

Kitsap County

Stormwater Design Manual Update

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KITSAP COUNTY
Community Development

Online

September 29, 2021



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Acknowledgements

Stormwater Design Manual/ Code Update Team

Kitsap County DCD

Kitsap County Public Works

Herrera Environmental Consultants

Robin Kirschbaum, Inc.

Public Participation

Associations, industry professionals,
and interested parties who provided
feedback throughout the process



*Photo Courtesy:
Chris May, formerly Kitsap County Public Works*



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Overview

- Summary of Ecology updates
- Summary of Kitsap SDM updates
 - Online Manual Overview
 - Breakout Exercises
- Discussion



Whispering Firs Stormwater Park, Silverdale, WA
Photo Courtesy: Michele Filley, Kitsap County Public Works



Rules of Engagement



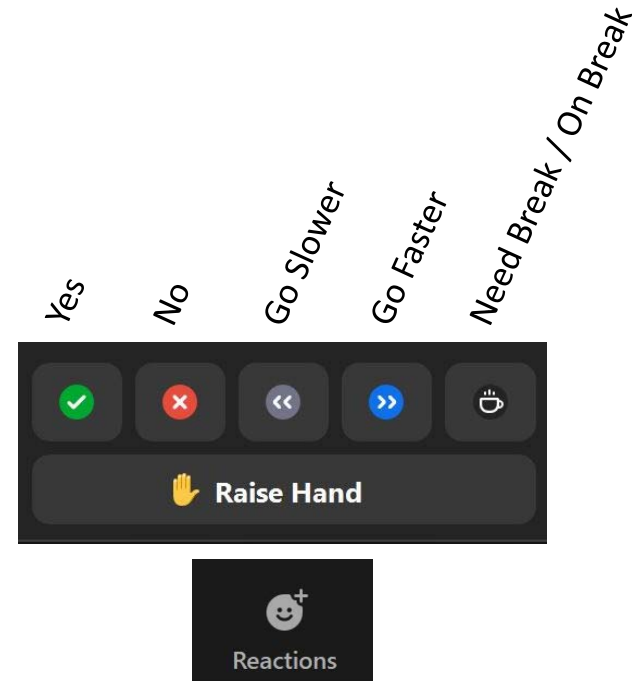
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Please use the “Raise Hand” feature to ask questions



Use the chat function to submit questions and comments



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Polling Question #1



Ecology Updates

2019 Ecology Manual

- Usability enhancements
 - Online Manual
 - Consolidation/clarification/reorganization for better flow
- Updated continuous simulation modeling requirements
- Replaced hard surfaces redevelopment threshold and equivalent area definitions

Stormwater Management Manual for Western Washington



July 2019



Publication Number 19-10-021



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Stormwater Management Manual for Western Washington



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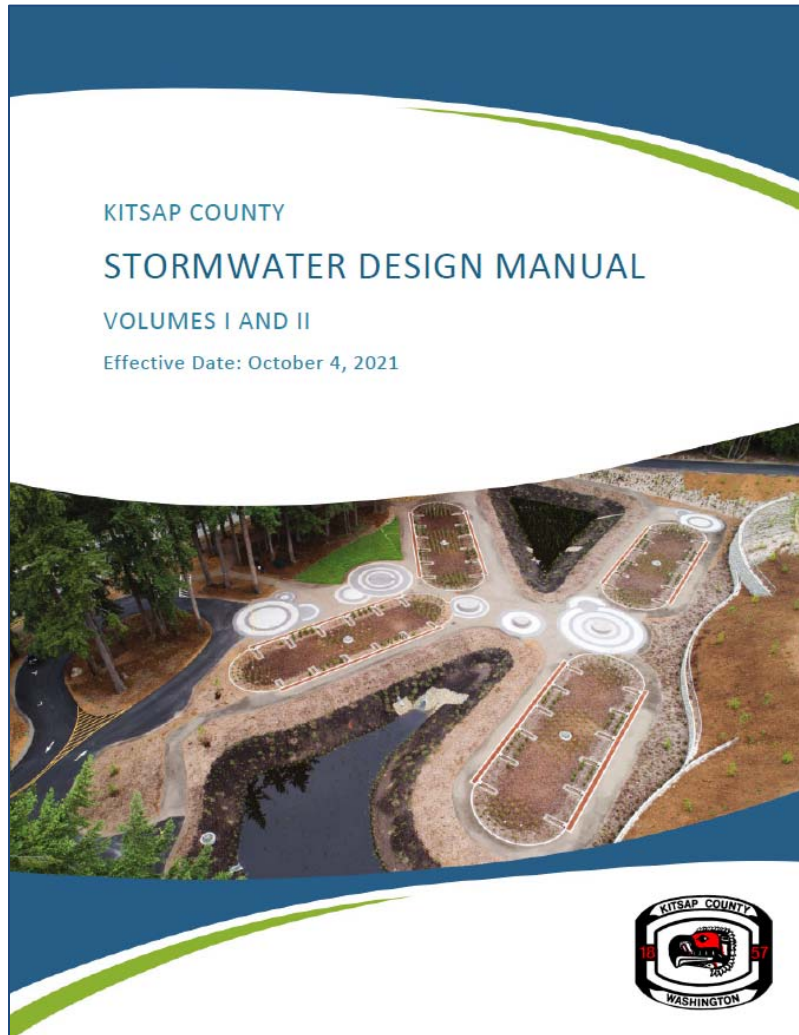
Ecology Updates 2019 Ecology Manual (Continued)

- Updated Minimum Requirement (MR) 2, 5, and 7
- New Source Control BMPs
- Updated wetlands guidance
- Incorporation of UIC Program guidance
- Expanded guidance for regional facilities



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Organization



Volume I – Project Minimum Requirements & Site Planning

1. Introduction
2. Site Assessment and Planning
3. Determining Minimum Requirements
4. Minimum Requirements for New and Redevelopment

Volume II – Technical Requirements

1. Plans and Reports
2. Construction Stormwater Pollution Prevention
3. Source Control of Pollution
4. Conveyance System Analysis and Design
5. Stormwater Management BMPs
6. Wetlands Protection
7. Operation & Maintenance
8. Critical Drainage Areas
9. Grading



Reference Manuals

Use in conjunction with relevant design manuals:

- Stormwater Management Manual for Western Washington (Ecology Manual)
- Western Washington Low Impact Development (LID) Operations and Maintenance (O&M)
- LID Technical Guidance Manual for Puget Sound
- WSDOT Highway Runoff Manual
- Hydraulics Manual by WSDOT
- Rain Garden Handbook for Western Washington



Hydraulics Manual

M 23-03.06
April 2019



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Polling Question #2



Kitsap SDM Update

Online Manual Overview



- Dynamic table of contents
- Ease of navigation (e.g., hyperlinks to relevant content)
- Enhanced search capabilities
- Downloads (e.g., full manual PDF, native CAD files)





Volume I Changes



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Kitsap SDM Update

Volume I Key Changes

- Added Step 8 (Delineate TDAs) to the process for determining minimum requirements (Chapter 3)
- Updated Minimum Requirements flowcharts
- Updated MR 2, 5, 6, 7, and 8 (for consistency with Ecology)



Chapter 3

Determining Minimum Requirements

Step #	Step Name	2021 SDM Update Notes
1	Define the boundaries of the project site	No change
2	Identify the receiving water and downstream conveyance	
3	Review minimum requirement exemptions.	
4	Perform site assessment and planning	
5	Calculate new plus replaced hard surface and native vegetation conversion	
6	Calculate new plus replaced pollution generating surface	
7	Determine which minimum requirements apply	Revised to include review for critical drainage areas
8	Delineate TDAs within the site (if applicable)	New step added



Step 8

Delineate TDAs within the site (if applicable)

- TDAs may be applicable for rural (outside the UA and UGA) residential sites that are 5 acres or greater.
- For each MR applicable to the project, use the TDA thresholds to determine which, if any, BMP(s) must be constructed within each TDA to satisfy that MR
 - See MR #6, #7, and #8
 - MR #1-5 and #9 do not have separate TDA thresholds and must be applied to the entire project if they are applicable
- Implementing a TDA approach requires
 - Downstream analysis
 - Other technical analyses depending on site conditions including, but not limited to:
 - Geotechnical analysis
 - Critical drainage area evaluation



Threshold Discharge Areas

- Area within a project site draining to a single natural discharge location or multiple natural discharge locations that combine within one-quarter mile downstream
- TDAs may be applicable for rural (outside the UA and UGA) residential sites that are 5 acres or greater

