

2017 Vermont Stormwater Management Manual

Designer's Technical Workshop

December 19, 2017, Vermont Department of Environmental Conservation

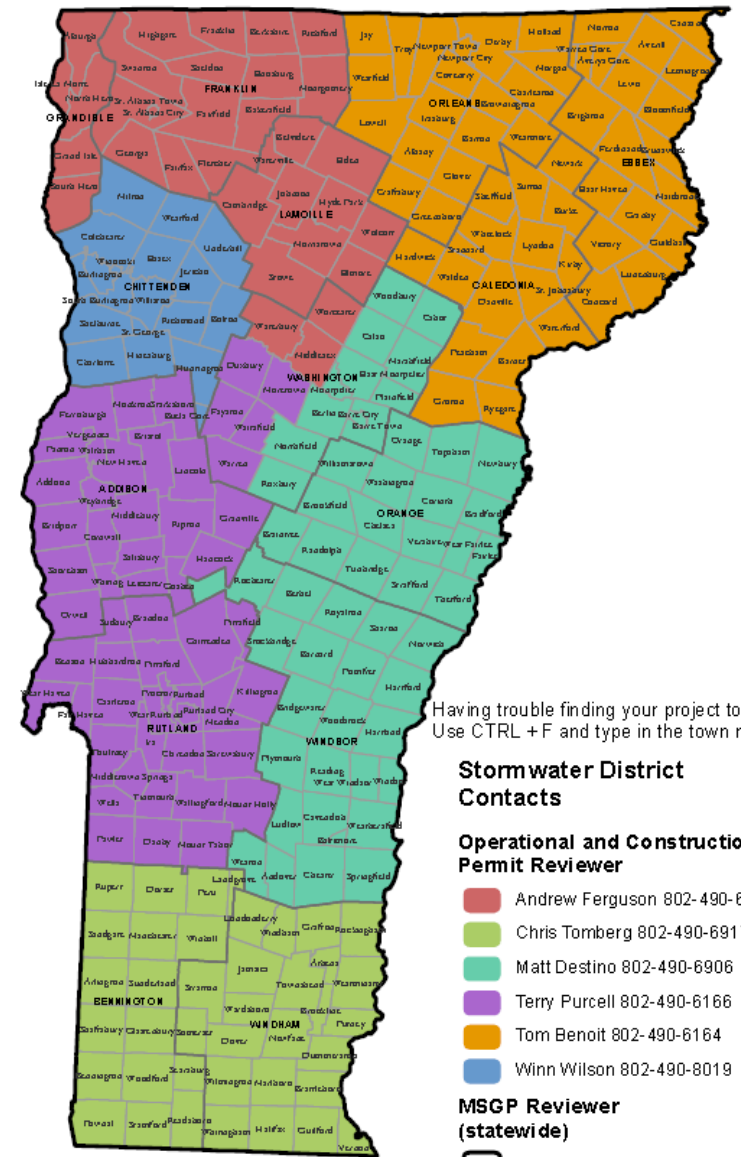
Montpelier, Vermont

Schedule

- 8:30-9:00 Arrival
 - 9:00 – 9:15 Introductions – Overview
- 9:15 – 10:00: 2017 Vermont Stormwater Management Manual:
 - 2017 VSMM Technical Design FAQs
 - Stormwater Program: Known Issues, Design Challenges, and Solutions
- 10:00 – 11:00: Review of 2017 VSMM application submittal and design example
- 11:00 – 11:15: Break
- 11:15 – 12:00: Designer Forum – Questions/Challenges
 - Pre-submitted Questions/Design Challenges for Discussion
 - Additional Questions/Design Challenges

Introductions

- Stormwater Program Staff
 - Operational and Construction
 - Industrial (Multi-Sector)
 - State Transportation (TS4)
 - Municipal Roads
 - Municipal Permitting (MS4)
 - Technical Development and Implementation



Overview: 2017 Vermont Stormwater Management Manual: “Rule and Design Guidance”

- Sets forth Treatment Standards for regulated stormwater discharges from impervious surfaces
 - Water Quality (1”)
 - Groundwater Recharge
 - Channel Protection (1-year, retention of HCv or extended detention)
 - Overbank and Extreme Flood Protection (Q_p10 , Q_p100)
 - Post-Construction Soil Depth and Quality
- Identifies Acceptable STPs and design requirements
- Requires use of runoff reduction STPs
- Provides design guidance

Overview: Why are we all here today?

