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May 13, 2021

City of Lee's Summit
Development Services
220 SE Green Street
Lee's Summit, Missouri 64063

Attn: Karen Quackenbush

Re: HEC RAS Responses to comments
Application Number: PL20211059
Application Type: Residential Preliminary Development Planning
Application Name: Summit Point 2nd Plat (Phase II)
Location: 510 NE Chipman road, Lee's Summit, MO 64063
Response to May 6, 2021 Comments

Karen,

Below are responses to the 2 sets of comments dated May 6, 2021. We are resubmitting revised plans and Storm Study and HEC RAS study with this response letter.

Public Works Review Comments



1. Within the report, it is stated that there was no readily available HEC-RAS model of Tributary P3 to Prairie Lee Lake. The Public Works Department has the 2006 model. It makes sense that any modeling done would start with the effective model. The effective model upstream section is approximately at the same location as the CFS duplicate model downstream section. It is therefore necessary to extend the FEMA effective model to produce your final model of the tributary. In addition to the HEC-RAS model, the PW Department also has the AutoCAD work map for the tributary. *Thank you for providing the downstream HEC RAS model, with our current model we are slightly higher (more conservative) at the tie point elevation. We believe it should not be necessary to tie the two models together as it has no effect on our property and due to time constraints we have not done so. However, if you still believe it is the developers responsibility to tie the two models together, we will do so at a later date.*

2. The Duplicate Effective Model created by CFS Engineers appears to utilize a much lower flow rate for the tributary. The FEMA effective model flowrate at the upstream end is 750 cfs for the 100-yr storm event. The rate at the downstream end of the CFS duplicate model appears to be only 485 cfs. It appears that when entering flows into your model one of two options are available. One – use the 750 cfs for the entirety of the model. Two – justify use of lower flows with a more detailed hydrologic report that reflects real world conditions, compares an appropriately updated flow rate to that of the FEMA flow

rate, and then using the same methodology calculates flow rates for the sections upstream of the Independence Avenue culvert. *CFS has revised the stream flow rates to match the rates given by StreamStats. A StreamStats analysis was also run where Tributary P3 crosses Highway 291. StreamStats gave a 100-year flow rate of 732 cfs compared to the FEMA FIS Study flow rate of 750 cfs .*

3. The Manning's n-value is a critical component in any HEC-RAS model, and use of a value that is lower than what it truly represented can result in fictitiously low water surface elevations. Public Works staff agrees with the assessment by Development Services staff that the use of a Manning's n-value of 0.03 is too low. Looking at Table 3-1 in the HEC-RAS Reference Manual indicates that the roughness coefficient should be between 0.030 for a stream that is clean, straight, and full with no rifts or deep pools and 0.1 for a stream that is very weedy, with deep pools, or floodways with heavy stands or timber and brush. It appears that in the Duplicate model created by CFS a Manning's n-value of 0.03 is used. It does not appear that the stream is clean and straight. In the body of the report, it is stated, that photos and field observations of the creek supported the use of a Manning's n of 0.03; however, no such photos are presented in the report. Given the sensitivity of the model run results on the roughness coefficient, please provide support in the form of pictures in the report. *CFS visited the site and took several photographs of the creek. A photo collage including eight pictures taken at different locations along the creek have been included in the revised HEC-RAS study. After studying the photos, CFS revised the Manning's Roughness Factors to use n=0.045 for the main channel based on the Table 3-1 recommendations for a Condition A.1.d 'Clean, winding, some pools and shoals, some weeds and stones.' CFS also used a n=0.100 for the overbank flood plains based on the Table 3-1 recommendations for a Condition A.2.c.4 'Medium to dense brush in summer.'*

4. Public Works staff has compared the water surface elevations at the downstream end of the CFS model to that of the upstream end of the FEMA Effective model. The water surface elevation from the CFS duplicate model is significantly lower than that of the FEMA effective model. This could speak to the use of a Manning's n that is too low, flows that are too low, and other problems with the model. It seems necessary to produce a model that has more realistic water surface elevations at the downstream end. *With the revised Manning's Roughness Factors and the StreamStats flows, the CFS HEC-RAS model is showing higher WSEL's compared to the previous model.*

5. Public Works staff also agrees with Development Services in the cross-sections from RS 10856.09 to RS 10280.58 need to utilize measures to insure that areas outside the main channel are not included in the active flow. Use of ineffective flow arrows are applicable. *CFS revised the HEC-RAS model to include stream obstructions to block-out stream flow in the side ruts along the main channel.*

