

# **Preliminary Stormwater Management Plan**

prepared for

**Blackwell Road  
Blue Parkway & Blackwell Road  
Lee's Summit, MO 64081**

**August 6, 2021**

**Revised: September 7, 2021**

prepared by



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**Schlagel & Associates Project 20-205**

for

**Griffin Riley Property Group  
21 SE 29<sup>th</sup> Terrace  
Lee's Summit, Missouri 64082**

## Executive Summary

August 6, 2021

Gene Williams, P.E.  
220 SE Green Street  
Lee's Summit, MO 64063

**RE: Blackwell Road  
Blue Parkway & Blackwell Road  
Lee's Summit, MO 64081**

Dear Gene Williams,

We are submitting the enclosed preliminary stormwater management study in support of the preliminary development plan for Blackwell Road. This report has been prepared to address permitting requirements and provides preliminary design calculations for the required storm water detention and BMP facilities. We have modeled the existing site conditions as they existed at the time this report was prepared.

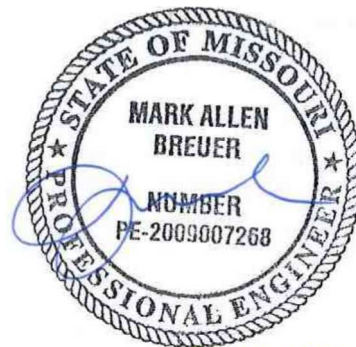
The proposed site is a 62.40-acre mixed use parcel located in Lee's Summit, MO at the intersection of Blue Parkway and Blackwell Road. The proposed development has been analyzed and designed to meet the APWA Comprehensive Control Strategy, which entails limiting post-development peak discharge rates from the site for the 2-Year, 10-Year, and 100-Year design storm events. One Extended Dry Detention Basin (EDDB) and three Extended Wet Detention Basins (EWDB) have been designed to detain the mentioned events as well as provided 40-hour detention of runoff from the local 90% mean annual event. All elements of the enclosed drainage system will be designed and constructed in accordance with all City of Lee's Summit, Missouri, requirements.

Sincerely,

**Schlagel & Associates, P.A.**



Nick Augustine, E.I.T.  
Design Engineer



Mark Breuer, P.E.  
Project Engineer

09.06.2021

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## 1.0 GENERAL INFORMATION

Griffin Riley Property Group is proposing to develop the 62.40 acres of land located in Section 11, Township 47 North, Range 31 West, Jackson County, Missouri. The property is located at the intersection of Blue Parkway and Blackwell Road. The proposed development consists of single-family lots, townhomes, apartments, and commercial use along with associated infrastructure.

### 1.1 OBJECTIVE

The intent of this report is to provide information pertaining to the existing and proposed watersheds, identifying and addressing any downstream drainage issues, determine and address any detention requirements, provide 40-hour extended detention of runoff from the local 90% mean annual event, and address permitting requirements. This study provides the preliminary design calculations for the development of the facility and associated infrastructure. Detailed designs will be required and provided with permit documents.

### 1.2 METHODOLOGY

The following were utilized in the assessment, preparation and analysis of watersheds in this design concept plan: *Section 5600, 2011, Storm Drainage Systems & Facilities* of the Standard Specifications & Design Criteria of the Kansas City Metropolitan Chapter of the American Public Works Association; *City of Lee's Summit, Missouri Design Criteria (2011 Revision), Storm Drainage Systems & Facilities*, prepared by the City of Lee's Summit, Missouri, Public Works Department.

Watersheds for the site were defined according to soil cover and type, tributary area, and runoff times of concentration. Soil cover was determined from inspection of the site and aerial photography. A soil survey for the project area was obtained from the United States Department of Agriculture, Natural Resources Conservation Service (NRCS), website and was utilized in determining soil type. The entire NRCS Soil Resource

Report can be found in Appendix B. Watershed size was determined from both aerial topography and topographical survey, and by the proposed grading plan.

Times of concentration were compiled according to *NRCS TR-55 Urban Hydrology for Small Watersheds (1986)* methodology for sheet flow, shallow concentrated flow, and channel flow. For this report, sheet flow travel lengths were modeled at a total distance of 100'. Travel times for channel flows were determined using the length and velocity of the open channel. *HydroCAD-10* was utilized to model the runoff. All storm events were modeled using *SCS 24-hour Type II* distributions and were modeled for 2-Year, 10-Year, and 100-Year storm events.

\* \* \* \* \*

## 2.0 EXISTING CONDITIONS ANALYSIS

The site lies within the East Fork Little Blue River Watershed. The existing site contains 4 watersheds which have release points located in the southwest, northwest, northern boundary, and eastern boundary of the site. Offsite stormwater comes into the site from south and drains to the release point located along the eastern boundary.

