FINAL
STORM WATER
DRAINAGE
REPORT

for

QuikTrip Store #0189

Missouri Highway 45 & Missouri Highway 9
Parkville, Missouri

Prepared For:
QuikTrip Corporation
5725 Foxridge Drive
Mission, Kansas 66202

Prepared By:
Darla K. Holman, P.E.
Project Civil Engineer
6734 Red Oak Drive
Shawnee, Kansas 66217
913.248.9385

June, 2015

PARKVILLE PUBLIC WORKS DEPT.
Approved for:
Site Development Permit
Date: 11/4/15
By: AMA

ENGINEER'S CERTIFICATION
Final Storm Water Drainage Report
QuikTrip Store #0189

MO HWY 45 & MO HWY 9
Parkville, Missouri

I Hereby Certify that this Engineering Document was prepared by me and that I am a duly Registered Professional Engineer under the laws of the State of Missouri.

Darla K. Holman, P.E.
Project Civil Engineer
Missouri Registration No. E-25284

6/25/15
Date

STATE OF MISSOURI
DARLA K. HOLMAN
NUMBER E-25284
REGISTERED PROFESSIONAL ENGINEER
6/25/15

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REPORT PURPOSE

This drainage report has been prepared to detail the final design for the storm water management and water quality treatment proposed for the QuikTrip Store #0189 facility to be located at the southeast corner of Missouri Highway 45 and Missouri Highway 9.

PROJECT SUMMARY

QuikTrip Corporation is proposing to build a new Generation III convenience store at the southeast corner of Missouri Highway 45 and Missouri Highway 9 in Parkville, Missouri. The store will be oriented to face Missouri Highway 45. The new facility will feature a 5,858 square feet convenience store and a 9 multi-dispenser fueling canopy. The property, after right of way purchase, will contain 117,982 s.f. (2.7085 acres).

EXISTING DEVELOPMENT

The existing property once contained two residential lots. Based on historical images from Google Earth, the original homes and gravel driveways were removed around 2007. From these images it was determined that the property once contained approximately 4,025 s.f. of impervious roof areas, and approximately 19,573 s.f. of gravel driveways (approximately 11.7% impervious).

The property is on a hill crest. No off-site storm water currently drains across the property. The property currently is divided into three drainage areas as detailed on the Pre-Development Drainage Map included in the Appendix. Runoff calculations for the 50% and 1% storm events are included on the map.

PROPOSED DEVELOPMENT

The proposed development will contain 76,274 s.f. of impervious area (64.6%). An on-site storm drainage system will be designed to capture a majority of the 1% storm water runoff from the site's impervious areas and direct it through an underground detention system. Water Quality Storm Inlet Insert Filters and a Water Quality Proprietary Unit will be installed to meet the required Value Rating for the development.

Since there are no downstream systems available on the east side of Missouri Highway 9 (within public right of way or within public storm drainage easements); a storm pipe is proposed to be installed from the QuikTrip site to an existing grate intake on the west side of the Highway 9. A separate analysis of this system has been performed by Water Resources Solutions and is detailed in a separate report. Peak discharge from the QuikTrip development will be limited to the allowable release rates detailed in the Section 5600 of APWA.

A majority of the site's storm water runoff will be discharged to Missouri Highway 9 thus significantly reducing any storm water discharge to the east and south. For this reason, the peak discharge from the detention cannot exceed the current peak discharge limitations from the existing drainage area that currently discharges to MO Highway 9 (Drainage Area 3 on the Pre-Development Drainage Map).

WATERSHED

This property lies within the Riss Lake watershed, which outlets to the White Aloe Branch, which discharges to Rush Creek (just south of Parkville) and eventually to the Missouri River. Connecting the QuikTrip storm sewer system to the public system on the west side of Missouri Highway 9 will change watersheds. Discharge from the QuikTrip property will flow to the Parkville Commons (PAC) regional detention pond on the west side of Missouri 9 Highway. This detention pond outlets to a tributary to Rush Creek. White Aloe Branch connects to Rush Creek just before Rush Creek reaches the Missouri River. The analysis of the PAC detention facility has been performed by Water Resources Solutions and is detailed in a separate report.

FLOODPLAIN CERTIFICATE

According to "Flood Insurance Rate Map" Community Panel No. 290291007-B, as published by the Federal Emergency Management Agency, this property lies within Zone C, areas of minimal flooding, determined to be outside the 100 year and 500 year flood plain.

