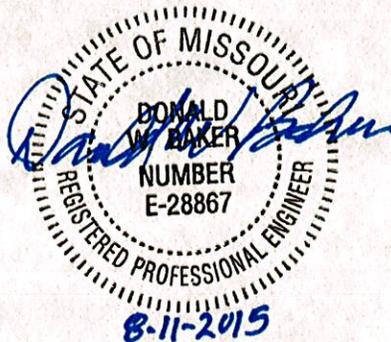


PAC Regional Detention Analysis Quik Trip/City of Parkville, Missouri



Water Resources Solutions



8800 Linden Drive
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PARKVILLE PUBLIC WORKS DEPT.

Approved for:

Site Development Permit

Date: 11/4/15

By: AKA





Water Resources Solutions

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August 11, 2015

Alysen M. Abel, P.E.
Public Works Director
City of Parkville, Missouri 64152

Subject: PAC Regional Detention Analysis

Dear Alysen:

Water Resources Solutions is pleased to submit our analysis for the PAC regional detention facility. In addition to the report, we have a variety of supporting models and information available to you should you require them.

If you have any questions, please contact Karen Quackenbush at 816-699-8105 or KQuackenbush@wrsr-rc.com. If Karen is unavailable, please contact me at 913-302-1030 or DBaker@wrs-rc.com.

Sincerely,
Water Resources Solutions, LLC

Donald W. Baker, P.E., D. WRE, CPESC
Principal and Owner
Enclosure[s]



Existing Conditions

Currently, approximately 47.26 acres contributes to the existing PAC Regional Detention Basin. The detention basin sits south of Clark Ave on the west side of Hwy 9. The basin has a maximum storage volume of 7.8 AC-FT. Currently, it outlets through an overflow structure located on the south side of the basin. The grate on the structure has eight equal openings that are 3 inches wide by 36 inches long for a total of 6 ft². There is also a 15" RCP that connects into the grated inlet. Based on future land use and current soils map, Water Resources Solutions (WRS) calculated the CN to be 93. The area shown in Figure 1 produced the flows shown in Table 1. WRS used the program Watershed Management System (WMS) 10.0 to determine the drainage area and lag time for the bulk of the drainage. For the remaining portion adjacent to Hwy 9, drainage areas were delineated using the contour mapping provided by the county. Those areas were then input into a storm system using EPA-SWMM. With the use of EPA-SWMM, a lag time for the smaller drainage areas was determined. Both watersheds were then input into HEC-HMS and routed to the detention basin. Table 2 shows the peak discharges and ponding elevation for the detention basin.

Table 1 Existing Condition Flows

Storm Event	Q (cfs)
1-yr	39.6
2-yr	48.8
5-yr	64.9
10-yr	78.7
25-yr	98.7
50-yr	114.8
100-yr	131.3

Table 2 Existing Basin Hydraulics

Storm Event	Discharge (cfs)	Peak Elevation (ft)
1-yr	16.6	908.8
2-yr	31.6	909.2
5-yr	59.8	910.0
10-yr	68.8	910.4
25-yr	79.3	910.9
50-yr	86.8	911.3
100-yr	95.7	912.0

