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Technical Memorandum

To: Board of Managers and Interim Administrator Jeffery
From: Barr Engineering Co. (Joel Swenson, PE; Jennifer Koehler, PE; Evan Christianson, PG, Brent Theroux, PE, and Scott Sobiech, PE)
Subject: Comment Resolution for the Technical Review of Noble Hills Stability and Interior Hydrology Analyses
Date: August 10, 2021
Project: 23270053.14 PRMT 0267

At the June 2, 2021 meeting the Riley Purgatory Bluff Creek Watershed District (RPBCWD) considered permit number 2021-012 for the Noble Hills development in Eden Prairie. During the discussion of the permit, the managers expressed the following concerns and need for additional information to make informed decisions to protect the water resources on the site (Riley Creek and an exceptional value wetland):

- Stability of the steep slopes,
- The effects of land disturbing activities, stormwater management, and vegetation removal/restoration on erosion potential along the proposed slopes,
- The potential for ground water seeps or springs along the steep slopes on the site,
- The potential for stormwater pollutants such as chloride to migrate toward the water resources.

As a result, the board extended the permit review timeline by 60 days consistent with Minnesota Statutes section 15.99 to allow time for additional information to be provided and considered by the board.

Following the June Board meeting, Barr Engineering Co. (Barr) convened a group of geotechnical engineers with experience in slope failures along the Minnesota River valley, a hydrogeologist, and a landscape architect in a brainstorming session to strategize the potential scope to identify site risks and analysis methods to answer the questions raised at the board meeting. The hydrogeologist reminded the group that the RPBCWD's 2017 surface water and groundwater study included a very high-level assessment of slope stability concerns throughout the district. That analysis identified risks with infiltrating stormwater near the slopes along Riley Creek in that the sandy site soils are highly erodible. During the scoping discussion the group identified the following items to consider as part of the slope stability analysis:

- Stormwater management and erosion protection are critical elements to the overall stability of the proposed slopes,
- Internal stormwater routing and overflows from the infiltration basins should be assessed for events that may exceed the typical design capacities of storm sewer systems and result in surface flows over the face of the regraded slopes,

- Based on the sandy soils identified in the borings, existing vegetated slopes at 2H:1V or less steep are likely stable because such slope angles are presumably less than the angle of repose of sand,
- Concentrated infiltration can change groundwater pathways and/or create new seeps along the slopes. Depending on site grading changes, new seeps could weaken slopes, cause erosion along the slopes, and lead to slope failures.
- Removal of vegetation during site grading exposes the underlying sands to significant erosion susceptibility. Therefore, project staging, stormwater management, and erosion management measures are essential,

Barr's recommended scope of work to aid in addressing the managers' concerns was presented to the City of Eden Prairie and the applicant on June 23rd. The applicant subsequently worked with their consultants (Braun Intertec and Alliant Engineering) to develop a slope stability analysis and analyze the interior drainage and erosion potential within the proposed Noble Hills development. The purpose of this memo is to summarize Barr's review of the technical information submitted. The assessment consisted of reviewing the following materials:

1. Geotechnical Evaluation, Noble Hill Development Stability and Seepage Analyses prepared by Braun Intertec, dated July 22, 2021 (revised August 2, 2021, August 5, 2021 and August 10, 2021).
2. Noble Hill Additional Hydrologic/Hydraulic Analysis prepared by Alliant Engineering, Inc., dated July 22, 2021 (revised August 2, 2021).
3. Noble Hill Final Plat and Land Alteration Plan Set, prepared by Alliant Engineering, dated July 21, 2021 (revised August 2, 2021 and August 6, 2021)
4. HydroCAD models on the interior drainage system received July 22, 2021 (revised model output received August 2, 2021).
5. Noble Hill, Eden Prairie, MN, Final Plat and Land Alteration Plan Set, prepared by Alliant Engineering, Inc., dated May 20, 2021.
6. Noble Hill Storm Water Management Study, Eden Prairie, MN, prepared by Alliant Engineering, Inc., dated May 20, 2021.
7. Noble Hill Development/Standal Property Memorandum of Field Review Observations of Riley Purgatory Bluff Creek Watershed Possible Mapped Stream Locations, prepared by Alliant Engineering, Inc., dated May 3, 2021.
8. Geotechnical Evaluation Report, Standal Property, Spring Road and June Grass Lane, Eden Prairie, MN, prepared by Braun Intertec, dated October 10, 2019 (B1909967).
9. Supplemental Soil Borings, the Overlook Residential Development, prepared by Braun Intertec, dated March 5, 2020 (B1909967.00).
10. Engineering Evaluation, Noble Hill Residential Development, prepared by Braun Intertec, dated May 26, 2021 (B1909967.01).

Summary of Findings

In general, Barr concurs with the approach and findings presented in Braun Intertec's Stability and Seepage Analysis and Alliant Engineering's Additional Hydrologic/Hydraulic Analysis. Below is a list of key findings from the submitted analyses:

1. Field Observations
    a. While no seeps and springs were observed on the property during the applicant's consultant site review, the area has received below normal precipitation which can directly impact the presence/absence of seeps.
    b. Soil borings show that soils in the project area are primarily silty sand with subsurface soils of mainly poorly graded sand.
    c. Soil borings and piezometer readings generally place groundwater at or below elevation 745 feet on the west side of the proposed development and less than 775 feet at boring ST-14.
2. Stability and Seepage analyzed existing, proposed, and hypothetical toe erosion slope scenarios while considering:
    a. normal and high-water levels in the creek and wetland
    b. dry and high-water level conditions in the infiltration basins
    c. continuous recharge in the infiltration basins
3. Stability and Seepage Results:
    a. The transient seepage analysis results indicate that saturated conditions do not develop between the bottom of the basins and the normal phreatic groundwater surface during scenarios of high basin water levels or continuous basin infiltration. The results indicate no significant water table mounding as a result of the infiltration basins. Therefore any impacts to groundwater flow resulting from infiltrating basins are expected to be negligible.
    b. The stability analysis revealed the proposed graded slopes result in factors of safety (FOS) against slope failure greater than 1.5. Note that a FOS of 1.0 is on the verge of failure and the higher the number, the more stable the slope is estimated to be. Typical design standards by USACE would look for FOS of 1.4 or greater in drained, sandy conditions (such as this site).
    c. The stability analysis showed the current FOS is less than 1.5 for existing natural slopes outside the construction limits when considering high water levels in Riley Creek. The FOS for these slopes under the high water scenario do not change when incorporating the developed slopes and infiltration from the basins.
    d. The stability results indicate an apparent slight decrease in FOS from existing (see Fig. A.3 with FOS = 1.5) to proposed (see Fig. A.12 with FOS = 1.4). However, Fig. A.12 represents

dry basin conditions and the slope segment in question is outside of the construction limits.

e. The stability and associated drainage systems of the proposed retaining walls could not be reviewed because the walls have not been fully designed. However, the City of Eden Prairie requires that all retaining walls over 4 feet high be designed and certified by a professional engineer as part of their approval process.

