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City of Bloomington

RE: IDS 271 Jefferson Highschool Stadium Improvements
Wold Architects
Project No.: 0V1.130612

STORMWATER MANAGEMENT MEMO

Project Overview/Background

ISD 271 proposes to construct new bleachers, walkways, outbuildings, and significant site regrading in the vicinity of the existing football field and track at Jefferson High School. Additionally, the artificial turf carpet is proposed to be replaced with no disturbance to the aggregate base. These improvements result in approximately 0.736 acres of new or reconstructed impervious area and approximately 4.15 acres of disturbance, requiring approval from the City of Bloomington as well as an NPDES Construction Stormwater Permit.

The site is located outside of the HVRA and Steep Slopes overlays indicated on the LMWRWD online GIS portal. As such, the site was designed to meet the requirements laid out in Section 4 of the City's Comprehensive Stormwater Management Plan for redevelopments.

- Surface Water Discharge Rates
    - Surface-water discharge rates from redevelopments that disturb land area greater than 50 cubic yards or 5,000 square feet must, at a minimum, achieve a net reduction of pre-project discharge rates for the 50-percent, 10-percent, and 1-percent annual-chance events.
    - New storm sewer systems must be designed to accommodate discharge rates for the 10-percent annual-chance event.
- Surface Water Discharge Volume
    - Surface-water discharge volumes from redevelopment sites that disturb land area less than 50 cubic yards or 5,000 square feet must be reviewed by the City engineer if the development will result in (a) volume increases for the 50-percent, 10-percent, and 1-percent annual-chance event.
- Volume retention
    - Sites that disturb land area more than 50 cubic yards or 5,000 square feet of new and/or fully reconstructed impervious surface shall capture and retain on-site a volume equivalent to 1.1 inches of runoff from the new and/or fully reconstructed impervious area.

- Where infiltration or filtration facilities, practices or systems are proposed, pretreatment of runoff must be provided.
- Drawdown of water levels in infiltration facilities must be achieved within 48 hours.
- Where the City engineer concurs that an applicant has demonstrated that volume retention cannot practicably be met, the applicant must provide water discharge rate control and volume as described above, and volume retention and water quality protection in accordance with the following priority sequence:
    - Retention of at least 0.55 inches of runoff from the new and/or fully reconstructed impervious surface.
    - Retention of runoff onsite to the maximum extent practicable.
    - Other options at the discretion of the City engineer.

- Flood Protection
    - New on-site stormwater detention shall be designed to accommodate the 1-percent annual-chance event.
    - The City requires a minimum of two feet of freeboard elevation between the low- floor elevation and the water-surface elevation resulting from the 1-percent annual- chance event.
- Water Quality
    - For projects that disturb land area greater than 50 cubic yards or 5,000 square feet or subdivide a parcel into three or more residential lots, all stormwater runoff from disturbed areas shall be treated to at least 60-percent annual-removal efficiency for TP and at least 90-percent annual-removal efficiency for TSS.
- Exceptions
    - Trails and sidewalks that do not exceed 10 feet in width and are bordered down gradient by a pervious buffer of at least half the trail width are exempt from meeting water quality requirements.

It should be noted that D soils have been identified on site, severely limiting the ability to treat runoff on site through infiltration. As such, filtration devices are proposed to be used to meet the City's requirements to the greatest extent possible.

Table 1. Summary of Disturbed Area

Disturbed Areas	Unit	Area
Total Disturbance Area	AC	4.15
Existing Impervious	AC	0.00
Proposed/Reconstructed Impervious	AC	0.736
Exempt Trail/Sidewalk Impervious	AC	0.024
Total Proposed Impervious Area Requiring Treatment	AC	0.712
Required Water Quality Volume (1.1" over impervious)	CUFT	2,843

Rate control and water quality treatment for the site are proposed utilizing an underground filtration system and a rain garden. Additionally, an advanced filtration device is proposed to meet the phosphorus and TSS removal requirements to the greatest extent possible.

