Stormwater Program Guidance for Meeting Phosphorus "Net Zero" Requirements pursuant to the Department's "Interim Procedure for Discharges of Phosphorus to Lake Champlain and Waters that Contribute to the Impairment of Lake Champlain. "

November 24, 2015

The following provides guidance for applicants in complying with the phosphorus "net-zero" requirements under the interim procedure. Per statute, all permits applied for after October 1st 2015 must show no increase in phosphorus load relative to existing conditions. Please contact the Stormwater Program District Analyst for the project in question prior to submitting an application.

Summary of Permit Application Requirements

Permit Application Requirement Summary Table				
Permit type	**Permit description**	**P Simple Method calculations required[1]**	**EFA[3] Required to meet VSMM?**	**General Permit or INDS[4]**
New	New Permit, new impervious	Yes	N/A	INDS
	Redevelopment/ new combination	Yes	Yes	INDS
Renewal	Project built, previous permit meets VSMM[2]	No	No	GP or INDS[5]
	Project not built, previous permit meets VSMM[2]	Yes	No	INDS
	Project built, previous permit is pre VSMM	No	Yes	INDS
Amendment	No material change in project, no change in expiration date	No	No	GP or INDS[5]
	Change in impervious, treatment, or discharge location	Yes	See last 2 rows	INDS
	Previous permit meets VSMM	Yes	No	INDS
	Previous permit is pre-VSMM	Yes	Yes	INDS

Notes:

1. Applications must show no net increase in phosphorus load from existing conditions. In addition to regular application materials, submit phosphorus offset calculations and a description of how the offset will be met if an offset is required. Please contact the district analyst before deciding on an offset project.
2. VSMM –Vermont Stormwater Management Manual- 2002 Standards
3. EFA –Engineering Feasibility Analysis. The analysis shall demonstrate the water quality, recharge, and channel protection criteria that are technically feasible to achieve on site. Applicants shall use the EFA criteria as established in GP 3-9030, Appendix A, Tables 1 & 2. The analysis shall be submitted with the application.
4. GP-General Permit, INDS- Individual Permit. Most applications will need to be submitted under an INDS.
5. If the permit being renewed or amended in these categories was previously under a GP then it can remain under a GP.

Meeting Net-Zero Phosphorus Load Requirements

If the application for a proposed project requires phosphorus (P) Simple Method calculations based on the table above, a calculation of pre-development and post-development load must be provided. Pollutant loading calculations shall be in accordance with Stormwater Program guidance (simple method calculation wkst.xlsx), unless otherwise approved. Please refer to the worksheet for more detailed guidance on the Simple Method calculations.

Projects should first maximize treatment on site through **infiltration** practices. Further guidance on infiltration practices and the treatment they receive is provided with the worksheet. A **treatment train** approach may be used provided that additional P removal from the upslope treatment system effluent is reasonably likely to occur. If a treatment train approach is proposed please contact the Program District Analyst for the project in question as this approach will be approved on a case by case basis.

An **offset** will be required if the project results in an increase in P load after maximizing treatment on site. Offset means a permitted action or project within the watershed of interest that a permittee or third party may complete to mitigate the impacts of an existing or proposed discharge. If Simple Method calculations indicate a need for an offset, then the options below can be used for offsets to meet the interim criteria. Check with the district analyst for the project area before pursuing these approaches.

a. **On site offset**: Treat existing *unpermitted* impervious on site to current standards. This approach requires that there be non-jurisdictional impervious cover on the site.
b. **INDO offset**: Purchase from an existing offset project within the same lake segment drainage area of the project.
c. **Offsite offset**- Seek out an off-site offset using traditional BMPs or a NISTOP per Appendix C of Chapter 22, "Technical Guidance for the Evaluation of Non-Impaired Surface Treatment Offset Projects (NISTOP) Within Impaired Watersheds" within the same lake segment drainage area.

C Factor Expanded Guidance

VT DEC has produced the following framework for phosphorus (P) Simple Method accounting under the *Interim Procedure for Offsets for Discharges of Phosphorus to Lake Champlain and Waters that Contribute to the Impairment of Lake Champlain* (hereafter the *Interim Procedure*). While our approach is generally modeled on the sediment offset procedures in Environmental Protection Rules Chapter 22, we made several modifications based on the uncertainty introduced by the widely documented variability in P concentrations and loads from developed and undeveloped land uses. This guidance includes the approach to be used for developed and existing land P accounting under the Simple Method and the rationale and justification for this approach. In cases where additional site specific data exist VT DEC is open to considering alternate approaches, however the expectation is that what follows will work for the majority of sites requiring P accounting under the *Interim Procedure*.

Approach

Developed Land, Non-Transportation (hereafter 'Developed Land')

VT DEC calculated a single Developed Land 'C' factor for use in Simple Method calculations by solving algebraically for the 'C' factor needed to match the base scenario P modeling developed by EPA's contractor (Tetra Tech, TT) for the Lake Champlain P TMDL analysis. This 'C' factor analysis was completed for each of the Vermont land areas draining to Lake Champlain, grouped by the same lake segment spatial discretization used in the TT modeling. We then took an area weighted average of the results to be used basin wide, given that the variability in resulting 'C' factors cannot be directly attributed to sub-basin characteristics. The steps in this analysis were as follows:

1. The percent impervious from the TT Soil and Water Assessment Tool (SWAT) model parametrization land use classification of pervious Developed Land and impervious Developed Land was calculated for each of the 12 identified lake segment drainage areas.