4. Interior surface flow conditions considered:
    a. Full project build-out,
    b. An interim condition with sparse vegetation,
    c. Conditions with reduce catch basin/out capacity in efforts to enhance the proposed designs resiliency to erosion.
    d. Atlas 14 rainfall depths (current climate conditions) and projected mid-century rainfall estimates (to assess climate resiliency):
        i. 1-year (2.50”),
        ii. 2-year (2.87”),
        iii. 10-year (4.27”),
        iv. 100-year (7.41”),
        v. 500-year (10.40”),
        vi. projected 10-year mid-21st century (6.6”)
        vii. projected 100-year mid-21st century (10.2”).
5. Interior drainage analysis summary:
    a. The applicant incorporated the following erosion control measure during construction:
        i. Adding biorolls along the emergency overflow (EOF) path to further attenuate the potential for erosion.
        ii. Post grading silt fence on the slope above and below the proposed retaining wall,
        iii. Silt fence J-hooks to prevent gully erosion along silt fence perimeter,
        iv. On grade piping of skimmers to the lower sediment basin to allow for no overland flow on steep slopes of skimming discharge,
        v. Adding flocculant to interim sedimentation basins in the event the sediment is not settling out sufficiently.
    b. The full-build-out interior drainage analysis revealed the potential for runoff to spill over the emergency overflows if catch basins plug or during extremely large storm events (e.g., 500-year event). This has the potential to produce erosive surface flow velocities to exceeding 14 feet per second (fps). To mitigate against the erosive flow velocities,
        i. The plans were revised to show Enkamat R45, a permanent turf reinforcing mat (TRM) on the emergency overflow swales between homes, within drainage and utility easements. The TRM is capable of withstanding velocities of 30 fps for 60 minutes and 14 fps for 50 hours when fully-vegetated. In an unvegetated condition the Enkamat R45 (TRM) is capable of withstanding velocities of 16 fps

for 60 minutes, thus providing erosion protection prior to vegetation establishment.

ii. Grading was revised to prevent uncontrolled overflows for the 500-year event

iii. Additional catch basin capacity was added at the low points.

6. The proposed stormwater management system does provide for stormwater pollutant removals of phosphorus and total suspended solids meeting RPBCWD regulatory requirements.
7. Chloride use within the development site will be managed by the City of Eden Prairie and only applied in accordance with the approved chloride management plan.

While Barr concurs with the general findings of the analysis, Table 1 and Table 2 summarize several comments based on the July 22nd submittals that the applicant's consultants have worked on addressing with subsequent submittals to increase the level of certainty in the modeling results presented in the technical memos and the overall resiliency of the proposed development. Barr discussed many of these items with the applicant's consultants during virtual meetings or calls on July 28th, 29th, August 3rd, and August 6th. Subsequent submittals have addressed the comments.

Table 1 Comments relate to slope seepage and stability analysis

Comment	Likelihood of significantly impacting outcome	Comment Resolution
Rerun stability analyses with expanded entry limits to verify the minimum factor of safety values were identified. If certain slope stability runs were completed to highlight scenarios, then that should be noted. It is standard practice to analyze and present the lowest factor of safety for a slope configuration. Please provide results.	Low	**Comment satisfied**. Results were provided with expanded entry-exit limits.
Optimized slip surfaces were presented, and several failure surfaces were concave. Please provide justification for presenting optimized failure surfaces with concave failure geometry.	Low	**Comment satisfied**. Affected analyses along section B-B show FOS well in excess of 1.5.
Include a list of assumed boundary conditions for seepage models. What is/are the references for these boundary conditions?	Low	**Comment satisfied.** Results now indicate water elevation boundary conditions at the wetland.
Seepage results do not depict head contours, so it is not possible to assess how seepage flows through soil. This is particularly relevant for transient analysis where two constant head water boundaries are incorporated. Please provide head contours.	Low	**Comment satisfied**. Head contours were included on flow nets.

There is not enough data to support blanket assumption that groundwater levels are steady given that very little precipitation (drought conditions) has occurred over of the course of this study. Please comment.	Low	**Comment satisfied**. Additional discussion was added to explain rationale for assumed groundwater levels.
Reference to groundwater rising near the toe was made in the document. However, there's no mention in the document if any seeps were simulated. Plot and comment on exit gradients and flux due to seepage. Were any critical exit gradients identified from the analysis?	Moderate	**Comment satisfied**. Exit gradients were evaluated, including no exit gradient greater than 0.5 was calculated. No explicit discussion of seeps daylighting on slopes. However, several flow nets show the phreatic surface daylighting above water levels in the wetland, both in Existing Conditions and Pond scenarios, which implies seepage may daylight on slopes independent of pond performance.
What are the stability impacts if segments of the slope are removed due to erosion? How does the factor of safety (slope stability and exit gradients) change?	Moderate-Plans modified to reduce erosion potential	**Comment satisfied**. Included case with assumed erosion to 2H:1V slope.
It is not clear which stability case results are from which seepage analysis. Please clarify.	Low	**Comment satisfied**. Tables 6 and 7 were added to Braun's report.
Was slope stability calculated for each time-step of the transient seepage analysis? If so, clarify and explain in the report. If not, provide more discussion of the transient seepage analysis.	Low	**Comment satisfied**. Braun provided the slope stability and transient seepage timestep information.
Neither of the upgradient borings or piezometers extended to groundwater (ST-12 and ST-14). So, groundwater elevations in the eastern areas of the site are unknown. Please comment on model boundary conditions.	Low	**Comment satisfied**. Additional discussion was added to explain rationale for assumed groundwater levels.

Table 2 Comments relate to hydrologic/hydraulic analysis

Comment	Likelihood of significantly impacting outcome	Comment Resolution
Typical retaining wall section with swale does not show TRM along swale and shows	Low	**Comment satisfied**.