STORM WATER PEAK RUNOFF CONTROL

The allowable peak storm water discharges from the site will be limited to the existing drainage area's peak flows currently flowing to Missouri 9 Highway. The allowable peak flows were calculated assuming an undeveloped site. Since only 1.5888 acres currently discharge to this area, the maximum peak discharges from the detention facility must be limited to (refer to Pre-Development Drainage Area Map):

2 year – 2.52 cfs
5 year – 3.48 cfs
100 year – 6.16 cfs

However, the APWA manual restricts runoff from a development as follows:

2 year – 0.5 cfs / acre or 2.52 X 0.5 = 1.26 cfs
5 year – 2.0 cfs / acre or 2.52 X 2.0 = 5.04 cfs
100 year – 3.0 cfs / acre or 2.52 X 3.0 = 7.56 cfs
Where 2.52 is the acreage draining through the detention facility.

Since 3,918 s.f. (0.0899 acres) of proposed additional impervious area contained within Drainage Area 8 will bypass the detention the allowable release rate for each storm event must be limited to:

2 –year :1.26 cfs – 0.43 cfs = 0.83 cfs
5 – year: 3.48 cfs – 0.59 cfs = 2.89 cfs
100-year: 6.16 cfs – 1.04 cfs = 5.12 cfs

An underground detention system has been sized and designed with a staged release system that will result in the following conservative storage/discharge values:

Storm Event	Storage Used	Peak Discharge
2-year	12,341 c.f.	0.758 cfs
10-year	20,253 c.f.	2.108 cfs
100-year	30,323 c.f.	4.166 cfs

The proposed detention system design contains 28,250 c.f. of storage in an 8-feet diameter underground pipe system. The staged discharge will be controlled by three orifices (4", 8" and 3"). Refer to appendix for calculations and plans.

WATER QUALITY TREATMENT

To address the water quality for this site, calculations were performed to determine the required Value Rating (VR) for the site and develop a BMP Mitigation Package for the proposed improvements per the 2012 APWA BMP Manual. Because the site once contained residential lots, these were considered when determining the required level of service. Worksheets for these calculations are included in the Appendix and are detailed as follows:

Step 1: Determine the amount of site area to be disturbed by redevelopment activities. Calculate the required area for treatment by subtracting the amount of existing impervious area within the disturbed area from the total disturbed area.

Total Disturbed Area: 2.71
Required Area for Treatment: 2.71 – 0.31 = 2.40

Step 2: Calculate the proposed percent impervious for the post-development condition by dividing the net increase in impervious area within the disturbed area by the required area for treatment. Enter Table 4.3 with the result to determine the required Level of Service.

Net Increase in Impervious: 1.68 – 0.31 = 1.37.
Proposed Percent Impervious: 1.37 / 2.40 = 0.57 or 57%
Required Level of Service from Table 4.3 is 5.8

Step 3: Determine the Minimum Required Total Value Rating of the BMP by multiplying the LS by the required area for treatment.

Total Required Value Rating: 5.8 X 2.40 = 13.91

Step 4: Calculate the Mitigation Package Total VR based on assigned VR for each BMP and the area of the site that the BMP would treat. If the proposed Mitigation Package does not meet the required Total VR, apply different BMPs or apply multiple BMPs in a "treatment train" approach.

Mitigation Package Total Value Rating:		
Areas to WQ Unit & WQ Inlet Inserts (TT)	2.17 X 8.0 =	17.36
Areas to WQ Unit	0.35 X 5.0 =	1.75
Areas of bypass	0.19 X 0.00 =	0.00
Total VR		19.11 > 13.04

PROPRIETARY UNITS

Since this is a fuel dispensing facility (labeled as a "hot spot" in the BMP manual) it has the capability of producing higher concentrations of pollutants and best management practices should be considered in the design. When a development is considered a "hot spot", a water quality protection package should be created that avoids the use of typical BMPs (such as infiltration practices) in order to avoid contributing to groundwater contamination. For this reason, two separate proprietary units are proposed to treat water quality. One system will be a curb inlet insert that contains a filter to capture hydrocarbons. These will be installed at every curb inlet on the property. The curb inlet filters will be the "Curb Inlet Baskets" by SunTree Technologies, Inc., or approved equal. Each basket is to include the "Storm Boom" for hydrocarbon absorption. The second system is the FloGard Dual –Vortex Hydrodynamic Separator with oil filter by Kristar. This unit will be placed downstream from the storm water detention facility so the majority of the storm water runoff from this property will be treated. Detailed information on these units can be found in the Appendix.

STORM DRAINAGE SYSTEM DESIGN METHODOLOGY

The Rational Method was used to calculate the peak discharges. The site's storm sewer systems were designed to convey the 100-year storm peak runoff to the proposed storm water detention facility. See Appendix for drainage calculations.

CONCLUSION

A storm water detention system has been designed to meet and exceed the City's Storm Drainage Design Criteria. The peak storm water discharge from the property will be less than the undeveloped site's peak storm water discharge for the 2-year, 10-year and 100-year storm events.

A water quality mitigation package is proposed to treat the storm water runoff. The proposed treatment package exceeds the 2012 APWA BMP Manual requirements. With the use of the proprietary units, all runoff from the property can safely be released to the existing public storm sewer system.