Volume Control / Infiltration Practice Worksheet – Revised 2017

Burnsville, MN

Owner / Developer Name: _____

Site Name/Block or Outlot ID:_____

Step 1: Determine the site areas for your project.

a. Total site area in acres. _____ acres

b. For New Development Projects:

1. What is the proposed new impervious area within the site. _____ acres

c. For Redevelopment Projects:

1. Site area to be redeveloped. _____ acres

2. Percent of site redeveloped (= 100*(1.c.1 / 1.a)). _____ %

3. New impervious area within the redevelopment. _____ acres

4. Redeveloped impervious area within the redevelopment. _____ acres

Step 2: New Development Projects - Calculate volume required for infiltration/filtration.

a. New Impervious Volume = Step 1.b.1 x 1.1 inch x 1/12 (ft./inch) x 43,560 (sq.-ft./acre)

= _____ x 1.1 x 1/12 x 43,560 = _____ cu.-ft

Step 3: Redevelopment Projects < 50% Redevelopment - Calculate volume required for infiltration/filtration.

a. New Impervious Volume = Step 1.c.3 x 1.1 inch x 1/12 x 43,560

= _____ x 1.1 x 1/12 x 43,560 = _____ cu.-ft

b. Redevelopment Volume = Step 1.c.4 x 0.55 inch x 1/12 x 43,560

= _____ x 0.55 x 1/12 x 43,560 = _____ cu.-ft

c. Total Volume = Step 3.a + Step 3.b = _____ cu.-ft.

Step 4: Redevelopment Projects > 50% Redevelopment - Calculate volume required for infiltration/filtration.

a. New Impervious Volume = Step 1.c.3 x 1.1 inch x 1/12 x 43,560

= _____ x 1.1 x 1/12 x 43,560 = _____ cu.-ft

b. Redevelopment Volume = Step 1.c.4 x 1.1 inch x 1/12 x 43,560

= _____ x 1.1 x 1/12 x 43,560 = _____ cu.-ft

c. Total Volume = Step 4.a + Step 4.b = _____ cu.-ft.

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Step 5. Infiltration Rate and Maximum Draw Down Time

Infiltration practices must be designed to draw down to the bottom of the practice within 48 hours. The maximum ponding depth shall be based on the soil infiltration rate determined from site-specific soils investigation data taken from the location of proposed infiltration practices on the site. The soils investigation requirement may be waived for smaller property practices (such as residential systems) where the maximum ponding depth is one (1) foot or less.

Infiltration Rate = _____ in/hr. (refer to the Minnesota Stormwater Manual for Guidance)

Step 6. Determine water quality volume for infiltration practices.

For each of the practices you will use, enter the data in the table provided below to summarize total water quality volume and total annual phosphorus removal. Note that TP removal data is not required if infiltration practices fully satisfy the water quality volume requirements for the site. Provide detail in the plans to support the data noted.

BMP Name / ID	Water Quality Volume (cubic-feet)	Annual Total Phosphorus (TP) Removal (lbs)
Totals =		

Step 7. Determine water quality volume and TP Removal for non-infiltration BMPs

For each of the non-infiltration practices you will use, enter the data in the table provided below to summarize total water quality volume and total annual phosphorus removal. Note that TP removal data is required if infiltration practices do not fully satisfy the water quality volume requirements for the site. Provide detail in the plans to support the data noted.

BMP Name / ID	Water Quality Volume (cubic-feet)	Annual Total Phosphorus Removal (lbs)
Totals =		

Step 8. Confirm Water Quality Volume Requirements Are Met.

The total volume provided in Step 6 must be equal to or greater than the volume required in Step 2 (New Development), Step 3 (Redevelopment disturbing less than 50% of the site) or Step 4 (Redevelopment Disturbing 50% or more of the site).

For projects where infiltration practices listed in Step 6 do not fully satisfy the water quality volume requirement, pollutant removal standards apply. New development portions of a site are required to achieve 75% TP removal on an annual basis and redevelopment portions of a site are required to achieve 60% TP removal on an annual basis. See Appendix C for more detailed information.

Appendix C

Engineering Standards

Appendix C – Development Standards

The City of Burnsville has developed specific requirements in this section that apply to development and redevelopment projects. These standards are intended to help achieve the water resource goals of the City's Water Resources Management Plan (WRMP) and help the City maintain compliance with the National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) permit program and the related NPDES/SDS General Construction Stormwater Permit. This summary highlights important aspects of the requirements for storm water quality, discharge rate and volume control, wetland management and erosion control.

This summary does not provide a complete listing of the requirements of this Plan or City Code. Note that other state and local watershed management organization rules and standards may also apply to development and redevelopment projects. For the convenience of users of this document a summary of the watershed rules and standards having jurisdiction within Burnsville is provided at the end of this Appendix in Table C-1. For a more detailed listing of requirements see the specific policies of the WRMP, the applicable City ordinances and watershed standards, or consult with City staff on your specific project.

To accomplish these goals, it is important to the City to have consistent approaches to evaluating proposed development projects. Therefore, all hydrologic, hydraulic and water quality analyses must be prepared and submitted in a format that will allow for a timely and efficient review by City staff. Project designers and/or developers are encouraged to schedule and complete a pre-design meeting with the City before any data will be accepted. The purpose of the meeting is to specifically address approvals and permits, pond requirements, trunk storm drain analysis, wetland impacts, water quality treatment, erosion control and discharge to lakes and sensitive wetland resources.