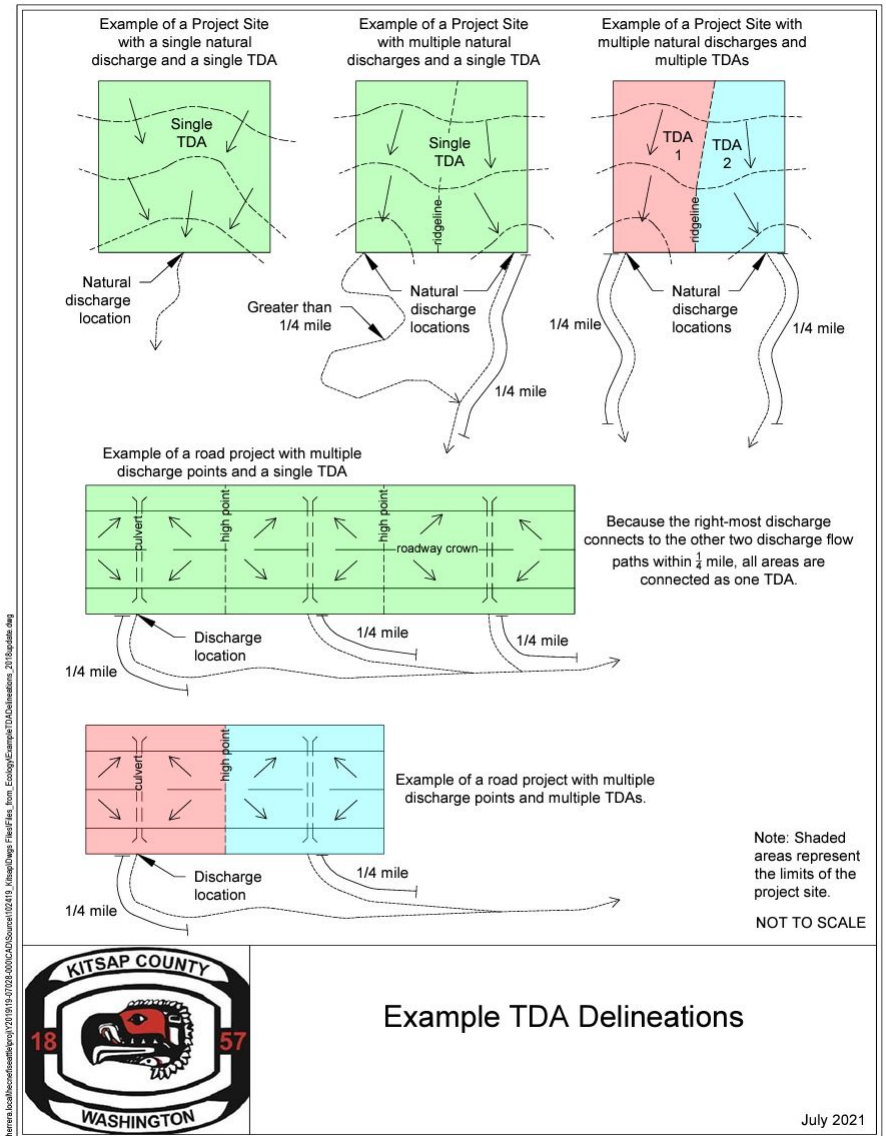
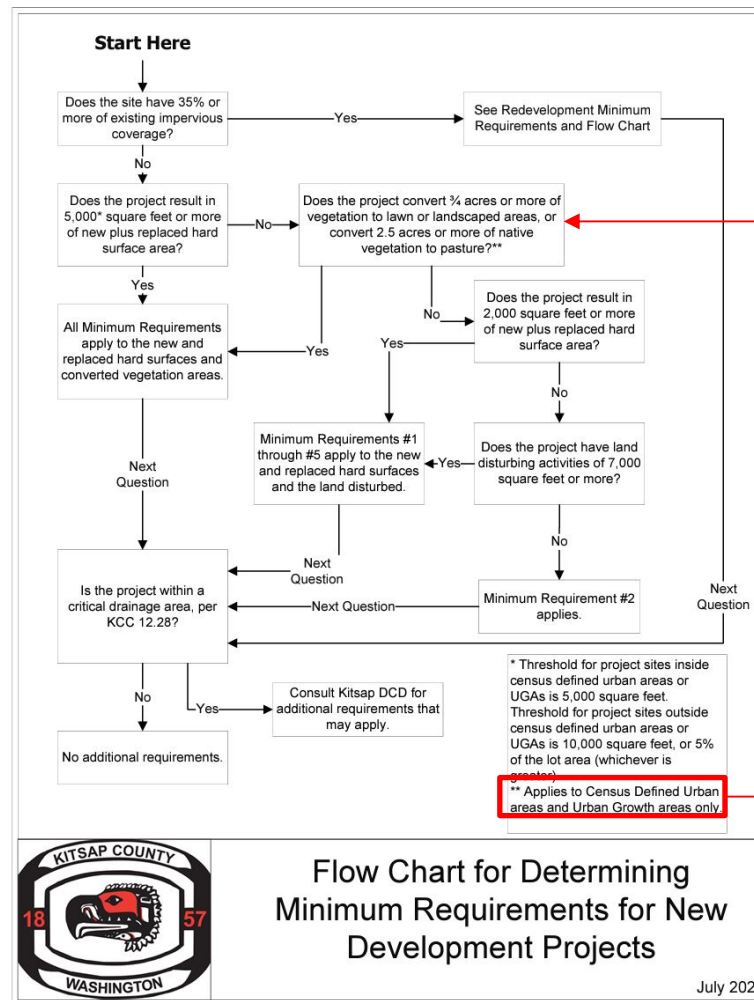


Figure A-1

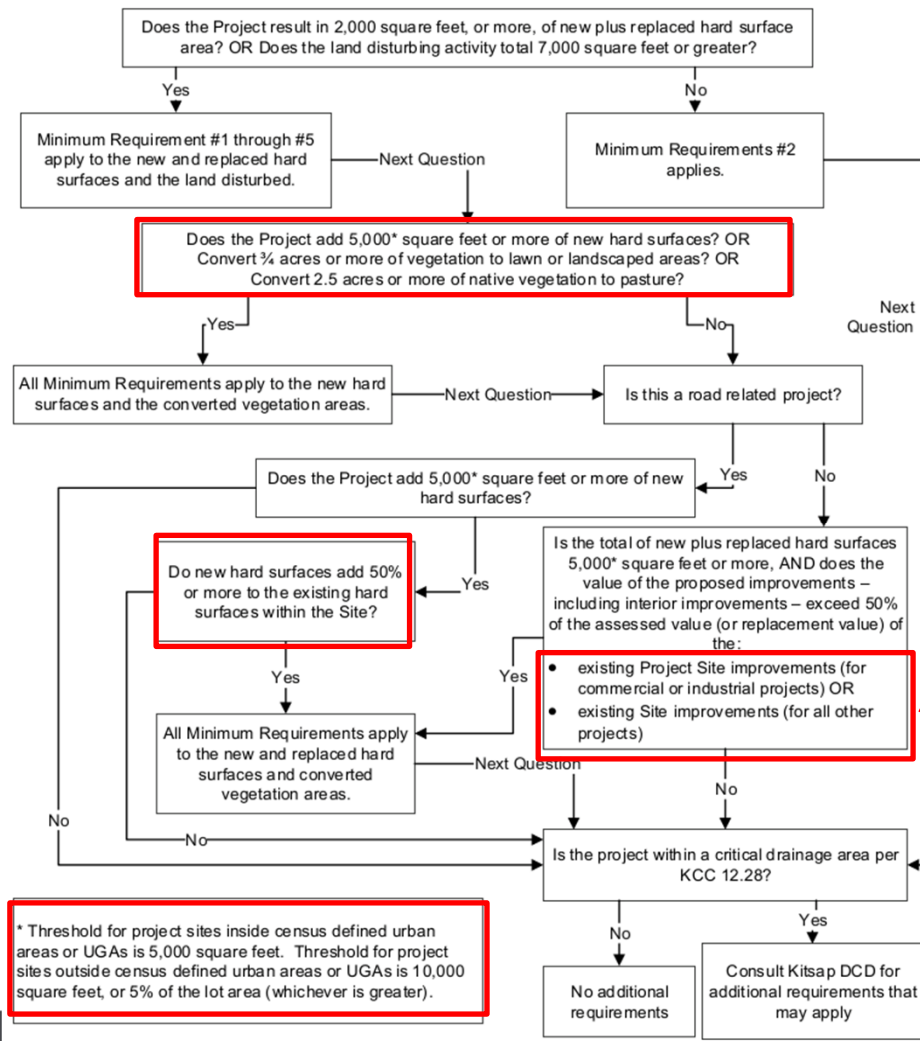
Chapter 4 – Minimum Requirements for New and Redevelopment

Figure I-4.1.
Flow Chart for
Determining
Minimum
Requirements for
New Development
Projects.



Chapter 4 – Minimum Requirements for New and Redevelopment

Figure I-4.2.
Flow Chart for
Determining
Minimum
Requirements for
Redevelopment
Projects.



* Threshold for project sites inside census defined urban areas or UGAs is 5,000 square feet. Threshold for project sites outside census defined urban areas or UGAs is 10,000 square feet, or 5% of the lot area (whichever is greater).

