memo

Project Name	BCWD Permit 24-09 CSAH 5 Phase 3 Improvements	**Date**	October 3, 2024
To / Contact info	BCWD Board of Managers		
Cc / Contact info	Ron leaf, PE / Kimley-Horn		
Cc / Contact info	Karen Kill, Administrator / BCWD		
From / Contact info	John Sarafolean; Paul Nation, PE / EOR		
Regarding	Permit Application No. 24-09 Engineer's Report		

The following review of the above mentioned project located within the legal jurisdiction of the Brown's Creek Watershed District (BCWD) was conducted to determine compliance with the BCWD rules for purposes of the engineer's recommendation to the Board of Managers for its determination of the permit application.

Applicant: Washington County
Permit Submittal Date: August 6, 2024
Completeness Determination: August 14, 2024
Board Action Required By: December 4, 2024
Review based on BCWD Rules effective April 1, 2020
Recommendation: Consider Variance Request and otherwise Approve with Conditions

GENERAL COMMENTS

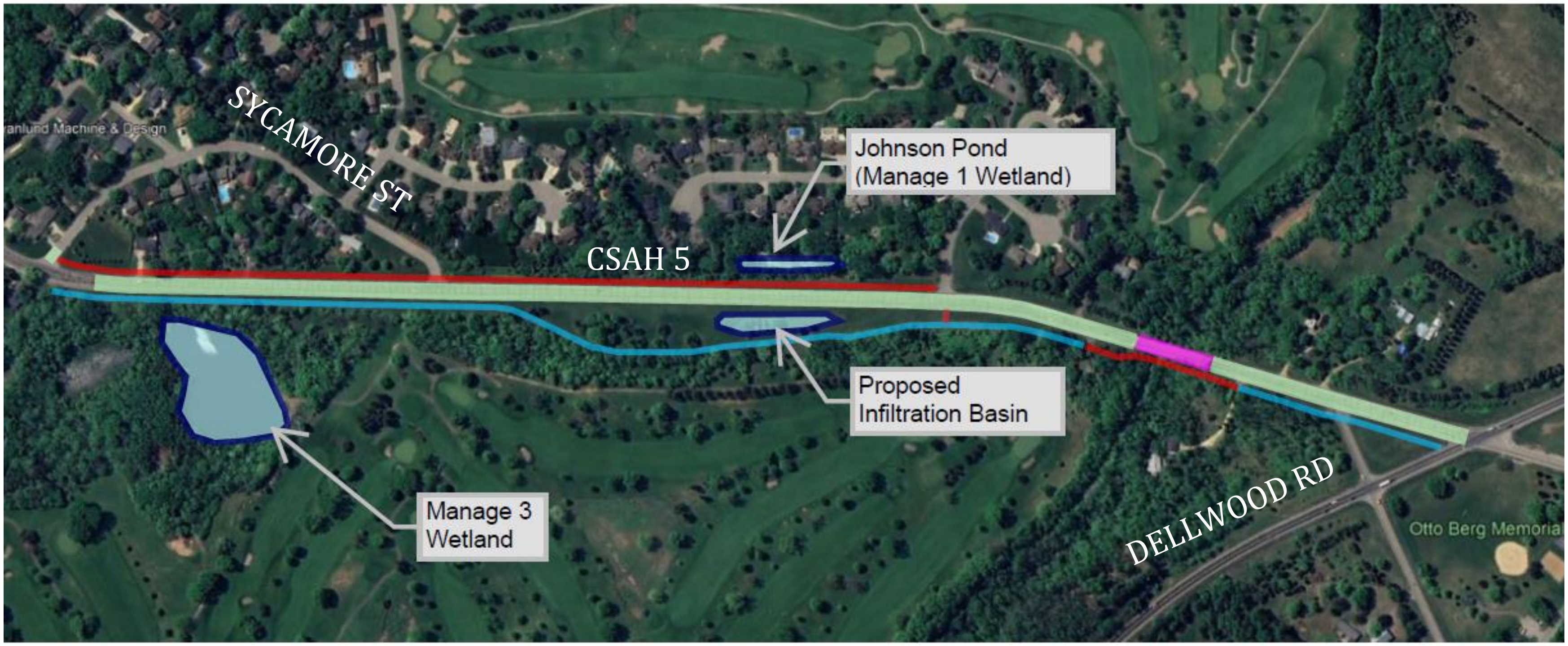
Washington County is proposing to improve Stonebridge Trail North (County State Aid Highway 5) from Sycamore Street West to Dellwood Road in Stillwater. The existing conditions of the linear project site consist of a bituminous roadway, bituminous trail, and a bridge crossing over Brown's Creek. The CSAH 5 roadway is a rural section using turf ditches to convey the stormwater. On the southern part of the project, runoff from CSAH 5 drains to a depression then through a west to east culvert to a Manage 3 wetland adjacent to the Stillwater Country Club golf course. This wetland is an open water pond located on Washington County property and is part of the site. The middle portion of the project, from 300 feet south of Sycamore Street to the south edge of the bridge crossing Brown's Creek, drains west to a Manage 1 wetland. This wetland is also a stormwater pond owned by the City of Stillwater, called Johnson Pond. Johnson Pond overflows to the east overland to the Stillwater Country Club. Runoff from the bridge crossing Brown's Creek drains by storm sewer discharging on the east side of the bridge, sheet flowing overland to Brown's Creek. Runoff from CSAH 5 north of the bridge drains to the east and west through the ditch and overland to Brown's Creek.