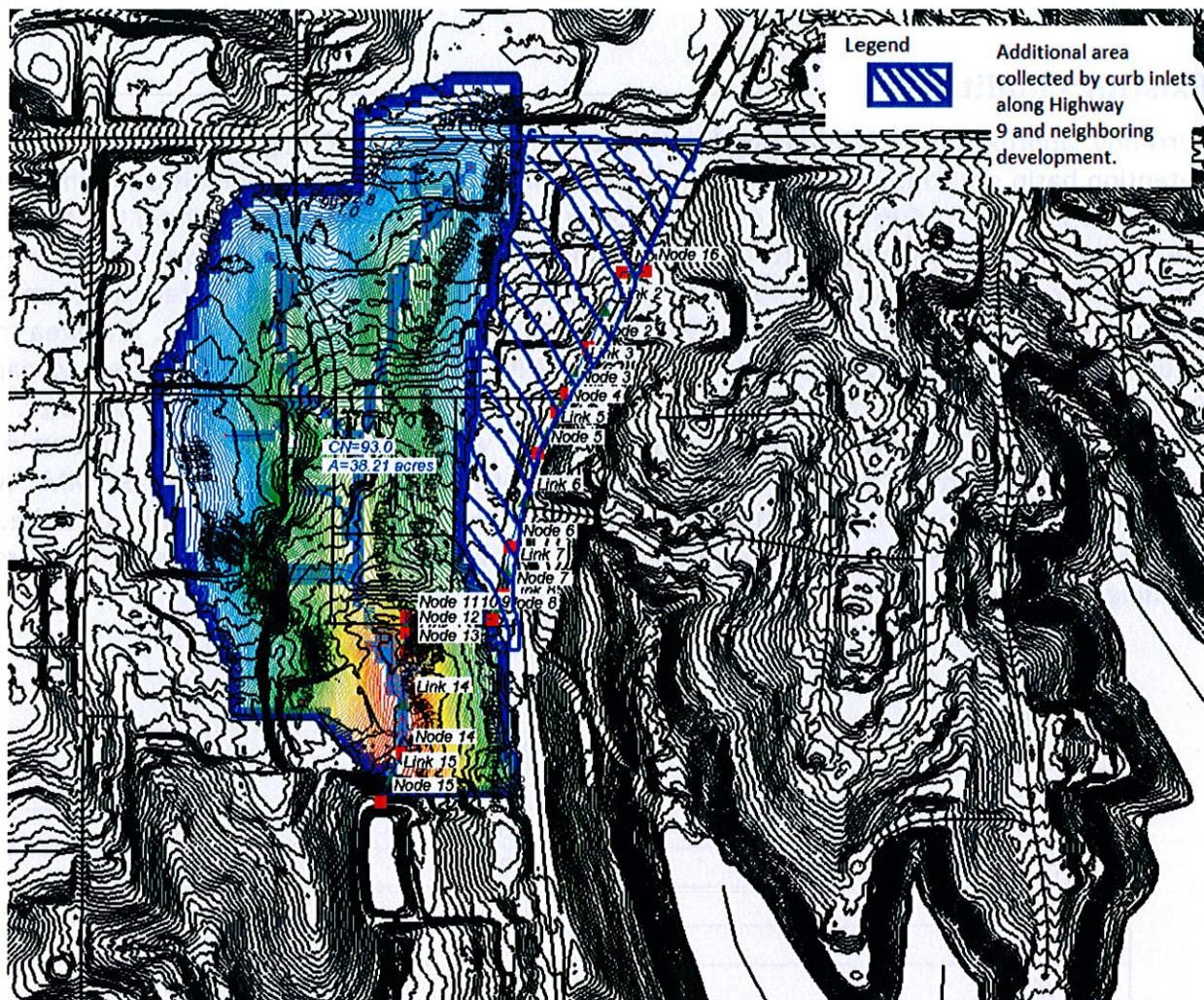


Figure 1 Existing Conditions Drainage Area

Proposed Conditions

In the proposed condition, approximately 48.7 acres contributes to the existing detention basin. Based on future land use and current soils map, WRS calculated the CN to be 93. It is the desire of the city of Parkville that the additional flow from the Quik Trip site be routed to the existing detention basin. The area shown in Figure 2 produced the flows shown in Table 3. WRS used the program WMS 10.0 to determine the drainage area and lag time for the bulk of the drainage. Two additional areas were added: 1) the portion adjacent to Hwy 9 on the west side, and 2) the area for the Quik Trip site. The additional flow from the Quik Trip site for the 100-yr storm event was provided to WRS by Darla K. Holman Land Development Engineer. All other flows for the 1-yr, 2-yr, 5-yr, 10-yr, 25-yr and 50-yr storm events were based on the provided flow. Those areas were then input into a storm system using EPA-SWMM. With the use of EPA-SWMM, a lag time for the smaller drainage areas was determined. Both watersheds were then input into HEC-HMS and routed to the detention basin. Table 4 shows the peak discharges and ponding elevation for the detention basin.