- Recommended guidance
- Use value from KC Assessor Database for base value
 - Use building code value for improvements

Section 4.2 – Minimum Requirements

MR #	2021 SDM Updates
2	<ul style="list-style-type: none"> • Updated for consistency with 2015-2020 CSGP • Revisions to Elements 3, 4, 5, 6, 7, 8, 9, 10, 12, and 13
5	<ul style="list-style-type: none"> • Updated Table 4.2, Table 4.3, and Figure 4.3 • Added language for TDAs
6	<ul style="list-style-type: none"> • Added language for TDAs
7	<ul style="list-style-type: none"> • Added language for TDAs • Clarified text under Exemptions • Updated to require 15-min time step for evaluating the increase in 100-year flow
8	<ul style="list-style-type: none"> • Added language for TDAs • Updated reference to Ecology Manual and KCC Critical Areas Ordinance



Section 4.2 – Minimum Requirements

MR #5 Onsite Stormwater Management

- No significant changes to Table 4.2

Table I-4.2. On-site Stormwater Management Requirements (MR #5) for Large Projects.^{a,b}

Project Type and Location	Requirement
Inside UGA or UA	
New development on any parcel inside the UGA, or new development inside a UA on a parcel less than 5 acres	Applicant option: <ul style="list-style-type: none"> ▪ LID Performance Standard and Post-Construction Soil Quality and Depth; or ▪ List #2^C
New development outside the UGA but inside a UA on a parcel of 5 acres or larger	LID Performance Standard and Post-Construction Soil Quality and Depth
Redevelopment on any parcel inside the UGA, or redevelopment outside a UGA but inside a UA on a parcel less than 5 acres	Applicant option: <ul style="list-style-type: none"> ▪ LID Performance Standard and Post-Construction Soil Quality and Depth; or ▪ List #2^C
Redevelopment outside the UGA but inside a UA on a parcel 5 acres or larger	LID Performance Standard and Post-Construction Soil Quality and Depth
Outside UGA and UA (Rural Areas)	
New development	Applicant option: <ul style="list-style-type: none"> ▪ LID Performance Standard and Post-Construction Soil Quality and Depth; or ▪ List #2^C
Redevelopment	<ul style="list-style-type: none"> ▪ List #2^C



Section 4.2 – Minimum Requirements



MR #5 Onsite Stormwater Management

- Shifted the List Approach into a tabular format and relabeled lists
 - No change to List #1 for small projects
 - 2016 List #2 and List #3 merged into List #2
 - List #3 is new and for flow control exempt projects

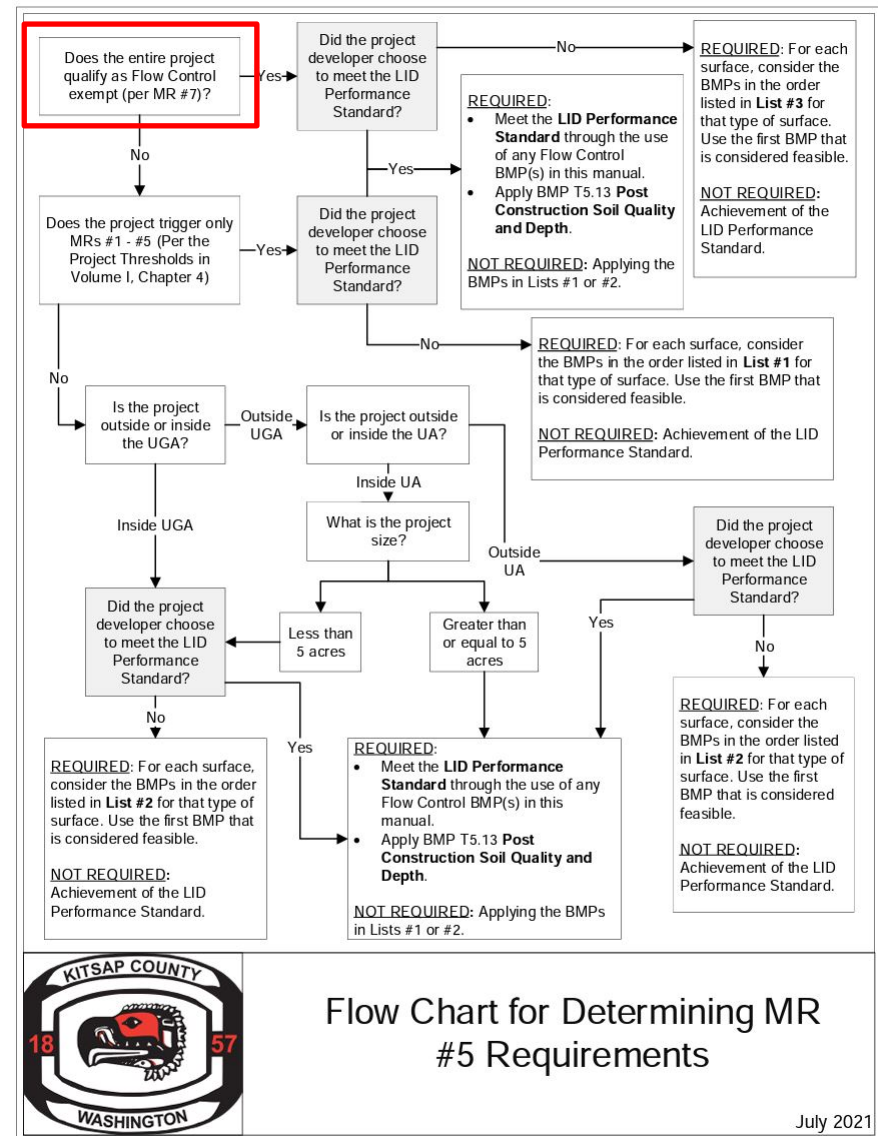
Table I-4.3. The List Approach for Minimum Requirement #5 Compliance.

List #1 (Small projects that trigger MR #1-5)	List #2 (Large projects that trigger MR #1-9)	List #3 (Flow control exempt projects)
Surface Type: Lawn and Landscaped Areas		
Post-Construction Soil Quality and Depth	Post-Construction Soil Quality and Depth	Post-Construction Soil Quality and Depth
Surface Type: Roofs		
1. Full Dispersion or Downspout Full Infiltration	1. Full Dispersion or Downspout Full Infiltration	1. Downspout Full Infiltration
2. Bioretention or Rain Gardens	2. Bioretention	
3. Downspout Dispersion Systems	3. Downspout Dispersion Systems	2. Downspout Dispersion Systems
4. Perforated Stub-out Connections	4. Perforated Stub-out Connections	3. Perforated Stub-out Connections
Surface Type: Other Hard Surfaces		
1. Full Dispersion	1. Full Dispersion	Sheet Flow Dispersion or Concentrated Flow Dispersion
2. Permeable Pavements or Bioretention or Rain Gardens	2. Permeable Pavements (not required for rural residential areas)	
	3. Bioretention	
3. Sheet Flow Dispersion or Concentrated Flow Dispersion	4. Sheet Flow Dispersion or Concentrated Flow Dispersion	



Section 4.2 – Minimum Requirements

- MR #5 Onsite Stormwater Management
- Added box for “Flow Control Exempt Projects”



Section 4.2 – Minimum Requirements

MR #5 Onsite Stormwater Management

Projects qualifying as flow control exempt in accordance with MR #7

shall either:

- Use LID BMPs from List #3 (Table 4.3) for all surfaces within each type of surface included in List #3; or
- Use any Flow Control BMP(s) desired to achieve the LID Performance Standard and apply Post-Construction Soil Quality and Depth.

Note: If the project has multiple TDAs, all TDAs must be Flow Control exempt per MR #7 for the project to use these options.



Section 4.2 – Minimum Requirements

- MR #6 Runoff Treatment
 - Added the following TDA thresholds (runoff BMPs are required if the following are met):
 - TDAs that have a total of 5,000 square feet or more of PGHS, or
 - TDAs that have a total of $\frac{3}{4}$ of an acre or more PGHS – not including permeable pavements, and from which there will be surface discharge in a natural or manmade conveyance system from the site
 - The project proponent must demonstrate that the TDA does not meet either of these thresholds for runoff treatment BMPs to not be required for that TDA



Section 4.2 – Minimum Requirements

- MR #7 Flow Control
 - Clarified text under exemptions
 - Updated to require 15-min time step for evaluating the increase in 100-year flow
 - Added the following TDA thresholds (flow control BMPs are required if the following are met):
 - TDAs that have a total of 10,000 square feet or more of effective impervious surfaces, or
 - TDAs that convert $\frac{3}{4}$ acre or more of vegetation to lawn or landscape, or convert 2.5 acres or more of native vegetation to pasture, and from which there is a surface discharge in a natural or manmade conveyance system from the TDA, or
 - TDAs that through a combination of effective hard surfaces and converted vegetation areas cause a 0.15 cfs increase in the 100-year flow frequency as estimated using WWHM or other approved continuous simulation model and 15-minute time steps





