MINNEHAHA CREEK WATERSHED DISTRICT

Rulemaking Task Force Meeting
October 29th 2009

6:30 PM – 8:30 PM

Minnetonka Community Center
14600 Minnetonka Blvd.
Minnetonka

AGENDA

1. Review and Discuss Draft Rule N: Stormwater Management (enclosed)

Memorandum

DATE: October 29th, 2009

TO: Rulemaking Task Force

FROM: James Wisker
District Planner

RE: Draft Rule N: Stormwater Management

The Technical Advisory Committee met on nine occasions between January and May of 2009 to discuss thresholds and triggers for a proposed draft of MCWD Rule N, Stormwater Management.

During those meetings, discussion focused on issues relating to:

- Linear Projects
- New Development
- Redevelopment
- Regional Solutions
- Sequencing/Feasibility

Following these meetings, a package of recommendations developed by the TAC was presented to the MCWD Board of Managers by District staff. Those recommendations included triggers and thresholds for the various project types listed above.

Staff then worked with legal counsel and the District engineer to compile a preliminary rough draft of Rule N based on these recommendations for another review by the Board of Managers. The recommendations and language proposed by the TAC were generally accepted by the MCWD Board.

During discussion by the Board of Managers, the issue of single family home redevelopment arose regarding its potential to increase stormwater runoff and impact water resources. The Board noted that these single family home projects generally fall into the category of "redevelopment" as they often involve a tear down and rebuild scenario.

Staff was directed to discuss with the TAC and Rulemaking Task Force the concept of regulating single family home redevelopment and other smaller redevelopment which would include lowering the threshold for redevelopment from 1 acre parcels to ¼ acre parcels.

Staff and engineering are performing some basic GIS/mapping analysis that will be used to conduct some modeling to better illustrate the potential water resource impacts such a change to the regulation would have.

In addition to reviewing the proposed language that is attached, the TAC and Rulemaking Task Force will be asked on October 29th, to discuss the topic of single family/small redevelopment regulation and provide input and recommendations to the Board of Managers.

If the GIS and modeling analysis is not complete in by October 29th, that information will be presented at a meeting in November for consideration by both committees.

In addition, the TAC and Rulemaking Task Force will be asked to comment and provide recommendations on how to quantify volume reduction credits for tree preservation as a site management BMP.

Wenck Associates outlines various methods to providing volume reduction credit for tree preservation in a 2009 memo (attached). The Board of Managers reviewed this information and preferred providing credit for preservation of existing canopies but did not reach a conclusion on if the rule should provide species specific credit or provide a broad average credit for all trees of a certain DBH or caliper size.

Discussion will be open to other topics of interest by the TAC or Rulemaking Task Force.

If you have questions or comments in advance of the meeting, please feel free to contact me directly.

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RULE N
STORMWATER MANAGEMENT

1. POLICY. It is the policy of the Board of Managers to:

(a) Promote abstraction of precipitation and storm water runoff where feasible for the purposes of improving water quality and increasing groundwater recharge;

(b) Preserve, maintain and improve aesthetic, physical, chemical and biological composition of surface waters and groundwater within the District;

(c) Limit or reduce storm water runoff from drainage within the watershed to decrease the negative effects of land disturbing activities;

(d) Protect and maintain existing groundwater flow, promote groundwater recharge and improve groundwater quality and aquifer protection; and

(e) Promote the preservation and use of native vegetation for the purpose of storm water runoff abstraction.

2. REGULATION.

No one may engage in land disturbing activities within the watershed that disturb 50 cubic yards or more of earth, or 5,000 square feet or more of vegetation without first submitting a stormwater management plan to the District, and securing a permit from the District approving the plan, unless:

(a) such land disturbing activities for the new development of a residential, commercial, industrial or institutional uses will create less than 20% impervious surface, or involve a parcel less than one acre;

(b) such land disturbing activities for the construction of a new road, trail, sidewalk, or other linear transportation project will create less than 10,000 square feet of impervious surface, or for the construction of sidewalks and trails will not exceed ten (10) feet in width and are bordered on either side by a pervious buffer at least half (1/2) the width of the sidewalk or trail, provided further that the interruption of pervious buffer by streets, driveways or other impervious surfaces crossing a sidewalk or trail does not invalidate this exception so long as these impervious surfaces do not exceed 25 percent of the area of the required pervious buffer; or