6. A small, public system drains the yards of the homes along the south side of Swann Circle. This system, outlets into the tributary at approximately RS 10280.56. Even a

comparison of the water surface elevation from the CFS duplicate model and applying that elevation as the tailwater condition for the public system shows that there will be issues with the system backing up into the yards. Public Works staff has further concerns with this system after model changes as discussed earlier are incorporated. Future modeling efforts should include analysis of this system, and should communicate that improvements will not cause flooding to adjacent properties along Swann Circle. *The proposed Summit Point Phase-II site contains 7.21 acres, and would provide stormwater detention in accordance with the City's requirements. The StreamStats calculations indicated that the total drainage area at Swann Circle was approximately 132 acres. The post-development stream flow in Tributary P-3 would be minimally affected with the Summit Point Phase-II improvements. If the public systems currently back up, they will back up the same amount after our development.*

7. In conjunction with comment 6, please address other minor drainage structures along the tributary. Namely, assure that improvements for Summit Point will not adversely affect the detention basin for the Summit Ridge apartments located on the north side of the stream. *We are providing detention that discharges higher than the local flood plain elevation at a lower peak flow rate than existing. The new development meets City standards and will not adversely affect the Summit Ridge detention basin.*

Development Services Review Gene Williams, P.E. Senior Staff Engineering
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1. The study should be renamed to an appropriate title, such as “Base Flood Elevation Determination in Unnumbered A Zone at Summit Point Apartments Phase 2” or equivalent language. Preparation of this study is a UDO requirement to comply with the City’s Floodplain Ordinance, and as such, the title should reflect the purpose of the study. *The HEC-RAS Study has been re-titled “Base Flood Elevation Determination in Unnumbered A Zone at Summit Point Apartments Phase II.”*

2. Body of the report still references an incorrect assumption concerning the end of the flood zone prior to Independence Ave. Our records indicate the flood zone extends the entire length between Independence Ave. and Swann Cir., and overtopping on each during the 100 year event. *The HEC-RAS Study has been revised to clarify that the FEMA flood zone extends along the north side of the Summit Point site.*

3. Purpose of the report shall be discussed within the body of the report. The purpose of the study is to delineate the floodplain for the site, and to establish base flood elevations along the stream abutting the development. *The HEC-RAS Study has been revised to include the Purpose.*

4. The report did not discuss model setup, including whether this is a 1D model, steady or unsteady state model, special considerations such as treating roadway tops as a weir, elimination of diverted flow using ineffective flow tool or other method used to eliminate divided flow from the model calculations, safety factors to ensure a conservative base flood elevation(s) is obtained, best practices for establishment of base flood elevations in an unnumbered A zone as published by FEMA circular using conservative values for flow rates, model calibration and sensitivity analysis, or reasoning behind the discounting of the StreamStats program which the report states was "overly conservative". *The HEC-RAS Study has been revised to discuss the model setup. The model was 1D, steady state flow. The roadway tops at Swann Circle and Independence Avenue were treated as weirs for overtopping. Divided channel sections at RS-10856.09, RS-10658.06, RS-10495.32 and RS-10280.58 were blocked-out using the stream obstruction routines in the cross-section modeller..*

6. Peak flow rates at each cross-section were only briefly discussed within the report, and a review would suggest these figures were based on the TR-55 method to determine time of concentration and resultant peak flows. Guidance from FEMA does not recommend this method be used when flow is divided between closed storm systems and overland flow systems. In addition, the results disagree from the StreamStats method ran by the City during an independent run (results of StreamStats or TR-55 method were not shown in appendix despite the statement they were provided). It also appears no provision was made for future conditions upstream of the project site. Time of concentration values were not presented, only mentioned with a short discussion within the report which stated that the TR-55 method was used and compared with the "overly conservative" values obtained using USGS StreamStats. *CFS has revised the stream flow rates to match the rates given by StreamStats. A StreamStats analysis was also run where Tributary P3 crosses Highway 291. StreamStats gave a 100-year flow rate of 732 cfs compared to the FEMA FIS Study flow rate of 750 cfs .*

7. Despite the report stating otherwise, no information was provided within the appendix concerning the discussion about TR-55 method versus the StreamStats method, and why the less conservative values were used. If the StreamStats method yielded a more conservative value for peak flowrate, why was it not used? *The HEC-RAS models have been revised to use the higher StreamStats Flow.*

8. Mannings n values were low for existing stream conditions. Staff has walked the stream from Independence Ave. to a point northwest of the existing apartment complex, and this stream is not a clean channel as implied by the low mannings n values used in the model. This area is heavily brushed, with stream channel containing small pools and small riffles. This might partially explain the lower than expected HGL values shown in the report. *CFS visited the site and took several photographs of the creek. A photo collage including eight pictures taken at different locations along the creek have been included in the revised HEC-RAS study. After studying the photos, CFS revised the Manning's Roughness Factors to use n=0.045 for the main channel based on the Table 3-1 recommendations for a Condition A.1.d 'Clean, winding, some pools and shoals, some weeds and stones.' CFS also used a n=0.100 for the overbank flood plains based on the Table 3-1 recommendations for a Condition A.2.c.4 'Medium to dense brush in summer.'*