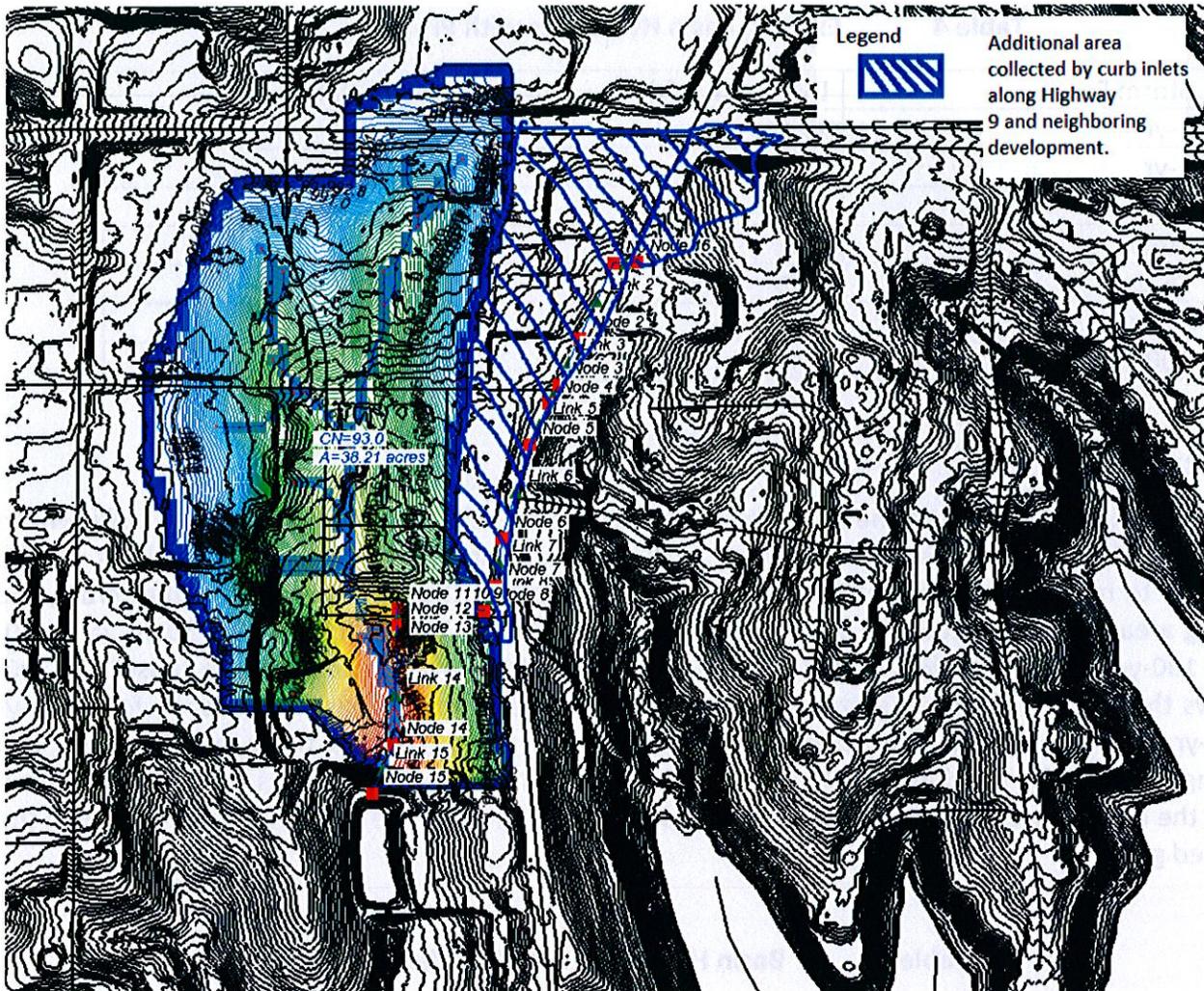


Table 3 Proposed Condition Flows

Storm Event	Q (cfs)
1-yr	41.7
2-yr	51.5
5-yr	68.4
10-yr	82.9
25-yr	104.0
50-yr	121.0
100-yr	138.4

Table 4 Existing Basin Hydraulics with Proposed Flows

Storm Event	Discharge (cfs)	Peak Elevation (ft)
1-yr	17.9	908.8
2-yr	35.9	909.3
5-yr	63.1	910.2
10-yr	71.1	910.5
25-yr	82.6	911.1
50-yr	90.4	911.6
100-yr	99.7	912.3