### 2.1 TRIBUTARY AREAS

The existing drainage tributary map is provided in Appendix A, Figure A.1. The site release points have been identified as Release Point 1 (RP-1), Release Point 2 (RP-2), Release Point 3 (RP-3), and Release Point 4 (RP-4). The area has been delineated according to the existing topography and an annotation callout of EX DA-1, EX DA-2, EX DA-3, EX DA-4, and EX OFF DA-4, on Figure A.2, have been provided for the watersheds that drain to the release points RP-1 – RP-4 respectively.

### 2.2 CURVE NUMBER AND TIME OF CONCENTRATION

The existing curve numbers and time of concentrations for each area have been established based on the procedures outlined in *NRCS TR-55 Urban Hydrology for Small Watersheds (1986)*. Existing curve numbers were based upon aerial photography, site inspection, and the soil types present on site.

The NRCS Soil Resource Report indicated that a Hydrologic Soil Group (HSG) of C and D were present on site. A current aerial photograph can be found in Appendix A; it depicts the existing cover conditions. Table 2-1 found in section 2.3 Existing Flow Rates summarizes the curve numbers for each of the watershed areas.

Cover types for existing conditions were considered to be “pasture/grassland” in fair condition for the on-site area, and “Woods/grass combo” in fair condition for the off-site area. Procedures outlined in *NRCS TR-55 Urban Hydrology for Small Watersheds* recommends utilizing curve numbers 79 and 84 for HSG C and D for pasture/grassland, and 76 and 82 for the Woods/Grass combination.



Time of concentration flow paths were based upon sheet flow and shallow concentrated flow for the existing conditions. Sheet flow lengths were limited to where a grade break occurred. Flow was then considered shallow concentrated flow until a channel was visible either from the USGS topographic map or the aerial photograph, and then from that point was considered channel flow determined by the length of the channel and the velocity of flow.

### **2.3 EXISTING FLOW RATES**

Existing flow rates were determined for the 2-Year, 10-Year, and 100-Year design storms. Offsite runoff is included in the calculations for Table 2-1 below for existing site conditions. Appropriate runoff coefficient curve numbers were based upon aerial photography, site inspection, and the soil types present on site. Detailed calculations with composite curve numbers and time of concentration can be found in the HydroCAD Model Output in Appendix B.

**Table 2-1 - Existing Flow Rates**

| Drainage Sub-Basin | Area (Acres) | CN | Storm Event | Runoff (CFS) |
|--------------------|--------------|----|-------------|--------------|
| EX DA-1            | 9.52         | 79 | 2-YR        | 14.34        |
|                    |              |    | 10-YR       | 28.81        |
|                    |              |    | 100-YR      | 48.20        |
| EX DA-2            | 4.28         | 80 | 2-YR        | 7.26         |
|                    |              |    | 10-YR       | 14.09        |
|                    |              |    | 100-YR      | 23.62        |
| EX DA-3            | 29.35        | 80 | 2-YR        | 36.97        |
|                    |              |    | 10-YR       | 72.33        |
|                    |              |    | 100-YR      | 121.81       |
| EX DA-4            | 19.25        | 82 | 2-YR        | 31.44        |
|                    |              |    | 10-YR       | 64.09        |
|                    |              |    | 100-YR      | 110.52       |
| EX OFF DA-4        | 4.58         | 92 | 2-YR        | 11.43        |
|                    |              |    | 10-YR       | 18.56        |
|                    |              |    | 100-YR      | 27.98        |

## 2.4 DOWNSTREAM DRAINAGE ISSUES

The existing downstream drainage system has been reviewed with this development plan. FEMA flood maps have been checked and currently no immediate downstream issues appear to be present. A FEMA FIRMette is included in Appendix A. The project lies outside of the identified FEMA floodplain per map numbers 29095C0437G, 29095C0439G, 29095C0441G, and 29095C0445G.

## 2.5 AGENCY REVIEW

Permitting requirements of the following agencies were reviewed as part of the existing conditions analysis.

### **2.5.1 Corps of Engineers Review**

The National Wetlands Inventory (NWI) map was reviewed for the site and there are no identified wetlands located within the project site. The NWI map can be found in Appendix A. We do not anticipate any Corps of Engineers requirements associated with this project at this time.

### **2.5.2 FEMA Requirements**

No FEMA identified floodplain is located on the proposed property per Flood Insurance Rate Map Panel Nos. 29095C0437G, 29095C0439G, 29095C0441G, and 29095C0445G. There is currently no work proposed in the regulated floodplain. Please see the attached FEMA FIRMette in Appendix A.

### **2.5.3 Missouri Department of Natural Resources**

All land disturbance activities will be permitted in accordance with the City of Lee's Summit, MO specifications as well as the Missouri Department of Water Pollution Control general permit under the National Pollution Discharge Elimination System (NPDES) and an authorized Notice of Intent (NOI) application form. The disturbance of the site is greater than one acre; therefore, NPDES and NOI applications are required with the future permitting of the site in compliance with local, state and federal guidelines.