As shown in Figure 1, Washington County proposes improvements to CSAH 5 consisting of bituminous street resurfacing, resurfacing of the bituminous trail along the east side of the roadway, an addition of a bituminous trail along the west side of the roadway, widening of the roadway for a turn lane, replacement of the vehicle and pedestrian bridge crossing over Brown's Creek, culvert and storm sewer improvements, and installation of an infiltration basin to treat storm water from the project. The project improvements will result in an increase of 0.98 acres of new impervious surface with 0.44 acres of fully reconstructed impervious, totaling 1.42 acres of new/fully reconstructed impervious surface on the 23.4-acre site. (The proposed resurfacing is exempt from the stormwater management requirements because it is excluded from the BCWD definition of "reconstruction.") As addressed in detail below, the applicant is seeking approval of variances from BCWD's stormwater rate, volume and water-quality criteria for several of the project discharge points.

The project site is located within a Drinking Water Supply Management Area that has been classified as having high vulnerability in the City of Stillwater's Wellhead Protection Plan. The site is not within an Emergency Response Area. Washington County completed a higher level review that was approved by the City of Stillwater to allow infiltration for this project.

The BCWD administrator extended the review period for the application on September 6, 2024. With the 60-day extension, board action is required by December 4, 2024.

Recommendation: The BCWD engineer recommends that the Board consider the applicant's variance request in light of the analysis provided below and otherwise approve the application with the conditions outlined in the report.



LEGEND

- MILL & OVERLAY ROADWAY
- NEW BITUMINOUS TRAIL
- RECONSTRUCTED BITUMINOUS TRAIL
- BRIDGE REPLACEMENT

Figure 1

Rule 2.0—STORMWATER MANAGEMENT

Under the definitions and subsection 2.2(c) of the rules, the proposed project triggers the application of Rule 2.0 Stormwater Management because it creates 1.42 acres of new and/or reconstructed impervious surface (i.e., more than 6,000 square feet) within the surface water contributing area of a groundwater-dependent natural resource (Brown's Creek) for roadway and trails within right-of-way and is not a component of a larger development or redevelopment. The site is not within the Diversion Structure Subwatershed, so the stormwater criteria in subsection 2.4.2(a) apply.

The stormwater management plan for the project includes;

- *One infiltration basin to treat for stormwater volume, rate, and water quality.*

Under current conditions, runoff leaves the site at the following discharge points:

- *Discharge Point A – This discharge point includes sheet flow from CSAH 5 south of the bridge, discharging into an adjacent depression on private property. From there, runoff flows through a culvert under CSAH 5 into the downstream Manage 3 wetland. The existing size of the drainage area flowing to discharge point A is 9.10 acres with 3.26 acres of impervious surface. Under proposed conditions, the drainage area size will remain the same with the impervious surface area increasing to 3.39 acres.*

- *Discharge Point B – This discharge point was removed from the analysis because it is discharge onto the site (from the adjacent depression) into the onsite Manage 3 wetland.*

- *Discharge Point C – This discharge point is the outlet of the Manage 3 wetland onto Stillwater Country Club property. From there, runoff flows through the golf course before reaching Brown's Creek. The existing size of the drainage area flowing to discharge point C is 34.73 acres with 4.83 acres of impervious surface. Under proposed conditions, the drainage area size will remain the same with the impervious surface area increasing to 4.96 acres.*

- *Discharge Point D – This discharge point includes flow from the CSAH 5 ditch southwest of the bridge, discharging into Johnson Pond. From there, runoff overflows CSAH 5 to the east under existing conditions. Under proposed conditions, a culvert outlet to Johnson Pond will be added, discharging under CSAH 5 into the proposed infiltration basin. The existing size of the drainage area flowing to discharge point D is 38.89 acres with 10.13 acres of impervious surface. Under proposed conditions, the drainage area size will remain the same with the impervious surface area increasing to 10.63 acres.*

- *Discharge Point E – This discharge point is the outlet of the proposed infiltration basin onto Stillwater Country Club property. From there, runoff flows through the golf course before reaching Brown's Creek. The existing size of the drainage area flowing to discharge point E is 45.18 acres with 12.26 acres of impervious surface. Under proposed conditions, the drainage area size will remain the same with the impervious surface area increasing to 13.05 acres.*