Comment	Likelihood of significantly impacting outcome	Comment Resolution
channel 0.95 deep. Other TRM swale detail shows swale to be 0.5 feet deep and 6 ft at top width. The plans should be revised to reflect a TRM swale with the modeled dimensions to fully accommodate the 500-year flow depths – if swale will vary in dimension, the plans should have several sections showing swale details.		Typical swale sections included in plans updated to match dimensions in H&H models and includes TRM callouts. TRM called out in plans along emergency overflow routes.
The HydroCAD model suggest that the catch basins modeled at the low points on Madelynn and Osprey are overestimating the flow area (3.74 SF) available for a R-3067-V grate (2.4 SF) – model should be updated to reflect R-3067-V flow area for each catch basin or design should be modified to provide higher capacity inlets or more inlets (and model updated appropriately.	Low	**Comment satisfied**. Model was updated to match available for a R-3067-V grate (2.4 SF) and performed accordingly to contain the 100-year storm event within each low point without utilizing the EOF during full buildout (unplugged) conditions. EOF swales include TRM stabilization to accommodate estimated overflows/velocities expected during the extreme events under plugged conditions.
Emergency overflows (EOF) from street low points on Madelynn and Osprey is provided by an overland swale between homes, within easement, stabilized with permanent turf reinforcement mat (TRM - Enkamat R45). There is concern about erosion potential at the discharge point from TRM channel (due to high velocity and channelized flow onto slope. Outline the plan to stabilize the transition from TRM channel/channelized flow to native vegetation with high velocity (>3 fps) along the retaining wall swale.	Moderate	**Comment satisfied**. Plans show the EOF TRM swale transitioning to a riprap channel before discharging to the native vegetated slope. The plans have been updated to show a flat-wider rip rap section for flow to disperse before flowing onto native slope. The modeled velocities through the riprap channel range from 4-6 fps, falls in the range of permissible velocities for long native grasses.
How is slope downstream of the EOF of each infiltration basin stabilized. There appears to be areas were the riprap transitions to native vegetation at a similar slope. Those transitions and downgradient slopes must be analyzed to ensure these is minimal erosion potential.	Moderate	**Comment satisfied**. Design of the infiltration basins was revised such that the basins are able to fully-contain the 500-year events in a full buildout condition and a primary plugged condition. All flows are conveyed through the outlet structure.

Comment	Likelihood of significantly impacting outcome	Comment Resolution
Confirm construction phasing and that infiltration basins will be fully constructed as part of Phase 1.	Low	**Comment satisfied**. Developer has confirmed that site grading and utilities will all to be installed in one phase including construction of the infiltration basins.
To increase system resiliency against catch basin plugging which could results in overflows occurring at additional locations, please verify the anticipated flow direction, rates, and velocities. Under the plugging scenario at both the low points on Madelynn and Osprey, during larger events, the estimate peak runoff elevation appears to reach an elevation where the flow will not only spill into the proposed TRM channel, but may also flow between adjacent homes. What flows/velocities are expected in these areas. May require revising grading to direct all emergency overflows into TRM lined channel, providing higher capacity inlets at the low points to reduce overflows, or require stabilization of additional slopes with TRM.	Low	**Comment satisfied**. Grading plan had been updated based on final modeling to ensure overflows from the low points in the roadways only occurs down intended EOF swales and will not flow between other homes/slopes.
Complete a model run looking at plugged outlet conditions for infiltration basins. Outline the plan to stabilize the transition from the proposed riprap EOF which currently ends midslope to native vegetation with high velocity (>3 fps).	Moderate	**Comment satisfied**. Model shows the run looking at a plugged outlet condition at the infiltration basin and demonstrates the infiltration basins are able to contain the 500-year event through the secondary overflow grate and downstream pipes.
Revise design to tie pipe joints on all steeper sections of pipe within slopes downstream of the Madelynn and Osprey low points	Moderate	**Comment satisfied**. Pipe joints called out to be tied on both storm sewer along steep slopes

Conclusions

Based on the information reviewed, Barr's professional engineers and geologist reviewing the materials concur with the applicant's findings and conclude:

- Exposed soils on site are highly erodible from surface runoff.

- Applicant's analyses are based on available site-specific information.
- Standard engineering principles were used to complete analysis.
- Interior drainage assessment revealed the need for additional erosion protection measures, which were incorporated into the project drawings, to increase the proposed projects robustness against potential erosion during extreme storm events (events larger than the Atlas 14, 100-year, 24-hour design storm event which exceeds the typical design standard for developments).
- Slope stability and seepage analysis results for the graded slopes are consistent with USACE guidelines for seepage gradients and factors of safety.
- The revised seepage and stability analyses results indicate only slight changes from existing conditions to exit gradients, flow nets, and safety factors due to subsurface drainage from the infiltration basins. Because the seepage gradients at the creek bank are within the thresholds suggested by the USACE, seepage relief or other mitigation measures to minimize soil loss at the toe of slopes appear unwarranted.

RILEY PURGATORY BLUFF CREEK WATERSHED DISTRICT

18681 Lake Drive East
Chanhassen, MN 55317
952-607-6512
www.rpbcwd.org

Riley Purgatory Bluff Creek Watershed District Permit Application Review

Permit No: 2021-012

Considered at Board of Managers Meeting: August 4, 2021 (continued to August 12, 2021)

Received complete: April 13, 2021

Applicant: Dean Lotter, Pulte Homes

Consultant: Mark Rausch, Alliant Engineering

Project: Noble Hills: proposed redevelopment of an existing single-family home site for 50 single-family residential lots. The construction will also disturb the turn lanes and the city trail along Spring Road. Proposed stormwater features include three infiltration basins and one sediment basin.

Location: 9955 Spring Road, Eden Prairie, MN 55347

Reviewer: Scott Sobiech, P.E., Barr Engineering

Proposed Board Action

Manager _____ moved and Manager _____ seconded adoption of the following resolutions based on the permit report that follows and the presentation of the matter at the August 4, 2021 (continued to August 12, 2021) meeting of the managers:

Resolved that the application for Permit 2021-012 is approved, subject to the conditions and stipulations set forth in the Recommendations section of the attached report;

Resolved that on determination by the RPBCWD administrator that the conditions of approval have been affirmatively resolved, the RPBCWD president or administrator is authorized and directed to sign and deliver Permit 2021-012 to the applicant on behalf of RPBCWD.

Upon vote, the resolutions were adopted, _____ [VOTE TALLY].

Applicable Rule Conformance Summary

Rule	Issue		Conforms to RBPCWD Rules?	Comments
C	**Erosion Control Plan**		Yes~~See comment.~~	~~See rule-specific permit condition C1-C4.~~
D	**Wetland and Creek Buffers**		See comment.	See rule-specific permit condition D1-D2.
J	**Stormwater Management**	Rate	Yes.	
		Volume	See comment.	See stipulations 1.
		Water Quality	Yes.	
		Low Floor Elev.	Yes.	
		Maintenance	See comment.	See rule-specific permit condition J1.
		Chloride Management	Yes	
		Wetland Protection	Yes.	
L	**Permit Fee**		Yes.	$3,000 received March 22, 2021
M	**Financial Assurance**		See comment.	The financial assurance is calculated at $150,030

Background

At the June 2, 2021 meeting the Riley Purgatory Black Creek Watershed District (RPBCWD) considered permit number 2021-015 for the Noble Hills development in Eden Prairie. During the discussion of the permit, the managers expressed the following concerns and need for additional information to make informed decisions to protect the water resources on the site (Riley Creek and an exceptional value wetland):

- Stability of the steep slopes during construction and following fall project build out,
- The effects of land disturbing activities, stormwater management, and vegetation removal/restoration on erosion potential along the proposed slopes,
- The potential for groundwater seeps or springs along the steep slopes on the site,
- The potential for stormwater pollutants such as chloride to migrate toward the water resources.