The stormwater management performance standards the City of Burnsville has adopted are similar to the MPCA Minimal Impact Design Standards (MIDS). The MIDS standards enable and promote the implementation of low impact development and other stormwater management techniques. Controlling a post-development runoff volume equivalent to 1.1 inches from the impervious surfaces is utilized as an approach to mimic the site's natural, pre-development hydrology. In addition to the hydrologic and water quality benefits anticipated through adoption of performance standards similar to MIDS, the MIDS performance criteria are being promoted and implemented statewide by many communities and watershed management organizations to standardize and streamline stormwater management regulatory programs for developers and communities. This enables developers to utilize standardized modeling methods and credit calculation tools such as the MIDS calculator.

1) <u>General</u>

   a) Water quality treatment, volume control, water quantity and rate control requirements apply to any project which results in one-half acre or more of disturbed area or 5,000 square feet or more of new impervious area. For the purposes of these standards, the new impervious area shall be considered the cumulative new impervious area.

   b) All maintenance, repair, resurfacing, reconditioning, or reconstruction activities on impervious surfaces, which do not involve constructing impervious surfaces outside of the existing impervious surfaces are exempt from rate, water quality, water quantity and volume control standards.

c) Construction Site Erosion and Sediment Control standards apply to all projects.

d) Additional requirements applicable to projects in Shoreland Areas are defined in City Code Section 10-8-10.

e) Any project within a floodplain area requires a permit from the City, County, MnDNR, and/or FEMA.

f) The owner shall submit the information listed in Section 10 of these Standards for review by the City.

g) Any project within the jurisdiction of the Vermillion River Watershed JPO that has obtained a variance from these standards by the City, must be reviewed and approved by the Vermillion River JPO.

2) Water Quality Treatment.

a) Infiltration / Volume Control Requirement:

i) For all new impervious portions of a project, a runoff volume of 1.1 inch must be treated in infiltration practices. The extent of infiltration / volume control practices required shall be determined using the worksheet in Appendix B.

ii) For all redevelopment impervious portions of a project on sites that redevelop greater than 50% of the site, a runoff volume of 1.1 inches from the reconstructed impervious surfaces must be treated in infiltration practices. The extent of infiltration / volume control practices required shall be determined using the worksheet in Appendix B.

iii) For all redevelopment impervious portions of a project on sites that redevelop less than or equal to 50% of the site, a runoff volume of 0.55 inches from the reconstructed impervious surfaces must be treated in infiltration practices. The extent of infiltration / volume control practices required shall be determined using the worksheet in Appendix B.

iv) Projects in the Vermillion River Watershed that create one or more acre of new impervious surface must control runoff volume for the 2-year, 24-hour storm event (2.75 inches) to the predevelopment volume.

b) Pollutant Removal Requirements. For projects that have met the infiltration/volume control requirements above, the pollutant removal requirements are considered to be met. For projects where infiltration is prohibited or restricted (see Items 3.a. and 3.b.), the following pollutant removal standards apply prior to reaching a downstream receiving water:

i) For new development portions of a site, provide treatment to remove 75% TP as modeled on an annual basis.

ii) For redevelopment portions of a site, provide treatment to remove 60% TP as modeled on an annual basis.

iii) Design engineers and developers shall determine the pollutant removal efficiency of the BMP(s) incorporated into the site plan using the available industry standard models including P8 (and using a standard NURP 50th percentile particle size distribution for the analysis), MIDS calculator, WinSLAMM or a comparable model approved by the City. As an alternative to preparing a site-specific model, the development may provide a treatment volume (dead storage) of not less than 2.5 inches calculated over the contributing drainage area to the

pond. For example, a 1-acre site that drains to a common treatment pond would be required to provide a dead storage volume of 0.21 acre-feet or 9,000 cubic feet.

3) Volume Control / Infiltration Practices.

a) Infiltration systems are prohibited:

i) Where industrial facilities are not authorized to infiltrate industrial stormwater under an NPDES/SDS Industrial Stormwater Permit issued by MPCA.

ii) Where vehicle fueling and maintenance occur.

iii) Where the bottom of the infiltration basin is less than 3 feet to bedrock or seasonally saturated soils.

iv) Where high levels of contaminants in soil or groundwater will be mobilized by infiltration.

v) Within the areas designated as Very High Vulnerability and High Vulnerability within the Drinking Water Supply Management Area (DWSMA) identified in Figure C-1

b) The City restricts the use of infiltration systems in areas:

i) With low permeability soils (i.e., Hydrologic Soil Group D soils) or where a confining layer exists below the proposed basin. Filtration or conservative drawdown rates should be considered in designing systems in HSG C soils.

ii) Within 1,000 feet upgradient or 100 feet down gradient of active karst features.

iii) Within the areas designated as: Moderate Vulnerability; and Low to Very Low Vulnerability within the Drinking Water Supply Management Area (DWSMA) identified in Figure C-1;

iv) Where soil infiltration rates are more than 8.3 inches per hour.

c) For linear projects not meeting the exemption in Part 1.b., and where the lack of right-of-way precludes the installation of volume control practices that meet the requirements in Part 2 (Water Quality Treatment) and Part 3 (Volume Control/Infiltration Practices), the City may allow a lesser volume control on the construction site provided a reasonable attempt has been made to obtain right-of-way during the project planning process and:

i) One or more of the prohibited or restricted site conditions listed above exists; and

ii) The owner implements other practices (e.g., evapo-transpiration, reuse, conservation design, green roofs, etc.) on the construction site that may not fully meet the volume control requirements of Part 2 (Water Quality Treatment).

d) Infiltration practices shall provide for pretreatment of the runoff. Examples of pretreatment include a mowed grass strip between a curb-cut and a small rain garden, a sump manhole or manufactured sediment trap prior to an infiltration basin and a sediment forebay as the first cell of a two-cell treatment system. Where the infiltration system captures only clean runoff (e.g., from a rooftop) pretreatment may not be required.

e) Infiltration practices must be designed to draw down to the bottom elevation of the practice within 48 hours. The maximum ponding depth shall be based on the soil infiltration rate determined from site-specific soils investigation data taken from the location of proposed infiltration practices on the site. The soils investigation requirement may be waived for

smaller residential property practices where the maximum ponding depth is one (1) foot or less.

f) The design shall incorporate a diversion or other method to keep construction site sediment from entering the infiltration system prior to final stabilization of the entire contributing drainage area.

g) The design shall incorporate provisions that will prohibit construction equipment from compacting the soils where infiltration practices are proposed.

h) A plan for maintenance of the system must be submitted that identifies the maintenance activities and frequency of activities for each infiltration practice on the site.

i) See part 8 for additional basin design details.