- Protection of water quality and existing uses
- Better site design
 - Implementation of most effective stormwater treatment and control
 - Stormwater practice longevity and performance
 - Reducing water quality impacts from developed lands
 - Siting STPs in consideration of other resources

2017 VSMM in practice...

...shared goals for training.

- Identify known issues, design challenges, and share solutions
- Attain effective, predictable, and efficient project permitting
 - Meet the Treatment Standards
 - Defensible permit applications and permit decisions
 - Known permit process and expectations

Frequently Asked Questions: Common Questions and Answers

2017 VSMM Applicability?

- Landowners seeking after-the-fact permit coverage, constructed pre-July 1, 2017
- Other amendments and retrofits

Frequently Asked Questions: Common Questions and Answers

2017 VSMM Applicability?

- Previously permitted projects seeking amendment:
 - Appendix 2 of Application Requirements for Operational Permits
 - Designers urged to contact District Staff prior to consideration of amendments seeking to modify or amend 2002 design or permit.

Frequently Asked Questions: Common Questions and Answers

Q2: Is the 2017 VSMM Applicable?

...if an applicant needs to obtain after-the-fact permit coverage for an expansion that exceeded what was permitted under the 2002 Manual, as discovered during post-permit inspection. That is, they constructed more impervious surface than authorized, but constructed said impervious prior to the effective date of the 2017 Manual, and wish to now permit the change routed to their existing 2002 system, through an application submittal after July 1, 2017.

Frequently Asked Questions: Common Questions and Answers

A2: The applicant cannot obtain an after-the-fact permit under the 2002 Manual and must seek coverage for the change under the 2017 Manual regardless of when the unpermitted impervious surface was constructed.

Frequently Asked Questions: Common Questions and Answers

Water Quality Practice Selection

- Justification for infeasibility of Tier 1 and Tier 2 STPs
- Tier 1 (Infiltration Practices and Disconnection)
 - HSG D Soils site-wide justifies inability to use infiltration practice.
 - Varied soil groups across a site, may require more project specific justification in consideration of: project purpose and layout, zoning, setbacks, utilities, particularly if HSG A, B, or C soils are proposed with impervious surfaces leaving only HSG D soils available for treatment areas.
 - Ability to utilize “disconnection” must still be evaluated on HSG D soils.

Frequently Asked Questions: Common Questions and Answers

Water Quality Practice Selection

- Justification for infeasibility of Tier 1 and Tier 2 STPs
- Tier 2 Infeasibility Justification (Bioretention and Gravel Wetland)
 - Existing STPs located on site is not sufficient justification for Tier 2 infeasibility
 - Must evaluate ability to provide inline or off-line Tier 2 treatment before use of Tier 3 STP.
 - Depth to SHGWT may justify infeasibility of Bioretention.
 - Depth to SHGWT does not alone justify infeasibility of Gravel Wetland.
 - 2017 VSMM does not specify separation distance to SHGWT.
 - Presence of Hotspot land use or activity may dictate lining of practice but not infeasibility.
 - Designer feedback requested.

Frequently Asked Questions: Common Questions and Answers

Soil Testing Requirements for Infiltration Practices

- Field Testing
 - Several methods are acceptable
 - Borehole infiltration test, pre-soak requirement (24-hours)
 - Practicality of pre-soak on highly infiltrative soils
 - Program has accepted other pre-soaking recommendations as prepared by Oregon State University for the “Portland Method” and “Reduction Factor Method” of infiltration testing.
 - Design Guidance to be provided that reference this acceptable variation.
 - Additional challenges with field infiltration testing, grade changes, excavation, etc.
- Laboratory Testing of hydraulic conductivity, not accepted

Frequently Asked Questions: Common Questions and Answers

Infiltration Feasibility for meeting Channel Protection, Q_p standards

When is a groundwater mounding analysis required?

- Per Section 4.3.3.1. (Infiltration Feasibility), a groundwater mounding analysis is required for practices
 - Designed to infiltrate more than the 1-year, 24-hour storm event; and
 - When the separation from the bottom of the STP to the SHGWT is less than 4 feet.