Breakout Exercise #1

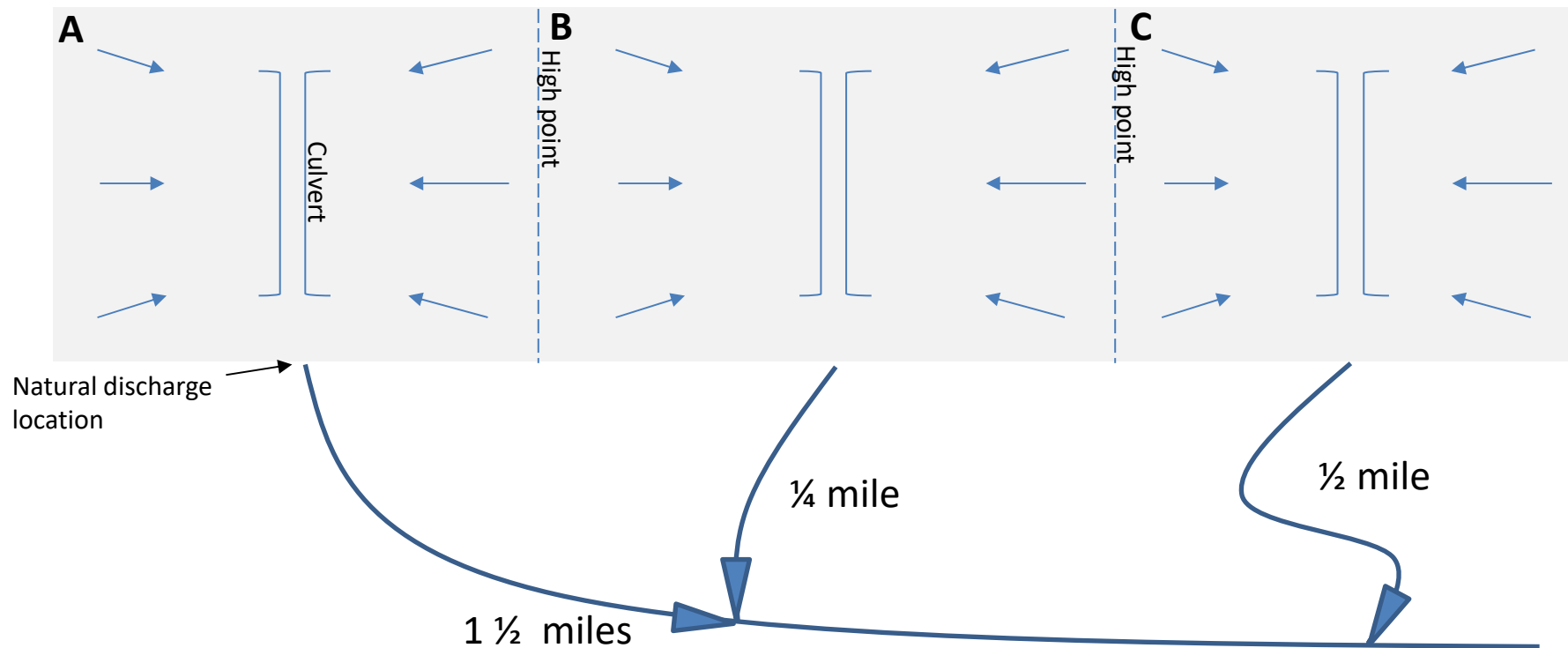


Breakout Exercise #1

- **Objective**
 - Determine Threshold Discharge Area delineation
 - 2 hypothetical projects
- **Timing**
 - 10 minutes to complete (in breakout groups)
 - 5 minutes to review results (breakout group leads to report results)
- **Information**
 - See slides 26-29 in your breakout exercise packet