4) Water Quantity / Flood Control.

a) The low building elevation shall be set to the higher of the following:

i) Where an effective Base Flood Elevation (BFE) has been established and is included in the City's FIRM, the low floor elevation adjacent to a surface water body shall be established in accordance with the City's Floodplain ordinance. The ordinance establishes the Regulatory Flood Protection Elevation (low floor elevation) at not less than one (1) foot above the BFE plus any increase due to encroachment of the floodway.

ii) The low floor elevation shall be two (2) feet or more above the 100-year/24-hour event as determined by a technical evaluation by a qualified engineer or hydrologist.

b) An emergency overflow shall be incorporated into the site design at or above the BFE or modeled high water level to convey a 100-year discharge away from buildings to the next downstream water body. Existing, natural or man-made emergency overflows shall be analyzed as part of the design process. The lowest opening shall be at least 1.5 feet above the emergency overflow elevation of the adjacent water body, unless the analysis shows that adequate storage volume exists within the basin to provide a reasonable level of protection from potential flooding. Where a natural overflow does not exist, the designer shall consider the possibility of long duration events, such as multiple-year wet cycles and high runoff volume events (e.g., snowmelt events that last for many weeks) when evaluating high water elevations and outlets from landlocked basins.

c) Fill around a building or structure shall be above the BFE and extend a horizontal distance of at least 15 feet in all directions.

d) For underground parking structures with a low floor elevation below the high water level or emergency overflow elevation, the drainage system within the parking structure shall include anti-backflow devices and flood protection to minimize the impacts of high ground water levels during flood events.

e) Projects in the Vermillion River Watershed must not result in a net loss in floodplain storage.

f) For landlocked basins, where additional stormwater volume is proposed to be routed, consideration shall be given to the effects of increased flood levels on trees and vegetation and potential for erosion.

5) Rate Control.

a) Discharge rates leaving the site must not exceed the existing rates for the 2, 10 and 100-year, critical duration (24-hour) storm events, using the updated Atlas 14 rainfall depths and antecedent moisture conditions 2 (AMC-2). The storm distribution shall be a NRCS MSE 3 MN distribution or the nested distribution for Atlas 14 based data. Discharge rates leaving the site should be reduced from existing rates where feasible. Predevelopment is defined as the conditions on the project site prior to the proposed improvements.

   i) For projects in the Vermillion River Watershed, discharge rates leaving the site must not exceed the predevelopment rates for the 1-year critical duration storm in addition to, the 2-year, 10, and 100-yr, 24-hour events. Predevelopment is defined as the conditions on the project site that existed in 2005.

b) On-site rate controls may not be needed if downstream (regional) facilities can be shown to adequately detain/retain the runoff to existing conditions and in accordance with the rates established in Appendix D of this Plan. In this case, the developer or design engineer shall submit a technical evaluation completed by a qualified engineer or hydrologist which must be review and approved by the City Engineer.

c) Where a flow rate variance involves inter-community issues or significant water bodies, the regulatory jurisdiction shall have a review role. Any variances shall be reflected in subsequent plan submittals.

d) Project sites discharging directly to the Black Dog Fen must not increase the discharge rate from the site for the 1-year event.

e) For proposed outlets from landlocked basins, an analysis of the water quality and flooding impacts on intercommunity flows or any downstream strategic waterbodies shall be prior to construction of the outlet. If analyses indicate a potential adverse effect on water quality or increased flood potential, the city must notify the watershed organization prior to approving the outlet.

6) Special Waters and Wetlands.

a) Developments shall meet the requirements of the National Pollutant Discharge Elimination System (NPDES) permit program for all applicable requirements of the most recent permits including, but not limited to the following:

   i) Sites discharging to Trout Stream #1, #4 or #7, must incorporate BMPs that address: runoff temperature requirements; maintain an undisturbed buffer zone of at least 100 feet between the project site and the trout stream; and cover exposed slopes that are steeper than 3:1 (H:V) within three days of the disturbance.

b) Horizontal vegetated buffer zones shall be established and/or maintained around existing wetlands and storm water treatment ponds. New development and redevelopment projects shall provide a buffer zone around wetlands in accordance with the requirements in the City's Wetland Protection and Management Plan. Storm water ponds with a permanent pool of water (i.e., wet ponds) shall have an average 20-foot buffer around the perimeter of the basin. The buffer shall extend form the normal water level to the top of the pond slope.

