

Summit Point Apartments, Phase-II
504 NE Chipman Road
Lee's Summit, Missouri 64063
CFS Project No. 21-5065/19-5293

SW ¼, Section 32 Township 48 North, Range 31 West
Jackson County, Missouri
Tributary P3 to Prairie Lee Lake Watershed

Preliminary Stormwater Drainage Study

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- Water Quality Volume and Outlet Orifice Calculations**
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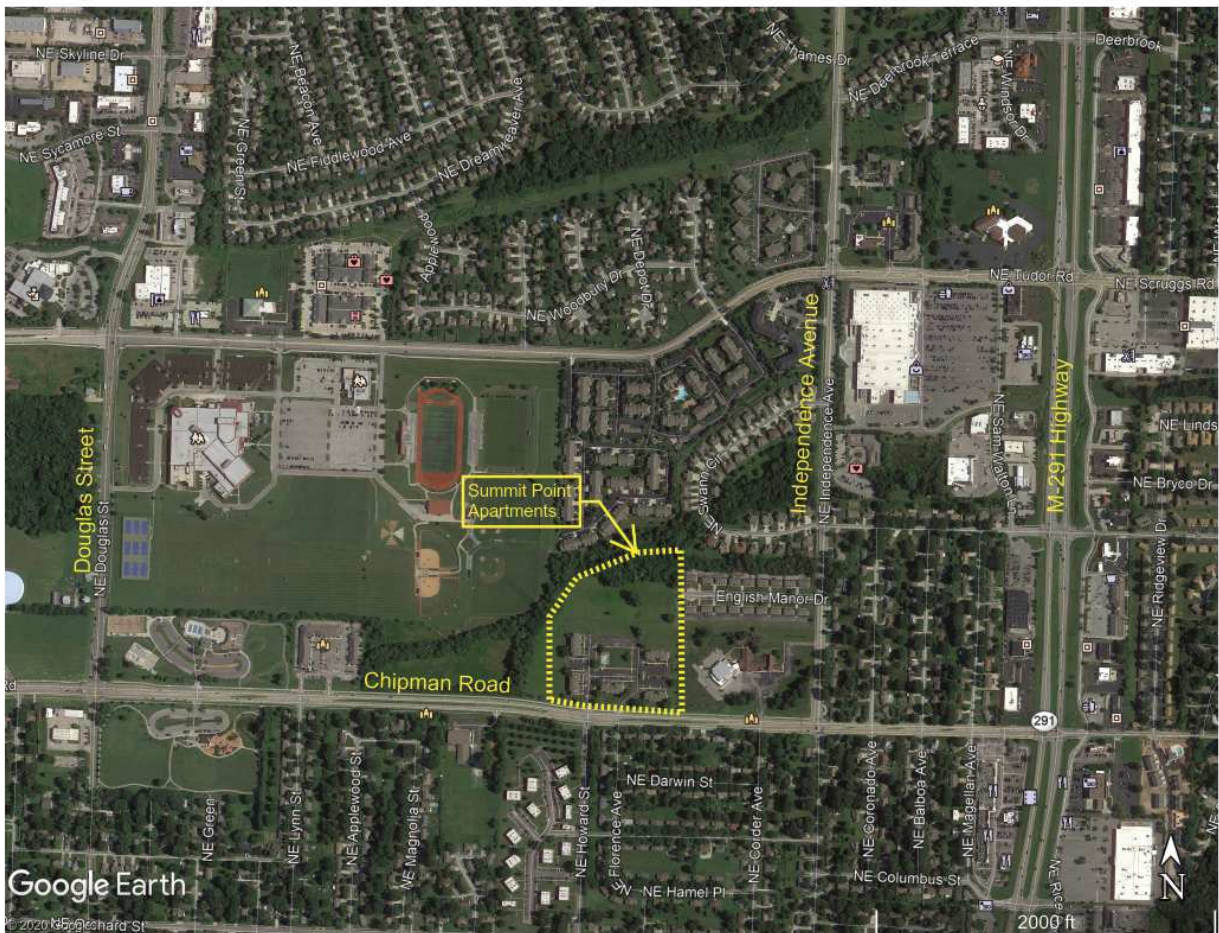
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Introduction:

This Preliminary Stormwater Drainage Study for the proposed Summit Point Apartments, Phase-II has been done at the request of the Canyon View Properties of Santa Cruz, California. The Phase-II addition would be constructed directly to the north of the existing Phase-I apartments located at 504 NE Chipman Road in Lee's Summit, Missouri. Phase I included five multi-unit apartment buildings plus a swimming pool on a 6.49 acre site constructed in 1980. The proposed Phase-II addition would cover 7.21 acres and include six new multi-apartment buildings along with parking lots and service drives.