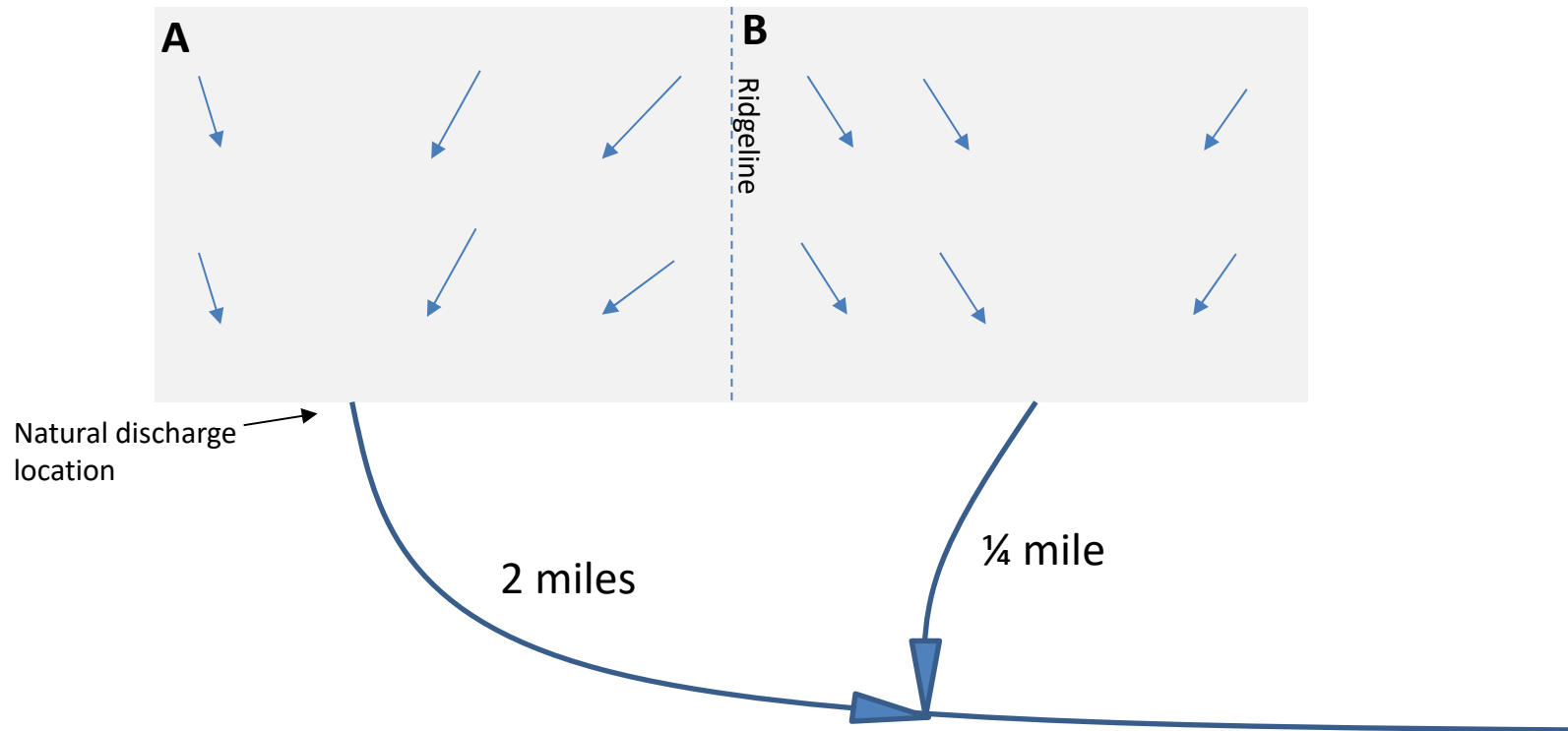
Breakout Exercise #1a



Total project area: 10 acres
Residential, outside UA and UGA



Breakout Exercise #1b



Total project area: 4 acres
Residential, outside UA and UGA

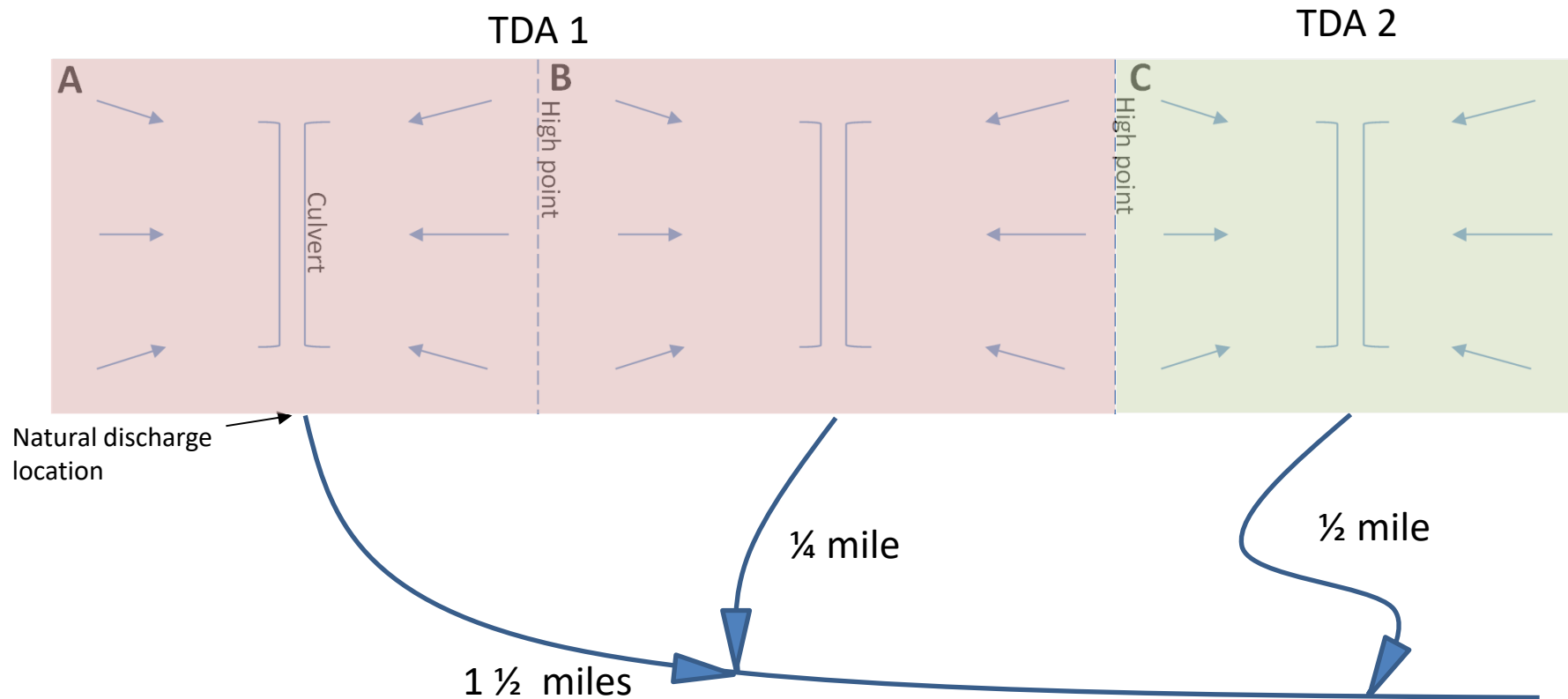




Breakout Exercise #1 Group Discussion



Breakout Exercise #1a

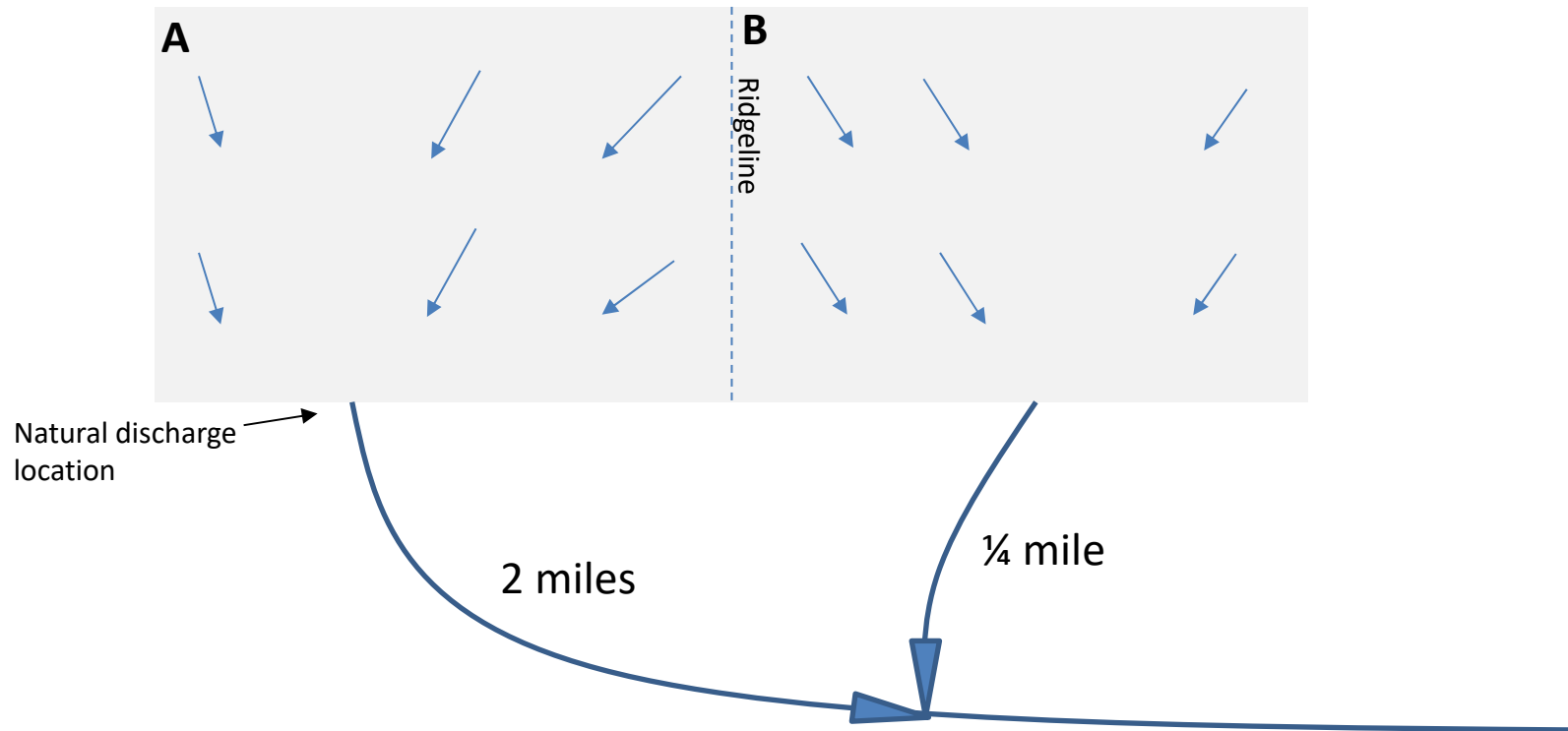


Total project area: 10 acres
Residential, outside UA and UGA



Breakout Exercise #1b

No TDAs delineated
because the project area is
less than 5 acres.



Total project area: 4 acres
Residential, outside UA and UGA



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Volume II Changes



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Kitsap SDM Update

Volume II Key Changes

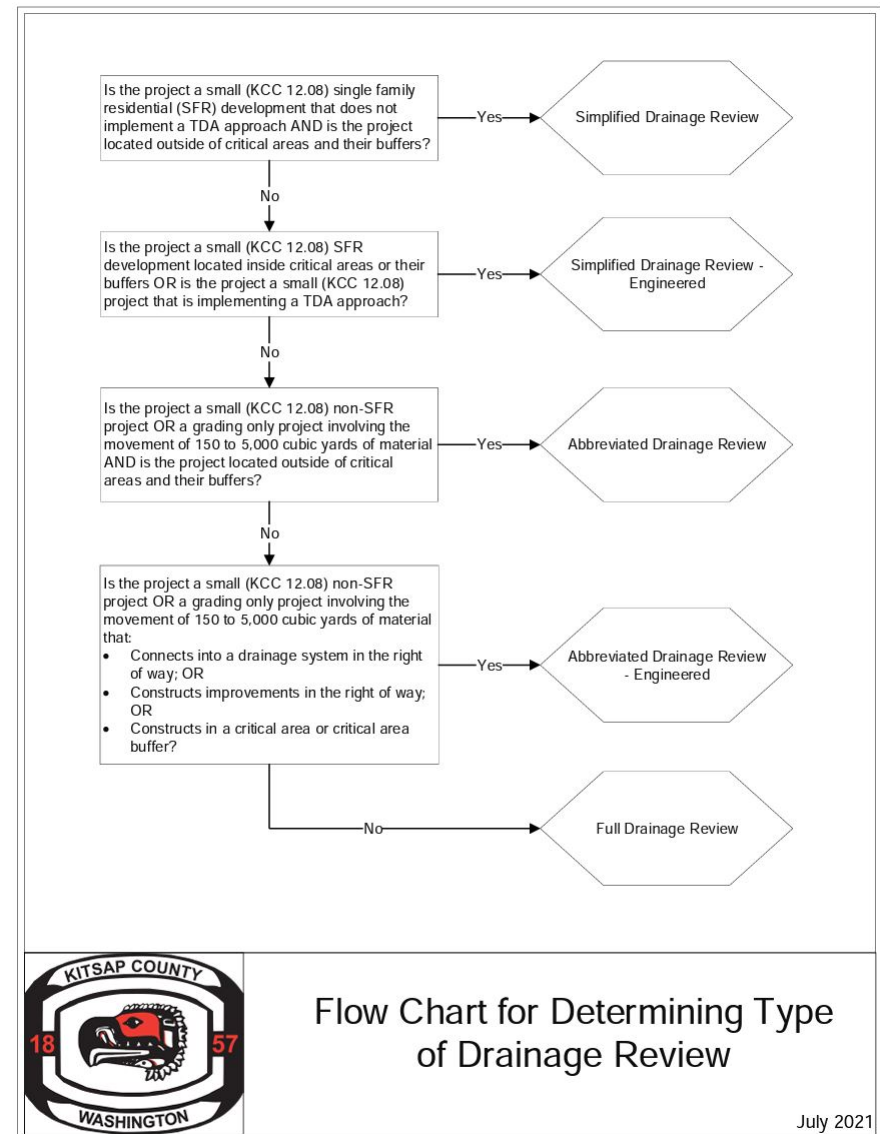
- Updated submittal requirements
- Added local amendments for source control BMPs
 - S427: BMPs for Storage of Liquid, Food Waste, or Dangerous Waste Containers
 - S429: BMPs for Storage or Transfer (Outside) of Solid Raw Materials, Byproducts, or Finished Products
 - S431: BMPs for Washing and Steam Cleaning Vehicles/Equipment/Building Structures
 - S449: BMPs for Nurseries and Greenhouses
- Clarified approved continuous models
- Updated infiltration feasibility methods
- Updated design criteria for pipes, outfall features, and tightline systems
- Added figures



Section 1.2

Drainage Review (Figure 1.1)

- Added TDA Requirements
 - **Small TDA project:** Simplified Drainage Review - Engineered
 - **Large TDA project:** Full Drainage Review



Section 1.2

Drainage Review (Table 1.3)

Table II-1.3. Summary of Submittal Requirements for Each Review Stage and Type of Drainage Review.

Submittal Materials	Type of Drainage Review ^a				
	Simplified Drainage Review ^b	Simplified Drainage Review – Engineered	Abbreviated Drainage Review	Abbreviated Drainage Review – Engineered	Full Drainage Review
Site Assessment and Planning Review					
Application Forms ^c	✓	✓	✓	✓	✓
Site Assessment and Planning Packet	✓	✓	✓	✓	✓
Preliminary Design Review (60 percent design, or higher)					
Site Improvement Plans			✓	✓	✓
Drainage Report				✓	✓
Other technical reports and documents (as applicable)			✓	✓	✓
Final Design Review (90 percent design)					
Site Improvement Plans	✓	✓	✓	✓	✓
Construction Stormwater Pollution Prevention Plan (Construction SWPPP)	✓	✓	✓	✓	✓
Drainage Report		✓		✓	✓
Geotechnical Analysis/Soils Report		✓		✓	✓
Other technical reports and documents (as applicable)	✓	✓	✓	✓	✓
Notes:					
a. For permit approval processes between DCD and Public Works, see "Site Development Activity Permit for Capital Projects; Process Procedures."					
b. If a project is implementing a TDA approach, engineered review or a full drainage review is required (Vol II-1.2.2 Review Types and Requirements).					
c. For specific application requirements, see KCC 21.04.160.					



