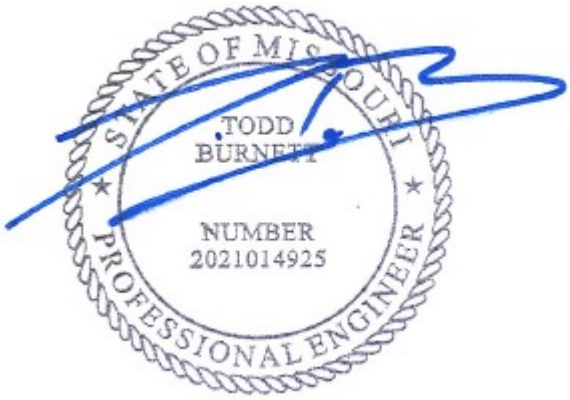
STORMWATER MANAGEMENT REPORT

Caliber Collision
710 SE 7th Terrace
Lee's Summit, Missouri 64063



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I. PROJECT DESCRIPTION

The following is the stormwater management report for the proposed Caliber Collision at 710 SE 7th Terrace in Lee's Summit, Missouri This site is approximately 1.38 acres . Development will consist of the construction of a 11,500 square foot Caliber Collision automotive collision repair facility, all associated utilities, vehicle storage area, parking areas, grading, landscaping, and stormwater management facilities. As there is not enough surface area available due to site restraints and landscape requirements, a StormTech Underground Detention System is proposed for the developed site's stormwater runoff requirements. This underground detention system consists of 45" high MC-3500 Chambers with 9" of stone below and 12 "of stone above it with total storage height of 66" from elev. 2008.5 to elev. 2014.0. The outfall of the underground detention system is to exit the site via a storm sewer to an existing catch basin storm structure located within the existing drainage easement at the northeast of the site in Lot 3 Chapman Plaza II. All of the runoff from the developed site (approximately 1.1 acres in total) is captured by/treated by the underground detention system. A storm sewer is provided along the north of site to by-pass the runoff from future development at west of the site. The construction activities for the Caliber Collision discussed above will disturb approximately 1.30 acres.

The property is bordered by SE 7th Terrace to the north, SE Blue Parkway to the south, Calvert's Express Auto Service & Tire to the east, and Classic paint & Collision, Inc. to the west.

As previously stated, ***all*** discharge from the site is ultimately routed to an offsite storm structure located in Lot 3, Chapman Plaza II which will be connected to storm system at SE 7th Terrace and ultimately directed to a tributary of the E. Fork Little Blue River.

Executive Summary

This hydraulic study will show the proposed site will be developed to meet all City of Lee's Summit Stormwater Management requirements. The on-site storm system has been designed to meet the requirements in Section 5608.4.C1 Comprehensive Control as outlined in APWA Section 5600 "Storm Drainage Systems & Facilities", which requires the design to "limit the two-year rate less than or equal to 0.5 cfs per site acre, ten-year rate less than or equal to 2.0 cfs per site acre, 100-yr rate less than or equal to 3.0 cfs per site acre and 40-hour extended detention of 1.37"/24 hour rainfall. The existing site has Hydrologic Soil group "C" soil. As previously mentioned, various site constraints prevent a traditional stormwater pond design. The provided system's designs primary method of attenuating the requirements will be via underground storage.

Flow Rate Summary Table

Developed Site Area Acre	Storm Event (24-hour duration)	Allowable Development Peak Flow Rate (cfs)	Post-Development Peak Flow Rates (cfs)
1.1	2-year	0.55	0.31
1.1	10-year	2.2	0.53
1.1	100-year	3.3	2.4

II. PRE-DEVELOPMENT CONDITIONS:

The proposed development is situated on an approximately 1.38-acre tract of land located at 710 SE 7th Terrace. The site is legally described as Lot 2, Chapman Plaza II.
Per topographic survey by Heideman Associates Inc. dated 05-04-21, the property was covered with gravel and grass and elevations varied from 2014 t0 2018. The site generally slopes downward in direction from south side of the site to north side. The runoff from the site is collected and conveyed by the existing storm drain system at SE 7th Terrace. As the required stormwater Management does not take account of the existing condition, this report has not analyzed the existing hydrology parameters.
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III. POST-DEVELOPMENT CONDITIONS:

An underground chamber detention system is proposed to be located at the north and east of the site within the open space and parking lot. The proposed underground detention system is a MC-3500 StormTech Chamber System, an open bottomed chamber. Reference the Site Development Plans for Caliber Collision for additional information of the underground detention system. Outflow from the detention system will be routed through an outlet riser structure and conveyed through a proposed storm pipe system to an existing catch basin storm structure located within the existing drainage easement at the northeast of the site in Lot 3 Chapman Plaza II. The outflow from detention system will be connected to the by-pass line from Lot 1 before connecting it to the existing catch basin structure. This piped system drains eventually to the tributary of E. Fork Little Blue River through the storm drain system at SE 7th Terrace.

The detention system is designed to store and release the majority of runoff generated by the proposed development.

The area analyzed in the Post-Development condition comprises of 1.1 acres of developed site from total of 1.38 acres. Visual representations of these areas and their layout configuration have been provided in Appendix A of this report and is titled the "Post Development Map". This area contains the majority of the proposed Caliber Collision

development including the building all the paved parking and curbed areas. Utilizing proposed curb and gutters, roof leaders, inlets, vegetated swales and the proposed storm sewer system by Caliber Collision, Post-Development Area will be routed to the proposed underground detention system.

Runoff Calculations:

Runoff calculations are performed for Post-Development drainage area as per SCS unit Hydrograph method using Hydraflow and TR-55.

A. Runoff Curve Number:

Land use curve number is used based upon Section 5602.3, Table 5602-3 APWA "Storm Drainage Systems & Facilities ".