3. STORM WATER MANAGEMENT PLAN GENERAL REQUIREMENTS.

A storm water management plan submitted to the District must generally meet the following requirements subject to the provisions in Sections 4-6 below:

(a) Phosphorus Control. The proposed land disturbing activity for new development shall result in no net increase in phosphorus loading from the site as compared to a naturally vegetated condition, based on the Hennepin County land cover classification for the site, or other available documentation; redevelopment activity shall result in no net increase in phosphorus loading from the site in its existing condition;

(b) Rate Control. The proposed land disturbing activity for new development shall result in no increase in the peak runoff rate where storm water discharges across the downgradient site boundary, compared to the rate for the site in a naturally vegetated condition; redevelopment activity shall result in no net increase in the peak runoff rate from the site in its existing condition; provided further that:

(i) in all cases, there shall be no net increase in the peak runoff rate for runoff-producing events of critical duration with return frequencies of 1, 10 and 100 years in the subwatershed in which the site is located;

(ii) peak runoff rates may not increase within particular drainage areas of a site so as to exacerbate existing drainage or erosion problems; and

(iii) land disturbing activities in Flood Sensitive Areas [*defined: areas where stormwater infrastructure is sized to accommodate a runoff event of less than 10 year frequency*] may not result in a peak runoff rate for a 100 year frequency event that exceeds the rate for a 10 year frequency event in the existing condition.

(c) Volume Control. The stormwater management plan must provide for the abstraction of the first 1.0 inch of rainfall on a site with adequate presence of Type A or B soils, or the first 0.5 inch of rainfall on all other sites. The method of abstraction method shall be determined in the following order of preference:

(1) Infiltration;

(2) For sites where the applicant demonstrates that adequate infiltration is not adequate to meet the abstraction requirement in whole or in part, capture, storage, and reuse of storm water, soil amendments, and tree canopy preservation or expansion shall be considered, based upon the following Abstraction Credit Schedule: **[insert];** along with a filtration plan that includes such practices as biotretention, filtration basins, media filters, or vegetative filters.

(3) For sites where the applicant demonstrates that infiltration, capture, storage or reuse, soil amendments, or tree canopy preservation are not adequate to meet the abstraction requirement in whole or in part, the applicant may acquire Abstraction Credits from the Abstraction Bank established by the District pursuant to Section 4 of this Rule;

(d) Anyone may elect to achieve compliance with this Rule by providing equal or greater phosphorus control, rate control, or volume control through a regional or sub-watershed plan approved by the District; such a plan must provide for an annual accounting to the District of treatment capacity created or utilized by projects or land disturbing activities within the drainage and treatment area of the plan.

4. REQUIREMENTS – DECREASED IMPERVIOUS SURFACE.

A storm water management plan submitted to the District that proposes through redevelopment to decrease impervious surface must meet the following requirements:

(a) For sites that are 1.0 acre or less, no phosphorus control, rate control, or volume control requirements apply, except that Best Management Practices are required where practical pursuant to Appendix X;

(b) For sites that are between 1.0 acre and 5.0 acres and the proposed activity results in at least a ten percent (10%) reduction in impervious surface, no phosphorus control, rate control, or volume control requirements apply;

(c) For sites that are between 1.0 acre and 5.0 acres and the proposed activity disturbs less than fifty percent (50%) of the site and results in a reduction in impervious surface that is less than ten percent (10%), no phosphorus control, rate control, or volume control requirements apply, except that Best Management Practices are required where practical pursuant to Appendix X;

(d) For sites that between 1.0 acre and 5.0 acres and the proposed activity disturbs fifty percent (50%) or more of the site and results in a reduction in impervious surface that is less than ten percent (10%), no phosphorus control or rate control requirements apply, but the storm water management plan must meet the volume control requirement;

(e) For sites that are greater than 5.0 acres and the proposed activity disturbs less than fifty percent (50%) of the site and results in at least a ten percent (10%) reduction in impervious surface, no phosphorus control, rate control, or volume control requirements apply;

(f) For sites that are greater than 5.0 acres and the proposed activity results in a reduction in impervious surface that is less than ten percent (10%), no phosphorus control or rate control requirements apply, but the storm water management plan must meet the volume control requirement.