Wetland Classification	Permanent Buffer Strip Average Width (feet)	Minimum Permanent Buffer Zone Width (feet)	Percentage Native Vegetation

Protection	50	30	100% Native
Improvement	35	25	100% Native
Management	25	20	Majority
Management II	20	20	Majority

c) Water level fluctuations in wetlands shall be managed in accordance with the City's Comprehensive Wetland Protection and Management Plan. A rise (bounce) in elevation greater than 12 inches during a 10-year storm shall be avoided.

d) New discharge points to all wetlands and waters must include pretreatment. New direct discharges to Management II wetlands must have at least grit removal prior to discharge.

e) State of Minnesota Buffer Law (Minnesota Statutes 2014, sections 103B.101, subdivision 12; 103E.315, subdivision 8; Minnesota Statutes 2015 Supplement, sections 103B.101, subdivision 12a; 103F.48, subdivisions 1, 3, 4, 7, 8, 10 and CHAPTER 85--S.F. No. 2503l 2016 amendments) requires the establishment of either a 50-foot average, 30-foot minimum, continuous buffer of perennial rooted vegetation around all public waters, streams, and public ditches as identified and mapped on a buffer protection map. The buffer protection map is maintained by the Minnesota Department of Natural Resources, through a buffer mapping website (http://arcgis.dnr.state.mn.us/gis/buffersviewer/). The buffer law is administered by the Board of Water and Soil Resources (BWSR), with technical support for land owners provided by the Dakota County Soil and Water Conservation District. Resources requiring protection under the buffer law are present in the City of Burnsville, but are limited to ten public waters, and four unnamed streams draining into Black Dog Lake. These aquatic resources currently meet the standards of the buffer law, and no action is required to comply with the recently implemented legislation. The current buffer standards incorporated in the Burnsville Surface Water Management Plan exceed the state requirements for the aquatic resources, which protects these resources should adjacent land use change.

7) Design Computations.

a) All hydrologic data shall be completed using NRCS methodology; i.e. HydroCAD or TR20/TR55, XP-SWMM or a comparable, City approved method. Hydraulic calculations will be accepted in the rational method format or in commonly used software packages such as FHWA HY-8, or XP-SWMM or a compatible, City approved method. These computations shall be submitted to the City, upon request.

b) Rainfall amounts for hydrologic analysis shall be based on Atlas 14 data. Burnsville analyses shall use the values in the following table for 24-hour design events.

Return Frequency	Rainfall Depth (inches)
2-year	2.9
10-year	4.3
100-year	7.5

c) Local storm sewer systems shall be designed for the 10-year storm event. The Rational Method shall be the preferred methodology for the design of local systems. Culvert crossings or storm systems in County or State right-of-way may have a design frequency which differs from the City's 10-year design storm. The designer shall contact each agency/unit of government to

determine the appropriate design frequency for hydrologically-connected systems.

d) For culvert outlet velocities less than or equal to 4 fps, check shear stress to determine if vegetation or riprap will be adequate. If vegetation is used, temporary erosion control during and immediately follow construction shall be used until vegetation becomes established. For velocities greater than 4 fps, energy dissipaters shall be designed in accordance with MnDOT Design Criteria.

e) High water elevations for landlocked areas (basins where no outlet exists) shall be established by first estimating the normal or initial water surface elevation at the beginning of a rainfall or runoff event using a documented water budget, evidence of mottled soil, and/or an established ordinary high water level. The high water level analysis shall be based on runoff volume resulting from a 100-year/10-day runoff (7.2 inches and saturated or frozen soil conditions [CN=100]) and/or the runoff resulting from a 100-year back-to-back event. The high water elevation shall be the higher of these two conditions.

8) Additional Pond and Infiltration System Design Criteria. Newly constructed or expanded/modified ponds and basins shall be designed and constructed to meet the following:

a) Any storm water pond constructed within the prohibited infiltration zone in Figure C-1, must meet the following criteria:

i) The basin bottom and side walls shall be constructed by compacting at least a 1-foot thickness of soils having at least 20 percent fines (at least 20% passing a #200 sieve). The bottom must have at least a 3-foot vertical separation to the seasonally-high groundwater elevation and/or bedrock.

ii) If a 3 foot separation to bedrock or the seasonally-high groundwater elevation cannot be obtained, the basin bottom and sidewalls shall be constructed of materials and methods that are approved by the City Engineer. Possible liner materials may include compacted cohesive soils, geosynthetic materials, plastic liner, soil additives or other materials.

iii) The seasonally-high groundwater elevation shall be determined by assessing soil mottling or soil coloration that indicates temporary saturation of the soil.

b) All ponds or basins shall:

i) If the pond will have a permanent pool of water, have an aquatic bench having a 10:1 (H:V) slope for the first 10 feet from the normal water level into the basin.

ii) Have a 3:1 maximum slope (above the NWL and below the 10:1 bench, if a wet pond);

iii) Maximize the separation between inlet and outlet points to prevent short-circuiting of storm flows;

iv) Be made accessible for maintenance and not be entirely surrounded by steep slopes or retaining walls which limit the type of equipment that can be used for maintenance. Vehicle access lane(s) of at least 10 feet shall be provided, at a slope less than 15 percent from the access point on the street or parking area to the pond, to accommodate maintenance vehicles. Maintenance agreements will be required when the pond is not located on City property.

v) Have a skimming device designed to remove oils and floatable materials up to a five-year

frequency event. The skimmer shall be set a minimum of 12 inches below the normal surface water elevation shall control the discharge velocity to 0.5 feet per second.

c) For wet ponds, an average 4 feet of permanent pool depth (dead storage depth) shall be provided. This constraint may not be feasible for small ponds (less than about 3 acre-feet in volume or less). In such cases, depths of 3-4 feet may be used. To prevent development of thermal stratification, loss of oxygen, and nutrient recycling from bottom sediments, the maximum depth of the permanent pool should be less than or equal to 10 feet.

d) Structural BMPs proposed as a stand-alone device or as part of the overall treatment system, shall be designed in accordance with standard engineering principles and practices.