Hydrologic and Hydraulic Modeling

HydroCAD was used to analyze the existing and proposed conditions for the proposed stadium improvements. HydroCAD utilizes SCS TR-20 methodologies to hydrodynamically route stormwater through the drainage system. The 50-, 10-, and 1- percent events were based on the NOAA Atlas 14 rainfall data from MSP International Airport and MSE Type 3 24-hour rainfall nested distribution. The corresponding depths for the 50-, 10-, and 1- percent events are 2.83 in, 4.24 in, and 7.50 in, respectively.

Water quality modeling for just the playground site was completed using the MPCA MIDS Calculator. MIDS estimates the stormwater runoff volume reductions for various low impact development (LID) best management practices (BMPs) based on the MIDS performance goal (1.1 inches of runoff over impervious surfaces per LMRWD's rules) and annual pollutant load reductions for total phosphorus (TP) and total suspended solids (TSS).

The results for the hydrologic, hydraulic and water quality models have been provided for review.

Existing Conditions

The site is located at the southwest corner of the school at the intersection of Heritage Hills Drive and Johnson Avenue S. Soils on site a primarily lean clay, hydrological soil group (HSG) D soils, which has minimal infiltration ability. The stadium area currently consists of the artificial turf and rubberized track, with grassed hill slope surrounding the field. The subgrade of the track and field is composed of at least 2 feet of sand overlaid by approximately 8 inches of rock with an estimated 30% void space in the media. A draintile system is located beneath the track and field that conveys water into the existing storm sewer line to the west of the track.

The onsite storm sewer conveys all drainage from the stadium area to one outlet, a manhole at the southwest corner of the site along Heritage Hills Drive. See Figure 1 for the project's existing conditions.

Proposed Conditions

Proposed BMP locations were assessed within the proposed disturbance area, which is located in the general vicinity of the existing football field. The proposed bleachers and pathways will be located on the east and west edges of the track. Proposed trails will be located around the site, and a concession building is proposed at the northwest corner of the field area. No alteration to the track or football field is proposed with the exception of turf carpet replacement.

Rate control and water quality treatment on the site will be accomplished using four BMPs, two underground filtration systems on the western half of the site, a rain garden located to the east of the track, and an advanced treatment device located near the outlet to the city storm sewer. See Figure 2 for proposed conditions. Additionally, the proposed site regrading will reduce the slope across most of the site to approximately 10:1.

The proposed BMPs were sized to meet the city's water quality volume to the greatest extent feasible or to meet the city's 1.1-inch requirement for all impervious that flows into a BMP. Soils within the project limits are HSG D, which highly limits their infiltration capacity. Table 2 shows the design details for each of the proposed BMPs.

Table 2 – BMP Sizing Summary

BMP	Total Inflow Area (sqft)	Total Impervious Inflow Area (sqft)	New/ Reconstructed Impervious (sqft)	Required Water Quality Volume (cuft)	Provided Water Quality Volume (cuft)
Underground Filtration 9P	3,000	3,000	3,000	275	377
Rain Garden 10P	46,024	6,278	6,278	576	1,937
Underground Filtration 11P	45,883	19,063	19,063	1,747	2,388
Advanced Filter Device 12P*					0
Untreated			2,674	0	0
Overall Site			31,015	2,843	4,702

*- Device 12-P will be placed at the outlet of Device 11-P.

It should be noted that 12P filters all flows below 0.09 CFS out of the proposed underground filtration system. Based on the proposed conditions HydroCAD model a volume of 0.025 acre-feet that will be routed through the filter on a 1.1-inch rainfall event, which equates to 1,089 cubic feet of filtered volume.

Untreated areas consist primarily of pathways located around the track and field that cannot be routed to a proposed BMP without reconstruction of the track and trunk sewer lines. In order to compensate for these areas that cannot be captured, other BMPs have been oversized to provide compensatory treatment and rate control.

Rate Control

City rules require that rate control be provided for the 50-percent, 10-percent, and 1-percent annual-chance event. As shown in Table 1, rate control is being met for the site as a whole, and for all events except the 100-year to Outlet O1. The expected increase of 0.14 CFS on the 100-year event is related to the diversion of drainage area from O2 to O1, and is expected to have a negligible impact on compared to existing conditions.