5. REQUIREMENTS – INCREASED IMPERVIOUS SURFACE.

A storm water management plan submitted to the District that proposes to increase impervious surface through redevelopment must meet the following requirements:

(a) For sites that are 1.0 acre or less, no phosphorus control, rate control, or volume control requirements apply, except that Best Management Practices are required where practical pursuant to Appendix X;

(b) For sites that are greater than 1.0 acre and the proposed activity results in an increase in impervious surface of 5,000 square feet or more, the phosphorus control, rate control and volume control requirements apply to the area of increased impervious surface;

(c) For sites that are greater than 1.0 acre and the proposed activity disturbs more than fifty percent (50%) of the site, or results in an increase in impervious surface of fifty percent (50%) or more, the phosphorus control, rate control, and volume control requirements apply to the entire site.

6. REQUIREMENTS - LINEAR TRANSPORTATION PROJECTS.

A storm water management plan for the construction or reconstruction of a road, trail, sidewalk, or other linear transportation project that will create 10,000 square feet or more of impervious surface must meet the following requirements:

(a) The New Construction of a road, trail, sidewalk, or other linear transportation project that will create 10,000 square feet or more of impervious surface must meet the phosphorus control and rate control requirements for the site in a naturally vegetated condition and the volume control requirement;

(b) The Reconstruction of a road, trail, sidewalk, or other linear transportation project that will create between 10,000 square feet and 1.0 acre of impervious surface must meet the phosphorus control and rate control requirements for the area of increased impervious surface and shall be compared to the existing condition; no volume control requirement shall apply;

(c) The Reconstruction of a road, trail, sidewalk, or other linear transportation project that will create more than 1.0 acre of impervious surface must meet the phosphorus control, rate control, and volume control requirements for the area of increased impervious surface and shall be compared to the existing condition.

7. ABSTRACTION BANKING.

The District has established and will maintain a bank of available storm water runoff Abstraction Credits pursuant to the following requirements:

(a) Abstraction achieved onsite in excess of the requirement of this Rule may be credited into the District's bank for use on other projects within the District that are unable fully to meet this requirement on the subject parcel.

(b) Stormwater management facilities or practices relied upon to create Abstraction Credits must be included in the recorded permanent maintenance plan specified in Paragraph 5(b) of this rule.

(c) Abstraction Credits may be utilized by permit applicants to meet the requirement of this Rule only after the applicant has demonstrated to the District that soil conditions or other site constraints prevent abstraction or retention of runoff onsite.

(d) The District will maintain an inventory of all qualified Abstraction Credits accumulated and sold. Permit applicants are responsible for contacting a seller of Abstraction Credits and arranging the sale on terms established by the interested parties. The District will certify the sale through a form established by the District and completed by the buyer and seller of the Abstraction Credits.

7. REQUIRED EXHIBITS.

(a) Plans certified by a professional engineer registered in the State of Minnesota and reflecting the following items shall accompany the permit application (one set of plans must be full size; one set must be reduced to a maximum size of 11" x 17"):

(1) Property lines and delineation of lands under ownership of the applicant.

(2) Delineation of the subwatershed contributing runoff from off-site and proposed and existing subwatersheds on-site.

(3) Proposed and existing stormwater facilities location, alignment, and elevation.

(4) Delineation of existing on-site wetland, shoreland, and/or floodplain areas.

(5) Classification and any available test results for site soils in both existing and proposed as-developed condition.

(6) Existing and proposed normal, and 100 year water elevations on-site.

(7) Existing and proposed site contour elevations at two foot intervals, related to NGVD, 1929 datum.

(X) Site map showing existing trees larger than six inches in diameter,

including species, diameter, and associated drip lines. Tree map must designate trees to be removed and trees to be added to the site.

(8) Construction plans and specifications of all proposed stormwater management facilities.

(9) Stormwater runoff volume and rate analyses for the 1, 10 and 100 year critical events, existing and proposed conditions.

(10) All hydrologic, water quality, and hydraulic computations completed to design the proposed stormwater management facilities including runoff volume abstractions.

(11) Documentation indicating conformance with an existing municipal stormwater management plan. When a municipal plan does not exist, documentation that the municipality has reviewed the project.

(12) Delineation of any flowage easements or other property interests dedicated to stormwater management purposes, including, but not limited to, county or judicial ditches.

