Renaissance Infrastructure Consulting

132 Abbie Ave.
Kansas City, KS 66103
P: 913.317.9500
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April 13, 2018

Mike Weisenborn
Project Manager, Development Center
City of Lee's Summit
220 SE Green Street
Lee's Summit, MO 64063

Re: **18-0129 Northpoint Summit Square II Apartments Sanitary Sewer Impact Statement**

Mr. Weisenborn:
Per the requirements provided by the City of Lee's Summit's planning code regarding the final development plan submittal for the proposed Summit Square II Apartments, a sanitary sewer impact analysis has been conducted. The following is a report of the analysis.

PROJECT DESCRIPTION
An approximately 12.8-acre multi-family complex is currently being proposed at the southeast corner of NW Ward Road and NE Tudor Road in Lee's Summit, MO. A site location map has been provided as Exhibit A. The complex generally consists of five primary 4/5-story buildings, a courtyard, and associated parking facilities. The entire site is located within the Little Cedar Creek watershed. Refer to Exhibit B for a layout of the proposed complex.

METHODOLOGY
Based on the provisions outlined in the Lee's Summit Design and Construction Manual (LS DCM) 6500 for Sanitary Sewers, the peak sanitary sewer flow has been determined. Using as-builts and survey information on the existing sanitary sewer infrastructure, the existing sanitary sewer system has been analyzed to determine if the proposed flows will require any modifications to the existing system.

PROPOSED PEAK FLOW
In 2016, a preliminary design was approved for the Summit Technology Campus. This preliminary design identified primarily office space for the property. A preliminary sanitary impact report was prepared by THHinc at this time, providing an estimate of proposed sanitary peak flows based on this use. The lots proposed herein are identified as lots 1 and 5 in the 2016 THHinc sanitary impact report. A copy of the report has been enclosed with this statement as Exhibit C.

From the LS DCM 6500, the peak sanitary sewer flow is the summation of the peak base flow, the peak infiltration, and the peak inflow. A summary of the flows calculated for the proposed use has been provided in Table 1. Also provided in Table 1 are the peak flows estimated for the proposed use in the 2016 sanitary impact report and the increase in the estimated peak flows in the currently proposed design from the peak flows calculated in the 2016 plan. Refer to Exhibit D for details regarding the proposed peak flow calculations.

Table 1. Summary of Sanitary Sewer Peak Flows

Lot Description	Area (ac.)	Peak Base Flow (gpd)	Peak Infiltration (gpd)	Peak Inflow (gpd)	Proposed Peak Flow (gpd)	Peak Flow Calculated in THHinc Report (gpd)	Increase in Estimated Demand (gpd)
Lot 1 (South)	8.1	12,150	4,050	153,914	170,114	89,018	81,096
Lot 5 (North)	4.7	7,050	2,350	96,781	106,181	51,798	54,383
Totals	**12.8**	**19,200**	**6,400**	**250,695**	**276,295**	**140,816**	**135,479**

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SANITARY IMPACT ANALYSIS

The capacities of the existing sanitary sewer infrastructure have been modeled to verify that the existing infrastructure is adequate to support the estimated peak sanitary sewer flows from the proposed site. Sanitary flows from buildings 1, 2, and 3 as labeled in Exhibit B (Lot 1 in the 2016 THHinc Sanitary Impact Report) are to be conveyed south to the existing sanitary sewer manhole north of Donovan Road at the southeast corner of the site. The existing sewer main immediately downstream of this manhole is an 8" PVC situated at a 1.15% slope. Flows from buildings 4 and 5 as labeled in Exhibit B (Lot 5 in the 2016 THHinc Sanitary Impact Report) are proposed to tie into the existing sanitary sewer manhole south of NE Tudor Road at the northeast corner of the site. The existing sewer main immediately downstream of this manhole is a 12" PVC situated at a 0.61% slope.

Based on the parameters of the existing sewer mains determined from the survey, the flow capacities of the existing pipes have been calculated using Manning's equation. A comparison of the flow capacities of the existing sewer mains and the design flow rates determined from the peak flow analysis has been summarized in Table 2. Refer to Exhibit E for details regarding the performance of the existing sanitary pipes under proposed conditions.

Table 2. Summary of Existing Sanitary Flow Capacities

Lot Description	Proposed Peak Flow (gpd)	Design Flow Rate (cfs)	Existing Pipe Capacity (cfs)
Lot 1 (South)	170,114	0.263	1.88
Lot 5 (North)	106,181	0.164	4.02

SUMMARY

The proposed use identified herein results in an increase in the expected sanitary sewer flows as compared to the approved development plan and sanitary sewer impact report submitted in 2016 by THHinc. The existing infrastructure, however, is still adequate to receive and convey the flows from the proposed multi-family development. It is our opinion that no modifications to the existing public sanitary sewer infrastructure will be required to accommodate the flows from the proposed development.

If you have any questions or need additional clarification, please do not hesitate to contact us.