Table 3: Rate Control Summary

	2-year		10-year		100-year	
	Existing [CFS]	Proposed [CFS]	Existing [CFS]	Proposed [CFS]	Existing [CFS]	Proposed [CFS]
Outlet O1 – To Heritage Hills	8.63	8.56	15.86	15.67	32.05	32.19
Outlet O2 - East	0.18	0	0.36	0	0.79	0
TOTAL -	8.81	8.56	16.22	15.67	32.84	32.19

Outlet O2 to the east consists of an existing culvert and draintile network. No work is planned in this area except hillslope grading associated with the rain garden (BMP 10-P), which will divert some area that currently drains east towards Outlet O1. Flows to Outlet 2 were analyzed to ensure consistency between the total areas modeled in the existing and proposed conditions.

Volume Control

The City requires that 1.1" of stormwater runoff from new impervious surface be infiltrated or abstracted. HSG D soils were identified on site, precluding infiltration as a BMP. As such, the required retention is 0.55" or to the maximum extent practicable. In order to maximize volume retention to the maximum extent practicable, the proposed filtration BMPs will be unlined to maximize infiltration. To maximize retention, 0.24' of media beneath the underdrains is proposed to allow for the system to drain within 48 hours. The retention volume stated in table 4 consists solely of the volume beneath the underdrain. The features have been oversized to provide adequate rate control.

Table 4: Volume Control Summary

WQV Summary	Units	Total
Proposed New Impervious (ac)	AC	0.736
Required Treatment	IN	1.1
Exempt Trail/Sidewalk Impervious	AC	0.024
Required Retention Volume (cu-ft)	CF	2,843
Provided Water Quality Volume (cu-ft)	**CF**	**4,702**
Provided Retention Volume (cu-ft)	**CF**	**696**

Water Quality

Water quality treatment is being provided by an underground filtration system and a rain garden. A theoretical model was completed that assumed 100% of runoff from non-exempt impervious areas could be infiltrated on site. The removals provided by the proposed BMPs for all contributing areas were then assessed against the theoretical model to determine compliance with the City's requirements. Four BMPs are proposed to be implemented to meet the city's rule; two underground filtration basins, a rain garden, and an advanced filtration device (Upflo, Jellyfish, or approved equal).

As shown in Table 3, the TSS and TP are being reduced to by approximately 117% and 87% respectively compared to a theoretical infiltration basin.

Table 5: Water Quality Summary

	Contributing Area	TSS Load	TSS Reduction	TSS % Reduction	TP Load	TP Reduction	TP % Reduction
	acres	lbs	lbs	%	lbs	lbs	%
Theoretical Model	0.712	233.13	233.13	94	1.2833	1.2833	100
Proposed BMPs							
Underground Filtration (9-P)	0.069	22.59	16.94	75	0.1244	0.028	22

	Contributing Area	TSS Load	TSS Reduction	TSS % Reduction	TP Load	TP Reduction	TP % Reduction
	acres	lbs	lbs	%	lbs	lbs	%
Underground Filtration (11-P)	0.438	143.41	129.07	90	0.7894	0.4086	56
Advanced Filtration Device (12-P)	0.438*	19.65*	15.72	80	0.7841*	0.2379	40
Rain Garden (13-P)	1.056	133.31	111.53	84	0.7338	0.4456	58
Total	1.651	318.96	273.26	86	2.4317	1.1201	46
% of Theoretical Model Achieved				117			87

*- Device 12-P will be placed at the outlet of Device 11-P and receives no additional drainage area. The associated loads are the outflows from 11-P as modeled in MIDS.

The advanced filter device will be sized to filter 100% of the runoff from a 1.1-inch precipitation event from the outflow of the underground filtration system (11-P). The theoretical and proposed BMP MIDS model outputs have been attached for reference.

Chloride Management

The proposed project is a previous playground area, therefore there are no plans for additional salt application. Other impervious areas will be managed under the schools existing chloride management plan.

Please reach out if you have any questions or concerns.

Sincerely,

Bolton & Menk, Inc.

Paul A. Strong

Paul Strong
Water Resources Project Engineer

Attachments:

1. Existing Drainage Conditions Map
2. Proposed Drainage Conditions Map
3. HydroCAD model results (existing and proposed)
4. MIDS model results (existing and proposed)