9) Construction Site Erosion and Sediment Control.

a) The City's Erosion Control Ordinances shall be followed for all projects, including those not regulated under the NPDES construction permit. Construction site erosion and sediment control practices shall be consistent with those required by the NPDES Construction Stormwater General Permit Section IV-Construction Activity Requirements, however, formal permit coverage is not required for sites disturbing less than one acre.

b) Prior to the start of any excavation or land disturbing activity for the site, the owner or contractor must have in place and functional an approved method of erosion control. The contractor must have received authorization from the City prior to commencing construction activities.

c) Development projects shall meet the requirements of the National Pollutant Discharge Elimination System (NPDES) construction permit program, including the requirement to prepare and follow a storm water pollution prevention plan (SWPPP). The owner shall submit proof of receipt and approval by MPCA of the permit application prior to commencing construction. A copy of the SWPPP prepared in accordance with the NPDES permit requirements, shall be submitted to the City if requested by the City Engineer. Site plans shall include:

i) Best management practices (BMPs) to minimize erosion.

ii) BMPs to minimize the discharge of sediment and other pollutants.

iii) BMPs for dewatering activities.

iv) Site inspections and keeping records of rainfall events.

v) Maintenance of BMPs during construction.

vi) Management of solid and hazardous wastes.

vii) Final stabilization of the site including the use of perennial vegetation and/or other methods on all exposed soils.

viii) Computations and documentation regarding the sizing and location of temporary sediment basins.

10) Storm Water Plan Submittals.

a) Property lines and delineation of lands under ownership of the project proposer.

b) Delineation of the subwatersheds contributing runoff from off-site, and proposed and existing subwatersheds on-site.

c) Location, alignment and elevation of proposed and existing stormwater facilities.

d) Delineation of existing on-site wetlands, shoreland and/or floodplain areas. Removal or disturbance of stream bank and shoreland vegetation should be avoided. The plan shall address how unavoidable disturbances to this vegetation will be mitigated.

e) Existing and proposed 100-year high water level elevations on-site.

f) Existing and proposed site contour elevations related to NAVD 1988 datum.

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

h) Stormwater runoff volume and rate analyses for existing and proposed conditions.

i) All hydrologic and hydraulic computations completed to design the proposed stormwater quality management facilities. Computations shall include a summary of existing and proposed impervious areas.

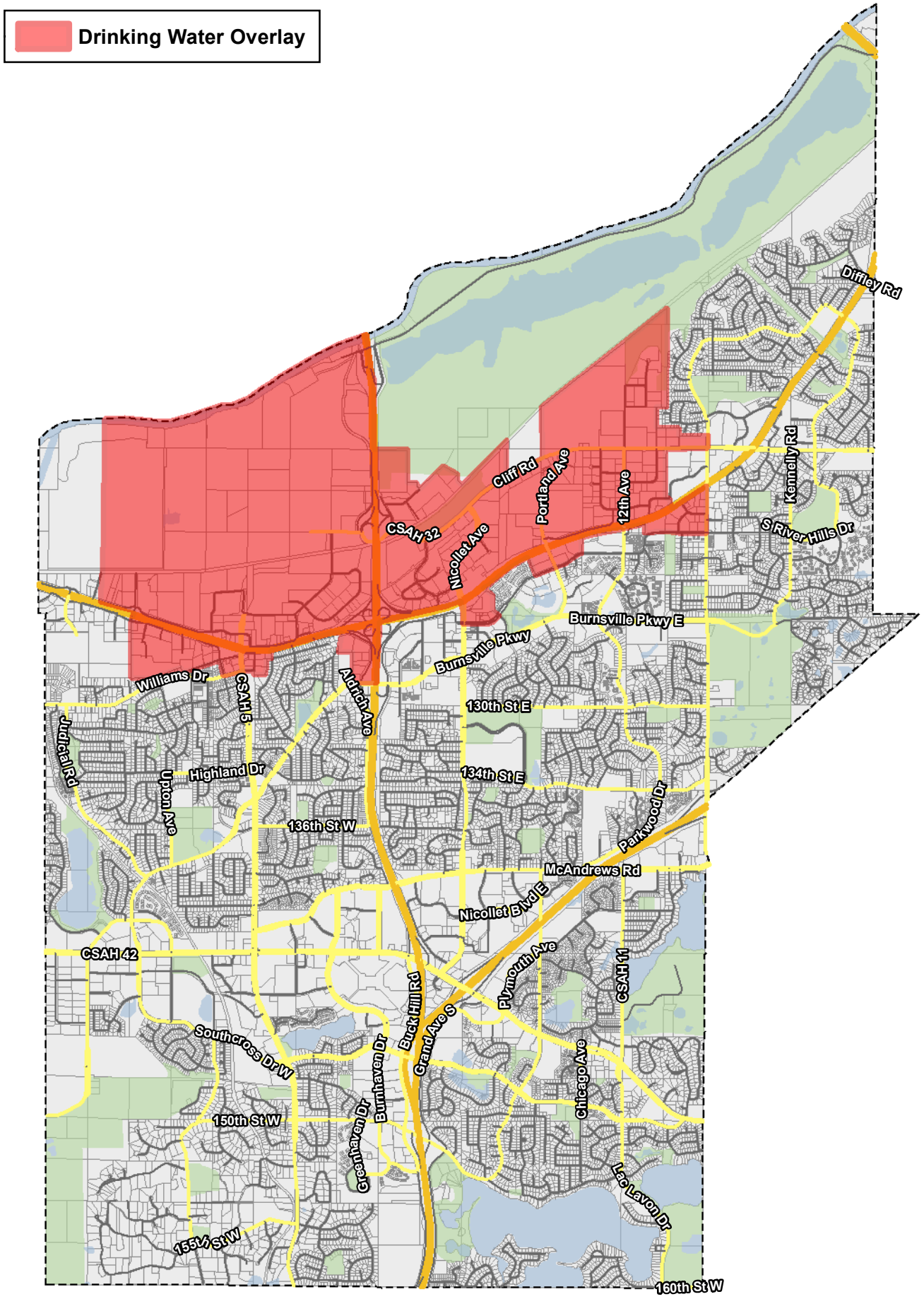
j) Provision of outlots or easements for maintenance access to detention basins, constructed wetlands and other stormwater management facilities.

k) Maintenance agreement between developer and city which addresses sweeping, pond inspection, sediment removal and disposal, etc.

l) Inlets to detention basins, wetlands, etc., shown at or below the outlet elevation.

m) Identification of receiving water bodies (lakes, streams, wetlands, etc.).

n) Documentation indicating conformance with this Plan



City of Burnsville

Drinking Water Overlay

FIGURE C-1

1 inch = 4,300 feet

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WSB & Associates, Inc.