Hantush Method or approved equivalent

- When is it really required, why is it required, how is this done, where do I start?
- Who is qualified to complete this analysis?
- What information can I use in equations?
- More in-depth discussion warranted.

Frequently Asked Questions: Common Questions and Answers

Redevelopment

What are the options for meeting WQ Treatment Standard?

Section 2.4 of the manual is not clear with “and” & “or” as written.

- Allows for any combination of reduction (25%) and treatment (50% WQ_v)
- Does not explicitly require 25% reduction
- Each bulleted item in Section 2.4 is to be interpreted as “or”
- If bulleted options not technically feasible, designer may propose alternatives that would achieve equivalent pollutant reduction, involves submittal of supporting documentation consistent with Section 4.4.

Frequently Asked Questions: Common Questions and Answers

Post-Construction Soil Depth and Quality Standard

- Certification
 - Will statement of compliance, to be completed by designer, include requirement to certify SDQ compliance?
 - Can the sitework contractor complete certification during or upon completion of construction?
 - Can the sitework contractor certify during construction to avoid 9 test holes/acre after construction?
 - Feedback from design community requested.
 - SW Program considering updates to existing form or creating new form.

Frequently Asked Questions: Common Questions and Answers

Hydrologic Modeling

Characterization of off-site contributing areas:

- Model as existing condition or ultimate (full-build-out) condition.

Use of area-weighted CNs:

- Section 2.2.5.1. HCM (page 2-20): Can I use composite-CN rather than weighted-Q?
- Area-weighted CNs shall not be used, unless prior Agency approval received.
- Area-weighted approval has been reserved for:
 - Reliance on existing complex or extensive models previously prepared for design of existing stormwater infrastructure.
 - Reliance on existing modeling for retrofits, if necessary and justified.
 - Other situations that truly represent a composite situation, that would otherwise be infeasible to model.
 - Opportunity for more in-depth discussion if necessary.

Frequently Asked Questions: Common Questions and Answers

Hydrologic Modeling

Modeling Reports

- When is it necessary to include modeling reports?
 - Reports required when reliance on model is necessary to verify compliance with VSMM.
- If all standards are met through runoff reduction, i.e. HCM, does modeling need to be submitted?
- Intent of updated materials, workbook had been to limit the modeling reports necessary for application.
- Requirement for submittal of all applicable storm modeling may be easier and more efficient
- Designer Feedback Requested.

Frequently Asked Questions: Common Questions and Answers

Standards Compliance Workbook / STP Worksheets

How does the workbook and worksheets address pre-treatment?

- See revised STP worksheets (November 2017)
- Volumetrically-sized pre-treatment considered in STP Worksheets only, and carried through to Workbook, either as T_v or WQ_v
- Rate-based sized pre-treatment also considering in STP Worksheets, through calculation of the Modified CN associated with WQ storm peak flow, to be supported by modeling report submitted with application.
 - Rate-based pre-treatment worksheet may be helpful, but may add unnecessary additional form.
 - Designer feedback requested.
- Pre-development and Post-development Drainage Area Changes
- Modified CN and Practice-specific runoff

Frequently Asked Questions: Common Questions and Answers

Standards Compliance Workbook / STP Worksheets

How is the Workbook to be completed when the Pre-development and Post-development drainage areas change on a project?

- Workbook provides **WARNING** advising designer that use of HCM for drainage area is not appropriate.
- Workbook does still allow designer to move forward and consider HCM across drainage areas.
- Designer must consider project specific information such as discharge points and respective receiving waters.
- Designer should use caution in situations that significantly reduce drainage area size from Pre- to Post-development.

Frequently Asked Questions: Common Questions and Answers

STP Design and Use of Filter Fabric

- Synthetic filter fabrics shall not be used to completely separate the filter media from the underdrain bedding material.
- Requirement stems from concern that fabric is an opportunity for clogging, particularly when a bioretention soil media is used.
- Designers have expressed concern with NOT placing fabric between sand media and underlying underdrain stone bedding material.
- An alternative to fabric in this case could be a course of pea-stone, consistent with other state Manuals.
- We may allow use of fabric between sand filter media and stone bedding material.
- Designer feedback requested.