- *Discharge Point F – This discharge point is flow from CSAH 5 northwest of the bridge, discharging from the road ditch directly to Brown's Creek. The existing size of the drainage area flowing to discharge point F is 5.19 acres with 0.41 acres of impervious surface. Under proposed conditions, the drainage area size will remain the same with impervious surface increasing to 0.42 acres.*

- *Discharge Point G – This discharge point includes flow from the bridge deck and CSAH 5 northeast of the bridge, discharging from a roadside culvert onto private property. From there,* *runoff flows down a vegetated slope before reaching Brown's Creek. The existing size of the drainage area flowing to discharge point G is 0.63 acres with 0.27 acres of impervious surface. Under proposed conditions, the drainage area remains the same with the impervious surface area increasing to 0.40 acres.*

- *Discharge Point H – This discharge point includes sheet flow from CSAH 5 northeast of discharge point G, discharging onto private property. From there runoff flows down a vegetated slope before reaching Brown's Creek. The existing size of the drainage area flowing to discharge point H is 0.38 acres with 0.24 acres of impervious surface. Under proposed conditions, the drainage area remains the same while the impervious surface area decreases very slightly, by 130 sf.*
- *Discharge Point I – This discharge point includes flow from CSAH 5 northeast of discharge point H, discharging from a roadside culvert into the Dellwood Road ditch. From there runoff flows east through the ditch and eventually south into Brown's Creek. The existing size of the drainage area flowing to discharge point I is 1.15 acres with 0.26 acres of impervious surface. Under proposed conditions, the drainage area remains the same while the impervious surface area decreases very slightly, by 305 sf.*

Rate Control

According to BCWD Rule 2.4.1(a)(i), an applicant for a stormwater management permit must demonstrate to the District that the proposed land-altering activity will not increase peak stormwater flow from the site, as compared with the pre-settlement condition, for a 24-hour precipitation event with a return frequency of two, 10 or 100 years for all points where discharges leave a site.

☐ Rule Requirement Not Met – *See section 10.0 Variances*

The stormwater management plan developed for the site was evaluated using a HydroCAD model of pre-settlement and post-development site conditions. A comparison of the modeled peak flow rate is included in Table 1. Offsite discharge rates that exceed the pre-settlement rate are bolded. See section 10.0 for further analysis and discussion of this variance request.

Table 1: Peak Discharge Rates

Discharge Point	Pre-Settlement Runoff Rate (cfs)			Proposed Runoff Rate (cfs)		
	2-year (2.81")	10-year (4.17")	100-year (7.23")	2-year (2.81")	10-year (4.17")	100-year (7.23")
A	11.2	20.9	44.3	**11.9**	**22.0**	43.8
C	0.0	0.0	3.8	0.0	0.0	**4.2**
D	25.1	45.2	94.0	**29.4**	**49.8**	**98.9**
E	0.0	0.0	9.8	0.0	0.0	8.7
F	1.2	5.6	19.9	1.2	4.7	**21.3**
G	1.0	1.8	3.9	**1.4**	**2.4**	**4.6**
H	0.9	1.4	2.9	**1.1**	**1.8**	**3.4**
I	1.0	2.3	6.0	**1.2**	**2.6**	**6.4**

Volume Control

According to BCWD Rule 2.4.2(a)(ii), outside the diversion structure subwatershed an applicant for a linear project must provide retention of the larger of the following: (i) 100 percent of the required volume per 2.4.1(a)(ii) from the net additional impervious surface; or (ii) 50 percent of the required volume per 2.4.1(a)(ii) from all new and reconstructed impervious surfaces.

☐ Rule Requirement Not Met - *see section 10.0 variances*

The proposed project improvements create 1.42 acres of new and fully reconstructed impervious surfaces (0.98 acres of net new impervious). A summary of the required and proposed stormwater runoff volume retention is provided in Table 2. Discharge points where volume retention values are not met are bolded. See Section 10.0 for further analysis and discussion of this variance request.

Table 2 – Retention of Discharge Volumes

Discharge Point	*Volume Retention Required (cf)*	*Volume Retention Provided (cf)*
A	4,124	0
C	138	0
D	4,586	0
E	1,998	25,823
F	82	0
G	1,506	0
H	100	0
I	44	0

Pollutant Loading

According to BCWD Rule 2.4.1(a)(iii), an applicant for a stormwater management permit must demonstrate to the District that the proposed land-altering activity will not at the downgradient property boundary or to an onsite receiving waterbody or wetland, increase annual phosphorus loading as compared with the pre-development condition.