9. Cross-sections starting at river station 10658 and progressing downward (i.e., river stations 10658, 10495.and 10280) include errors in model setup. HEC-RAS software was used by the City during an independent model run to show where these errors exist, and was not dicussed within the report. Ineffective flow tool or other methods were apparently not used to remove the “divided flow” sections. This would likely explain the very low HGLs (in addition to the low mannings n values). *The divided flow area were changed to ineffective flow area. The warning provide in the HEC RAS study are normal, the same type warnings also exist in the provided FEMA model starting at Independence Ave.*

10. Drainage areas shown in the report upstream of the site appear to be lower than StreamStats USGS web based software, and our estimates by a significant amount. Drainage area subbasin east of the triple culvert was also not shown correctly since a large portion of this subarea drains to the triple culvert, not after the triple culvert. Both our estimate and StreamStats yielded a value of 132 acres draining to the triple box culvert at Swann Cir. A conservative approach shall be utilized, and it would appear this was not done. *A discussion of the StreamStats flows and approximate drainage areas at the various cross-section locations has been included in the revised HEC-RAS Study.*

12. General comment concerning this report: The floodplain delineation shall use a conservative approach during all aspects of model setup. It would appear the model includes assumptions which are not conservative, and the cumulative effect of these non-conservative assumptions is a lower than expected HGL for this unnumbered A zone. We would recommend the applicant review guidance produced by FEMA when performing HEC-RAS studies to determine base flood elevations in unnumbered A zones. There are conservative approaches that must be followed to ensure the development is not affected by future changes to the floodplain. The intent is to err on the side of caution in the model setup for determining the base flood elevations within an unnumbered A zone, and the proposed model does not appear to have utilized this methodology. *With the revised Mannings Roughness Coefficients and the StreamStats flows, the revised HEC-RAS model results should be more conservative.*

13. Since model calibration data does not appear to exist, a sensitivity analysis of the model should be performed. The sensitivity analysis should include model runs with a few progressively higher flow rates, and a few varied mannings n values. Results should be discussed within the body of the report. *A brief sensitivity analysis comparing the 100-year WSEL values between the minimum, normal and maximum recommended Mannings Roughness Coefficients has been included in the revised HEC-RAS Study.*

14. For purposes of specifying the lowest floor elevation for any habitable building constructed with this project, the highest base flood elevation that crosses the property line shall be utilized as a reference point. Lowest floor elevations shall be set at a minimum of 2.00 feet above this elevation, preferably higher. This elevation shall be discussed and shown within the report. *The revised HEC-RAS model indicated that the highest point where the 100-year WSEL crossed the site's property line was approximately 998.81' located just upstream of RS-10658.06. The lowest proposed building finish floor elevation was set at 1005.0'. The revised HEC-RAS Study includes a discussion.*

15. No presentation of the error log was provided or discussed within the report. As ran by the City using the applicant's model, the model included divided flow errors, area ratio warnings and exceedances in the energy loss of 1.0 feet which would indicate additional cross-sections be provided. *An Error Log containing warnings from the HEC-RAS model has been included in the appendix of the revised HEC-RAS Study.*

16. Drainage area setup exhibit shown within the report was not divided correctly, and was also missing drainage areas. StreamStats and our own independent analysis shows the total area upstream of Swann Cir. is approximately 132 acres rather than 115 acres. A portion of the drainage area shown draining to point 3 is also shown incorrectly since the majority shown within the subarea to the east of the triple culvert at Swann Cir. flows to join the main channel prior to flowing beneath Swann Cir. There are also additional drainage areas to the south of Chipman Rd. within the residential subdivisions that were not extended far enough. This may partially explain the lower-than-expected flowrates and lower-than-expected 100 year WSEs. *The Drainage Area Maps have been revised, the areas did not*

*change, the Streamstat flows are just extremely concervative, expecially in smaller watersheds.*

17. Peak flowrate calculations for all cross-sections is low compared with StreamStats USGS web-based analysis software. For example, CFS calculated a peak 100 year flowrate of 454 cfs at the upstream end of the triple culvert. StreatStats showed 604 cfs. This is only one example, as all the peak flowrates show disagreement with StreamStats. *The HEC-RAS models have been revised to use the higher StreamStat flows.*

Respectfully,

**Cook Flatt & Strobel Engineers, P.A.**

Lance W. Scott, P.E.
Vice President