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Table C-1
Local Watershed Standards Summary

	VRWJPO	LMRWD	BDWMO[2]
Stormwater Management Standards	Applicability: All land disturbing activities (disturbance of <5000 sf may be exempt) Water Quality: Must meet water quality standards established by the MPCA NPDES Construction Stormwater permit Runoff Temperature Control: No specific criteria since other standards (volume control, buffers, etc.) emphasize approaches to control runoff temperature Peak Runoff Rate Control: Proposed peak runoff rates must not exceed the existing (2005 baseline) runoff rates for the 1-, 10-, and 100-yr critical duration storm events. Runoff Volume Control: Development creating ≥ 1 ac of new impervious surface must control the increase in runoff volume from the 2005 conditions for a 2-yr, 24-hr storm event.	Applicability: The disturbance of ≥1 acre of land or creating of ≥10,000 sf new impervious within the High Value Resource Area Overlay District[1] Water Quality: No net increase from existing conditions in TP or TSS to receiving waterbodies Runoff Temperature Control: Stormwater facilities must be designed to minimize an increase in the temperature of receiving trout waters for the 1- and 2-yr, 24-hr events. Peak Runoff Rate Control: The stormwater runoff rate shall not exceed the existing ratefor the 1- or 2-, 10-, and 100-year return frequency storms. Runoff rates shall not accelerate on or off-site watercourse erosion, downstream nuisance, flooding, or damage. Runoff Volume Control: Must comply with the MPCA NPDES Construction Stormwater permit requirements for stormwater runoff volume retention equivalent to 1 in of runoff from impervious surfaces. Regional ponds and practices can be used provided the design is based on the ultimate conditions for the contributing watershed and practices are constructed and operational prior to constructing impervious surfaces within the contributing drainage area.	Applicability: The disturbance of ≥1 acre of land Water Quality: Must meet water quality standards established by the City of Burnsville Peak Runoff Rate Control: Must meet peak runoff rate control standards established by the City of Burnsville Runoff Volume Control: Must meet runoff volume control standards established by the City of Burnsville All new or replaced stormwater management systems and structural BMPs must conform to current standards and engineering practices. Pretreatment is required for stormwater discharge points/outfalls and existing inlets to the stormwater system.

Table C-1 (continued)
Local Watershed Standards Summary

<table>
<tr><th></th><th>VRWJPO</th><th>LMRWD</th><th>BDWMO[2]</th></tr>
<tr><td>Erosion and Sediment Control Standards</td><td>Applicability: All land disturbing activities > 5000 sf, > 30 cy of soil, or changing existing drainage

Standards: Erosion and sediment controls shall meet the standards of the MPCA NPDES Construction Permit and have a SWPPP for projects disturbing more than 1 ac. Erosion and Sediment control plans shall be used for sites disturbing < 1 ac.</td><td>Applicability: The disturbance of ≥1 acre of land or ≥ 5,000 sf within the High Value Resource Overylay District

Standards: Erosion and sediment controls shall meet the standards of the MPCA NPDES Construction Permit and stormwater conveyances must be designed to a 10-year design storm.</td><td>Applicability: All land disturbing activities of ≥ 1 acre.

Standards: Erosion and sediment controls shall meet the standards of the MPCA NPDES Construction Permit</td></tr>
<tr><td>Buffer Standards</td><td>Applicability: Any new lot created by the subdivision of an existing property must maintain a buffer around all wetlands, watercourses, and pubic waters wetlands

Standards: Buffer width varies upon stream classification,
<table>
<tr><th></th><th>Avg.</th><th>Min.</th></tr>
<tr><td>Conservation Corridor</td><td>150</td><td>100</td></tr>
<tr><td>Aquatic corridor principal connector & trout stream</td><td>NA</td><td>100</td></tr>
<tr><td>Aquatic corridor principal connector</td><td>100</td><td>65</td></tr>
<tr><td>Aquatic corridor tributary connector</td><td>50</td><td>35</td></tr>
<tr><td>Water quality corridor</td><td>30</td><td>20</td></tr>
</table>
Or wetland classification
<table>
<tr><th></th><th>Avg.</th><th>Min.</th></tr>
<tr><td>Exceptional quality</td><td>50</td><td>30</td></tr>
<tr><td>High quality</td><td>40</td><td>30</td></tr>
<tr><td>Medium quality</td><td>30</td><td>25</td></tr>
<tr><td>Low quality</td><td>25</td><td>16.5</td></tr>
</table></td><td>NA</td><td>Applicability: Any development maintain a buffer around all wetlands

Standards: Member cities will continue to enforce wetland management standards. Buffer width varies upon wetland classification.
<table>
<tr><th></th><th>Avg.</th><th>Min.</th></tr>
<tr><td>Protect</td><td>50</td><td>30</td></tr>
<tr><td>Improve</td><td>35</td><td>25</td></tr>
<tr><td>Manage 1</td><td>25</td><td>20</td></tr>
<tr><td>Manage 2</td><td>20</td><td>20</td></tr>
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Table C-1 (continued)
Local Watershed Standards Summary