As a result, the board extended the permit review timeline by 60 days consistent with Minnesota Statutes section 15.99 to allow time for additional information to be provided and considered by the board. Following the August 4, 2021 meeting the applicant provided written request to extend the permit review period by seven days to August 18, 2021.

The applicant is planning a low-density residential redevelopment consisting of 50 single-family homes on a 32-acre site in Eden Prairie, Minnesota. The existing site is used as a single-family residence and tree farm. The existing imperviousness on the site is comprised of a residential structure, driveway and outbuildings. The site features significant varying slopes, and steep slopes constituting a high-risk erosion area as delineated by the District, and most of the site discharges to a wetland which abuts Riley Creek on the western border of the site. The proposed redevelopment into 50 single-family homes will include construction of associated streets, underground utilities, and stormwater features. Three infiltration basins and one sediment basin are proposed to provide stormwater quantity, volume and quality control.

The water resources are within the project site or downgradient of the proposed activities are summarized in the following table. The table also provides a brief explanation of how each resource is implicated in the permit application review process.

Water resource impacted by project

Water Resource	Projected resource impacts
Wetland 1	A Wetland Conservation Act (WCA) protected wetland abuts Riley Creek, is downgradient from proposed land-disturbing activities.
Riley Creek	Creek is downgradient from land-disturbing activities. l
High Risk Erosion Area Watercourses	One watercourse on the property within a high risk erosion area.

The project site information is summarized below:

Project Site Information	Area (acres)
Total Site Area	31.98
Existing Site Impervious	0.44
Disturbed Site Impervious Area	0.44 (100%)
Proposed Site Impervious Area	6.49 (>100% increase)
Change in Site Impervious Area	6.05 (>100% increase)
Total Disturbed Area	21.56

The following materials were reviewed in support of the permit request:

1. Application received March 15, 2021 (Incomplete notice was sent on March 29, 2021; materials submitted to complete application on April 13, 2021)

2. Construction Plan Sheets (37 sheets) dated February 19 ,2021 (revised April 13, 2021, April 23, 2021, and May 20, 2021), updated Wetland Management Plan sheet (sheet 27) dated May 4, 2021

~~3. Noble Hill Final Plat and Land Alteration Planset, prepared by Alliant Engineering, dated July 21, 2021~~

~~4.~~3. Stormwater Management Study dated March 15, 2021 (Revise April 13, 2021, April 23, 2021, and May 20, 2021)

~~5.~~4. Geotechnical Evaluation Report by Braun Intertec dated March 5, 2020

~~6.~~5. Wetland Delineation Report received March 15, 2021

~~7.~~6. Double Ring Infiltrometer test dated April 6, 2021

~~8.~~7. Electronic HydroCAD models received on March 15, 2021 (revise April 13, 2021 and April 23, 2021)

~~9.~~8. Electronic MIDS models received on March 15, 2021 (revised April 13, 2021 and April 23, 2021)

~~10.~~9. Engineers' opinion of probable cost received April 13, 2021

~~11.~~10. Response to RPBCWD review comments received April 13, 2021

~~12.~~11. Response to RPBCWD review comments received April 23, 2021

~~13.~~12. Noble Hill Development / Standal Property Field Review Observations of Riley Purgatory Bluff Creek Watershed Possible Mapped Stream Locations memo dated May 3, 2021.

~~14.~~13. Noble Hill Final Plat and Land Alteration plan set (40 sheets) dated May 20, 2021

~~15.~~14. Geotechnical Evaluation, Noble Hill Development Stability and Seepage Analyses prepared by Braun Intertec, dated July 22, 2021 (revised August 2, 2021, August 5, 2021 and August 10, 2021).

~~16.~~15. Noble Hill Additional Hydrologic/Hydraulic Analysis prepared by Alliant Engineering, Inc., dated July 22, 2021 (revised August 2, 2021).~~.~~

16. Noble Hill Final Plat and Land Alteration Plan Set, prepared by Alliant Engineering, dated July 21, 2021 (revised August 2, 2021 and August 6, 2021)

17. HydroCAD models on the interior drainage system received July 22, 2021 (revised model output received August 2, 2021).

Rule A: Procedural Requirements

Because the proposed project includes undertaking an activity for which a RPBCWD permit is required, the applicant must obtain the required permit prior to commencing the activity that is regulated by the District and must conform to the RPBCWD's Procedural Requirements (Rule A).

Rule A, Subsection 2.3 requires that an application be authorized by all property owners must be submitted to the District to obtain a permit. Because the construction of the proposed turn lanes on City of Eden Prairie right of way is part of the project, the applicant provided documentation demonstrating that the necessary land-use rights have been obtained for the proposed activities.

Rule C: Erosion and Sediment Control

Because the project will involve 21.56 acres of land-disturbing activity, the project must conform to the requirements in the RPBCWD Erosion and Sediment Control rule (Rule C, Subsection 2.1). The erosion control plan prepared by Alliant Engineering, Inc. includes installation of silt fence and bio-rolls, inlet protection to protect storm sewer catch basins, a rock construction entrance, decompaction of areas compacted during construction, rip-rap at outfalls into infiltration basins, stabilization of steep slopes, and retention of native topsoil onsite. The Erosion and Sediment Control plan sheet indicates that Chad Onsgard, Pulte Homes (952-229-0723) is responsible for erosion prevention and sediment control for the site.

Because slope stability and minimizing erosion potential from surface runoff are integral to protecting the on-site exceptional value wetland and Riley Creek, Barr reviewed of Braun Intertec's Stability and Seepage Analysis and Alliant Engineering's Additional Hydrologic/Hydraulic Analysis and provided comments to the applicant. The attached Technical Memorandum – Comment Resolution for the Technical Review of Noble Hills Stability and Interior Hydrology Analyses dated August 10, 2021 summarizes Barr's review, review comments, and how the applicant resolved comments on the July 22, 2021 submittals. The applicant's revised submittals adequately address the review comments related to the July 22, 2021 submittal. Barr concurs with the findings of analyses prepared by the applicant's consultants and concludes:

- The slope stability and seepage analysis results for the graded slopes are consistent with USACE guidelines for seepage gradients and factors of safety.
- The revised seepage and stability analyses results indicate only slight changes from existing conditions to exit gradients, flow nets, and safety factors due to subsurface drainage from the infiltration basins. Because the seepage gradients at the creek bank are within the thresholds suggested by the USACE, seepage relief or other mitigation measures to minimize soil loss at the toe of slopes appear unwarranted.