Frequently Asked Questions: Common Questions and Answers

Pre-Treatment for Sheet Flow to STPs

Pre-Treatment Filter Strip Sizing

- Sizing requirements unintentionally were omitted from the 2017 VSMM.
- Expect to insert sizing information under Design Guidance.

Interim: Designers are asked to rely on the following guidance for sizing of filter strips:

Parameter	Requirements			
Maximum Impervious Contributing Flow Path Length	35 feet		75 feet	
Filter Strip Slope (maximum 6%)	<2%	>2%	<2%	>2%
Filter Strip Minimum Length (feet)	10	15	20	25

- Is the use of Stone Diaphragms for pre-treatment of sheet flow acceptable?
 - When designed in accordance with Section 4.2.3.2., this will be acceptable for meeting pre-treatment requirements for sheet flow. Contributing length may be a consideration for acceptance (75' maximum).

Frequently Asked Questions: Common Questions and Answers

Disconnection:

Simple Disconnection and Disconnection to Filter Strips and Vegetated Buffers

References to “site-specific soil evaluation”

- This is intended to allow for reliance on NRCS soil mapping for determining required lengths.
- On-site field soils characterization may still be necessary for urban or fill soils, or where mapping is insufficient.

“Routing” to disconnection area

- Can an impervious surface be routed via sheet flow down a slope or area in route to the required disconnection area? Y
- Yes, provided sheet flow can be maintained, subject to review.
- Conveyance length, stepped grade control, use of stone diaphragm, level spreader, or other methods along conveyance to ensure for maintenance of sheet flow may be considerations.

Frequently Asked Questions: Common Questions and Answers

Stormwater Hotspots...where, what, when?

- No list of Stormwater Hotspots and Activities, case-by-case, however there are known land uses and activities, such as vehicle fueling stations.
- May require information from DEC's Waste Management and Prevention Division for known sites.

Infiltration Prohibition / STPs and Conveyance at Stormwater Hotspots

- STPs that are designed to infiltrate, include disconnections.
- Lining of conveyances or detention practices to restrict infiltration may be considered.

Underground Injection Control Rule:

Structural infiltration STPs such as basins and trenches are considered to be Class V injection wells, and infiltration of runoff from a hotspot land use or activity may be further prohibited.

Stormwater Program: Known Issues, Design Challenges, and Solutions

ISSUE: Standards Compliance Workbook

- Permit Amendments
- Existing Impervious Surfaces for Permit Coverage
- Existing Impervious Surfaces NOT for Permit Coverage
- Site Balancing / Net Reduction

SOLUTION: Introduce and review updated Standards Compliance Workbook.

Stormwater Program: Known Issues, Design Challenges, and Solutions

ISSUE: STP Worksheets

- Sizing of STP for subcatchment
- Sizing of pre-treatment for subcatchment

SOLUTION: Introduce and review updated STP Worksheet(s).

Stormwater Program: Present and Review 2017 application submittal

Applicant: VR US Holdings II, LLC

Project: Harlow Hill West – New Parking Area

Location: Stowe Mountain Resort

Stormwater Treatment Practices: Infiltration Trenches



LEGEI

- BUILDING FOOTPRINT
- PARKING SPACE
- ROAD
- 30' STREAM SETBACK
- PROPOSED BUILDING FOOTPRINT
- PROPOSED PARKING SPACE
- PROPOSED ROAD
- PROPOSED 30' STREAM SETBACK
- PROPOSED ROAD
- PROPOSED 30' STREAM SETBACK



