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June 25, 2018

MEMO

TO: Town of Skaneateles – Planning Board
Janet Aaron, Town Supervisor
Howard Brodsky, Town Planner
Scott Molnar, Town Attorney

FROM: John Camp, P.E., CPSWQ

RE: **Small-Scale Stormwater Management Guidelines**

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1. Background

The Town of Skaneateles Town Code has contained provisions to protect the water quality of Skaneateles Lake for quite some time. Development applications within the lake watershed are reviewed with substantial consideration of their potential impact to lake water quality. Within the past several years, the Planning Board has required "small to medium" scale subdivisions in the lake watershed (3 to 5 lots) to include stormwater management facilities and drainage districts.

This past summer, "harmful algal blooms" (HABs) appeared in Skaneateles Lake. These HABs caused substantial concern and resulted in multiple statements and communications from several regulatory agencies. The quality of water in the municipal systems that draw water from the lake was tested regularly and frequently both during and immediately following the appearance of HABs. Lakefront residents with private water systems that draw water directly from the lake were advised not to use those systems.

As of this writing, the cause(s) of these recent HABs has not been scientifically identified. It is widely suspected that nutrients conveyed to the lake during stormwater runoff events play a critical role in HAB formation. During public discussions of HAB formations, it has frequently been mentioned that the occurrence of several substantial rain events during the spring of 2018 resulted in noticeable conveyances of organic debris into Skaneateles Lake.

These recent events have caused the Planning Board, along with other agencies, to review certain regulatory practices. More specifically, the Planning Board is considering potential changes to the management of stormwater runoff from new development applications.

2. Stormwater Management Considerations

2.1. Quality of Stormwater Runoff

Research has shown that without mitigation, development of land can have an adverse effect on the quality of stormwater runoff. The physical and chemical processes involved in the degradation of water quality are complex and challenging to quantify. However, a straightforward set of calculations known as "The Simple Method" allows for the relatively easy comparison of expected pollutant loading from varying types of landuses. The Simple Method assigns pollutant runoff rates based on vegetative cover, presence of impervious area, application rate of fertilizers and pesticides, agricultural practices, and other factors.

While the Simple Method would not be the best predictor of actual pollutant concentrations in streams, the foundations of the Simple Method are science-based and can reasonably be used as design tools. The Simple Method is being used as a regulatory and planning tool, particularly in areas where Total Maximum Daily Loads (TMDLs) have been established for surface water bodies. In these watersheds, regulations are currently being developed. It is likely that developers and project applicants in these watersheds will need to demonstrate that their projects will result in "No Net Increase" (NNI) of "pollutants of concern" in stormwater. This approach to managing stormwater quality would be very similar to the long-used practice of using detention basins to mitigate the increase in stormwater quantity typically associated with development projects. As of this writing, a TMDL has not been developed for Skaneateles Lake.

C&S has worked with agencies that are crafting these regulations. This work was commissioned by the Central New York Regional Planning and Development Board (CNYRPDB) and was tested using the Onondaga Lake TMDL for phosphorus. C&S recommended that a version of the Simple Method, with assumed pollutant reduction rates of various stormwater management practices, be used to demonstrate NNI. These recommendations are currently being reviewed by NYSDEC and EPA.

2.2. Proposed Conditions vs. Existing Conditions vs. Pre-Development Conditions

When mitigation is required, stormwater management is often based on a comparison of *proposed conditions* to *existing conditions*. Typically, an applicant is required to demonstrate that the *proposed conditions* peak stormwater runoff rate from the project site does not exceed the *existing conditions* peak stormwater runoff rate. In locations where flooding is a regular issue, stricter mitigation is often required. This stricter mitigation often requires that the *proposed conditions* peak stormwater runoff rate be mitigated to the *pre-development conditions* peak stormwater runoff rate.

As an example of this stricter mitigation requirement, if a developer is converting an abandoned gas station into a group of condominiums, the condominium project would be required to include a stormwater management facility that would mitigate *proposed conditions* peak flows to levels of *pre-development conditions*, which might be a wooded lot. Mitigating to *pre-development conditions* typically result in larger stormwater management facilities and lower peak rates of stormwater runoff when compared to mitigating to *existing conditions*.