Alliant Engineering provided HydroCAD model of the interior surface flow conditions of the site in response to concerns raise by the Board at the June 2, 2021 RPBCWD Board meeting. Their analysis considered full project build-out, an interim condition with sparse vegetation, and conditions with reduce catch basin/out capacity in efforts to enhance the proposed designs resiliency to erosion. The analysis simulated the following events: 1-year (2.50"), 2-year (2.87"), 10-year (4.27"), 100-year (7.41"), 500-year (10.40"), projected 10-year mid-21st century (6.6") and the projected 100-year mid-21st century (10.2") rainfall events. As a result of their analysis, the applicant incorporated~~is proposing to incorporate~~ the following erosion control measure during construction:

- Adding biorolls along the emergency overflow (EOF) path to further attenuate the potential for erosion.
- Post grading silt fence on the slope above and below the proposed retaining wall,

- Silt fence J-hooks to prevent gully erosion along silt fence perimeter,
- On grade piping of skimmers to the lower sediment basin to allow for no overland flow on steep slopes of skimming discharge,
- Adding flocculant to interim sedimentation basins in the event the sediment is not settling out sufficiently.

The full-build-out interior drainage analysis revealed the potential for runoff to spill over the emergency overflows if catch basins plug or during extremely large storm events (e.g., 500-year event). This has the potential to produce erosive surface flow velocities to exceeding 14 feet per second (fps). To mitigate against the erosive flow velocities the applicant incorporated the following into the construction drawings:

- A permanent turf reinforcing mat (TRM) on the emergency overflow swales between homes, within drainage and utility easements. The TRM is capable of withstanding velocities of 30 fps for 60 minutes and 14 fps for 50 hours when fully-vegetated. In an unvegetated condition the Enkamat R45 (TRM) is capable of withstanding velocities of 16 fps for 60 minutes, thus providing erosion protection prior to vegetation establishment.
- Grading was revised to prevent uncontrolled overflows for the 500-year event
- Additional catch basin capacity was added at the low points.
- Pipe joints called out to be tied on both storm sewer along steep slopes

The proposed project is in conformance with RPBCWD's Rule C.~~Barr's review of Braun Intertec's Stability and Seepage Analysis and Alliant Engineering's Additional Hydrologic/Hydraulic Analysis is presented in the attached Technical Memorandum - Review of Noble Hills Stability and Interior Hydrology Analyses. While Barr concurs with the general findings of analyses prepared by the applicant's consultants, Barr's comments about the analysis methods and design must be addressed to increase the level of confidence in the modeling results presented in their technical memos and the overall resiliency of the proposed development. Because slope stability and minimizing erosion potential from surface runoff are integral to protecting the on-site exceptional value wetland and Riley Creek, the following revisions are needed to address the comments and conform to RPBCWD Rule C:~~

~~C1. The applicant's proposed measures described above must be incorporated onto the construction drawings.~~

~~C2. The Stability and Seepage Analysis and Alliant Engineering's Additional Hydrologic/Hydraulic Analysis must be updated to address RPBCWD's comments in the Technical Memorandum – Review of Noble Hills Stability and Interior Hydrology Analyses and submission for RPBCWD's review and approval.~~

~~C3. Incorporation of seepage relief or other mitigation measures to minimize soil loss at the toe of slopes if analysis shows excessive seepage, exit gradients, or subsequent risk of erosion, including but not limited to where potential seeps develop downslope of infiltration basin 1 or at flared end section outlets.~~

~~C4. Modify the construction drawing to increase the proposed projects robustness against potential erosion during large storm events (greater than the Atlas 14, 100-year, 24-hour event) which could lead to slope stability concerns including:~~

a. ~~Revised grading around low points at Osprey and Madelynn to direct all emergency overflows into turf reinforcement mat (TRM) lined channel from both low points~~
b. ~~Increasing inlet capacity at Osprey and Madelynn low points (e.g. high capacity inlets, more inlets)~~
c. ~~Armoring the entire surface overflow route with TRM or other suitable products between infiltration basins 2 and 3 or demonstrate the 500-year event will not spill over the emergency overflow.~~
d. ~~Stabilizing the transition from channelized flow to native vegetated slope at end of proposed TRM channels, especially if velocities exceed 3 fps, or disperse flow to eliminate concentrated flow routes.~~
e. ~~Incorporate measures to ensure pipe joints are be protected against separation and potential erosion.~~

Rule D: Wetland and Creek Buffers

Because Riley Creek and a wetland are downgradient from the proposed land disturbing activities, the project must conform to the requirements in the RPBCWD Wetland and Creek Buffers rule (Rule D, Subsection 3). Because the creek and wetland will not be disturbed by the proposed activities, buffers are needed only along the areas downgradient from the land-disturbing activity. The site also features significant varying slopes, and steep slopes constituting a high-risk erosion area (HREA) as delineated by the District.

The MnRAM analysis submitted with the wetland delineation report indicates the wetland is an exceptional value wetland (Appendix D1). Rule D, Subsection 3.1.b.i requires a wetland buffer with an average of 80 feet from the delineated edge of the wetland, minimum 40 feet. The buffer widths are summarized in the Table 4 below. The property boundary and land-disturbing activities are also located upgradient from Riley Creek, which is along the western portion of the property, requiring a 50-foot average, 30-foot minimum buffer, extending 50 feet from each of the upstream and downstream extent of disturbance (Rule D, subsections 3.1.c and 3.2.b.v). Because the required buffer for the creek overlaps and buffer for the exceptional value wetland, the applicant is providing buffer to whichever requirement extends farther upgradient.

In some areas the base buffer required intersects a steep slope as defined in Rule D, subsection 3.2c. In these areas, the buffer must extend to the top of the slope. Because the property encompasses steep slopes within a high risk erosion area, the project must provide for buffers averaging 50 feet wide with minimum width of 30 feet from the thalweg of any watercourse within the high risk erosion area (Rule D, Subsection 2.1b and 3.2bvi). The RPBCWD HREA maps, based on a desk top analysis, identified nine potential watercourse within the HREA on the site. The applicant conducted a site review on May 1, 2021 to identify the presence or absence of existing watercourse within the HREAs and summarized the finding in a May 3, 2021 memorandum (attached for reference). The RPBCWD engineer also visited the site on May 3rd to review the HREA for existing watercourses and erosion. The engineer concurs with the applicant's assertion that there are no visible signs of existing watercourses in eight of the nine potential areas identified on RPBCWD's HREA maps. Because existing watercourse were not

observed in the field, buffering requirements do not apply to those eight areas. The RPBCWD engineer also concurs with the applicant's observation of the presence of an existing drainage way located in the southwest corner of the site (identified as location 9 in the applicant's memo). The applicant's proposed buffer for the watercourse within the HREA conforms to the Rule D, Subsection 3.2.b.vi requirements.