(13) Documentation that the project has received a National Pollutant Discharge Elimination System (NPDES) Stormwater Permit from the Minnesota Pollution Control Agency (MPCA) if required by the MPCA.

(b) A maintenance agreement shall be submitted for: stormwater treatment ponds, outlet structures for such ponds, culverts, outfall structures, and all other stormwater facilities. The maintenance agreement shall specify the methods, schedule and responsible parties for maintenance and must include at a minimum, the elements contained in the District's Maintenance Agreement Form. A Maintenance Agreement Form will be provided to the applicant for use by the applicant as a maintenance agreement or as guidance if the applicant desires to draft a separate maintenance agreement. The maintenance agreement must be filed of record in the county recorder's office before any land-altering activity occurs at the site.

(c) Geotechnical soil boring and related test results. For projects proposing infiltration of storm water runoff, the borings must be at the location of the infiltration facility and extend at least five (5) feet deeper than the proposed bottom elevation of all infiltration practices.

7. EXCEPTIONS.

(a) The water quality requirement in Paragraph 3 (a) of this rule will be waived on a determination by the Board of Managers that a downstream facility(ies) is in place or has been ordered and the facility(ies) is designed to limit total phosphorus export from runoff entering the facility from the subwatershed to the phosphorus loading from a naturally vegetated condition.

(b) The peak flow requirement in Paragraph 3 (b) of this rule will be waived on a determination by the Board of Managers that a downstream facility(ies) is in place or has been ordered and the facility(ies) is designed with adequate capacity to limit the peak runoff rate from the subwatershed under fully developed conditions. The peak flow requirement of this rule may also be waived on a determination by the Board of Managers that the time of concentration of the downstream receiving water body is sufficiently long such that limiting the peak rate of runoff from the project has either no practical effect or an adverse effect.

(c) The abstraction requirement in Paragraph 3 (c) of this rule will be waived on a determination by the Board of Managers that a downstream facility(ies) is in place or has been ordered and the facility(ies) is designed with adequate capacity to provide for meeting the abstraction requirement on a regional or sub-watershed basis.

(d) The requirement that peak flow or Storm water quality be managed on site will be waived on a determination by the Board of Managers that meeting the requirement on site is infeasible; that an off-site facility treating the runoff from the applicant's development or its equivalent will allow the applicant to meet the requirement or provide equivalent management; and that the applicant, before commencing any land-altering activity, will hold the legal rights necessary for design, construction and long-term operation and maintenance of the facility.

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DRAFT
TECHNICAL MEMORANDUM

TO: James Wisker, Minnehaha Creek Watershed District

FROM: Todd Shoemaker, P.E.
Mike Panzer, P.E.

DATE: April 20, 2009

SUBJECT: Stormwater Runoff Volume Abstraction Methods

The Minnehaha Creek Watershed District (MCWD) plans to incorporate a stormwater runoff volume abstraction requirement in its forthcoming development rules. The most common volume abstraction Best Management Practice (BMP) is infiltration. Low permeability soils and site conditions, however, may preclude the use of infiltration on some sites.

The purpose of this memorandum is to present alternatives to infiltration that may be considered for implementation. The memorandum describes four alternatives; offers a method to quantify volume abstraction for each; presents design and maintenance considerations; and lists potential drawbacks or challenges for implementation. The cost to implement the four alternatives is not considered here due to time and scope limitations, but it can be added to this memorandum at the direction of staff or the Board of Managers.

Chapter 11 of the *Minnesota Stormwater Manual* presents six additional methods for stormwater credits. The chapter is included as an appendix to this memorandum. A table is provided at the end of the memorandum to summarize and compare the four alternatives presented by Wenck and the six alternatives presented in the *Minnesota Stormwater Manual.*

PRESERVATION of TREE CANOPY

It is generally understood that maintaining tree canopy minimizes negative impacts of development on water quality and runoff volume, but this observation is difficult to quantify. There are two components to volume abstraction by trees: interception and

evapotranspiration (ET). Our research points to four approaches to quantify these two components.

Volume Reduction Credit. The first option is offering a volume reduction credit to developers that preserve trees. Credits could be assigned based on the DBH (diameter at breast height) and the tree type.

A resource to use for implementing this approach is the *Municipal Tree Resource Analysis* completed by the United States Department of Agriculture for the City of Minneapolis. The study reports annual rainfall interception volumes for various tree species (Table 1).