☐ Rule Requirement Not Met - *see section 10 Variances*

The permit applicant submitted Minimal Impact Design Standards modeling demonstrating compliance with Rule 2.4.1(a)(iii). The pollutant loading requirement is not met as demonstrated by the results in Table 3. Proposed phosphorus loading values that exceed the pre-development phosphorus loading values are bolded

Phosphorus loading to discharge points H and I was not modeled as the impervious area to these two discharge points decreases, resulting in a lower phosphorus loading for proposed conditions. There is no phosphorus loading from discharge point E in either pre-development or proposed conditions. The existing depression retains all phosphorus for pre-development conditions and the proposed infiltration basin will retain all phosphorus for proposed conditions.

Table 3 - Offsite Phosphorus Loading

Discharge Point	*Pre-Development Annual Phosphorus Loading (lbs)*	*Proposed Annual Phosphorus Loading (lbs)*
A	8.5	**8.7**
C	0.0	0.0
D (Wetland P-1)	31.0	**32.0**
E	0.0	0.0
F	1.3	1.1
G	0.3	**0.5**
Wetland PE-3	12.4	12.4

Infiltration Pretreatment

According to BCWD Rule 2.5.2 surface flows to infiltration facilities must be pretreated for long-term removal of at least 50 percent of sediment loads.

☒ Rule Requirement Met

The project includes an infiltration basin to meet the stormwater requirements (rate, volume and water quality). Therefore, pretreatment is required for runoff directed to this facility.

All runoff being routed to the infiltration basin will first be directed to vegetated swales on the east side of CSAH 5 or to Pond P-1 on the west side of CSAH 5. The Permit Applicant submitted Minimal Impact Design Standards modeling demonstrating compliance with Rule 2.5.2. The pretreatment requirement is met as demonstrated by the results in Table 4.

Table 4 - Infiltration Basin Pretreatment

Practice	*TSS Inflow Loading (lb/yr)*	*TSS Outflow Loading (lb/yr)*	*TSS Reduction (%)*
Swale	1,078	284	74
Pond P-1	5,805	8	100

Lake/Wetland Bounce

According to BCWD Rule 2.4.1(a)(iv), an applicant for a stormwater management permit must demonstrate to the District that the proposed land-altering activity will not increase the bounce in water level or duration of inundation, for a 24-hour precipitation event with a return frequency of two, 10 or 100 years in the subwatershed in which the site is located, for any downstream lake or wetland beyond the limit specified in Appendix 2.1.

☒ Rule Requirement Met

As mentioned previously, this site discharges to a Manage 1 onsite wetland and a Manage 3 offsite wetland. A HydroCAD model was provided to demonstrate compliance with Rule 2.4.1(a)(iv). Table 5 indicates that the wetland bounce requirements are met. Table 6 indicates that the wetland inundation requirement is met for wetland PE-3. For Johnson Pond (P-1), the inundation period will decrease for all storm events due to the culvert outlet added to the pond.

Comparison of the hydrographs demonstrates that the period of inundation remains the same from existing to post-development conditions as well.

Table 5 - Downstream Wetland High-Water Levels (ft)

		2-year		10-year		100-year	
Waterbody	Management Category	Pre-development	Proposed	Pre-development	Proposed	Pre-development	Proposed
PE-3	3	897.7	897.7	898.3	898.3	899.4	899.4
P-1	1	858.1	858.0	861.2	860.5	863.1	862.1

Table 6 - Downstream Wetland Inundation Increase (days)

Waterbody	2-year	10-year	100-year
PE-3	0.0	1.1	0.9

Basins in Contributing Area to Groundwater-Dependent Natural Resources

According to BCWD Rule 2.5.3, a stormwater basin within the surface contributing area to a groundwater-dependent natural resource must contain and infiltrate the volume generated by a two-year, 24-hour storm event, if feasible.

☒ Rule Requirement Met.

The proposed infiltration basin contains and infiltrates the entire volume of the two-year, 24-hour storm event satisfying this requirement.

Rule 2.0 Conditions:

2-1. Provide BCWD with the final Civil Plan Set prior to start of construction. (BCWD 2.7.9)

2-2. The stormwater management facilities to be constructed for the project must be added to the inventory of those maintained under the May 20, 2008, programmatic maintenance agreement between the county and BCWD (BCWD Rule 2.6).

2-3. Provide documentation as to the status of a National Pollutant Discharge Elimination System stormwater permit for the project from the Minnesota Pollution Control Agency and provide the Storm Water Pollution Prevention Plan as it becomes available (BCWD Rule 2.7.15).

Rule 3.0—EROSION CONTROL

According to BCWD Rule 3.2, all persons undertaking any grading, filling, or other land-altering activities which involve movement of more than fifty (50) cubic yards of earth or removal of vegetative cover on five thousand (5,000) square feet or more of land shall submit an erosion control plan to the District, and secure a permit from the District approving the erosion control plan. The proposed project triggers the application of Rule 3.0 Erosion Control because of the movement of more than fifty cubic yards of earth and removal of vegetative cover on more than five thousand square feet of land.