\* \* \* \* \*

### 3.0 PROPOSED CONDITIONS ANALYSIS

With the proposed development, the site watershed will be divided into four sub-basins for analysis. These sub-basins correspond to: Release Points 1-4. Stormwater runoff will be conveyed through the site via open sheet flow, shallow concentrated flow, one extended dry detention basin, and 3 extended wet detention basins. All detention facilities have been designed to detain the 2-Year, 10- Year, and 100-Year storm events.

All components of the overland and enclosed storm sewer systems will meet or exceed the specifications provided in *Section 5600 – Storm Drainage Systems & Facilities* of the *Standard Specifications and Design Criteria* compiled by the Kansas City Metropolitan Chapter of the American Public Works Association.

#### 3.1 TRIBUTARY AREAS

RP-1 will be divided into two sub-catchments, Onsite 1 and Onsite 2. Onsite 1 will bypass the proposed extended dry detention basin, while Onsite 2 will be collected by the extended dry detention basin and then released to two existing 24" pipes located under Blue Parkway. RP-2 sub-catchment existing flows are proposed to be routed to the detention facility located in the northeast corner of the site. RP-3 will also be divided into two sub-catchments, Onsite 4 and Onsite 5. Onsite 4 will be collected by a proposed extended wet detention basin. It will then be routed downstream to a second proposed extended wet detention basin that will collect Onsite 5 and then be released via storm sewer to an existing area inlet located directly north of our proposed site. Final design of this basin will be designed to ensure the downstream storm sewer system does not exceed the 100-year storm event. RP-4 sub-catchment, Onsite 6, will be collected by an extended wet detention basin. The proposed extended wet detention basin will also collect the off-site area, EX OFF, from the south. Stormwater runoff will be released into the existing swale and continue to flow to the northeast.

### **3.2 CURVE NUMBER AND TIME OF CONCENTRATION**

Curve numbers for the proposed development were developed in a similar manner as the existing conditions. Hydrologic Soil Group (HSG) of D was utilized for post-development conditions. Cover types for the proposed conditions were considered to be 1/8 acre lots, Single Family lots, and urban commercial in good condition.

Time of concentration was established in a similar manner as the existing conditions. Shallow concentrated flow lengths were shortened and considered paved. Detailed calculations with composite curve numbers and time of concentration can be found in the HydroCAD Model Output in Appendix B. Appendix A, Figure A.2 depicts the proposed drainage conditions.

### 3.3 PROPOSED FLOW RATES

Proposed flow rates were determined for the 2-Year, 10-Year, and 100-Year design storms. Detailed calculations can be found in the HydroCAD Model Output Report in Appendix B.

**Table 3-1 – HydroCAD Runoff Conditions**

| Drainage Sub-Basin | Drainage Area (Acres) | Storm Event | Peak Discharge (CFS) |
|--------------------|-----------------------|-------------|----------------------|
| OnSite 1           | 0.54                  | 2-YR        | 2.43                 |
|                    |                       | 10-YR       | 3.79                 |
|                    |                       | 100-YR      | 5.58                 |
| OnSite 2           | 4.97                  | 2-YR        | 22.39                |
|                    |                       | 10-YR       | 34.88                |
|                    |                       | 100-YR      | 51.36                |
| OnSite 3           | 10.76                 | 2-YR        | 44.14                |
|                    |                       | 10-YR       | 71.05                |
|                    |                       | 100-YR      | 106.44               |
| OnSite 4           | 25.50                 | 2-YR        | 88.82                |
|                    |                       | 10-YR       | 143.48               |
|                    |                       | 100-YR      | 215.38               |
| OnSite 5           | 20.47                 | 2-YR        | 83.49                |
|                    |                       | 10-YR       | 130.29               |
|                    |                       | 100-YR      | 192.01               |
| EX OFF             | 4.58                  | 2-YR        | 11.43                |
|                    |                       | 10-YR       | 18.56                |
|                    |                       | 100-YR      | 27.98                |

### 3.4 DETENTION ANALYSIS

The runoff hydrographs utilized to determine the peak flow volumes for each tributary area were determined using *TR-55* methodology and *HydroCAD-10*. For the 2-Year, 10-

Year, and 100-Year storm events, the complete hydrograph routing and model output can be found in the HydroCAD Model Output Report in Appendix B.

