – Biofiltration

RTC 5.48: BMP Criteria – Narrow Area Filter Strips

Commenters: City of Seattle, City of Tacoma

Summary of range of comments:

- Ecology should not remove Narrow Area Filter Strips from the list of approved BMPs.

Response to the range of comments:

Ecology feels that the Narrow Area Filter Strip is not a valid treatment technology, and removed it from the SWMMWW. In situations where a filter strip design is desirable, you should use either the design criteria for filter strips or compost-amended filter strips.

RTC 5.49: BMP Criteria - Bioswales

Commenters: Pierce County

Summary of range of comments:

- White Sweet Clover is not an appropriate plant for bioswales.

Response to the range of comments:

Ecology removed White Sweet Clover from the list of plants for bioswales.

RTC 5.50: General Editorial Comments – Bypass

Commenters: City of Seattle

Summary of range of comments:

- How did Ecology develop the conversion factors in Table 9.6b? Can Ecology eliminate the conversion factors?

Response to the range of comments:

Ecology created the adjustment factors to make the results from the continuous simulation and the single storm event equivalent. The intent is to continue to make biofiltration swales and filter strips just as large as they were when using the recommended single event modeling approaches.

Ecology developed the conversion factors about seven to eight years ago by comparing peak runoff flow rates estimated by SBUH with water quality design flow rates using WWHM.

Ecology could eliminate the conversion factor if it adjusted the design criteria. Ecology has decided to wait for the results of biofiltration swale performance monitoring before proposing any design criteria adjustments.

Chapter 10 – Wet Ponds/Wetlands

RTC 5.51: BMP Criteria – Wet Ponds/Wetlands

Commenters: Kitsap County, City of Seattle, Thurston County

Summary of range of comments:

- The requirement to line the first cell of a wet pond is too strict.
- Designers may use vaults as forebays for wet ponds.
- There are alternative configuration for inlets and outlets to minimize short-circuiting in the pond to those included in the SWMMWW.

Response to the range of comments:

Stormwater enters the first cell untreated. Ecology prohibits the infiltration of untreated stormwater into the ground. Ecology allows infiltration into the ground below the second cell because the first cell provides pretreatment. However, if you plan for a large amount of infiltration, the second cell should follow the design requirements for infiltration basins. Wet pond designs, by definition, primarily treat water through a long detention time. They must have a permanent pool of standing water. To maintain a permanent pool a low permeability liner or a treatment liner is necessary.

Engineers can consider alternative designs to minimize short-circuiting. Local governments will have to consider whether alternative methods provide equivalent pollutant control. Alternative designs to prevent short-circuiting do not justify a reduction in the volumetric sizing of a wet pond.

Chapter 11 – Oil and Water Separators

RTC 5.52: BMP Criteria – Oil/Water Separators

Commenters: City of Tacoma

Summary of range of comments:

- There is a lack of information in the SWMMWW on the sizing of the forebay and afterbay for oil/water separators.
- Ecology listed only one plate thickness, while there are alternative plate sizes.

Response to the range of comments:

Ecology provides information on sizing for the forebay and afterbay of oil/water separators in Figures 11.2.1 and 11.2.2. The ¾-inch dimension is for minimum plate spacing, not the thickness of plates. Ecology has not changed the minimum plate spacing.