Plan sheets submitted by the applicant show buffer that conforms to Rule D, subsection 3.2b. As shown in the table below, the required buffer width to conform to Rule D, subsection 3.2c, is greater than the required buffer width to conform to Rule D, subsection 3.2.b.i, 3.2.b.v and 3.2.b.vi; the width requirements are met.

Wetland Buffer Analysis Summary

Resource ID	RPBCWD Wetland Value	Required Minimum Width[1] (ft)	Required Average Width[1] (ft)	Provided Minimum Width (ft)	Provided Average Width (ft)
Wetland 1[2]	Exceptional	40	80	40	80.7
Riley Creek	NA	30	50	75	244
HREA 9[2]	NA	30	50	50	75

[1] Average and minimum required buffer width under Rule D, Subsection 3.1.b
[2] The buffers for these resources intersect a steep slope and extend to the top of the slope, see attached Wetland Management Plan (sheet 27) for buffer illustration.

Plan documents show that disturbed areas within the buffer area will be maintained with native vegetation and maintained in a natural state (subsection 3.3). As shown on the Wetland Management Plan (Sheet 27), the buffer markers will be placed per District criteria (subsection 3.4). The following revisions are needed to conform to the RPBCWD Rule D:

D1. A note must be included on the plan sheet indicating the project will be constructed so as to minimize the potential transfer of aquatic invasive species (e.g., zebra mussels, Eurasian watermilfoil, etc.) to the maximum extent possible conforming to Rule D, Subsection 3.6.
D2. Buffer areas and maintenance requirements must be documented in a declaration recorded after review and approval by RPBCWD in accordance with Rule D, Subsection 3.5. The maintenance declaration must also include an exhibit clearly showing the buffer area and monument locations.

Rule J: Stormwater Management

Because the project will disturb 21.56 acres of land-surface area, the project must meet the criteria of RPBCWD's Stormwater Management rule (Rule J, Subsection 2.1). The criteria listed in Subsection 3.1 will apply to the entire project site because the project will increase the imperviousness of the entire site by more than 100 percent (Rule J, Subsection 2.3).

The developer is proposing construction of three infiltration basins and one sediment basin to provide rate control, volume abstraction and water quality management on the site.

Rate Control

In order to meet the rate control criteria listed in Subsection 3.1.a, the 2-, 10-, and 100-year post development peak runoff rates must be equal to or less than the existing discharge rates at all locations where stormwater leaves the site. The applicant used a HydroCAD hydrologic model to simulate runoff rates for pre- and post-development conditions for the 2-, 10-, and 100-year frequency storm events using a nested rainfall distribution, and a 100-year frequency, 10-day snowmelt event. The existing and proposed 2-, 10-, and 100-year frequency discharges from the disturbed site area are summarized in the table below. The proposed project is in conformance with RPBCWD Rule J, Subsection 3.1.a.

Modeled Discharge Location	2-Year Discharge (cfs)		10-Year Discharge (cfs)		100-Year Discharge (cfs)		10-Day Snowmelt (cfs)	
	Ex	Prop	Ex	Prop	Ex	Prop	Ex	Prop
Riley Creek	1.3	0.5	2.0	1.0	10.7	4.3	4.1	0.8
SW	0	0	0	0	0.2	0.2	0.4	0.3
Spring Rd Pond	1.5	1.1	2.3	1.7	5.5	4.8	1.6	1.1

Volume Abstraction

Subsection 3.1.b of Rule J requires the abstraction onsite of 1.1 inches of runoff from all new or disturbed impervious surface of the parcel. An abstraction volume of 25,899 cubic feet is required from the 6.49 acres (282,530 square feet) of new and reconstructed impervious area on the site for abstraction.

Soil borings performed by Braun Intertec on September 9, 2019 show that soils in the project area are primarily silty sand with subsurface soils of mainly poorly graded sand. Braun Intertec conducted a double-ring infiltration test at IB-2 resulting in a measured infiltration rate of 19.2 inches per hour (in/hr). The applicant is proposing 6 inches of compost into the design of infiltration basin IB-2 to reduce the infiltration rate below the maximum allowable rate listed in Rule J, Subsection 3.1.b.4 (8.3 in/hr). The engineer concurs with the applicant's design infiltration rate at IB-2 of 4.0 in/hr, which is significantly lower than the measure rate because of the compost amendments. Because of dense tree cover at IB-1 and the proximity to the existing house at IB-3, infiltration testing was not feasible at IB-1 or IB-3. Based on the soils present at IB-1 and IB-3 the engineer concurs with the applicant's use of a design infiltration rate of 4.0 in/hr and 0.8 in/hr respectively. The engineer concurs that the basins will drawdown within 48 hours (Rule J, subsection 3.1b.3). The table below summarizes the volume abstraction for the site based on the design infiltration rate.

Volume abstraction summary

Required Abstraction Depth (inches)	Required Abstraction Volume (cubic feet)	Provided Abstraction Depth (inches)	Provided Abstraction Volume (cubic feet)
1.1	25,899	1.5	36,388

Sump manholes with baffles and the sedimentation basin will serve as pretreament for runoff into the infiltration basins (Rule J, Subsection 3.1.b.1). Groundwater was encountered in soil boring ST-4 at the proposed infiltration basin (IB-3) at a depth of 19 feet (elevation 745). Groundwater is not encountered at ST-12 and ST-3, which are located at infiltration basins IB-1 and IB-2. The end of boring elevation for ST-12 and ST-3 are 783 and 778, respectively. The following table demonstrates that the proposed design provided adequate separation between the bottom of the infiltration basins IB-1, IB-2, and IB-3 and the groundwater (Rule J, Subsection 3.1.b.2.a). Because soil boring ST-1 stopped at elevation 793, which is only 2 feet below the bottom of infiltration basin IB-1, additional soil investigation will be needed to verify compliance with Rule J subsection 3.1.b.2.

Infiltration Basin	Bottom Elevation (feet)	Groundwater Elevation (feet)	Separation (feet)
IB-1	795	783[1]	12
IB-2	806	778[1]	28
IB-3	757	745	12

[1] No groundwater observed at the bottom of the soil boring

Because of existing site constraints at infiltration basins IB-1 and IB-3, infiltration testing was not taken at those BMP locations and it is unclear if the soils have adequate infiltration capacity. Per Rule J, Subsection 3.1.b.2.c measured infiltration capacity of the soils at the bottom of the infiltration systems must be provided. The applicant must submit documentation verifying the infiltration capacity of the soils and that the volume control capacity is calculated using the measured infiltration rate. If infiltration capacity is less than needed to conform with the volume abstraction requirement in subsection 3.1b, design modifications to achieve compliance with RPBCWD requirements will need to be submitted (in the form of an application for a permit modification or new permit).