The site will need to provide detention that meets the requirement under the Comprehensive Control release rates under Section 5608.4C1a and 5608.4C1b of the APWA. This entails limiting post-development peak discharge rates from the site for the 2-Year, 10-Year, and 100-Year design storm events, as well as providing 40-Hour extended detention of runoff from the local 90% mean annual event. The post-development peak discharge rates from the site shall not exceed the following:

- 50% storm peak rate less than or equal to 0.5 cfs per site acre
- 10% storm peak rate less than or equal to 2.0 cfs per site acre
- 1% storm peak rate less than or equal to 3.0 cfs per site acre

For Release Points 1, 3, and 4, HydroCAD output represents the design release rate. For Release Point 2, we are proposed to route all existing flows to the proposed detention facility located in the northeast corner of the site.

Table 3-1 – HydroCAD Runoff Conditions are shown in Table 3-3.B - Required & Proposed Runoff Comparison. The proposed post-development design release rates are shown next to the allowable release rates for comparison.

**Table 3-2.B – Allowable Release Rate Calculations**

| Allowable Release Rate (CFS) Calculations |              |             |  |   |                                    |
|---|--------------|-------------|--|---|------------------------------------|
| Release Point                             | Area (Acres) | Storm Event | Allowable On-Site Release Rate (CFS) (A) | Allowable Off-Site Release Rate (CFS) (B) | Allowable Release Rate (CFS) (A+B) |
| RP-1                                      | 5.51         | 2-YR        | 2.76                                     | 0.00                                      | 2.76                               |
|   |              | 10-YR       | 11.02                                    | 0.00                                      | 11.02                              |
|   |              | 100-YR      | 16.53                                    | 0.00                                      | 16.53                              |
| RP-3                                      | 36.31        | 2-YR        | 18.16                                    | 0.00                                      | 18.16                              |
|   |              | 10-YR       | 72.62                                    | 0.00                                      | 72.62                              |
|   |              | 100-YR      | 108.93                                   | 0.00                                      | 108.93                             |
| RP-4                                      | 20.47        | 2-YR        | 10.24                                    | 11.43                                     | 21.67                              |
|   |              | 10-YR       | 40.94                                    | 18.56                                     | 59.50                              |
|   |              | 100-YR      | 61.41                                    | 27.98                                     | 89.39                              |



**Table 3-3.B - Required & Proposed Runoff Comparison**

| Site Release Information (cubic feet per second) (w/ EDDB) |               |             |                              |                           |
|--|---------------|-------------|------------------------------|---------------------------|
| Area   | Drainage Area | Storm Event | Allowable Release Rate (CFS) | Design Release Rate (CFS) |
| RP-1   | 5.51          | 2-YR        | 2.76                         | 2.67                      |
|  |               | 10-YR       | 11.02                        | 4.05                      |
|  |               | 100-YR      | 16.53                        | 15.22                     |
| RP-3   | 36.31         | 2-YR        | 18.16                        | 13.80                     |
|  |               | 10-YR       | 72.62                        | 35.30                     |
|  |               | 100-YR      | 108.93                       | 87.30                     |
| RP-4   | 20.47         | 2-YR        | 21.67                        | 4.69                      |
|  |               | 10-YR       | 59.50                        | 10.37                     |
|  |               | 100-YR      | 89.39                        | 12.89                     |

Please note: Site release rates are not a direct addition of sub-basin runoff due to differences in the time peak as well as storage effects within the basins.

Proposed stormwater drainage structures will be located throughout the site to capture and convey proposed stormwater runoff to both dry detention basins. The Water Quality volume for all proposed basins will be released over 40 hours. Water quality outlet structures have been provided for each basin and have been designed to meet the allowable release rates provided in Table 3-2 for the 2, 10, and 100 year storm events. The water quality storm event will be controlled by a 15" riser pipe with 1" diameter orifices evenly spaced across the pipe for the extended dry detention basin, and V-notch weirs will be utilized for all proposed extended wet detention basins.

Emergency spillways will be provided for each basin per Section 5600 of the Design and Construction Manual. Each emergency spillway will be set 0.5 feet above the 100-year water surface elevation and designed to carry the 100-year storm event assuming a 100% clogged condition. An additional 1 foot of freeboard will be provided from the

water surface elevation in the spillway and the top of dam. Final emergency spillway details will be provided with the Final Stormwater Management Report and construction documents.

Additionally, erosion control procedures will be designed and implemented at the outlets to reduce impact on the site downstream.

\* \* \* \* \*

#### **4.0 SUMMARY AND RECOMMENDATIONS**

The proposed drainage site is a 62.40-acre mixed use parcel of land located in Lee's Summit, MO at the intersection of Blue Parkway and Blackwell Road. The proposed development has been analyzed and designed to meet the APWA Comprehensive Control Strategy, which entails limiting post-development peak discharge rates from the site for the 2-Year, 10-Year, and 100-Year design storm events. One extended dry detention basin and three extended wet detention basins have been designed to detain the mentioned events as well as provided 40-hour detention of runoff from the local 90% mean annual event. All elements of the enclosed drainage system will be designed and constructed in accordance with all City of Lee's Summit, Missouri, requirements.

\* \* \* \*