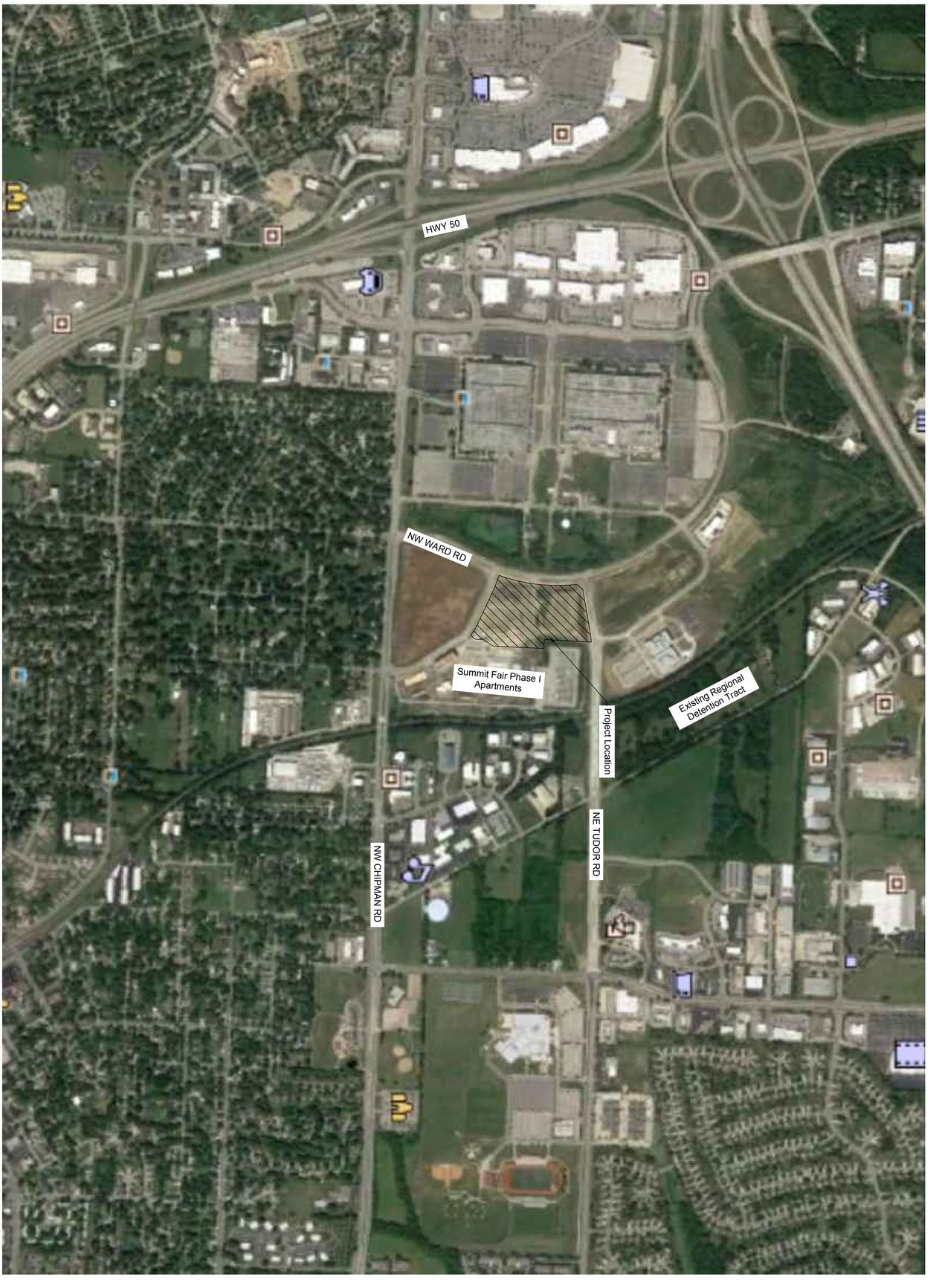
Sincerely,

Mick E. Slutter, P.E.
mslutter@ric-consult.com

Kelsey L. Fitzpatrick, E.I.
kfitzpatrick@ric-consult.com

RENAISSANCE INFRASTRUCTURE CONSULTING

Exhibit A
Site Location Map



NORTH
0 250' 500'
1"=500'