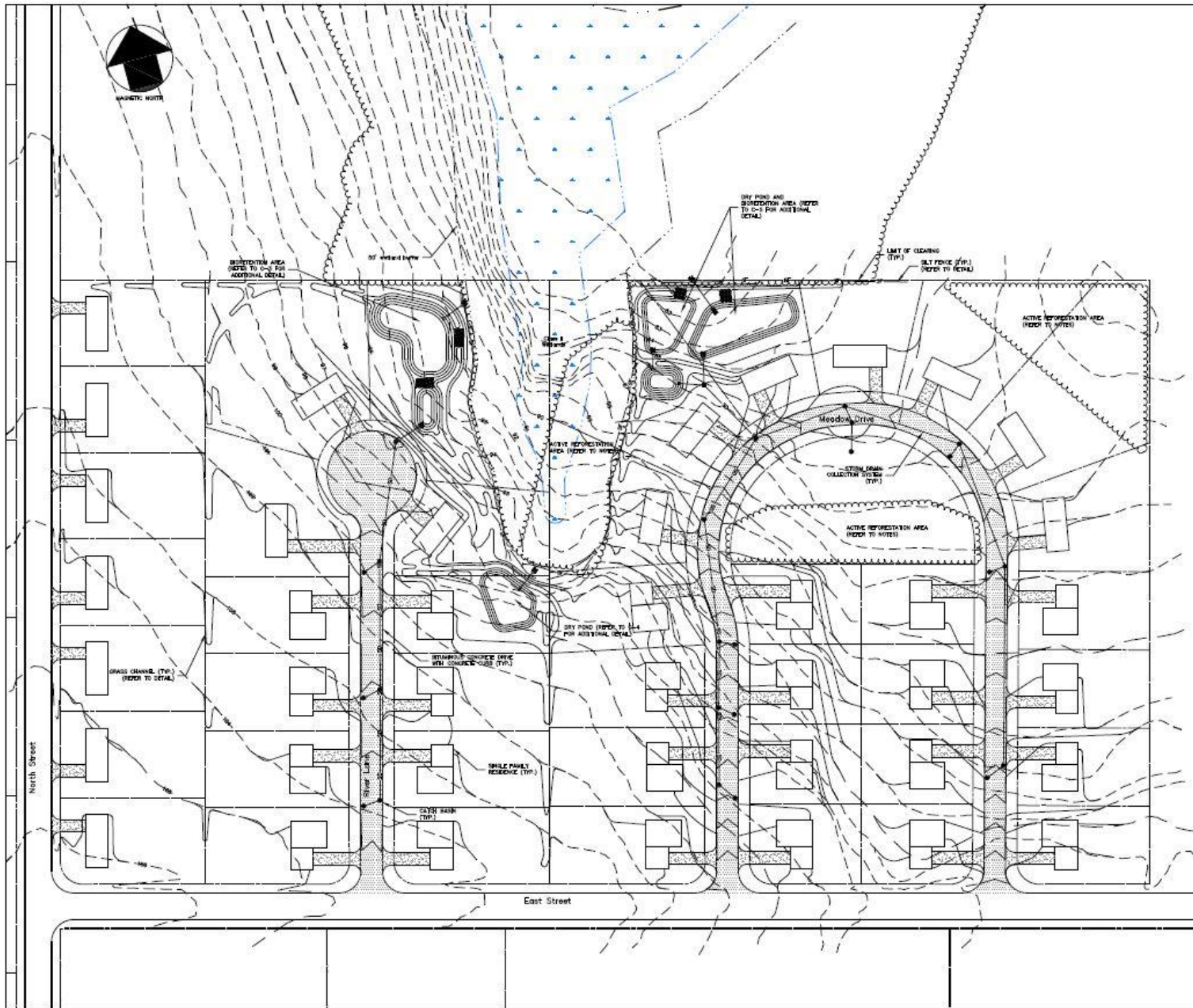
Stormwater Program: 2017 application design example High Density Residential

Applicant: n/a

Project: High Intensity Residential – 41 lot residential subdivision

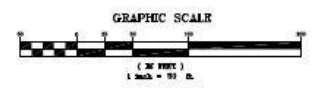
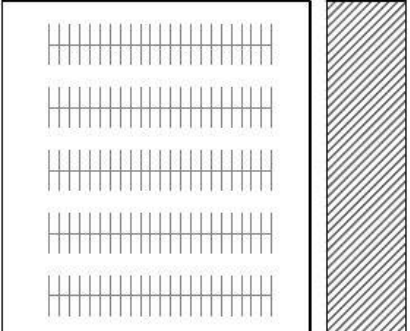
Location: n/a

Stormwater Treatment Practices: Simple Disconnection, Bioretention, Dry Swales, Dry Detention, Reforestation



