

Stormwater Management Memorandum (Royal Stone & Landscaping)

To: City of Independence
Attn: Rick Arroyo
From: HG Consult (Richard Michael)
Date: March 22, 2023
Re: Detention Pond Calculations



Introduction

The purpose of the study was to analyze the hydrology/hydraulics of the Royal Stone & Landscaping development and determine detention pond sizes in accordance with APWA 5600 (Stormwater Detention and Retention) and City of Independence Detention Basin Requirements.

The subject property is a group of un-platted parcels (3.42 total acres) located north of West 23rd Street and west of South Cottage Street. The parcels are undeveloped and are currently zoned C-2 (General Commercial) and R-12 (Two Family Residential) per the city's zoning map. The development is proposing a rezoning to C-3 (Service Commercial). The site drains north as represented in the grading plans. A detention pond is being proposed to capture the runoff from the proposed improvements. An outlet structure will be installed in the detention pond with an outlet pipe discharging to the north (the same direction the existing discharge flows). The drainage area discharging to the pond is 3.42 acres. An SCS curve number of 88 (Light Industrial per APWA Table 5602-3) has been applied for the drainage area. The proposed detention pond release rate shall not exceed 1.8 cfs per site acre, as stated in the City of Independence Detention Basin Requirements. The proposed detention does release the WQ event (1.37" of rainfall) over a 40-hour duration. See Water Quality Hydrograph for more information. An SCS 24-hour hydrograph with a Type II distribution was used for all calculations. The analysis was completed with Pond-Pack Connect Edition utilizing SCS Hydrograph methodology. Time of concentration was assumed at 5 minutes for calculations. The subsequent 100-Year event with the primary outlet clogged will be routed through the top of the outlet structure.

Findings

Methods and Rainfall Data				
Pond Routing	Pondpack using SCS Method			
Existing CN	74			
Tc	5 minutes			
Water Quality, type II, 24-hr	1.4 inch			
2-yr rainfall, type II, 24-hr	3.5 inch			
10-yr rainfall, type II, 24-hr	5.3 inch			
100-yr rainfall, type II, 24-hr	7.7 inch			

Table I – Methodology and Rainfall Data



Existing Drainage Areas and CN Values

Area ID	Area (Ac)	CN Value (Existing)	
E-1	3.42	74	

Proposed Drainage Areas and CN Values

Area ID	Area (Ac)	CN Value (Proposed)	
P-1	3.42	88	

Allowable Discharge

	100-Year
P-1 (Ac)	3.42
Allowable Discharge per acre (cfs)	1.8
Allowable Discharge (cfs)	6.16

Proposed Flow Values and Pond Results

	2-Year	10-Year	100-Year	100-Year*
P-1 POI (Detention Pond Discharge) (cfs)	3.89	4.98	6.04	20.18
Detention Pond WSE	921.98	922.77	923.67	925.06
Freeboard	9.02	8.23	7.33	5.94

*Assumes zero flow through primary outlet with subsequent 1% storm event

Detention Pond Input Data/Outlet Structure Design

	ELEV
18" Culvert (Upstream Invert)	919.90
(1) 2" Dia. Orifice (WQ)	920.00
(1) 0.4' x 2.0' Orifice (100yr)	920.90
4'x4' Outlet Structure Top (100-Year*)	924.20
Top of Pond	931.00

*Assumes zero flow through primary outlet with subsequent 1% storm event



Water Quality Hydrograph



Detention Pond Volume Table

Volume Results Table

	Elevation (ft)	Planimeter (ft²)	Area (acres)	A1+A2+sqr (A1*A2) (acres)	Volume (ac-ft)	Volume (Total) (ac-ft)
1	920.00	0.00	0.08	0.00	0.000	0.000
2	922.00	0.00	0.21	0.42	0.282	0.282
3	924.00	0.00	0.35	0.83	0.552	0.834
4	926.00	0.00	0.42	1.15	0.764	1.598
5	928.00	0.00	0.50	1.37	0.916	2.514
6	930.00	0.00	0.58	1.62	1.078	3.592
7	931.00	0.00	0.65	1.84	0.613	4.205



Detention Pond Volume Graph



Conclusion

The proposed development will provide control for all developed areas via a detention pond that discharges to the north, matching the existing topography. A riprap area will help dissipate the minimal amount of flow leaving the detention pond before it is discharged. The subsequent 100-Year storm event will flow through the top of the outlet structure (4'x4' riser).

As mentioned previously in this report, a 1.8 cfs per site-acre release rate was applied to the proposed drainage area, per City of Independence Detention Basin Requirements. The proposed detention does release the WQ event (1.37" of rainfall) over a 40-hour duration. See Water Quality Hydrograph for more information.

The top of the outlet structure will act as the emergency spillway in the subsequent 100-year event if the primary outlet is clogged. The elevation of said spillway is greater than 0.5 feet above the 100-year WSE, meeting APWA criteria. There is also more than 1 foot of freeboard from the design stage to the top of dam per APWA criteria. See attached PondPack calculations for additional information.