Section 1.4.4

Drainage Report

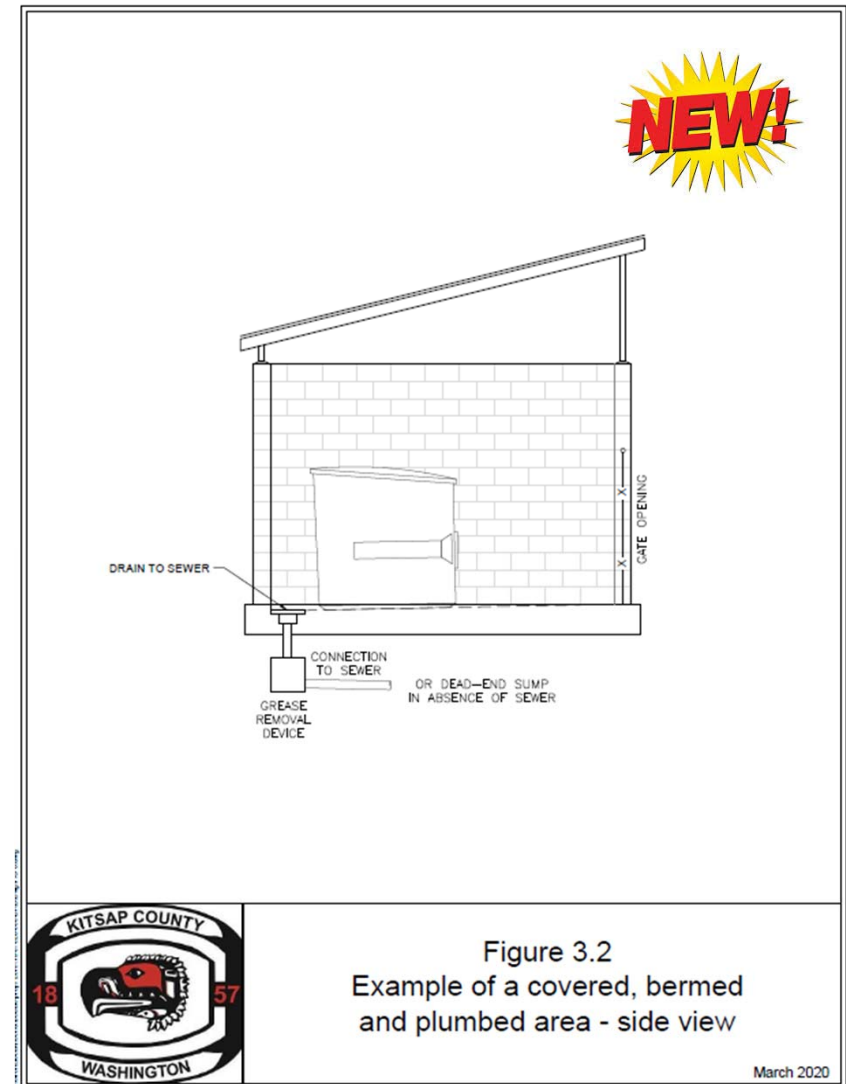
- Additional requirements for projects implementing a TDA approach
 - TDA Delineation Map
 - Large projects must tabulate the following for each TDA
 - New pollution-generating hard surfaces (PGHS)
 - Replaced PGHS
 - Effective impervious surfaces
 - Converted vegetated areas
 - Downstream analysis
 - Other technical analyses depending on site conditions, may include:
 - Geotechnical analysis
 - Critical drainage area evaluation



Chapter 3

S427: BMPs for Storage of Liquid, Food Waste, or Dangerous Waste Containers

- Keep containers inside a building unless impracticable due to site constraints or International Fire Code requirements
- Store containers in a designated area, which is covered, bermed, and paved



Section 4.7

Downstream Analysis

- Required for:
 - Projects with SDAP applications and that meet any of the criteria listed in KCC 12.10.060
 - Large projects
 - Project sites located within critical drainage areas
 - Projects implementing TDAs



Section 5.3.1 Dispersion Feasibility

- Added Infiltration Basins
- Updated setback requirements between Stormwater BMPs and Onsite Sewage System Components
- Added clarification that the Kitsap County Board of Health setbacks take precedence

Table II-5.2: Minimum Horizontal Setback Requirements between Stormwater BMPs and Onsite Sewage System (OSS) Components.

Stormwater BMP ^{a,b}	From Edge of Soil Dispersal Component and Reserve Area (feet) ^c	From Sewage Tank and Distribution Box (feet) ^c	From Building Sewer and Nonperforated Distribution Pipe (feet) ^c
UPGRADIENT			
Individual Lot Infiltration System	30	30	N/A
Individual Lot Dispersion System	30	30	N/A
Individual Lot Rain Garden	30	10	N/A
Individual Lot Downspout Splash Blocks	10	10	N/A
Subsurface Stormwater Infiltration or Dispersion Component	30	10	N/A
DOWN- OR SIDE-GRADIENT			
Individual Lot Infiltration System	10	10	N/A
Individual Lot Dispersion System	30	10	N/A
Individual Lot Rain Garden	10	10	N/A
Individual Lot Downspout Splash Blocks	100	100	N/A
Subsurface Stormwater Infiltration or Dispersion Component	10	10	N/A
UP-, DOWN-, OR SIDE-GRADIENT			
Regional Infiltration Facility	100	100	N/A
Unlined Detention Ponds/Infiltration Basins	100	50	10
Notes:			
N/A: Not Applicable.			
a. BMP horizontal setback distances shall be measured from closest edge of the BMP to the feature of interest.			
b. BMP discharge location(s) and flow path(s) shall be directed away from or around OSS.			
c. If the Kitsap County Board of Health setback conflicts with this manual, the Kitsap County Health District setback will take precedence.			

New column, only affects Unlined Detention Ponds/Infiltration Basins

Section 5.3.1

Dispersion Feasibility

- Added infiltration basins
- Added clarification that the Kitsap County Board of Health setbacks take precedence

Table II-5.3: Minimum Horizontal Setback Requirements Between Stormwater BMPs and Private/Public Wells.

Stormwater BMP ^a	Private Well	Public Well
	(feet) ^b	(feet) ^b
Stormwater BMPs	Private Well (feet)	Public Well (feet)
Individual Lot Infiltration System	30	100
Individual Lot Dispersion System	50	100
Individual Lot Rain Garden	50	100
Individual Lot Downspout Splash Blocks	30	50
Unlined Detention Ponds Infiltration Basins	50	100
Regional Infiltration Facility	100	100

Note:

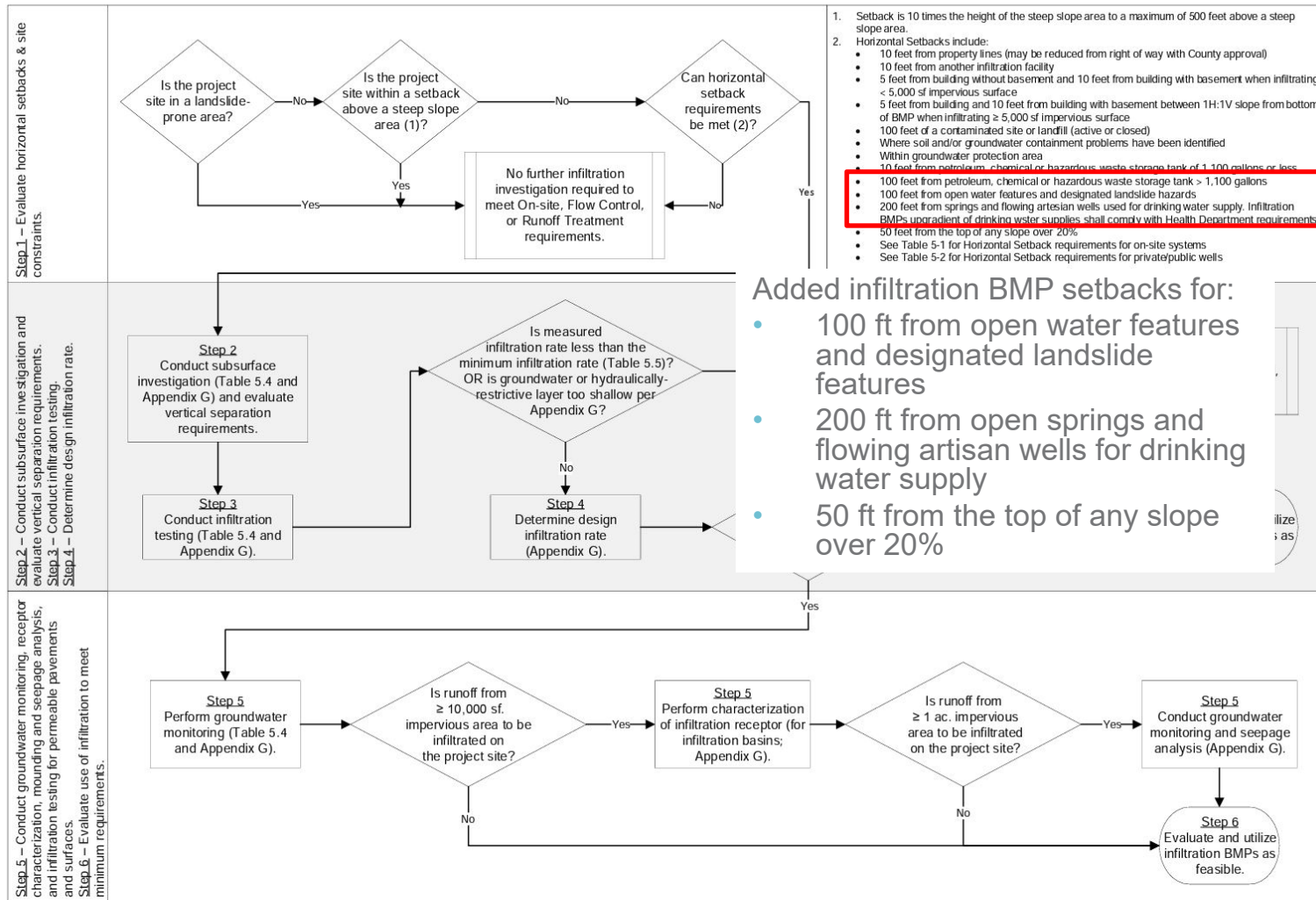
a. Discharge location(s) and flow path(s) shall be directed away from wells.

b. If the Kitsap County Board of Health setback conflicts with this manual, the Kitsap County Health District setback will take precedence.