☒ Rule Requirements Met with Conditions

The erosion and sediment control plan includes:

- *Silt Fence*
- *Sediment Control Logs*
- *Rip Rap Flared End Sections*
- *Temporary Seeding*
- *Erosion Control Blanket*

The following conditions must be addressed in the erosion and sediment control plan to comply with the District's requirements:

Rule 3.0 Conditions:

3-1. Provide the contact information for the erosion and sediment control responsible party during construction once a contractor is selected. Provide the District with contact information for the Erosion Control Supervisor and the construction schedule when available (BCWD 3.3.2).

Rule 4.0—LAKE, STREAM, AND WETLAND BUFFER REQUIREMENTS

According to BCWD Rule 4.2.1, Rule 4.0 applies to land that is (a) adjacent to Brown's Creek; a tributary of Brown's Creek designated as a public water pursuant to Minnesota Statutes section 103G.005, subdivision 15; a lake, as defined in these rules; a wetland one acre or larger; or a groundwater-dependent natural resource; and (b) that has been either (i) subdivided or (ii) subject to a new primary use for which a necessary rezoning, conditional use permit, special-use permit or variance has been approved on or after April 9, 2007, (for wetlands and groundwater-dependent natural resources other than public waters) or January 1, 2000 (for other waters).

☐ Rule Not Applicable to Permit. The project does not include any subdivision or use change of any land.

Rule 5.0—SHORELINE AND STREAMBANK ALTERATIONS

According to BCWD Rule 5.2, no person may disturb the natural shoreline or streambank partially or wholly below the ordinary high-water mark of a waterbody, without first securing a permit from the District and posting a financial assurance. Disturbance of a streambank wholly above the ordinary high water mark of a waterbody may require a permit under Rule 7.0. A permit will issue only on a demonstration that erosion is occurring or likely to occur.

☒ Rule Requirements Met

Rule 5.0 applies to the site because of the bridge replacement work over Brown's Creek, which will disturb the natural shoreline below the ordinary high water mark of the waterbody due to the removal of the existing bridge pier.

The BCWD engineer finds that erosion is likely to occur if the area disturbed by the pier removal is not stabilized. Due to the steepness of the slope (2:1) at this location, bioengineering is not a feasible option. Instead, riprap will be placed along the slope down to the location of the existing pier. The proposed design slope will be greater than 3:1, and so is analyzed as a retaining wall, per BCWD Rule 5.4.2.

The proposed design does not increase floodplain encroachment beyond that required by technically sound and accepted repair/reconstruction methods, thereby meeting BCWD Rule 5.5.2.

A certified as-built survey of the riprap will be required as a stipulation of permit approval per BCWD Rule 5.5.3.

Rule 6.0—WATERCOURSE AND BASIN CROSSINGS

According to Rule 6.2, no person may use the beds of any waterbody within the District for the placement of roads, highways and utilities without first securing a permit from the District.

☐ Rule Not Applicable to Permit. *The proposed bridge design places the new abutments above the ordinary high water line of Brown's Creek and, therefore, does not use the bed of the creek for placement of the bridge.*

Rule 7.0—FLOODPLAIN AND DRAINAGE ALTERATIONS

According to Rule 7.2, no person may alter or fill land below the 100-year flood elevation of any waterbody, wetland, or stormwater management basin, or place fill in a landlocked basin, without first obtaining a permit from the District. No person may alter stormwater flows at a property boundary by changing land contours, diverting or obstructing surface or channel flow, or creating a basin outlet, without first obtaining a permit from the District.

☒ Rule Requirements Met

Bridge pier removal and rip rap installation within the floodplain of Brown's Creek are alterations below the 100-year flood elevation of the creek but will result in no net fill due to the removal of the pier.

Because there are no buildings adjacent to the proposed infiltration basin, subsection 7.3.2 imposes no requirements on the project.

The addition of a culvert outlet to Johnson Pond constitutes an alteration of stormwater flow at a property boundary and requires analysis under 7.3.5. As discussed under the stormwater rule, the outlet results in lower peak water levels and a shorter duration of inundation for the pond which will decrease flood risk for upstream landowners. The new outlet will drain the pond into the proposed infiltration basin, which will retain all runoff for small storms and reduce runoff rates below pre-settlement conditions for all storms. The increase in runoff volume during the 100-year storm event (9%) will be conveyed over the golf course before reaching the creek and does not increase flood risk for any golf course structures. The velocity of this runoff is sufficiently low that it will not have an adverse effect on *channel stability of the creek, especially considering the energy dissipation that will occur over the 1,000 path to reach the creek.*

Rule 8.0—FEES

As a government entity, Washington County is exempt from permit fees.

Rule 9.0—FINANCIAL ASSURANCES

As a government entity, Washington County is exempt from financial assurances.