CONSTRUCTION NOTES

1. ACTIVE RESTORATION AREAS NOTED ON THE PLANS SHALL BE PLANTED WITH NATIVE TREES AND SHRUBS, AND SHALL BE GUARANTEED USING FENCING, STAKE, MULCHING, OR OTHER PROMINENT DEMONSTRATION TO EXTEND THE LIMITS OF THE RESTORED AREA.
2. ACTIVE RESTORATION AREAS SHALL BE PLANTED WITH A DENSITY OF 200 SHRUBS PER ACRE. TREES SHALL BE PLANTED WITH A DENSITY OF 20 TREES PER ACRE.
3. SHRUBS SHALL BE SPACED 10 FEET APART, BE A MINIMUM HEIGHT OF 34 INCHES AND SHALL BE COMPRISED OF THE FOLLOWING SPECIES PLANTED RANDOMLY:
 - A. HART'S DOGWOOD
 - B. VIBURNUM NELLIS
 - C. CLEYERHART
 - D. SLATE SPINDLETREE
4. TREES SHALL BE SPACED 60 FEET APART AND BE 1 INCH CALIPER NEWMAN AND SHALL BE COMPRISED OF THE FOLLOWING SPECIES:
 - A. SHAW-NUT TREE
 - B. RED MAPLE
 - C. SUGAR MAPLE
5. PLANTINGS SHALL BE MONITORED FOR A PERIOD OF TWO YEARS. A PLANT SURVIVAL RATE OF 80% IS REQUIRED.



**INTENSIVE DEVELOPMENT
HIGH DENSITY
RESIDENTIAL**

PROPOSED
SITE PLAN

Project No.	19-031
Scale	1/8" = 1'-0"
Drawn by	JLH
Checked by	JLH
Date	11/11/2017
Drawn	11/11/2017
Drawn number	

404 East Main Street
Anytown, VA
Telephone: 555-1234
Fax: 555-5789

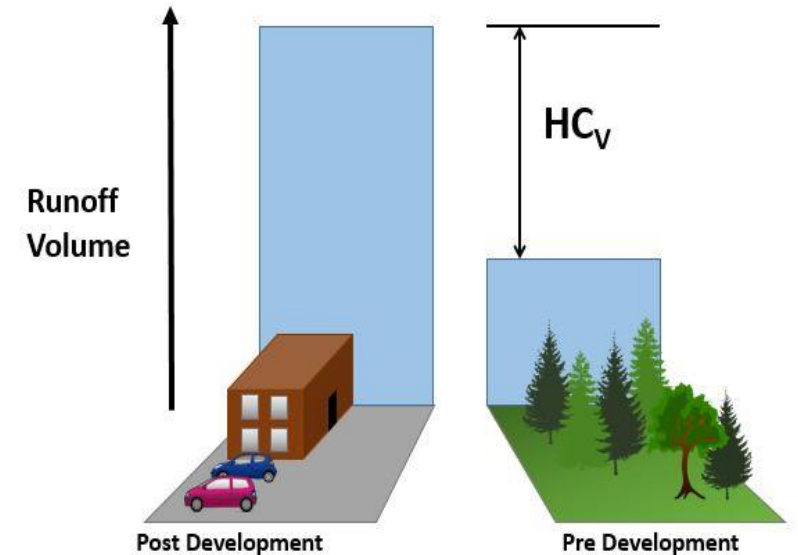
Designer Forum:

Channel Protection Standard

- Hydrologic Condition Method (HCM) and Implications on Disconnection

HCM when implemented will approximate runoff characteristics of “woods in good condition” for the 1-year, 24-hour storm event.

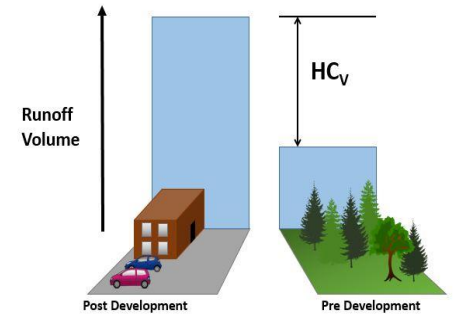
HC_v is the change between the pre-development and post-development runoff **volume** for the 1-year, 24-hour storm event.



Designer Forum:

Hydrologic Condition Method (HCM)

- Disconnection on HSG B/C/D soils currently receive $T_v \approx WQ_v$
- Disconnection on HSG A soils may receive $T_v = HC_v$ with additional length as specified.
- When all regulated impervious surfaces are disconnected for a project only Water Quality and Groundwater Recharge standards are met.



What additional options exist for CP Standard compliance?