Table 1: Average Annual Rainfall Interception by Tree Species

Species	Average Annual Rainfall Interception (cubic feet)
Green Ash	240
Sugar Maple	89
Norway Maple	109
Littleleaf Linden	145
American Elm	939
Honeylocust	104
American Basswood	115
Northern Hackberry	104
Ginkgo	21
Silver Maple	270
Elm	626
White Ash	151
Basswood	238
Red Maple	99
Other Species	90
Average	225

Consider a developing parcel of land as an example. The developer wishes to construct one acre of impervious surface. With a one-inch volume reduction standard, the developer would be required to retain 3,267 cubic feet of runoff on the site. If the developer preserves 10 existing red maples, he or she would receive a volume reduction credit of 990 cubic feet (99 cubic feet per tree according to Table 1). The volume reduction requirement would be reduced to 2,277 cubic feet.

If MCWD is interested in this approach, additional work is needed to determine the percentage of trees in MCWD that are included in the species listed in Table 1. Other questions to consider include:

- For those species in MCWD not listed specifically, should the “other” or “average” categories be used?
- What trees are included in the “other” category?

- Is there a minimum DBH necessary to receive volume reduction credit?

Tree Evapotranspiration (ET). We understand that the University of Minnesota recently completed or is working on a study to quantify annual tree ET volume. Wenck staff attended a presentation of study results on April 19, 2009 in which ET volumes for specific species were presented. We have attempted to contact the study author and presentation host to obtain the study results. This information can be added to this memorandum when it is received.

Impervious Surface Credit. The cities of Indianapolis, Philadelphia, Portland, and Sacramento allow developers to reduce the amount of impervious surface used in stormwater management calculations for each tree planted or preserved within certain proximity of impervious area. These municipalities allow a reduction in management requirements by 100-200 square feet of impervious surface when new trees are planted or existing trees are kept within 20-25 feet of the impervious areas. Typically, only trees that are of an approved species and a minimum diameter qualify for the credit.

This approach is essentially the opposite of the volume reduction credit example above whereas this option allows developers to reduce the impervious surface area used in the required volume reduction calculation. Again using the one acre impervious example, maintaining an existing tree within 20 feet of the impervious surface would allow the developer to reduce the "effective" impervious surface by 100 square feet. For a one-inch rainfall, an area of 100 square feet generates 7.5 cubic feet of runoff. Therefore, this option is less of an incentive than the first example where the minimum volume reduction credit is 21 cubic feet per tree.

Tree Preservation as a BMP. If the BMP requirement remains in the MCWD stormwater management rule, the simplest approach may be to consider the preservation of trees as a best management practice under Rule N. This would likely require establishing a minimum number of trees to be preserved and/or a minimum DBH for those trees in order to be considered as a BMP. For example, preserving ten 3-inch DBH silver maples would not qualify as a BMP, but preserving five 8-inch DBH Norway maples could count as a BMP.

SOIL AMENDMENTS

Soil compaction appears to be an inevitable result of mass grading and construction traffic. An increase in soil compaction leads to an increase in runoff rates and volumes. Numerous studies have evaluated practices to reverse compaction after it occurs. These practices are commonly called soil amendments and refer to tilling, composting, or other amendments to urban soils that recover soil porosity, increase water holding capacity, and reduce runoff. Typical amendment materials include compost, top soil, fly ash, or peat.

Data to substantiate a decrease in runoff volume due to soil amendments is limited. In their recent *Water Resources Management Plan*, the City of Minnetonka gives developers