Post-Development Area

Business: Neighborhood Areas Hydrologic Soil Group C
CN = 94

Total Land Area = 1.1 Acres
Weighted Runoff Curve Number = 94

B. Time of Concentration:

Shortest time of concentration of 0.10 hour is assumed.

C. Rainfall:

The 24-hour precipitation amounts for the site as provided by SCS Tr-55 for Jackson County are as follows:

2-year storm event:	3.8 inches
10-year storm event:	5.5 inches
100-year storm event:	8.3 inches

D. Rate of Runoff:

Above curve numbers and times of concentration were used to determine rate of runoff using the SCS hydrograph method. A hydrograph for the post-development conditions of the site under study can be generated showing rate of flow versus time. These hydrographs are included in Appendix B. Following are the computed peak rates of runoff for the drainage basins:

Post-Development Area (to Underground Detention System)

Storm Event (24-hour duration)	Peak Flow Rate, Q (cfs)
2-year	5.3
10-year	8.0
100-year	12.3

Post-Development Area (Out of the Underground Detention System)

Storm Event (24-hour duration)	Peak Flow Rate, Q (cfs)	WS elev (Top of Storage el. 2014.0)
2-year	0.31	1010.4
10-year	0.53	1011.3
100-year	2.4	1013.0

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As can be seen in the table above, the underground detention system acts to reduce the developed peak discharges from the 2-year, 10-year, and 100-year, 24-hour storm events. This is aided by the by the open bottomed design of the MC-3500 StormTech Chamber System proposed for this development.

IV. WATER QUALITY DESIGN AND CALCULATIONS:

Water Quality for the project was designed per the City of Lee's Summit's ordinances which requires the 40-hour extended detention of 1.37"/24 hour rainfall.

The Water Quality Volume (WQ_V) that is to be detained for 40 hour is calculated as per APWA/MARC-BMP Manual, 6.2:

- WQ_V = P x Rv x (43560/12) where:
  - P = Rainfall event in inches = 1.37"
  - Rv = Volumetric runoff coefficient = 0.05 +0.009 (I)
  - I = Percent Site Impervious
    I = 85%
    Rv = .05 +.009 x 85 = 0.815

- WQ_V = (1.37) x (0.815) x (43560/12)
  = 4053 Cu. Ft
  Use storage at elev. 1009.83, Storage available = 4199 Cu. Ft
  Release it in 40 hours

- Release rate :4199 cu ft x (1/40x 3600 sec) = 0.029 cf/sec
- Using a 1.0" Orifice
- $Q_{Release} = C_d A_o (SQRT(2*G*H)$
  =0.6*0.055*SQRT(2*32.2*1.33/2)
  =0.022 cf/sec < 0.029 cf/sec, therefore orifice meets 40 hour minimum

Water Quality Storage is provided from elev. 1008.5 to elev. 1009.83 and is released by 1" orifice at elev. 1008.5.
Next opening is 4" orifice at 1009.83

V. PIPE SIZING CALCULATIONS:

Included in this report in Appendix C are the pipe sizing calculations for the on-site pipes and catch basins. These are generated by the rational method, and are based on the 100-year intensity for all storm drain structures flowing to the detention system. These calculations show the total flow for each pipe section, velocity, hydraulic grade elevations, and spreads at each inlet. Reference the Inlet Area Map in Appendix A for clarification of the drainage areas discharging to each inlet and pipe.

Drainage areas for each structure were delineated (see Inlet Area Map in Appendix A) and flow to each catch basin was determined. The drainage to each structure was determined using the Rational Method form of storm analysis where weighted Runoff Coefficients were determined based on each area's coverage. In addition to each structure's added stormwater from their respective drainage area, the discharge from the underground

detention system was added to the pipe's directly "downstream" of the underground detention system.

An analysis of the proposed storm system along SE Blue Parkway was performed to ensure the discharge to the proposed pipe under the proposed driveway is adequately sized when combined with the discharge from the upstream pipes. Also, a storm sewer stub is proposed from the adjacent property to the west of the Caliber Collision property. Inlet "1B" in the plans is proposed to provide connection to an existing storm structure for the adjacent site should it be developed in the future. Per the City of Lee's Summit Code, the maximum allowed discharge form a developed site is 3 cfs per developed acre. Assuming the 1.70 acres delineated in the Inlet Area Map (in Appendix A) is developed, the maximum discharge allowed from the adjacent site would be approximately 5.1 cfs. This runoff value is less than the existing conditions site runoff calculated the Rational Method. Reference should once again be made to the Inlet Area Map provided in Appendix A for calculations and delineations of the drainage areas. To be conservative in the design, the runoff values generated from the existing conditions (the higher value) are used for adequately sizing the storm sewer pipe for the adjacent property's connection to Inlet 1B, and ultimately to the existing storm structure connection point.

Storm profiles of the storm sewer pipe network were created and the Hydraulic Grade Lines resulting from the 100-year, 24-hour storm event discharge was mapped to each pipe. Having each pipe's HGL remain within the pipe proves that each storm pipe is sufficiently sized to accommodate the storm runoff from each structure and development. In the analysis performed for this project, each pipe's 100-year storm event HGL remained within their respective pipes. Reference the Storm Profiles Sheets within the Site Development Plans prepared by Freeland and Kauffman, Inc.

Appendix A

July 20, 2021

Tax Parcels

Selected Parcel

Addresses

Addresses

Nearmap

Red: Band_1

Green: Band_2

Blue: Band_3

1:2,257

0 0.01 0.03 0.06 mi

0 0.02 0.04 0.09 km

City of Lees Summit, Jackson County, MO, Missouri Dept. of Conservation,