Vicinity Map of the Summit Point Apartments at 504 NE Chipman Road in Lee's Summit

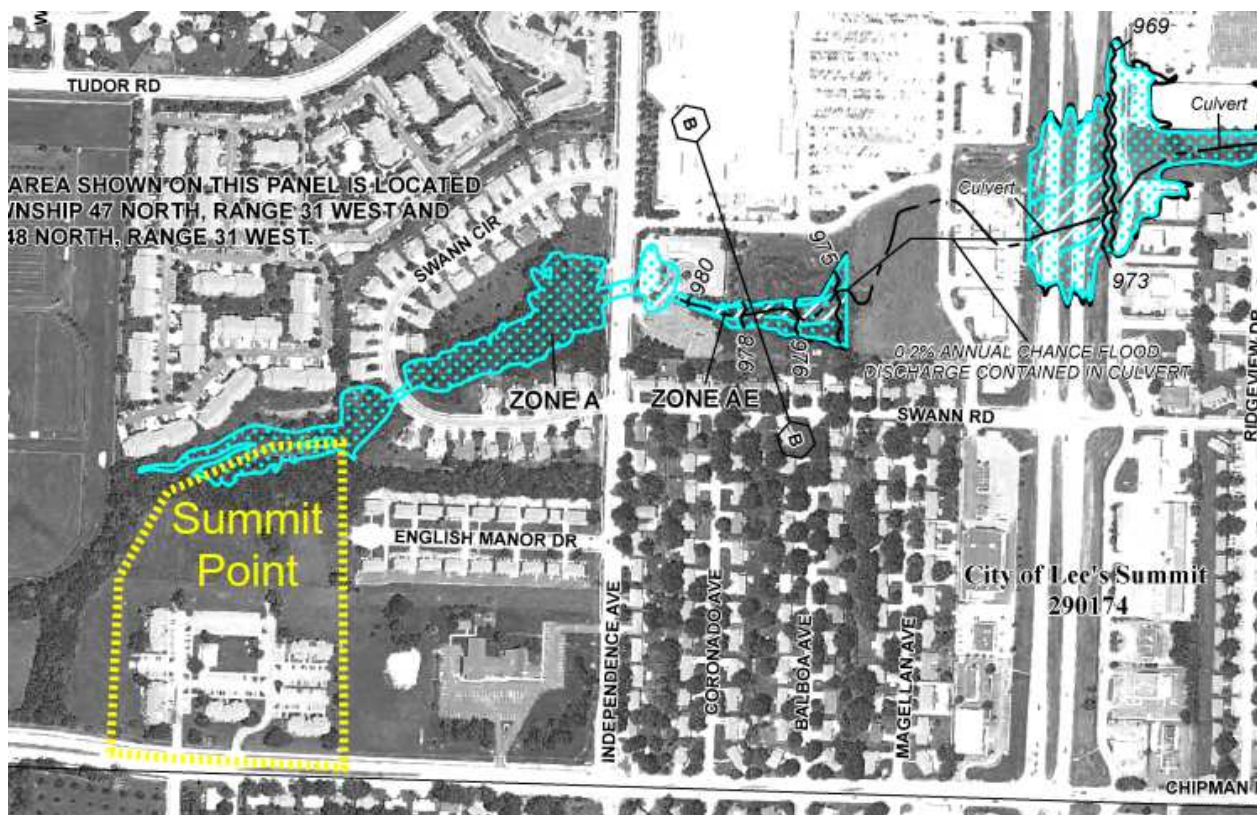
The site would include stormwater detention with an open-graded detention basin on the northeast corner of the project. The stormwater detention release rate for the proposed Phase-II development would comply with the City's allowable release rates for the 2, 10 and 100-year design storms, and would also provide for the extended detention of the 1.37" BMP water quality volume.

General Information:

The proposed Phase-II addition to the existing Summit Point Apartments would be constructed on the 7.21 acre parcel located directly north of the existing apartment complex. The proposed Phase-II site is completely undeveloped. The site slopes downwards to the north where an existing creek (Tributary P3 to Prairie Lee Lake) flows eastwards along the site's northern boundary.