2.3. Enhanced Phosphorus Removal Standards

For watersheds in which a TMDL for phosphorus has been established, the NYSDEC has developed a sub-set of regulations called the Enhanced Phosphorus Removal supplement. This is included as chapter 10 of the New York State Stormwater Management Design Manual. A link to this information is included in the "References" section at the end of this document.

The Enhanced Phosphorus Removal standards generally require that proposed stormwater management facilities be designed such that they maximize the removal of phosphorus from their outflow. This is assumed to be accomplished by "upsizing" the portions of the proposed stormwater management facilities that are designed to treat the more frequent (smaller) rainfall events.

As previously stated, the cause(s) of HABs in Skaneateles Lake has not been scientifically identified. However, it is widely accepted that excess nutrients can lead to formation of HABs. The nutrients phosphorus and nitrogen are often associated with HABs.

2.4. Sheet Flow vs. Point Discharges

As has been discussed at recent Planning Board meetings, one of the challenges associated with constructing a new stormwater management facility is the manner in which water will be released. For sites with adjacent watercourses, this issue is less important. In these situations, a new stormwater management facility can be equipped with an outfall pipe that discharges directly to a stabilized or armored area and then immediately into that watercourse.

Where sites do not have adjacent watercourses, conveying water released from stormwater management facilities can be challenging. Generally, it is best to avoid creating new pipe outlets (point discharges) that are not directed to stabilized watercourses. This can lead to erosion through the "cutting" of new channels where none had previously existed.

There are two general approaches to minimizing point discharges from stormwater management facilities. One is oversizing the stormwater management facility to decrease the frequency of outflows. The other is through the use of "level spreaders". A level spreader is a device that attempts to convert concentered (channel) flow back to sheet flow by diverting flow over a long, flat (level) lip. Level spreaders have a long history of not working particularly well. Level spreaders require relatively long flat areas to work properly, they can be expensive, they can be difficult to properly construct, and they can require substantial maintenance.

2.5. Centralized vs. Distributed Approach

Stormwater can be managed at larger, more regional facilities using a "centralized" approach, or stormwater can be managed at smaller, more local facilities using a "distributed" approach. Stormwater management in a centralized approach results in a smaller number of larger facilities, while a distributed approach results in a larger number of smaller facilities. The following is a list of characteristics of each approach:

2.5.1. Centralized Approach

- Fewer stormwater management facilities - easier maintenance and inspection
- The Town could control the facilities to ensure for more effective operation
- Drainage districts could be established to pay for maintenance
- Facilities could be customized to address problems specific to certain areas
- Larger areas of land would be needed to construct effective facilities

2.5.2. Distributed approach

- Stormwater is arguably more effectively treated closer to its source
- The Town might not be responsible for maintaining infrastructure
- Some sites will not allow straightforward creation of stabilized outfalls
- The large number of facilities will be challenging to monitor and enforce maintenance requirements

3. Procedural Recommendations

3.1. Overall

- *Stormwater management facilities in the Skaneateles Lake watershed should be designed to the NYSDEC's Enhanced Phosphorus Removal Standards.*

- *For projects in the Skaneateles Lake watershed, mitigation should be included to maintain or improve the water quality of stormwater runoff.* The Simple Method should be used to demonstrate compliance.

- *For project sites without opportunities for stabilized outfalls, other mitigation techniques should be considered.* These techniques might include minimization of impervious areas, disaggregation of impervious areas, or others. Level spreaders could be considered where other options do not exist.

3.2. Short Term

- *Include stormwater quality mitigation on individual lot development projects.* While it would be challenging to sustain the use of individual-lot systems, recent events have demonstrated that the lake may be nearing its capacity to absorb influxes of nutrients.

3.3. Long Term

- *Work toward establishing a program of more regional water quality treatment facilities.* These facilities could be supported by the establishment of drainage districts. Monies from the "Land and Development Rights Acquisition Fund" (DRA Fund) could be used to establish locations for these facilities.