In addition, the infiltration testing completed at infiltration basin IB-2 resulted in an infiltration rate of 19.2 in/hr which significantly higher than the allowable rate listed in Rule J, Subsection 3.1.b.4 (8.3 in/hr).The plans include a note requiring infiltration testing to ensure the infiltration rates do not exceed the allowable rate. Because the proposed existing soils have a higher than allowable infiltration capacity, performance monitoring for the site will be required to ensure that the project is able to meet the RPBCWD abstraction criteria. In accordance with Rule J, Subsection 2.6 performance monitoring, and as a stipulation of issuing a permit for this project, the Applicant must monitor the proposed infiltration basins to determine the ability of the system to achieve the design requirements as presented in the design for two years after final site stabilization.

Water Quality Management

Subsection 3.1.c of Rule J requires the Applicant provide volume abstraction in accordance with 3.1b or least 60 percent annual removal efficiency for total phosphorus (TP), and at least 90 percent annual removal efficiency for total suspended solids (TSS) from site runoff, and no net increase in TSS or TP loading leaving the site from existing conditions. Because the BMPs proposed by the applicant provide volume abstraction that meets the standard in 3.1b, the engineer finds that the proposed project is in conformance with Rule J, Subsection 3.1.c.

Low floor Elevation

All new buildings must be constructed such that the lowest floor is at least two feet above the 100-year high water elevation or one foot above the emergency overflow of a stormwater-management facility according to Rule J, Subsection 3.6a . In addition, a stormwater-management facility must be constructed at an elevation that ensures that no adjacent habitable building will be brought into noncompliance with this requirement, according to Rule J, Subsection 3.6b. The low floor elevation of the homes and the adjacent stormwater management feature is summarized below and shows proposed project is in conformance with Rule J, Subsection 3.6.

Lot Riparian to Stormwater Facility	Low Floor Elevation of Building (feet)	Adjacent Stormwater Facility	100-year Event Flood Elevation of Adjacent Stormwater Facility (feet)	Freeboard to 100-year Event (feet)
Blk 3, Lot 26	816	Sedimentation Pond	799.44	16.56
Blk 1, Lot 1	800.9	IB-1	799.41	1.49[1]
Blk 3, Lot 6	853.6	IB-2	809.49	44.11
Blk 3, Lot 7	858.8	IB-2	809.49	49.31
Blk 3, Lot 8	863.5	IB-2	809.49	54.01
Blk 3, Lot 9	860	IB-2	809.49	50.51
Blk 3, Lot 10	854.4	IB-2	809.49	44.91
Blk 3, Lot 11	848.4	IB-2	809.49	38.91
Blk 3, Lot 12	842.4	IB-2	809.49	32.91
Blk 3, Lot 13	826.0	IB-2	809.49	16.51
Blk 3, Lot 14	820	IB-2	809.49	10.51
Blk 3, Lot 15	815.2	IB-2	809.49	5.71
Blk 3, Lot 16	810.2	IB-3	762.7	47.5
Blk 3, Lot 17	806.9	IB-3	762.7	44.2
Blk 3, Lot 18	803.9	IB-3	762.7	41.2
Blk 3, Lot 19	804.4	IB-3	762.7	41.7
15559 Lilac Dr	819[2]	IB-1	799.41	19.59
15561 Lilac Dr	819[2]	IB-1	799.41	19.59
15563 Lilac Dr	820[2]	IB-1	799.41	20.59
15565 Lilac Dr	820[2]	IB-1	799.41	20.59

[1] Because the low floor elevation of Block 1, Lot 1 (800.9 ft) is greater than 1-foot above the emergency overflow of the adjacent stormwater management facility, the proposed low floor conforms to Rule J, subsection 3.6a.

[2] The low floor of the existing structures adjacent to IB-1 were estimated by subtracting 10 feet from the lowest adjacent grade taken from available topographic information.

Maintenance

Subsection 3.7 of Rule J requires the submission of a maintenance plan. All stormwater management structures and facilities must be designed for maintenance access and properly maintained in perpetuity to assure that they continue to function as designed.

J1. Permit applicant must provide a maintenance and inspection declaration. A maintenance declaration template is available on the permits page of the RPBCWD website. (http://www.rpbcwd.org/permits/). A draft declaration must be provided for District review prior to recording.

Chloride Management

Subsection 3.8 of Rule J requires the submission of chloride management plan that designates the individual authorized to implement the chloride management plan and the MPCA-certified salt applicator engaged in implementing the plan. The RPBCWD chloride-management plan requirement applies to the streets and common areas of the project site, but not the individual single-family homes. Because the streets within the proposed residential development will be dedicated to the city as public right of way and therefore maintained by Eden Prairie and the city has provided its chloride management plan and its designated state-certified chloride applicator is Eden Prairie's Streets Division Manager Larry Doig, the proposed development conforms with Rule J, subsection 3.8.

Wetland Protection

Because the proposed activities discharge to a protected wetland (Wetland 1) on the site and alter the discharge the wetland receives from the site, the proposed activities must conform to RPBCWD wetland protection criteria (Rule J, subsection 3.10). Wetland 1 falls in the exceptional value category. The following table summarizes the allowable change in bounce and inundation duration from Table J1.

Summary of allowable impacts on onsite wetland from Rule J, Table J1

Wetland Value/ Waterbody	Permitted Bounce for, 10-Year Event	Inundation Period for 1- and 2-Year Event	Inundation Period for 10-Year Event	Runout Control Elevation
High	Existing	Existing	Existing	No change

Because wetland 1 is on slopes and is not an enclosed natural depression, bounce and inundation periods cannot be estimated. As a surrogate to support compliance with the bounce and inundation criterion the applicant has demonstrated, and the engineer concurs, that the proposed flow rate and volumes flowing towards wetland 1 are slightly less than the existing flows. The reduction in the 10-year runoff volume reaching the wetland is roughly 784 cubic feet. Distributing this volume over the wetland area results an immaterial change in depth. Therefore, the project is in conformance with Rule J, subsection 3.10a.

Rule J, subsection 3.10b requires discharge from regulated disturbed areas be treated to meet at least 75 percent annual removal efficiency for phosphorus and 90 percent annual removal efficiency for total suspended solids prior to discharge to an exceptional value wetland. As summarized in the water quality analysis in table below, the portion of the site runoff tributary to Wetland 1 will be treated by two infiltration basins to provide 98% TSS and 98% TP removal prior to discharging to the wetland in accordance with Rule J, subsection 3.10b.

Annual TSS and TP removal prior to discharging to Wetland 1

Pollutant of Interest	Regulated Site Loading (lbs/yr)	Required Load Removal (lbs/yr)	Provided Load Reduction (lbs/yr)
Total Suspended Solids (TSS)	2,142	1,923 (90%)	2,106 (98%)
Total Phosphorus (TP)	11.8	8.8 (75%)	11.6 (98%)

Rule L: Permit Fee Deposit:

The RPBCWD permit fee schedule adopted in February 2020 requires permit applicants to deposit $3,000 to be held in escrow and applied to cover the $10 permit-processing fee and reimburse RPBCWD for permit review and inspection-related costs and when a permit application is approved, the deposit must be replenished to the applicable deposit amount by the applicant before the permit will be issued to cover actual costs incurred to monitor compliance with permit conditions and the RPBCWD Rules. A permit fee deposit of $3,000 was received on March 22, 2021.