Summit Point Apartments Phase-II Grading Plan

The existing Tributary P3 to Prairie Lee Lake creek has flowline elevations ranging between approximately 994' to 1000' along the northern side of the Summit Point Apartments, Phase II. NE Swann Circle is located directly to the east of Summit Point and has triple 48" HDPE culverts draining the existing creek below the roadway. The existing triple 48" HDPE's have upstream flowline elevations of approximately 986.91' and the top of the roadway has an overflow elevation of approximately 994'.



FEMA FIRM Flood Map 29095C0436G, Showing the Existing Tributary P3 to Prairie Lee Lake Flowing along the Northern Border of the Summit Point Apartments

The FEMA flood map shows defined 1% (100-year) flood elevations further to the east along the creek, but stops short of Independence Avenue. A small portion of the northern side of the site is within the FEMA Zone-A 1%(100-year) floodplain, with the remaining ground above the defined flood limits.

The Ordinary High Water Mark (OHWM) was determined by CFS and verified by Frank Norman of Norman Ecological. The definition of the Ordinary High Water Mark as defined in the US Clean Water Act is as follows:

(7) Ordinary high water mark. The term ordinary high water mark means that line on the shore established by the fluctuations of water and indicated by physical characteristics such as a clear, natural line impressed on the bank, shelving, changes in the character of soil, destruction of terrestrial vegetation, the presence of litter and debris, or other appropriate means that consider the characteristics of the surrounding areas.

The proposed apartment buildings were placed outside of the stream setback along the existing Tributary P3 to Prairie Lee Lake. Stormwater detention for the site would be provided in the open-graded stormwater detention basin located on the northeast corner of the site. The detention basin would have a bottom elevation of approximately 995.0' (the calculated 100-year WSEL in the creek was approximately 994.4'), and the top of dam would be approximately 1003.25' the detention basin would store approximately 1.895 ac-ft of runoff at a peak WSEL of 1000'50' during a 100-year design storm event.

The US Fish and Wildlife Service's National Wetlands Inventory website was reviewed to check if the proposed Summit Point Apartments, Phase II, has any existing wetland areas or streams. The National Wetlands Inventory Map showed the existing Tributary P3 to Prairie Lee Lake as a Riverine, and no other wetlands features on the Summit Point Apartments site.



April 6, 2020

Wetlands	Freshwater Emergent Wetland	Lake
Estuarine and Marine Deepwater	Freshwater Forested/Shrub Wetland	Other
Estuarine and Marine Wetland	Freshwater Pond	Riverine

This map is for general reference only. The US Fish and Wildlife Service is not responsible for the accuracy or currentness of the base data shown on this map. All wetlands related data should be used in accordance with the layer metadata found on the Wetlands Mapper web site.

National Wetlands Inventory (NWI)
This page was produced by the NWI mapper

US Fish and Wildlife National Wetlands Inventory Map of Summit Point Apartments

A review of the project vicinity on the NRCS Web Soil Survey Site showed that the area surrounding the Summit Point Apartments, Phase-II, was comprised of Arisburg-Urban Land Complex soil, 1 to 5 percent slopes, Hydrologic Soil Group C, and Udfarents-Urban Land Sampsel Complex soil, 5 to 9 percent slopes, Hydrologic Soil Group C. A copy of the Natural Resources Conservation Service's Web Soil Survey for the site and surrounding region has been included in the appendix of this report.



**NRCS Web Soil Survey Map of the Summit Point Apartments
(Blue shading indicates Type-C Soils)**

Methodology:

This preliminary stormwater drainage study has been prepared in accordance with Section 5600 Storm Drainage Systems and Facilities, by the American Public Works Association, Kansas City Metropolitan Chapter, and the City of Lee's Summit's Stormwater Report Requirements. The stormwater runoff analysis was analyzed using PondPack's Version 8 hydraulics/hydrology

software, which utilized TR-55 hydrology methods and rainfall depths as stipulated in the APWA-5600 standards and design criteria.

SCS curve number runoff coefficients were calculated based on pervious greenspace at CN = 74 and impervious surfaces at CN = 98. The existing and proposed conditions drainage areas were derived from the existing ground contours and the proposed grading contours, and the amounts of pervious and impervious surface areas were measured and used to calculate composite SCS curve numbers. The times of concentrations for the existing conditions drainage basins were derived using the TR-55 methodology with overland sheet flow, shallow concentrated flow and channel flows. For the proposed site conditions, inlet times for each drainage basin were simplified to five minutes to account for the curbed site and enclosed storm sewer system.