4. Technical Options

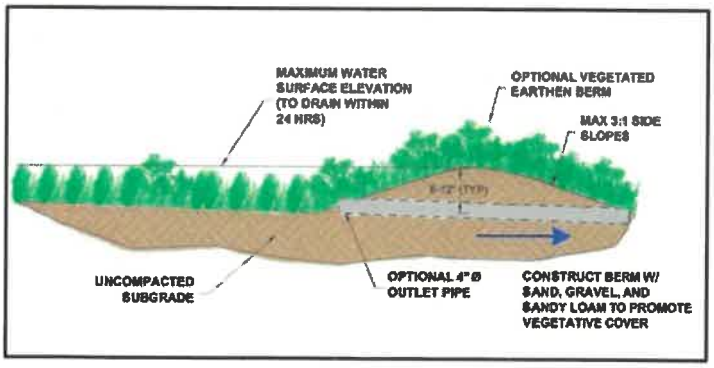
There are several general approaches to site-scale stormwater management that will benefit the quality of stormwater runoff. As the Planning Board has been concerned about stormwater quality for many years, many of these approaches will be familiar. Several are already included in the Town Code. Generally, the quality of stormwater runoff will be improved if:

- *Potential sources of hazardous materials are minimized*
- *Impervious surfaces are minimized*
- *Impervious surfaces are set back from water courses and drainage inlets*
- *The peak runoff rates of "flashy" events are minimized*
- *Water course embankments are stable, either via hard treatments (rock) or preferably vegetation* – during the large, flashy rainfall events of early summer 2017, large amounts of material were washed into the Finger Lakes. Much of this material was dislodged from higher elevations along streambanks that had not been subjected to concentrated flows in several years.
- *Watercourse buffers are healthy and vibrant*
- *Point discharges of stormwater are minimized*
- *Roof leaders are discharged onto lawns rather than to subsurface piping*
- *Site designs generally reduce the rate of runoff and promote the infiltration of stormwater and the recharge of groundwater*

At the Planning Board's request, we have compiled specific information related to the potential construction of small-scale stormwater management facilities that would fit into the following three categories:

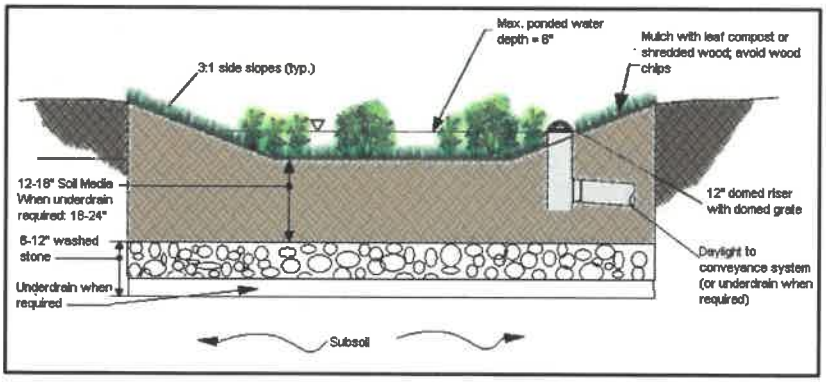
4.1. Basic Treatment Option

A basic treatment option could involve the direction of surface runoff to a low portion of the site. This low portion of the site could take the form of a grass/turf area with a short containment berm and a stabilized outlet. This basic treatment option would be a relatively low-cost approach that would require only basic maintenance of mowing, clearing of debris, as well as the occasional removal of sediment and/or repair of minor erosion. The adjacent image is a cross-sectional representation of this type of basic treatment option.



4.2. Comprehensive Treatment Option

A more comprehensive treatment option could involve the creation of stormwater management facilities that more closely resembled the facilities shown in Chapter 5 of the New York State Stormwater Design Manual. These types of facilities are typically identified as "green infrastructure" and can include vegetated swales, bioretention areas, rain gardens, as well as pocket ponds for small- to medium-scale scale projects. These types of facilities generally differ from the more basic option described above in that they often contain soil augmentations, underdrains, and /or more specialized plantings. The adjacent image is a general cross-sectional representation of this type of treatment option.



4.3. Enhanced Phosphorus Removal Option

A treatment option that would provide additional water quality protection could involve the creation of stormwater management facilities that were similar to those described in the previous section but that also meet the standards of the NYSDEC's Enhanced Phosphorus Removal requirements discussed elsewhere. These facilities would be approximately twice as large as those discussed in the previous section.