	VRWJPO	LMRWD	BDWMO[2]
Wetland Alteration Standards	Applicability: Whenever there is a proposed activity that may affect a wetland. Standards: Any wetland alteration must comply with the Minnesota Wetland Conservation act (WCA) and other applicable State and Federal regulations	NA	Applicability: Whenever there is a proposed activity that may affect wetland hydrology. Standards: Limits on changes in hydrology and water level bounce during storm event based upon the wetland management classification as defined by the City of Burnsville.
Floodplain Alteration Standards	Applicability: Any change in the floodplain below the 100-year flood elevation. Standards: No net decrease in flood storage capacity below the 100-year flood elevation. New structures must have sufficient freeboard over the BFE as required by local floodplain ordinances.	Applicability: Any alteration below the 100-year flood elevation of any wetland, public water, or subwatershed. Standards: No filling is allowed within the 100-yr floodplain which causes a rise in the 100-yr flood elevation without providing compensatory floodplain storage ≥ the volume of fill. Structures must be 2 ft above 100-yr HWL or 1 ft above EOF, whichever is greater. No permanent structure may be located within the floodway.	Applicability: All new structure construction adjacent to inundation areas. Standards: The BDWMO requires cities to set minimum building elevations at least 1 ft above the critical 100-yr flood elevation for structures adjacent to inundation areas.
Drainage Alteration Standards	Applicability: Any outlet of a landlocked basin with a contributing drainage area of ≥ 100 acres or a drainage alteration to a watercourse, public water or wetland that drains ≥ 640 acres Standards: Sound H&H analysis ensures no adverse downstream flooding, stability or water quality impacts, and runoff volume and peak rate criteria are met.	See Floodplain alteration standards.	Standard: BDWMO requires member cities to protect and maintain downstream drainage systems to provide permanent and safe conveyance of stormwater, and to reduce the frequency and/or duration of downstream flooding. Planned level of protection for trunk conveyors, streams, channels and around wetlands ponds and detention basins shall be based on the 100-year flood. Non-trunk conveyance systems shall provide a min. 5-yr frequency event level of service, preferably a 10-yr frequency event. EOFs shall be incorporated where feasible in designs for events larger than a 100-yr frequency. Multi-stage outlets for smaller storms and maintenance of base flows is encouraged.

Table C-1 (continued)
Local Watershed Standards Summary

	VRWJPO	LMRWD	BDWMO[2]
Shoreline and Streambank Alteration Standards	NA	Applicability: Any shoreline or streambank alteration Standard: Bioengineering techniques shall be used in place of traditional stabilization. Retaining walls shall only be used when no adequate alternative exists.	NA
Stream and Lake Crossing Standards	NA	Applicability: Any road, utility, or structure placed on the bed or bank of a watercourse or waterbody Standards: Hydraulic impact analysis is completed by a qualified PE demonstrating the crossing will retain adequate hydraulic and navigational capacity. Minimum culvert width shall be ≥ bankfull width. Culvert length shall extend beyond side slope toe, alignment and slope should match the stream, and inverts shall be buried 1/6 of height.	NA
Water Appropriation Standard	NA	Applicability: Surface or groundwater appropriation and issuance of a DNR appropriation permit (≥10,000 gal per day or 1M gal per year) Standards: The effects of the proposed appropriation must be defined and a copy of any DNR appropriations permit must be provided to the District. Known non-compliant ISTS within the WHPA shall be upgraded within 3 years.	NA

Table C-1 (continued)
Local Watershed Standards Summary

	VRWJPO	LMRWD	BDWMO[2]
Bluff Standard	NA	Applicability: Any land disturbing activity or land alterations on bluffs within the LMRWD Bluff Overlay District Standards: All grading, clear cutting, removal of vegetation and/or other land-disturbing activities are prohibiting on the bluff and/or bluff impact zone. A minimum of 40 ft setback from the top of bluff/bluffline is required for: • structures, • ISTS and CSTS, and • stormwater ponds, swales, basins or other soil saturation-type features	NA
See For More Information	See Standards for the VRWJPO (2016) for details.	See Appendix K of the LMRWD (2017 draft) plan for details.	See BDWMO Watershed Management Plan (2012) for details.

[1]See Appendix K of the LMRWD (2017 draft) plan for stormwater management standards in High Value Resource Area (HRVA) Overlay district.

[2]The BDWMO reserves the right to review regulations of member cities affecting the BDWMO water resources for compliance with BDWMO performance standards.

Appendix D

Hydrologic and Hydraulic Model Summary

Appendix D - Hydrologic System Information

The City of Burnsville developed this Water Resources Management Plan (WRMP) to analyze its water resources and to establish an overall program to achieve their water resource management goals. These goals are generally intended to reduce or minimize the future impacts of development on the City's natural and water resources and improve the quality of the City's resources.

In 2016 as part of the 2017 WRMP update, the City developed a City-wide xp-swmm hydrologic/hydraulic model. The 2017 model incorporated more detail in the pipe networks for much of the City than had previously been modeled. In general, pipes having a diameter of 18-inches or greater were included in the model and the majority of smaller pipes were excluded. Lake, ponds, wetland and selected depressional storage areas were also included in the City-wide model. For the data presented in the Hydrologic Summary Data Table D-1 in Appendix D, the source of the data for building the model consisted of the following:

- City owned and inventoried ponds (from City provided GIS Database in January 2016) that outlet to the City storm sewer and that had complete storm sewer data available in City GIS Database (i.e., pipe size, inverts).
- Privately owned and inventoried ponds (from City provided GIS Database in January 2016 that outlet to the City storm sewer with complete storm sewer data available in City GIS database.
- Some natural depression areas that were not included in the GIS water body database were developed from available LIDAR data.

The following systems and features were not included in the model:

- Underground Systems.
- Infiltration or filtration Systems (with a few exceptions)
- Privately owned and inventoried ponds without complete storm sewer data available in the City GIS database (i.e., missing pipe size and/or inverts)
- Non-inventoried ponds.