Rule 10.0—VARIANCES

According to BCWD Rule 10.0, the Board of Managers may hear requests for variances from the literal provisions of the rules in instances where their strict enforcement would cause undue hardship because of the circumstances unique to the property under consideration. The Board of Managers may grant variances where it is demonstrated that such action will be keeping with the spirit and intent of these rules. Variance approval may be conditioned on an applicant's preventing or mitigating adverse impacts from the activity.

The Permit Applicant has submitted a request for a variance from the following rule provisions:

1. *BCWD Rule 2.4.1(a)(i) states, "an applicant for a stormwater management permit must demonstrate to the District that the proposed land-altering activity will not: (i) Increase peak stormwater flow from the site, as compared with the pre-settlement condition, for a 24-hour precipitation event with a return frequency of two, 10 or 100 years for all points where discharges leave a site."*
2. *BCWD Rule 2.4.1(a)(iii) states, "an applicant for a stormwater management permit must demonstrate to the District that the proposed land-altering activity will not: (iii) At the downgradient property boundary or to an onsite receiving waterbody or wetland, increase annual phosphorus loading as compared with the pre-development condition."*
3. *BCWD Rule 2.4.2(a) states, "an applicant must… provide retention of larger of the following:*
    (i) 100 percent of the required volume per 2.4.1(a)(ii) from the net additional impervious surface; or
    (ii) 50 percent of the required volume per 2.4.1(a)(ii) from all new and reconstructed impervious surfaces."

These three rule provisions will be discussed together for each discharge point.

The applicant asserts the following constitute an undue hardship, supporting its variance application.

- Limited right-of-way restricting the available opportunities for stormwater management
- Discharge points that go directly from the road surface to the receiving water body
- A need for improved pedestrian safety at the bridge crossing

Although the volume control criterion applies at each site discharge point, the applicant examined the impact of the increase in volume on creek temperature collectively for all discharge points draining to Brown's Creek to support a determination that the variance from the BCWD volume standard does not significantly negatively affect the creek. The applicant considered the impact of increased impervious surface on creek temperature, due to the increased runoff volume from the net new impervious surface. The applicant's engineers used a conservative approach to estimate the increase in temperature by weighting the runoff temperature with the volume of runoff relative to the flow volume and temperature of the creek. For a 2-year storm, the runoff volume from the new impervious draining to the creek is 0.006% of the flow within the creek. If the runoff temperature from this impervious is assumed to be 22.5° C (the maximum observed runoff temperature from impervious draining to the rock crib project at Brown's Creek Park) and the creek temperature is assumed to be 18° C (the minimum threat level for trout), then the creek temperature under proposed conditions would increase from 18°C to 18.003°C. This indicates that the project does not have a measurable impact on creek temperature. Individual volume control shortfalls will be discussed further for each discharge point.

Discharge Point A

The runoff rate into the offsite depression increases by 0.7 cfs and by 1.1 cfs for the 2 and 10-year storm events, respectively, due to the proposed new trail. The volume control shortfall at this discharge point is 4,124 CF. Phosphorus loading increases by 0.2 lbs from pre-development conditions.

There are minimal opportunities for rate control for this discharge point as the trail drains off site directly down a slope into this depression. The peak flow velocities down this slope are sufficiently low that they won't cause erosion. Changes to the culvert draining this depression result in lower high water levels for all storm events, providing improved flood protection for the adjacent homes. The increased flow volume from this discharge point drains back onsite to Pond PE-3 which will be discussed under discharge point C. Since the increased flow volume drains back onto the site and high water levels in the offsite depression are reduced, the increase in flow volume doesn't cause any adverse impacts. Likewise, the additional phosphorus loading from this discharge point is retained in discharge point C which meets the phosphorus loading requirement. The offsite depression does not have standing water that would be negatively impacted by the increase in phosphorus loading.

The applicant considered the following alternatives as options for meeting the rate, volume control, and phosphorus loading requirements.

- Increase the live storage of Pond DW-3 – This option would require substantial clearing and grubbing, including grading on properties outside the right-of-way, and would not provide any volume control.

Discharge Point C

The runoff rate for the 100-year event increases by 0.2 cfs. The volume control shortfall at this discharge point is 138 CF. The phosphorus loading criterion is met.

The 100-year HWL for Pond PE-3 does not change from pre-settlement to proposed conditions, indicating that the 0.2 cfs increase in rate is a computational rounding change, not a real, observable increase in runoff rate. Discharge from Pond PE-3 has a flow path of 2,200 feet, through golf course vegetation before reaching Brown's Creek. The peak velocity of 1.1 ft/sec does not pose a risk of erosion due to the grasses on the golf course stabilizing the soil (vegetated surfaces can withstand velocities up to roughly 6 ft/sec). There is no discharge from the pond for the 2 or 10-year storm events. Therefore, providing the required volume control would only reduce runoff volumes during storm events larger than the 10-year event. Since the volume control standard is determined for the 2-year event, the storage provided by Pond PE-3 meets the intent of the rule by retaining the entire runoff volume from the 2-year event onsite.