Section 5.3.2

Figure II-5.1. Infiltration Feasibility Flow Chart



Added infiltration BMP setbacks for:

- 100 ft from open water features and designated landslide features
- 200 ft from open springs and flowing artesian wells for drinking water supply
- 50 ft from the top of any slope over 20%

Section 5.3.2

Infiltration Testing

- Allow for **Grain Size Analysis** only in rural residential project sites
- Small PIT no longer allowed for sites with ≥ 1 acre impervious
- Large PITs, Deep Infiltration Tests, and Grain Size Analysis require a licensed professional

Table II-5.4. Summary of Minimum Investigation and Testing Requirements for Shallow Infiltration BMPs, Steps 2, 3, and 5.^a

Impervious Area Infiltrated on the Project Site	Step 2		Step 3		Step 5			
	Subsurface Investigation		Infiltration Testing		Groundwater Monitoring		Characterization of Infiltration Receptor	Groundwater Mounding and Seepage Analysis
	Minimum Number	Type	Minimum Number	Type	Minimum Number of Wells	Duration and Frequency		
<2,000 ft ²		Simple subsurface investigation	For Grain Size Analysis: At least one per 5,000 square feet of infiltration basin (BMP T7.10) AND at least one per 200 linear feet of trench length (BMP T7.20) AND in no case fewer than 2 tests per BMP For all other test types: 1 per BMP AND at least 1 per 150 linear feet of a BMP ^{e,f}	Simple Infiltration Test ^b or Grain Size Analysis ^{c,d}	0	NA	No	No
$\geq 2,000$ to <5,000 ft ²	1 per BMP AND at least 1 per 150 linear feet of a BMP ^{e,f}	Standard subsurface investigation		Simple Infiltration Test ^b , Grain Size Analysis ^{c,d} , or Small Pilot Infiltration Test (PIT); if $\geq 2,000$ ft ² of the site infiltration will occur within a single BMP ^g , the Small PIT ^d method is required	0	NA	No	No
$\geq 5,000$ to <10,000 ft ²		Comprehensive subsurface investigation ^h		Small PIT ^d or Grain Size Analysis ^{c,d}	1	Monthly for at least 1 wet season; monthly for at least 1 year if within 200 feet of a designated receiving water ⁱ		
$\geq 10,000$ ft ² to <1 acre				Small PIT ^d or Grain Size Analysis ^{c,d}	3		Yes, for infiltration basins	No
≥ 1 acre				Large PIT ^d or Grain Size Analysis ^{c,d}				Yes ^l



Section 5.3.2 Infiltration Testing

Updated from 0.6 in/hr to 0.3 in/hr for consistency with Ecology Manual

Table II-5.5. Minimum Measured Infiltration Rates.

Infiltration BMP	Minimum Measured Infiltration Rate for List Approach (in/hr)	Minimum Allowed Measured Infiltration Rate for Meeting Flow Control, Runoff Treatment, and LID Performance Standards (in/hr)
Infiltration Trenches	5	5
Drywells	5	5
Bioretention without underdrain	0.3	0.3
Bioretention with underdrain	0.3	No minimum
Rain Gardens	0.3	Not applicable (only for On-Site List Approach)
Permeable Pavement	0.3	0.3
Perforated Stub-out Connections	0.3	Not applicable (only for On-Site List Approach)
Infiltration Basins	Not applicable	0.6
Infiltration Chambers	Not applicable	0.6



BMP Selection

- Updated per Ecology Manual:
 - Removed Media Filter from Phosphorus Control BMP menu
 - Clarified process for considering whether Enhanced Treatment BMP is required after selecting a Phosphorus Control BMP
 - Added Permeable Pavement to listed BMPs for Infiltration after pre-treatment

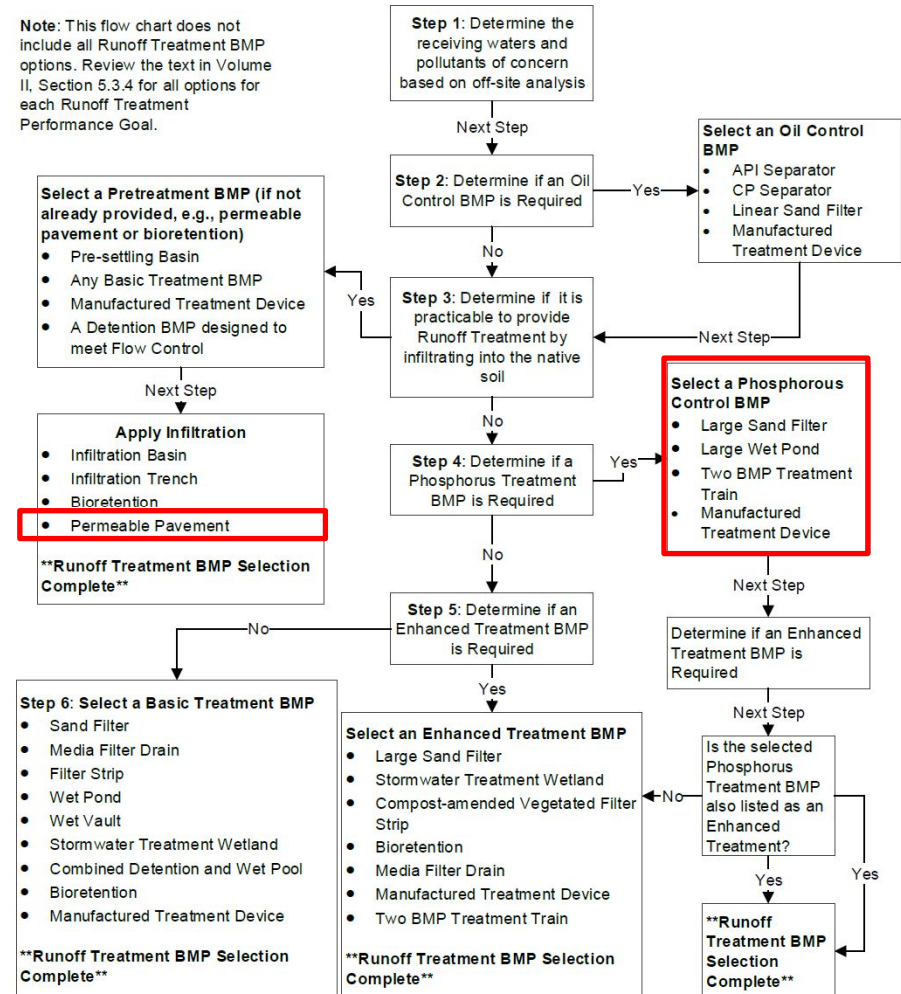
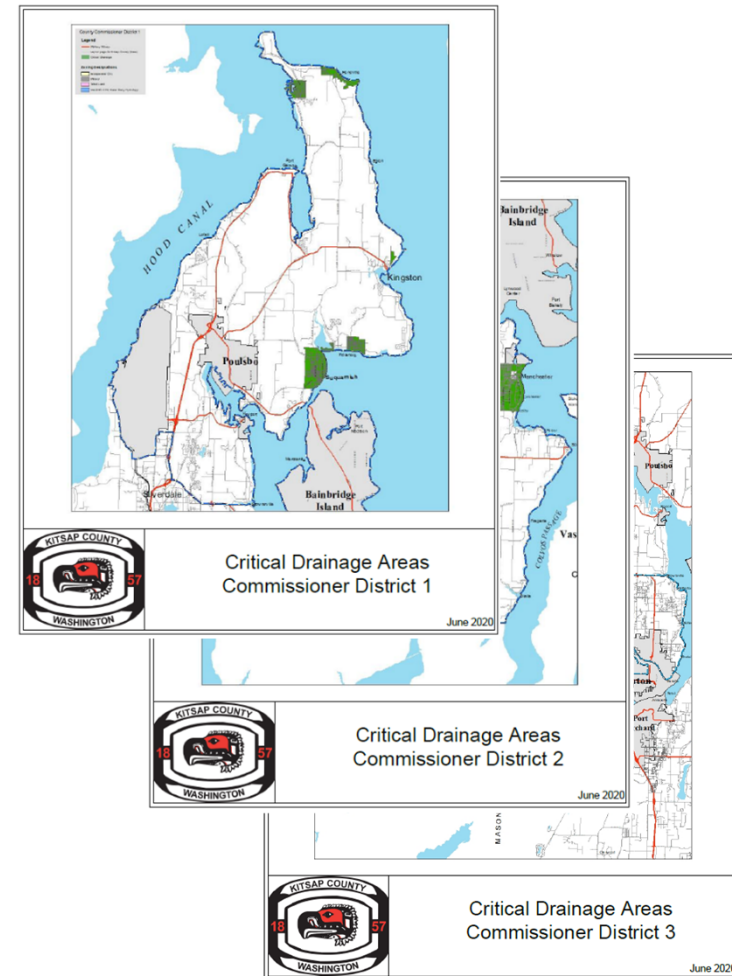


Figure 5.2. Runoff Treatment BMP Selection Flow Chart

Chapter 8

Critical Drainage Areas

- Updated Critical Drainage Area maps to remove the Gamblewood, Edgewater, Miller Bay Estates and a portion of Manchester areas