- Meet CP via HCM site-wide.
- Develop modeling/tables that provide additional required lengths.
- Consider other state manual approaches to providing disconnection credit for CP/ Q_p
- Forgo disconnection on sites where CP is applicable, if otherwise can't be met by HCM
- Designer feedback requested.

Designer Forum:

Stone Outlet Trench

- Applicability
 - Required for WQ_v and CP_v outlet for wet ponds and shallow surface wetlands.
 - Required for CP_v outlet for dry detention ponds, except when min. orifice size is used (1") and detention time is less than 500 minutes.
 - Sizing of outlet for WQ and CP, when component of WQ is provided by extended detention (ED), outlet sized for CPv (12 or 24 hours). WQ ED "shall drain over 24-hours," but will allow to be less than 24-hours if necessary to comply with CP.

Designer Forum:

Groundwater Mounding Analysis – Hantush Method

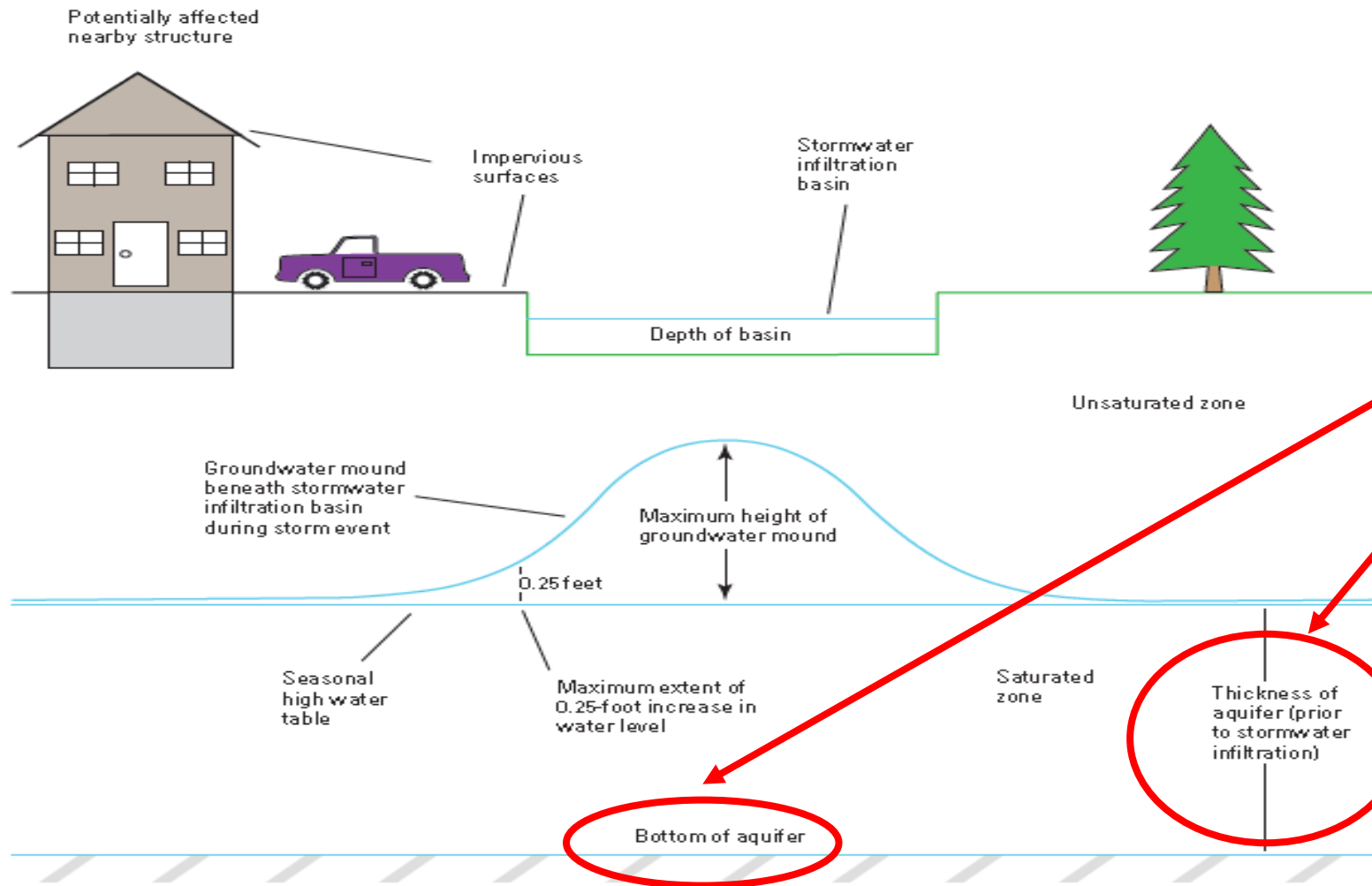
Applicability

- Infiltration of more than the 1-year, 24-hour storm event, and
- Less than 4 feet separation from bottom of practice to SHGWT.

Purpose?

- Groundwater mounding may affect basements of nearby homes or structures.¹
- Stormwater infiltration systems designed with inaccurate assumptions or insufficient analysis may not function as designed.¹
- Drain time may be based on assumption of vertical flow out of basin bottom into unsaturated sediments.¹
- Groundwater mounding beneath basin may affect actual rate of infiltration.¹
- Long-term system integrity
- May serve a different purpose than that of a mounding analysis for wastewater disposal

¹ USGS, 2010. Carleton, Glen B. Simulation of Groundwater Mounding Beneath Hypothetical Stormwater Infiltration Basins. Scientific Investigations Report 2010-5102.



VT DEC Stormwater:
Mounding Analysis
dependent on this
information.

USGS, 2010. Carleton, Glen B. Simulation of Groundwater Mounding Beneath Hypothetical Stormwater Infiltration Basins. Scientific Investigations Report 2010-5102.

Designer Forum:

Groundwater Mounding Analysis – Hantush Method

Some Available Tools/Resources (may incur licensing cost)

- USGS spreadsheet: <https://pubs.usgs.gov/sir/2010/5102/>
- GeoHydroCycle: <http://www.geohydrocycle.com/>