The applicant considered the following alternatives as options for meeting the rate and volume control requirements.

- Increase the live storage of Pond PE-3 – This option would require substantial clearing and grubbing which would cause greater negative impacts than the 0.2 cfs increase in rate.

Discharge Point D

The runoff rate increases by 4.3, 4.6, and 4.9 cfs for the 2, 10, and 100-year events, respectively, at this discharge point. The volume control shortfall at this discharge point is 4,586 CF. Phosphorus loading increases by 1.0 lbs from pre-development conditions.

The increases in flow rate, volume, and phosphorus loading are due to the location of the discharge point upstream of Johnson Pond, which provides treatment. Since the pond is located on city property, it is downstream of the discharge point. However, the city has provided authorization to Washington County to continue to use the pond for stormwater treatment. The new outlet for Johnson Pond functions to lower high-water levels, protecting the adjacent homes from the potential harm (increased risk of flooding) potentially caused by the failure to meet the volume control requirement. The 3% increase in phosphorus loading to the pond may result in lowered water quality. While this pond was built to treat stormwater, it is also a Manage 1 wetland. The Manage 1 wetland classification is due to high stormwater sensitivity and medium vegetative diversity. The lowered water quality in this wetland may decrease the value of the vegetative diversity in this wetland. Discharge from the pond flows into the proposed infiltration basin which provides treatment meeting rate, volume, and phosphorus loading requirements at discharge point E.

The applicant considered the following alternatives as options for meeting the rate, volume control, and phosphorus loading requirements.

- Increase the live storage of Pond P-1 – This option would require substantial clearing and grubbing, including grading on properties outside the right-of-way, and would not provide any volume control.

Discharge Point F

The runoff rate increases by 1.4 cfs for the 100-year storm event at this discharge point. The volume control shortfall at this discharge point is 82 CF. The phosphorus loading criterion is met.

The runoff rate increase is due to disturbed areas on the road shoulder being modeled with pre-settlement curve numbers (HSG B soils, 57) under pre-settlement conditions and modeled with grass land cover and one soil type higher to represent compaction (HSG C soils, 74). These soils are likely already compacted from when the road was built, so runoff rates are not expected to be greater than existing conditions. However, the rate control standard is pre-settlement conditions and the proposed 100-year rate represents a 7% increase in peak rate from pre-settlement conditions. Bank erosion has not been identified at this location during past stream assessments.

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The required volume represents 0.005% of total flow in Brown's Creek for the 2-year storm. The design includes "micro-grading" in this area which promotes slight pooling of water within the ditch to increase infiltration. Although not modeled, this design will provide a small amount of volume control to offset the shortfall from required volume control. The potential harm from increased runoff volume is that Brown's Creek flows at bankfull conditions for a longer period of time during the 2-year storm, resulting in more risk of erosion of streambanks. The 0.005% increase in flow is unlikely to cause a measurable change in time at bankfull conditions by itself, but in combination with other projects increasing runoff to the creek, may have a cumulative negative impact on stream stability.

The applicant considered the following alternatives as options for meeting the rate and volume control requirements.

- Constructing a volume control facility (infiltration basin) within right-of-way – This option would require substantial clearing and grubbing down the slope toward Brown's Creek. This disturbance would pose a risk of erosion and sediment deposition within the creek and reduce shading of the creek provided by mature trees in this area.

Discharge Point G

The runoff rate increases by 0.4, 0.6, and 0.7 cfs for the 2, 10, and 100-year storm events, respectively, at this discharge point. The volume control shortfall at this discharge point is 1,506 CF. Phosphorus loading increases by 0.2 lbs from pre-development conditions.

Flow from this discharge point does not immediately enter Brown's Creek, but instead flows through a densely wooded lot before reaching the creek. While this lot will provide significant treatment, reducing runoff rates and removing particulate phosphorus, since it is outside of the applicant's control, it can't be assumed that it will always remain in the current wooded condition.

The required volume represents 0.08% of total flow in Brown's Creek for the 2-year storm. The design includes "micro-grading" in this area which promotes slight pooling of water within the ditch to increase infiltration. Although not modeled, this design will provide a small amount of volume control to offset the shortfall from required volume control. The potential harm from increased runoff volume is that Brown's Creek flows at bankfull conditions for a longer period of time during the 2-year storm, resulting in more risk of erosion of streambanks. The 0.08% increase in flow is unlikely to cause a measurable change in time at bankfull conditions by itself, but in combination with other projects increasing runoff to the creek, may have a cumulative negative impact on stream stability.

While overtreating from one discharge point does not make up for a shortfall at another (i.e., the water-quality criterion is not applied on a site-aggregate basis), the increase in phosphorus loading for this discharge point is balanced out by the reduction in phosphorus loading at discharge point F. The total phosphorus loading to Brown's Creek from the project is unchanged from pre-development to proposed conditions.