5. References

Harmful Algal Blooms

https://www.epa.gov/nutrientpollution/harmful-algal-blooms

NYSDEC Stormwater Management Design Manual

http://www.dec.ny.gov/chemical/29072.html

TMDL

http://www.dec.ny.gov/docs/water_pdf/tmdlfaq17.pdf

http://www.dec.ny.gov/chemical/69889.html

Enhanced Phosphorus Removal

http://www.dec.ny.gov/docs/water_pdf/swdm2015chptr10.pdf

Simple Method

http://www.hydrocad.net/pdf/NY-Simple-Method.pdf

Level Spreaders

http://fliphtml5.com/wmuo/akvx/basic

No Net Increase

http://www.cnyrpdb.org/stormwater/?No-Net-Increase-in-Pollutants-of-Concern-to-Impaired-Waters-from-Urban-Runoff-100

http://www.cnyrpdb.org/images/2013_POC_Modeling_FINAL_report.pdf?pdf=Pollutant_of_Concern__Modeling_in_the_Syracuse_Urbanized_Area_Using_the_Watershed_Treatment_Model__WTM__FINAL_Report_

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October 22, 2018

MEMO

TO: Town of Skaneateles – Planning Board
Janet Aaron, Town Supervisor
Howard Brodsky, Town Planner
Scott Molnar, Town Attorney

FROM: John Camp, P.E., CFM, CPESC, CPSWQ

RE: **Small-Scale Stormwater Management Guidelines**
Facility Sizing

This memo should be read with reference to the "Small-Scale Stormwater Management Guidelines" memo by C&S dated June 25, 2018. In that memo, several options for stormwater treatment at individual lot development were outlined. This memo contains recommendations for demining sizes of stormwater management facilities. Sizing was determined based on formulas presented in the NYSDEC's Stormwater Management Design Manual, which can be found at: http://www.dec.ny.gov/chemical/29072.html . This calculation is the Water Quality Volume (WQv) as referenced in Table 4.1 of the current version of the manual. The chart on this page contains the results of several versions of the WQv calculation using 1 inch of rainfall depth and assuming a 1.5-foot deep stormwater management facility. The length and width shown in the table should be measured at the bottom elevation of the facility. For lot sizes and ISC's that fall between the data points, a linear interpolation can be used. For a more customized sizing procedure, please see the next section of this memo.

Stormwater Management Facility Sizing for Small-Scale Development

LOT SIZE (ac)	ISC (%)	SW FACILITY LENGTH (ft)	SW FACILITY WIDTH (ft)
0.25	10	5	15
0.5	10	8	25
1	10	10	30
1.5	10	13	40
2	10	15	45
0.25	15	6	18
0.5	15	10	30
1	15	12	37
1.5	15	15	45
2	15	17	52

For a more customized approach, the following formula can be used:

$$WQv = \frac{(0.05 + 0.009 * I) * A}{12}$$

Where:

WQv = Water Quality Volume (ft^3)
I = Impervious Surface Coverage (%)
A = Site Area (ac)

Once the WQv is determined, the stormwater management facility should be designed based on the following:

- The depth should typically be a minimum of 1.5 feet and a maximum of 3 feet – certain exceptions could be considered
- The length to width ratio should be 3:1 or longer – this will promote a longer "residence time" for runoff in the facility
- The side slopes should be 3:1 or flatter – this will allow for more convenient mowing and should allow better establishment of turf grasses in and around the facility
- The facility should be located in the lowest practicable area of the lot – this will maximize the area of land that drains to the facility
- The facility should include underdrains where feasible, unless it can be shown that they would not be necessary
- Where a stabilized outfall is present, an outlet structure would be desirable.
- The facility design can include a planting plan OR can be shown with turf grass – this will allow the designer to consult with the owner to determine the scenario in which the facility is most likely to be maintained
- As the drainage area approaches 2 acres, consideration should be given to overflow spillways
- As the drainage area approaches 3 acres, alternate facility designs should be considered

It is likely that alterations and additions to these guidelines will be considered as more facilities are constructed in the Town.