- Environmental Software Online, LLC:
<http://www.groundwatersoftware.com/newsletter/dec06/index.htm>
- HydroSOLVE Inc. (AqteSOLVE - Glenn Duffield):
<http://www.aqtesolv.com/forum/rmound.asp>
- NDWRCDP spreadsheet: http://www.ndwrcdp.org/documents/wu-ht-02-45/wuht0245_electronic.pdf

¹ USGS, 2010. Carleton, Glen B. Simulation of Groundwater Mounding Beneath Hypothetical Stormwater Infiltration Basins. Scientific Investigations Report 2010-5102.

Designer Forum:

Groundwater Mounding Analysis – Hantush Method

Review of Variables (Hantush_USGS_SIR_2010-5102-1110.xlsm)

- Recharge (infiltration) rate (R) in feet/day (equivalent to design volume, T_v)
- Specific yield
- Horizontal hydraulic conductivity (K)
- Infiltration practice dimensions (feet)
- Duration of infiltration period (1-2 days)
- Initial thickness of saturated zone ($h_i(0)$)

Additionally, this analysis is based on a flat surface, though other methods exist.

¹ USGS, 2010. Carleton, Glen B. Simulation of Groundwater Mounding Beneath Hypothetical Stormwater Infiltration Basins. Scientific Investigations Report 2010-5102.

Designer Forum:

Groundwater Mounding Analysis – Hantush Method

- Considerations for changes/additional feedback

Designer Forum:

Solar Development

- STP limitations and design on landfill installations
- Construction/Installation Methods, Limits of Disturbance
- Post-Construction Soil Depth and Quality Standard
- Phased development considerations
- Considerations for existing conditions – existing mining/extraction activities

Designer Forum:

Stormwater Program: Additional Topics for Possible Discussion

- Application Submittal Instructions and Requirements
 - Format, submittal of MS Excel spreadsheet vs. PDF
 - Format, submittal of modeling software output, in addition to PDF report.
- Amendments, can we do this differently?
- How best to communicate this information with design community and the public?
- Specific Training Needs/Opportunities Going Forward
- Time of Concentration – Watershed Lag Method
- Annotated Maintenance Plan



Thank you for your participation!

Vermont DEC Stormwater Program

<http://dec.vermont.gov/watershed/stormwater>

<http://dec.vermont.gov/watershed/stormwater/contacts>