The following descriptions correspond to the information presented in the hydrologic summary table. Note that while the data table report that elevations are in NAVD 88 datum, largely due to the use of the data from the City's GIS data is reported in NAVD 88 datum. Data should be checked by users to confirm elevations noted in as-built plans and site specific surveys.

Storage Area ID

These columns identify the unique storage area ID for each row within the table and corresponds to the drainage areas and the specific pond/water body/storage areas shown Map Figure Series D-1.1 to D-1.12 and D-2.1 to D-2.12. The subwatershed boundaries were generally determined using available contour mapping and storm sewer networks. The boundaries should be considered approximate and should be review during subsequent and more detailed analyses.

Water Body Common Name

The water body common name is listed for lakes and key water bodies.

Surface Area at NWL

The water surface area at normal water level (in square feet) is determined from Lidar data based on the elevation of the water body normal water level, outlet structure, pump control elevation or a DNR established elevation. The surface area at NWL shown are those listed in the City GIS Pond/Water Body data.

Approximate Outlet Size

The approximate outlet size is the approximate outlet pipe size of the associated water body. The approximate outlet sizes shown are those listed in the City GIS Pond/Water Body data. This information should be used for planning purposes only and not for final design.

NWL

The normal water level of the pond is the lowest controlling elevation. It is usually taken as the invert of the outlet structure or the pump control elevation and is the elevation that the pond will drain down to after a rainfall event. The NWL does not reflect the lowest elevation that may be attained naturally by infiltration, evaporation or transpiration. The elevation is listed in National Geodetic Vertical Datum (NAVD 88). The NWL data shown are those listed in the City GIS Pond/Water Body data.

Ordinary HWL

The OHWL listed represents the level reported in the DNR's Lake Finder database for the water body listed in the comments column of the table. The OHWL data shown are those listed in the City GIS data.

100-Year Event (7.45" Rainfall Event)

The 100-year event is also referred to as a rainfall event that has a 1% chance of occurrence in a given year.

> The 100-year high water level data presented in these tables should be viewed as an approximate elevation and the user/designer is encouraged to complete additional analysis prior to initiating site planning, design and obtaining approvals. In general, the City may complete detailed updated modeling upon the initial contact with a project owner and provide the owner with updated high water level and low building elevation information.

HWL (NAVD 88)

The highest water level achieved in a storage area as predicted by the 2017 model for a 100-year event. The model assumes that the water body elevation is equal to the NWL at the beginning of the storm event. The HWL is affected by the accuracy of the data such as drainage area, storage capacity, outlet description and condition, and run-off factors. All of these factors should be reviewed when HWL is considered critical.

BFE from FEMA (NAVD 88)

The regulatory base flood elevation as defined in the most recent flood insurance study or flood insurance rate map. This number is only reported for water bodies that have a defined base flood elevation. The BFE may be more or less than the HWL listed in the previous column if more recent modeling was completed that has not yet been incorporated into an official map change by FEMA. These numbers will not change as a result of any additional analysis requested or required by the City to reevaluate the effects of updated Atlas 14 precipitation data.

Bounce in Pond/Water Body. The difference in elevation between the NWL and the modeled HWL.

Storage. The volume of water stored in the pond between the NWL and the HWL.

Peak Outflow Rate. The maximum discharge rate from a pond through the outlet. This normally occurs when the pond is at the HWL and it assumes the full efficiency of the outlet structure(s).

Approximate Overflow Elevation

The elevation at which the pond would overflow from the surface if the storage capacity is exceeded. The approximate overflow elevations shown are those listed in the City GIS Pond/Water Body data.

Approximate Existing Low Building Elevation

This elevation was determined from the "House-Print" on the contour mapping and does not indicate low-floor or basement elevations. These elevations should be considered approximate due to possible inaccuracies in the mapping and buildings that have been constructed or modified after the mapping was completed. The approximate existing low building elevation shown are those listed in the City GIS Pond/Water Body data.

Low Building Elevation

This elevation is determined based on the standards presented in Appendix C. This should be considered a planning level minimum elevation that is required by City standards. The developer should review the source and quality of data available and evaluate the low building elevation for each site directly to ensure a reasonable level of protection is provided. The low building elevations shown are those listed in the City GIS data.

Freeboard (LBLDG – HWL)

The difference between the low building and 100-year high water level elevations. A negative number indicates that the HWL is higher than the LBLDG. This dimension along with the comments column is intended to highlight areas in the City that could experience problems with flooding. Actual low building elevations, and other pertinent hydrologic data,, should be field verified to determine the extent of the problems. It should be noted that LBLDG elevation may be different elevation than the low floor elevation per City Ordinance.

Risk of Inundation

This column provides a relative risk of inundation of adjacent structures. The relative risk is not intended to take the place of detailed analyses to evaluate risk. Instead it is intended as an initial planning-level starting point. Almost any structure adjacent to a water body may have a risk of inundation during certain hydrologic events. The data is based on approximate overflow elevations and not on actual surveyed field conditions.

Relative Risk of Inundation

Distance Low Bldg. Elevation is Above the BFE or AOE (feet) (1)	**Base Flood Elevation (BFE) or 100-Year HWL**	**Approximate Overflow (AOE)**	**Overall Risk**
≤ 0	HIGH	HIGH	HIGH
0 to 1.5	MODERATE	HIGH	HIGH
1.5 to 2.0	MODERATE	LOW	MODERATE
2.0 or more	LOW	LOW	LOW

1. A value of zero means the low building elevation is at the same elevation of the BFE or EOF. A negative number means the elevation is below the BFE or EOF.

Notes

This column provides miscellaneous notes relating to the drainage area.