The surface areas for the proposed contour grading for the stormwater detention basin was measured at one foot intervals to derive stage versus storage curves for performing stormwater routing. The outlet structure consisted of a small 2-¼" diameter orifice for storing and metering the outflow from the 1.37"/24-hour rainfall, and a 27" rectangular weir for storing and metering the outflow for the 2, 10 and 100-year storms. The detention basin would also have a 30 ft long emergency overflow weir with a crest set 6" above the peak 100-year WSEL. Calculations showed that the overflow from a second 100-year storm under full conditions with all other outlets blocked would rise approximately 1.01 ft above the crest of the overflow spillway to elevation 1002.01'. The top of the dam would be set at 1003.25' to provide the minimum 12 " of freeboard.

Inflow hydrographs based on the 24-hour SCS Type-II rainfall distribution were modeled from the individual drainage basins and times of concentration. Allowable release rates from the site were based on the City's requirements for the 2, 10 and 100-year storms along with the water quality treatment of the 1.37"/24-hour rainfall having to be held and released over a 40-hour span.

Existing Conditions Analysis:

Under the pre-development conditions, the Summit Point Apartments Phase-II site contains approximately 7.21 acres of on-site drainage area and is completely undeveloped. The 7.21 acres was considered to be completely pervious with no existing impervious pavement or building area. With the Hydrologic Type-C soils covering the site, the pre-development SCS runoff curve number was estimated to be CN = 74.0. The time of concentration was calculated to be approximately 8.10 minutes based on the TR-55 methodology which included overland flow, shallow concentrated flow and channelized flow.

The Summit Point Apartments Phase-I located directly to the south of the proposed Phase-II site were built during the 1980's and contain a total of 6.49 acres. Approximately 4.21 acres of

off-site area from the Phase-I site drains directly onto the Phase-II site. There was no other off-site drainage flowing onto the Phase-II site since Chipman Road catches and conveys drainage from the area further to the south. The off-site Phase-I apartments did not have any enclosed storm sewers or inlets or catch basins to collect surface drainage and pipe it to the existing creek along the northern boundary of the Phase-II site. The 4.21 acres was estimated to contain approximately 2.55 acres of impervious surface and approximately 1.66 acres of pervious green-space. The composite SCS runoff curve number was estimated to be 88.5. The time of concentration was calculated to be approximately 9.00 minutes based on the TR-55 methodology which included overland flow, shallow concentrated flow and channelized flow.

Proposed Conditions Analysis:

The proposed site improvements for the post-development drainage conditions included the construction of six new multi-unit apartment buildings along with parking lots and connecting service drives. The proposed improvements would also include an enclosed storm sewer system to collect the surface drainage from the Phase-II site along with runoff contributed from the existing Phase-I areas. The proposed Phase-II improvements would also include a new open-graded stormwater detention basin on the northeast corner of the site to provide detention and meet the City's required water quality treatment standards for new developments. The City of Lee's Summit uses the APWA Section 5608.4, Performance Criteria, C, Release Rates, for setting the post-development release rates from an improved site:

- The 50% (2-year Storm) would be limited to 0.5 cfs per acre
- The 10% (10-year Storm) would be limited to 2.0 cfs per acre
- The 1% (100-year Storm) would be limited to 3.0 cfs per acre.

Contributing off-site areas unaffected by the construction would be allowed to release drainage at their pre-development rates.

Using the existing Tributary P3 to Prairie Lee Lake at the northeast corner of the proposed Phase-II site as the Point of Interest (POI) for the cumulative stormwater runoff from the Summit Point Apartments Phases I and II sites, the existing Phase-I Apartments had a contributing off-site area of 4.21 acres with an SCS Curve Number of CN = 88.5 and a time of concentration of Tc = 9.00 minutes. The calculated flow rates from Phase-I at the POI at the existing Tributary P3 to Prairie Lee Lake were 13.58 cfs, 22.37 cfs and 36.18 cfs, respectively for the 50%, 10% and 1% storms (2, 10 and 100-year). The allowable release rates from the 7.21 acre Phase-II site were calculated using the 0.5, 2.0 and 3.0 cfs per acre designated release rates for the 50%, 10% and 1% storms (2, 10 and 100-year). The following table summarizes the Phase-I and Phase-II flows and the composite allowable release rates at the POI at the northeast corner of the Phase-II development:

Post-Development Allowable Release Rates

Storm Frequency	Existing Off-Site Phase-I Runoff	Allowable On-Site Phase-II Runoff	Composite Allowable Release Rate
10% (10-Year)	13.58 cfs	3.61 cfs	17.19 cfs
2% (50-Year)	22.37 cfs	14.42 cfs	36.79 cfs
1% (100-Year)	36.18 cfs	21.63 cfs	57.81 cfs

Stormwater detention for the post-development Phase-II site would be provided with an open-graded detention basin on the northeast corner of the site. The stormwater detention basin would have a bottom elevation of approximately 995.30', and a top of impoundment dam elevation of approximately 1003.25' with full storage capacity was estimated at approximately 3.134 ac-ft. Approximately 5.53 acres at CN = 90.5 of the Phase-II on-site drainage would flow into the detention pond along with approximately 4.21 acres at CN = 88.5 of contributing drainage from the Phase-I off-site area.

The time of concentration for the on-site Phase-I drainage area was estimated at a minimal 5 minutes and the off-site Phase-I drainage area time of concentration was calculated to be approximately 9.00 minutes based on the TR-55 methodology which included overland flow, shallow concentrated flow and channelized flow.

Approximately 1.68 acres of the Phase-II site would be undetained by-passing the proposed stormwater detention basin. The undetained area was located along the northern and western fringes of the Phase-II site where the ground was too low for runoff to be caught and piped into the detention basin.

The required water quality storage for the 1.37" rainfall from the Phase-II development was calculated based on the total proposed impervious surface area over the 7.21 acre site. The total impervious and pervious surface areas were measured for the proposed site and the Water Quality Volume (WQv) was calculated based on the 2012 MARC Best Management Practices Manual. The Water Quality Volume was calculated to be approximately 19,338 cubic feet or 0.444 ac-ft.

The City of Lee's Summit requires that the BMP Water Quality Volume be detained and slowly released over a 40-hour interval. The BMP Water Quality Volume storage volume in the bottom of the proposed stormwater detention basin was estimated to correspond to elevation 996.72'. The invert elevation of the outlet orifice was set at 995.00' inside the proposed outlet structure, so that the maximum storage depth would be 1.72 ft and the average depth would be half of that value at 0.86 ft. Dividing the 19,338 cubic feet of Water Quality Volume by 40 hours yields an average outflow rate of approximately 0.1343 cfs. Sizing calculations for the proposed low-flow outflow orifice indicated that a circular diameter of approximately 2.35 inches would be needed

to release the storage volume over the 40 hour interval. For simplicity of construction, a 2-¼ inch diameter orifice was designed in the bottom of the outlet structure.

A 42" HDPE storm sewer pipe would enter the basin from the South and the storm would exit to the North. The proposed 2-¼ inch diameter Water Quality Volume outflow orifice at invert elevation 995.00' was conjoined with a 27 inch wide outlet weir at crest elevation 996.75' to meter the outflow from the 2, 10 and 100-year design storms. The proposed outlet structure would be constructed on the northern side of the proposed stormwater detention basin to house the 2-¼ inch orifice and 27 inch weir. A 36" HDPE outlet pipe would drain out of the north side of the outlet structure and discharge toward the existing creek on the north side of the site. The 100-year water surface elevation of the creek was calculated to be approximately 994.92', and the bottom of the detention storage outlet orifice was set at 995.0', so that backwater from the creek would not surcharge the detention basin during a 100-year flood event. A summary of the stormwater routing characteristics for the stormwater detention basin has been tabulated below:

Stormwater Detention Basin Routing Summary

Storm Frequency	Peak Inflow	Peak Outflow	Peak WSEL	Peak Storage	Total Release Rate	Allowable Release Rate
50% (2-Year)	33.73 cfs	11.37 cfs	998.14'	0.927 ac-ft	12.58 cfs	17.19 cfs
10% (10-Year)	54.40 cfs	27.10 cfs	999.25'	1.358 ac-ft	30.93 cfs	36.79 cfs
1% (100-Year)	86.74 cfs	48.87 cfs	1000.48'	1.882 ac-ft	56.36 cfs	57.81 cfs

The Total Release Rates from the contributing on and off-site drainage areas that were either detained or undetained were all less than their corresponding allowable release rates required by the City. The proposed Summit Point Phase II development would provide on-site stormwater detention in accordance with the City of Lee's Summit's requirements. The peak post-development runoff rates from the proposed development would not increase above the peak pre-development runoff rates.