Conclusions

With the additional flow from the proposed Quik Trip site, the existing detention basin is sufficient to contain the 100-yr storm event. However, peak flows leaving the basin are increased. It will be necessary to modify the pond outlet works by covering up 2 of the 8 "slots" in the outlet grate, the opening area will be reduced to 4.5 ft². This will decrease the peak flows for the 5-yr, 10-yr, 25-yr, 50-yr and 100-yr storm events leaving the basin. The extra head of elevation necessary to "push" the 100-yr flows through the modified grate will be contained in the detention basin. However, for the 1-yr and 2-yr storm events there is an increase in discharge. Table 5 shows the peak discharges and ponding elevation for the detention basin when the modified overflow structure is functioning. Table 6 shows the discharge differences between the existing conditions and the proposed conditions with the modified grate.

Table 5 Basin Hydraulics with Modified Grate

Storm Event	Discharge (cfs)	Peak Elevation (ft)
1-yr	17.7	908.8
2-yr	35.1	909.3
5-yr	58.6	910.4
10-yr	64.5	910.9
25-yr	72.1	911.6
50-yr	79.8	912.4
100-yr	88.1	913.5

Table 6 Discharge Comparison between Existing and Modified Grate

Storm Event	Existing Discharge (cfs)	Proposed Discharge (cfs)
1-yr	16.6	17.7
2-yr	31.6	35.1
5-yr	59.8	58.6
10-yr	68.8	64.5
25-yr	79.3	72.1
50-yr	86.8	79.8
100-yr	95.7	88.1

Further analysis was done in an attempt at lowering the outlet flows for the 1-yr and 2-yr storm events. The reason we have an increase in flow for the small storms is the fact that they pond up just beyond the elevation of the inlet, so reducing the inlet opening has a minimal effect on the discharge. WRS looked at two options.

Option 1

Option 1 is to lower the 15" RCP to an elevation of 902 ft. This solution not only held the 100-yr storm in the existing basin, but also reduced the flows for all of the storms. Table 7 shows the peak discharges and ponding elevation for the detention basin for Option 1. Table 8 shows the discharge differences between the existing conditions and the flows for option one. Option 1 would require the excavation of approximately 175 yd³ of dirt, the need to core through the existing inlet, removal of the existing 15" RCP, as well as the cost of 30 feet of new 15" RCP.

Table 7 Basin Hydraulics for Option 1

Storm Event	Discharge (cfs)	Peak Elevation (ft)
1-yr	15.0	908.1
2-yr	24.8	908.7
5-yr	47.1	909.8
10-yr	65.0	910.6
25-yr	76.6	911.5
50-yr	84.0	912.3
100-yr	90.8	913.0

Table 8 Discharge Comparison between Existing and Option 1

Storm Event	Existing Discharge (cfs)	Proposed Discharge (cfs)
1-yr	16.6	15.0
2-yr	31.6	24.8
5-yr	59.8	47.1
10-yr	68.8	65.0
25-yr	79.3	76.6
50-yr	86.8	84.0
100-yr	95.7	90.8

Option 2

Option 2 would be to raise the grate up to an elevation of 909.50 ft as well as covering only 1 of the 8 “slots”. Option 2 held the 100-yr storm. However, the 25-yr storm had an increase of 0.6 cfs. Table 9 shows the peak discharges and ponding elevation for the detention basin for Option 2. Table 10 illustrates the comparison of flows between the existing condition and the proposed Option 2 condition. Option 2 does not require any excavation to the surrounding area. From an ease of construction as well as cost effective point of view, it is the recommendation of WRS that Option 2 be implemented.

Table 9 Basin Hydraulics for Option 2

Storm Event	Discharge (cfs)	Peak Elevation (ft)
1-yr	15.9	909.1
2-yr	23.5	909.9
5-yr	51.5	910.8
10-yr	68.1	911.4
25-yr	79.9	912.3
50-yr	86.0	912.9
100-yr	92.0	913.4

Table 10 Discharge Comparison between Existing and Option 2

Storm Event	Existing Discharge (cfs)	Proposed Discharge (cfs)
1-yr	16.6	15.9
2-yr	31.6	23.5
5-yr	59.8	51.5
10-yr	68.8	68.1
25-yr	79.3	79.9
50-yr	86.8	86.0
100-yr	95.7	92.0



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