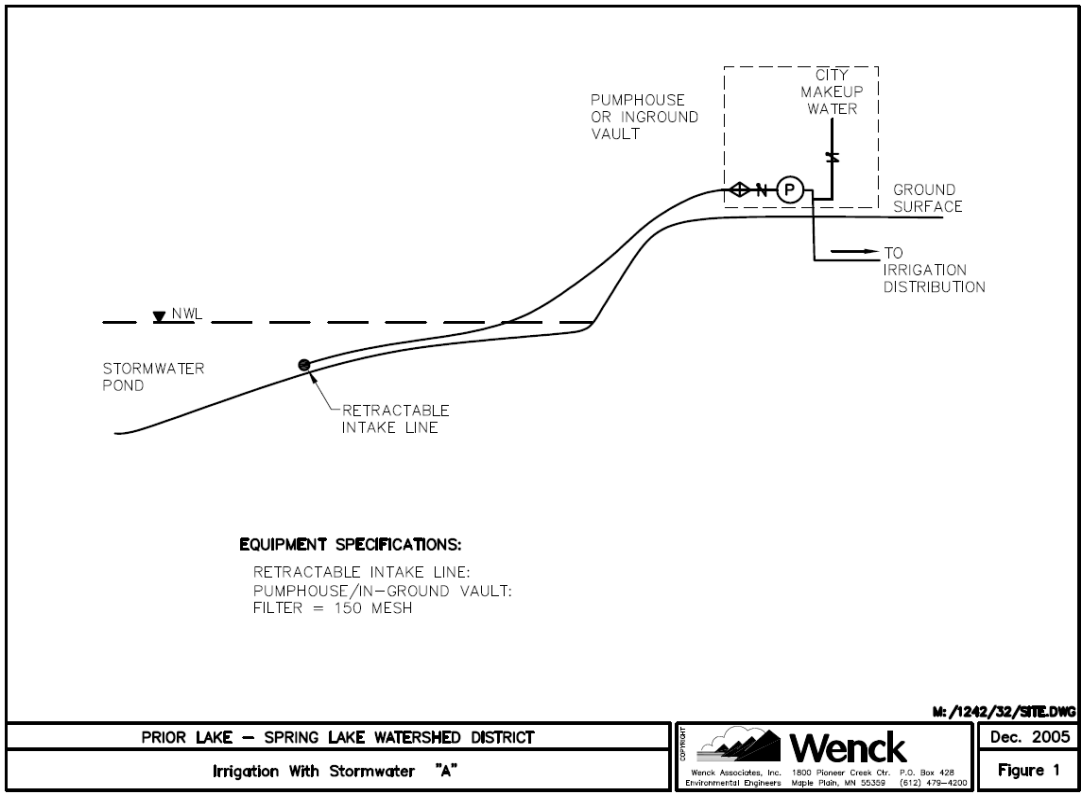
a 0.5-inch volume reduction credit for the area of soil amendment. The *Pennsylvania Stormwater Best Practices Manual* reports the same volume reduction credit. Chapter 11 of the *Minnesota Stormwater Manual* mentions that soil amendments can increase water holding capacity and reduce runoff volume, but it does not offer a specific calculation or measure of volume reduction.

CAPTURE and REUSE of STORMWATER

Capture and reuse of stormwater can be as simple as a rain barrel connected to a residential downspout or as complex as a community irrigation system. The latter of those two methods will be considered here. We believe that use of individual rain barrels, although effective, are not reliable to satisfy District standards due to the cooperation required by individual property owners.

A community irrigation system can be designed to pump stormwater runoff from a detention pond to irrigate lawns. A schematic of the system is shown in Figure 1. The pump is also connected to a municipal or private well to augment water during dry months.

To quantify the volume reduction and pollutant removal achieved, the District would likely have to prescribe modeling parameters for use by design engineers. A dynamic computer model or spreadsheet will be needed to incorporate daily or hourly precipitation; irrigation need; pumping rate; pond volume; and the primary pond outlet.



FILTRATION

Filtering practices include bioretention, media filters (surface or underground), and vegetative filters (filter strips, grass channels). Bioretention and media filters operate similarly and provide comparable water quality treatment capabilities. Vegetative filters are generally more suitable as pre-treatment practices, but in some situations can be used on a stand alone basis. All types of filtration, however, provide no reduction in runoff volume.

Filtration basins are essentially infiltration basins or rain gardens that have been modified to include an underdrain to collect the infiltrated water and discharge it to a downstream sewer system. This modification makes them a good option for areas with groundwater contamination or impervious subsoils that prevent infiltration in the soil system. This modified design makes the area act more as a filter that discharges treated water than as an infiltration device. They can also be installed underground to prevent the consumption of valuable land space (often an important retrofit or redevelopment consideration).