The applicant considered the following alternatives as options for meeting the rate, volume control, and phosphorus loading requirements.

- Underground storage – This option would require extensive earthwork, along with clearing of tree cover.
- Downsizing culvert – This option could increase ponding depths causing additional sheet flow onto the adjacent property and wasn't pursued further.
- Porous pavement for new trail – This option would have minimal impact on reducing runoff rates, which are primarily due to the widened bridge.
- Constructing a volume control facility (infiltration basin) within right-of-way – This option would require substantial clearing and grubbing due to the elevations within the right-of-way being significantly lower than the roadway elevation. To tie in to existing elevations, clearing and grubbing would have to occur down the slope toward the creek on private property. This disturbance would pose a risk of erosion and sediment deposition within the creek and reduce shading provided by mature trees in this area.

Discharge Point H

The runoff rate increases by 0.2, 0,4, and 0.5 cfs for the 2, 10, and 100-year storm events, respectively, at this discharge point. The volume control shortfall at this discharge point is 100 CF. The phosphorus loading criterion is met.

Increases in runoff rate and required volume control are due to a small portion of reconstructed impervious surface, which is modeled using pre-settlement curve numbers. Flow from this discharge point does not immediately enter Brown's Creek, but instead flows through a densely wooded lot before reaching the creek. While this lot will provide significant rate attenuation, since it is outside of the applicant's control, it can't be assumed that it will always remain in the current wooded condition.

As discussed above under discharge points F and G, the required volume control represents a very small percentage (0.005%) of total flow within the creek, but may have a negative effect on stream stability in combination with increases from other projects. For this discharge point, runoff volume will be less than existing conditions due to a reduction in total impervious surface, but would not be reduced down to pre-settlement conditions to improve any existing stream stability issues.

The applicant considered the following alternatives as options for meeting the rate and volume control requirements.

- Minor grading to create a ditch within the right-of-way – This option would require substantial clearing and grubbing and reduce shading provided by mature trees in this area.
- Porous pavement for new trail – This option would have expensive maintenance that outweighs the benefits provided in rate reduction.
- Constructing a volume control facility (infiltration basin) within right-of-way – This option would require substantial clearing and grubbing onto private property and reduce shading provided by mature trees in this area.

Discharge Point I

The runoff rate increases by 0.2, 0,3, and 0.4 cfs for the 2, 10, and 100-year storm events, respectively, at this discharge point. The volume control shortfall at this discharge point is 44 CF. The phosphorus loading criterion is met.

Increases in runoff rate and required volume control are due to a small portion of reconstructed impervious surface, which is modeled using pre-settlement curve numbers. Flow from this discharge point does not immediately enter Brown's Creek, but instead flows through a densely wooded lot before reaching the creek. While this lot will provide significant rate attenuation, since it is outside of the applicant's control, it can't be assumed that it will always remain in the current wooded condition.

As discussed above under discharge points F and G, the required volume control represents a very small percentage (0.002%) of total flow within the creek, but may have a negative effect on stream stability in combination with increases from other projects. For this discharge point, runoff volume will be less than existing conditions due to a reduction in total impervious surface, but would not be reduced down to pre-settlement conditions to improve any existing stream stability issues.

The applicant considered the following alternatives as options for meeting the rate and volume control requirements.

- Constructing a volume control facility (infiltration basin) within right-of-way – This option would require substantial clearing and grubbing onto private property and reduce shading provided by mature trees in this area.

The BCWD engineer finds that sufficient evidence has been provided to support the board's grant of the requested variances for all the above-mentioned discharge points.

RECOMMENDED CONDITIONS OF THE PERMIT:

The following is a summary of the remaining tasks necessary to bring the project into compliance with the BCWD Rules in all respects other than where variances are requested as discussed above:

1. Address all stormwater management requirements (Conditions 2-1 to 2-3).
2. Address all erosion control requirements (Condition 3-1).

STIPULATIONS OF APPROVAL:

1. Note that the permit, if issued, will require that the applicant notify the District in writing at least three business days prior to commencing land disturbance. (BCWD Rule 3.3.1)
2. To ensure that construction is carried out according to the approved plan, provide verification that construction standards have been met for all infiltration basins and pretreatment swales. This includes but is not limited to confirmation that infiltration basin sub-cut reaches soil material reflected in the geotechnical report and that the vegetation establishment procedures have been followed per the landscaping/restoration plan. This can be achieved by scheduling a BCWD inspection during the excavation of the basins, independent geotechnical engineer observation and note of confirmation, or well-documented photographic evidence by the onsite engineer along with collected survey elevations of the basins.
3. Provide the District with As-built record drawings showing that the completed grading and stormwater facilities conform to the grading plan.
4. Provide a certificate of survey prepared by a registered land surveyor locating the finished wall (riprap). (BCWD Rule 5.5.3)