Rule M: Financial Assurance:

Rules C: Silt fence and bio-logs:8,720 L.F. x $2.50/L.F. = ...$21,800

Inlet protection: 34 x $100 =.....$3,400

Rock Entrance: 1.0 x $900 =.....$900

Restoration: 21.56 acres x $2,500/acre = ...$53,900

Rules J: Stormwater Management Facilities: $45,112 x 125% of engineer's opinion of cost= $56,390

Contingency (10%) $13,640

Total Financial Assurance.....$150,030

Applicable General Requirements:

1. The RPBCWD Administrator and Engineer shall be notified at least three days prior to commencement of work.
2. Construction must be consistent with the plans, specifications, and models that were submitted by the applicant that were the basis of permit approval. The date(s) of the approved plans, specifications, and modeling are listed above and on the permit. The granting of the permit does not in any way relieve the permittee, its engineer, or other professional consultants of responsibility for the permitted work.

3. The grant of the permit does not relieve the permittee of any responsibility to obtain approval of any other regulatory body with authority.
4. The issuance of this permit does not convey any rights to either real or personal property, or any exclusive privileges, nor does it authorize any injury to private property or any invasion of personal rights, nor any infringement of federal, state, or local laws or regulations.
5. In all cases where the doing by the permittee of anything authorized by this permit involves the taking, using or damaging of any property, rights or interests of any other person or persons, or of any publicly owned lands or improvements or interests, the permittee, before proceeding therewith, must acquire all necessary property rights and interest.
6. RPBCWD's determination to issue this permit was made in reliance on the information provided by the applicant. Any substantive change in the work affecting the nature and extent of applicability of RPBCWD regulatory requirements or substantive changes in the methods or means of compliance with RPBCWD regulatory requirements must be the subject of an application for a permit modification to the RPBCWD.
7. If the conditions herein are met and the permit is issued by RPBCWD, the applicant, by accepting the permit, grants access to the site of the work at all reasonable times during and after construction to authorized representatives of the RPBCWD for inspection of the work.

Findings

1. The proposed project includes the information necessary, plan sheets and erosion control plan for review.
2. The proposed project will conform to Rules C, D and J if the Rule Specific Permit Conditions listed above are met.

Recommendation:

Approval of the permit issuance contingent upon:

1. Continued compliance with General Requirements.
2. Financial Assurance in the amount of $150,030.
3. The applicant providing documentation demonstrating that the necessary land-use rights have been obtained for the proposed activities within right of way.

~~4. Revision of Braun Intertec's Stability and Seepage Analysis and Alliant Engineering's Additional Hydrologic/Hydraulic Analysis to address RPCWD's comments and submission for RPBCWD's review and concur.~~

~~5. Incorporation of seepage relief or other mitigation measures to minimize soil loss at the toe of slopes if analysis shows excessive seepage, exit gradients, or subsequent risk of erosion, including but not limited to where potential seeps develop downslope of infiltration basin 1 or at flared end section outlets.~~

~~6. Submission to RPBCWD of updated drawings that:~~

~~a. Incorporate the applicant's proposed additional erosion control measures described in the Rule C analysis.~~

~~b. Revise grading around low points at Osprey and Madelynn to direct all emergency overflows into turf reinforcement mat (TRM) lined channel from both low points~~

~~c. Increase inlet capacity at Osprey and Madelynn low points (e.g. high capacity inlets, more inlets)~~

~~d. Armor the entire surface overflow route with TRM or other suitable products between infiltration basins2 and 3 or demonstrate the 500-year event will not spill over the emergency overflow.~~

~~e. Stabilize the transition from channelized flow to native vegetated slope at end of proposed TRM channels, especially if velocities exceed 3 fps, or disperse flow to eliminate concentrated flow routes.~~

~~f. Incorporate measures to ensure pipe joints are protected against separation subsequent potential erosion.~~

~~7.~~4. Receipt in recordation a maintenance declaration for the stormwater management facilities and buffers. Drafts of any and all documents to be recorded must be approved by the District prior to recordation.

By accepting the permit, when issued, the applicant agrees to the following stipulations:

1. Per Rule J, Subsection 3.1.b.ii measured infiltration capacity of the soils at the bottom of the infiltration systems IB-1 and IB-3 must be provided. The applicant must submit documentation verifying the infiltration capacity of the soils and that the volume control capacity is calculated using the measured infiltration rate. If infiltration capacity is less than needed to conform with the volume abstraction requirement in subsection 3.1b, design modifications to achieve compliance with RPBCWD requirements will need to be submitted (in the form of an application for a permit modification or new permit).
2. Per Rule J Subsection 4.5, upon completion of the site work, the permittee must submit as-built drawings demonstrating that at the time of final stabilization, all stormwater management facilities conform to design specifications and function as intended and approved by the District. As-built/record drawings must be signed by a professional engineer licensed in Minnesota and include, but not limited to:
    a) the surveyed bottom elevations, water levels, and general topography of all facilities;
    b) the size, type, and surveyed invert elevations of all stormwater facility inlets and outlets;
    c) the surveyed elevations of all emergency overflows including stormwater facility, street, and other;
    d) other important features to show that the project was constructed as approved by the Managers and protects the public health, welfare, and safety.
    e) photographic evidence of buffer marker locations indicated by permanent, free-standing markers in accordance with Rule D, Subsection 3.4 criteria.
3. Providing the following additional close-out materials:
    a) Documentation that constructed infiltration and filtration facilities perform as designed. This may include infiltration testing, flood testing, or other with prior approval from RPBCWD

b) Documentation that disturbed pervious areas remaining pervious have been decompacted per Rule C.2c criteria

4. The work on the Noble Hills parcel under the terms of permit 2021-012, if issued, must have an impervious surface area and configuration materially consistent with the approved plans. Design that differs materially from the approved plans (e.g., in terms of total impervious area) will need to be the subject of a request for a permit modification or new permit, which will be subject to review for compliance with all applicable regulatory requirements.
5. Because the proposed existing soils have a higher than allowable infiltration capacity, performance monitoring for the site will be required to ensure that the project is able to meet the RPBCWD abstraction criteria has been proposed. In accordance with Rule J, Subsection 2.6 performance monitoring, and as a stipulation of issuing a permit for this project, the Applicant must monitor the proposed infiltration basins to determine the ability of the system to achieve the design requirements as presented in the design for two years after final site stabilization. If it is determined that the system is not performing as designed, property owner will need to submit a revised design and construction plan to demonstrate that the design criteria are achieved.