Appendix Changes



Appendix A – Glossary


- Added definitions
 - Bioengineering
 - Steep slopes (30% or greater)
 - Strahler order
 - Threshold discharge area (TDA)
 - Treatment train
 - Underground Injection Control well
 - Vegetated flow path
- Revised definitions
 - Conveyance system (expanded definition)
 - Onsite stormwater management BMPs (refers to 12.08 KCC)
- Added acronyms
 - BMPs - Best Management Practices
 - CESCL - Certified Erosion and Sediment Control Lead
 - CMP - Corrugated metal pipe
 - CPEP - Corrugated polyethylene pipe
 - GSS - Green Stormwater Solutions
 - HDPE - High density polyethylene
 - HDPP - High density polyethylene pipe
 - LID - Low Impact Development
 - PVC - Polyvinyl chloride
 - SDAP - Site Development Activity Permit
 - SWPE - Solid wall polyethylene



Appendix C – Site Assessment and Planning Packet

- Added TDA delineations
- If using TDAs, complete separate tables for each TDA.
Applies to:
 - (D) Existing and Proposed Site Land Cover Areas
 - (E) Potential LID BMP Matrix

6. HYDROLOGIC PATTERNS & FEATURES

- Identify/Delineate on map: 
- Sub-basin(s) or Threshold Discharge Area(s) (TDAs) _____
- Existing drainage swales and ditches (please describe) _____
- Location(s) of any natural seeps or springs (please describe) _____
- Existing discharge location(s) from each sub-basin or TDA and overall project site: (please describe) _____
- Signs of existing erosion (please describe) _____
- Other: _____

7. VEGETATION

- Native vegetation type(s): _____
- Approximate tree canopy coverage (acres)^a: _____
- Number of trees (greater than 4-inch diameter)^b: _____
- Identify source(s) of information used: _____


Notes:

- a Tree canopy area may be estimated from current aerial photographs and/or documented field observations. Mark on composite map and provide copy of source information
- b Number of trees with diameter equal to or greater than 4 inches may be determined through existing survey or estimated based on documented field observations by a qualified individual.


8. LAND USE CONTROLS

- What is the project site zoning? _____
- Describe landscaping requirements: _____
- Describe parking requirements: _____
- Describe any applicable comprehensive plan designation, zoning classification, and/or overlay districts that may apply to the site: _____
- Does a Shoreline Master Program apply to the site? Yes No
If yes, describe: _____
- Other: _____

9. ACCESS

- Identify/Delineate on map: 
- Roads, driveways, and other points of ingress and egress within 50 feet of the project site
- Identify the street classification of the street that will provide access to the site, per the Kitsap County Road Standards: _____
- Identify frontage improvement requirements: _____
- Identify and Describe any other geometric design requirements that could impact the amount of impervious surface coverage on the site and the location of the access road/driveway: _____

10. UTILITY AVAILABILITY AND CONFLICTS

- Identify/Delineate on map: 
- Existing utilities and easements present on and adjacent to the project site, including utility owner. Also note any utility or easement setback requirements that affect site planning: _____
- Existing utilities that may need to be moved and new utilities that may need to be extended to the site: _____



Appendix F – Hydrologic/Hydraulic Modeling Methods

- Added missing tables and figures (from 2010 SDM)
- Added a new figure (formerly in Volume II, Chapter 4)
- Updated equation formatting

Appendix G – Subsurface Investigation and Infiltration Testing for Infiltration BMPs

- Updated terminology and references
- Added UIC well language for consistency with Ecology
- Updated procedural guidelines for clarity
- Added Grain Size Analysis (from 2019 SWMMWW)



Appendix H – LID Infeasibility Criteria

- Updated infeasibility criteria for consistency with updated SDM text and the Ecology Manual (primarily related to dispersion BMP updates)
- Added infeasibility criteria for perforated stub-out connections
- Removed infeasibility criteria for permeable pavement; replaced with reference to Ecology Manual





Breakout Exercise #2



Breakout Exercise #2

- **Objective**

- Identify allowable infiltration testing methods
- 4 hypothetical projects

- **Timing**

- 10 minutes to complete (in breakout groups)
- 5 minutes to review results (breakout group leads to report results)

- **Information**

- See slides 52-54 in your breakout exercise packet
- Use online SDM:
<http://d73um4zgzsxwp.cloudfront.net/KitsapSDM/Default.htm>



Breakout Exercise #2a-2d

Determine infiltration testing requirements for the following projects:

Hypothetical Project	Type	Impervious Area Added (SF)
2a	Rural residential	1,500 SF
2b	Non-rural residential	1,500 SF
2c	Rural residential	20,000 SF
2d	Non-rural residential	20,000 SF

Hint: Search “Minimum Investigation”

OR Search “Subsurface Investigation” with filter on for Volume II, Chapter 5





Breakout Exercise #2 Group Discussion



Breakout Exercise #2 Discussion

- **Table II-5.4**
- Project 2a: Simple Infiltration Test or Grain Size Analysis
- Project 2b: Small PIT
- Project 2c: Small PIT or Grain Size Analysis
- Project 2d: Small PIT



Table II-5.4. Summary of Minimum Investigation and Testing Requirements for Shallow Infiltration BMPs, Steps 2, 3, and 5.^a

Impervious Area Infiltrated on the Project Site	Step 2		Step 3		Step 5			
	Subsurface Investigation		Infiltration Testing		Groundwater Monitoring		Characterization of Infiltration Receptor	Groundwater Mounding and Seepage Analysis
	Minimum Number	Type	Minimum Number	Type	Minimum Number of Wells	Duration and Frequency		
<2,000 ft ²		Simple subsurface investigation	For Grain Size Analysis: At least one per 5,000 square	Simple Infiltration Test ^b or Grain Size Analysis ^{c,d}	0	NA	No	No
≥2,000 to <5,000 ft ²	1 per BMP AND at least 1 per 150 linear feet of a BMP ^{e,f}	Standard subsurface investigation	feet of infiltration basin (BMP T7.10) AND at least one per 200 linear feet of trench length (BMP T7.20) AND in no case fewer than 2 tests per BMP	Simple Infiltration Test ^b , Grain Size Analysis ^{c,d} , or Small Pilot Infiltration Test (PIT); if ≥2,000 ft ² of the site infiltration will occur within a single BMP ^g , the Small PIT ^d method is required	0	NA	No	No
≥5,000 to <10,000 ft ²			Comprehensive subsurface investigation ^h	1 per BMP AND at least 1 per 150 linear feet of a BMP ^{e,f}	Small PIT ^d or Grain Size Analysis ^{c,d}	1	Monthly for at least 1 wet season; monthly for at least 1 year if within 200 feet of a designated receiving water ⁱ	
≥10,000 ft ² to <1 acre				Small PIT ^d or Grain Size Analysis ^{c,d}	3		Yes, for infiltration basins	No
≥1 acre				Large PIT ^d or Grain Size Analysis ^{c,d}				Yes ^j



Notes:

- a. Deviations from the minimum requirements in this table, when recommended and documented by the licensed professional, may be approved by the director. If the licensed professional determines continuity or subsurface materials based on site investigations or if infiltration testing will be done during construction, then fewer tests may be approved. Designs for infiltration BMPs shall provide allowances for review and update during construction if site conditions differ than assumed during design or if infiltration test during construction (as specified in the designs) determines that the infiltration rate is lower than assumed for the designTab.
- b. The Simple Infiltration Test is not allowed for projects with no offsite point of discharge. The Simple Infiltration Test is only allowed for project sites located in rural areas (outside the UGA and UA), with the drainage area limitations listed in this table. The Small PIT or Large PIT shall be used where the Simple Infiltration Test is not applicable or not allowed.
- c. Grain Size Analysis is allowed for rural (outside the UA and UGA) residential project sites and can only be used if the site has soils unconsolidated by glacial advance. Refer to [Volume V, Section V-5.5](#) of the Ecology Manual for additional guidance.
- d. The investigation and infiltration testing report shall be prepared by a licensed professional. See [Volume II, Chapter 1](#) for report requirements.
- e. For bioretention or rain gardens, a BMP refers to either a single cell, or a series of cells sized to meet applicable standards.
- f. The investigation shall be conducted at the location of the proposed infiltration BMP whenever possible. When not possible to conduct the investigation at the proposed BMP location, it shall be conducted within 50 feet of the proposed BMP location.
- g. A single BMP is defined as a BMP that has at least a 10-foot separation distance from another infiltration BMP, measured from the closest vertical extent of maximum ponding before overflow, or for bioretention and rain gardens, the maximum vertical extent of the top of the bioretention soil or compost amended soil.
- h. The investigation and infiltration testing report shall be prepared by a licensed professional. See [Volume II, Chapter 1](#) for report requirements.
- i. For projects where runoff from 5,000 square feet or more of impervious surface area will be infiltrated on the site, infiltration within 500 feet up-gradient or 100 feet down-gradient of a contaminated site or landfill (active or closed) requires analysis and approval by a licensed hydrogeologist.
- j. If the project site is within 200 feet of tidal waters, groundwater data capturing low/high tide fluctuation for one wet season shall be collected to determine if groundwater at the project is influenced by tidal fluctuations. Groundwater monitoring is not required if available groundwater elevation data within 50 feet of the proposed BMP shows the highest measured groundwater level to be at least 10 feet below the bottom of the proposed infiltration BMP or if the initial groundwater measurement is more than 15 feet below the bottom of the proposed infiltration BMP.
- k. Groundwater mounding and seepage analysis is required where the depth to the seasonal high groundwater elevation or hydraulically restrictive material is less than 15 feet below the bottom of the proposed infiltration BMP.





Discussion



THANK YOU!

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