2. Developed Land P export load data were extracted directly from the TT SWAT modeling output for each of the 12 lake segment drainage areas.

3. Drainage area specific annual rainfall depths for each of the 12 lake segment drainage areas were extracted. These were computed as median values from 800 meter grid 30-yr Normal Precipitation PRISM data from the period of 1981-2010.

4. Next, using the 12 estimates of a) annual Developed Land P export, b) Developed Land percent impervious, and c) PRISM 1981-2010 derived annual precipitation totals, 12 different estimates of Developed Land 'C 'factors that produce P export estimates were computed matching the sub-basin scale loads produced by the TT SWAT modeling.

5. These 12 estimates ranged from 0.277 (Isle La Motte) to 0.739 (South Lake A) and were normally distributed. An area (i.e., Developed Land area) weighted average was taken which computed to **0.441**. This value includes lands both with and without jurisdictional stormwater treatment, and thus the value would be higher if computed solely for Developed Lands before stormwater treatment is provided. However, given the various simplifications and abstractions used in this analysis, no further adjustment to the 'C' factor **0.441** will be made.

Transportation Developed Lands (Roads)

A similar approach as to what was just described for Developed Land was used to calculate 'C' factors for the transportation sector based on the TT SWAT analysis. Transportation land uses in the TT Champlain Basin analysis were split between 'Paved Roads' and 'Dirt Roads', and thus the same categorization scheme is used here. The analysis followed the same steps as just described except that an additional assumption had to be made for the percent impervious. The raster based land use classification used in the TT analysis uses grid cells that are classified as road, however finer scale details such as pervious road shoulders, medians and ROWs (right-of-ways) are not broken out. Thus, the Transportation Developed Lands area extracted from the TT SWAT modeling can be taken as mostly, though not entirely impervious. To account for the presence of these pervious areas in the 'C' factor analysis we simply assumed 90% impervious cover for all land cover cells classified as either Paved Roads or Dirt Roads. The resulting 'C' factors were only moderately sensitive to this assumption.

Applying this approach to the Paved Roads lands within the Vermont portion of the Champlain basin produced a range of 'C' factors between 0.220 (Mallets Bay) and 0.325 (South Lake A), with an area weighted average value of **0.237**. Applied to lands categorized as Dirt Roads, this analysis produced a range of values from 0.562 (Missisquoi Bay) to 0.813 (South Lake A) with an area weighted mean value of **0.618**. In the absence of additional site specific data, these 'C' factor values should be used for Paved and Dirt Road land uses on transportation projects requiring P accounting under the *Interim Procedure*. Driveways, access drives, and other transportation surfaces within larger development projects (e.g., residential and commercial subdivisions) should not use these values. Instead, they should simply be lumped with other land surfaces under the single composite Developed Lands 'C' factor.

Non-Developed Land (little to no existing impervious)

When a site is to be newly developed and there is little to no existing impervious on site computing the annual P load as a direct function of impervious cover (e.g., using the Simple Method) is of limited validity. Instead, the P load should be estimated based on dominant categorical land covers using the following approach. The TT Champlain modeling identified unit area P loading rates for a range of land uses across the Vermont portion of the Champlain Basin. From these data, the land cover P export rate(s) best matching existing site conditions should be used to calculate the predevelopment load. VT DEC has extracted the rates for grasslands, pasture, forest, and various agricultural land uses from the EPA produced Scenario Analysis Tool (based on the TT SWAT output) and included these values in the Interim Procedure P Accounting Spreadsheet (simple method calculation wskt.xlsx). VT DEC will consider alternate approaches on a case by case basis when other site specific data exists that would enable calculation of pre-development loads.

Rationale and Justification

VT DEC reviewed available data and approaches for estimation of developed land P export in deciding how to balance water quality protection, scientific soundness, ease of implementation and the expected temporary nature of the *Interim Procedure*. A highly spatially discretized implementation of the Simple Method was considered, modeled directly on the approach currently used for Chapter 22 sediment offset accounting. In formulating the above described P framework we reviewed the following sources of urban P concentration data to inform our approach:

- Urban Stormwater Management and Technology, Update and Users Guide, Lager et al. (1977)
- Results of the Nationwide Urban Runoff Program, Volume 1 Final Report, US EPA (1983)
- Updating the U.S. Nationwide Urban Runoff Quality Database, Smullen et al. (1999)
- Water Quality, Diffuse Pollution and Watershed Management, Novotny (2002)
- The National Stormwater Quality Database (Version 1.1), Pitt et al. (2004)
- Identification of Significant Factors Affecting Stormwater Quality Using the NSQD, Maestre and Pitt (2005)
- Western Washington NPDES Phase 1 Stormwater Permit, Final S8.D Data Characterization 2009-2013 (2015)
- Various other State guidance materials

Based on our review of these data, we have concluded that there is not a sufficient basis to assign different phosphorus 'C' factors to highly discretized developed land surfaces (e.g., residential roof, commercial parking, lawns) in Vermont. That is, lack of statistical differentiation due to wide variability precludes such an approach, particularly here in Vermont where local data are limited. Instead, we have adopted the approach used in other jurisdictions, namely, assigning a single composite Developed Land 'C' factor for all areas. By solving for a Vermont Developed Land 'C' factor from the TT SWAT modeling (which has been calibrated using local tributary monitoring data) we were able to build this approach off of our best current understanding of Vermont Developed Land P export. As stated throughout this guidance, whenever an applicant provide an alternate approach using site specific data, VT DEC will be open to considering such alternatives on a case by case basis.