CONCLUSION and RECOMMENDATIONS

The MCWD plans to incorporate a stormwater runoff volume abstraction requirement in its forthcoming development rules. However, the most common volume abstraction method, infiltration, may not be an option in portions of MCWD due to low permeability soils. Therefore, MCWD has a unique opportunity to institute volume reduction credits for alternative methods into the rules. We recommend that MCWD provide volume abstraction credit for tree preservation, soil amendments, and stormwater reuse systems.

Trees reduce runoff volume during a portion of the year through interception and evapotranspiration. Methods to quantify the amount of interception were provided. A forthcoming study by the University of Minnesota quantifies evapotranspiration.

The combination of deep tilling and soil amendments has shown to reduce the level of post-construction soil compaction and increase the water holding capacity of amended soil. The City of Minnetonka and the State of Pennsylvania state a volume reduction credit of 0.5-inch is appropriate for those areas with soil amendments. The Three Rivers Park District has done extensive research on the use of soil amendments and may have local data to quantify the effect of soil amendments.

Stormwater reuse involves collecting stormwater runoff in a receptacle and reusing it at a later date – typically for irrigation. Runoff is collected in rain barrels, cisterns, underground storage tanks, and stormwater ponds. Large-scale applications include pump systems that serve as community irrigation systems for entire neighborhoods.

Tree preservation, soil amendments, and stormwater reuse provide some amount of runoff volume abstraction. The fourth option (filtration) does not provide volume abstraction, but may be useful in areas of groundwater contamination. The following

table provides a comparison of the four methods discussed in this memorandum and six methods presented in the *Minnesota Stormwater Manual*.

	Volume Abstraction	Design	Maintenance	Challenges
Tree Preservation	1. Interception credit per tree preserved. 2. ET credit per tree preserved. 3. Impervious surface credit per tree preserved within distance to impervious surface.	None	None	1. Quantifying interception and ET for each tree species. 2. Decreased abstraction in cold weather. 3. Enforcement/inspection to ensure long-term presence of tree.
Soil Amendments	1. City of Minnetonka offers 0.5-inch credit for area of soil amendment 2. *Pennsylvania Stormwater Best Practices Manual* recommends 0.5-inch credit for area of soil amendment 3. Refer to Three Rivers Park District (John Barten)	1. Soil test. 2. Three Rivers Park District (John Barten) 3. Table 11.3 in the *Minnesota Stormwater Manual*	Refer to Three Rivers Park District (John Barten)	1. Quantifying interception and ET for turf grass. 2. Enforcement, inspection to ensure use of amendment.
Capture and Reuse	1. Determined based on pump and pond design and available pervious area.	1. Water budget 2. Pump 3. Electrical 4. Distribution system	Pumps, electrical components.	1. Quantifying volume abstraction. 2. Design
Filtration	None	1. Similar to infiltration basins. 2. Add 12-18” layer as filtration media. 3. Add perforated pipe(s) at bottom of filtration media.	Weeding, mulch, sediment accumulation	No volume abstraction.

	Volume Abstraction	Design	Maintenance	Challenges
Natural Area Conservation	1. Refer to *Minnesota Stormwater Manual*, Chapter 11. 2. City of Minnetonka *Water Resources Management Plan*, Table AppA-1			1. Counter-intuitive for some developers 2. Encourage LID practices
Site Reforestation or Prairie Restoration	1. Refer to *Minnesota Stormwater Manual* 2. City of Minnetonka *Water Resources Management Plan*, Table AppA-1			1. Counter-intuitive for some developers 2. Encourage LID practices
Drainage to Stream or Shoreline Buffers	1. Refer to *Minnesota Stormwater Manual*, Chapter 11. 2. City of Minnetonka *Water Resources Management Plan*			MCWD Rule D requires buffer
Surface Impervious Cover Disconnection	1. Refer to *Minnesota Stormwater Manual*, Chapter 11. 2. City of Minnetonka *Water Resources Management Plan*, Table AppA-1			1. Enforcement, inspection 2. Cooperation with property owners
Rooftop Disconnection	1. Refer to *Minnesota Stormwater Manual*, Chapter 11. 2. City of Minnetonka *Water Resources Management Plan*, Table AppA-1			3. Enforcement, inspection 4. Cooperation with property owners
Use of Grass Channels	1. Refer to *Minnesota Stormwater Manual*, Chapter 11. 2. City of Minnetonka *Water Resources Management Plan*, Table AppA-1			1. Minimal volume abstraction 2. Maintenance 3. By-pass high flows