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NO	BY	QD	DATE	REVISION
	KLF	MES	4/13/2018	ORIGINAL SUBMITTAL

Site Location Map

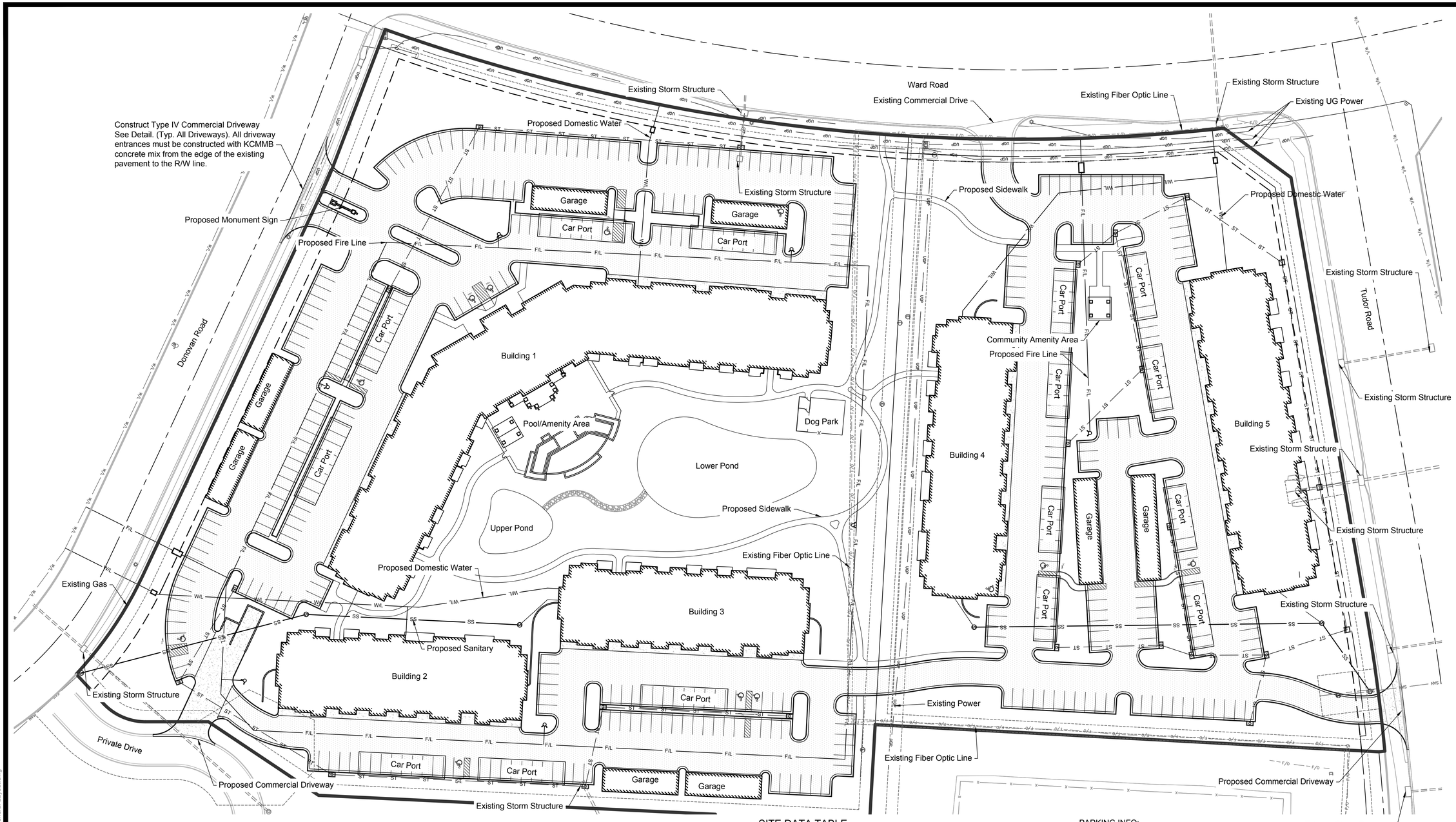
Sanitary Sewer Impact Statement

18-0129
Northpoint Summit Fair II
Apartments

Sheet
Exhibit A

Exhibit B

Proposed General Layout



FOR NON-PUBLIC WORK

A. Screened items indicate a pre-construction topographic survey
B. Contraction joints shall conform to APWA Section 2200.
C. All concrete to be 4000 psi with 5% (+/- 1%) air entrainment. Cement mixtures with water/cement ratios at 0.5 or below are recommended
D. Construction of reinforced concrete pavements shall be in accordance with ACI 330 standard specifications.
E. Curing compound to be applied to all concrete surfaces immediately after broom finish.
F. Contractor shall reject concrete if it cannot be placed within 90 minutes of batch time expiration time shall be reduced to 60 minutes on high summer temperatures.

PAVEMENT MARKING AND SIGNAGE NOTES

1. Parking stall marking stripes shall be four inch (4") wide white stripes. Handicap stall marking shall be furnished at locations shown on plans.
2. Traffic control devices and pavement markings shall conform to the requirements of the "Manual of Uniform Traffic Control Devices." and to the City of Lee's Summit.
3. Traffic control and pavement markings shall be painted with a white Sherwin Williams S-W traffic marking series b-29y2 or approved equal. The pavement marking shall be applied in accordance with manufacturers recommendations. Apply on a clean, dry surface and at a surface temperature of not less than 70°f and the ambient air temperature shall not be less than 60°f and rising. Two coats shall be applied.
4. All pavement markings for handicap stalls and aisles shall be blue.

LAYOUT & PAVING NOTES

1. All construction shall conform to the City of Lee's Summit's minimum design standards.
2. The contractor shall check existing grades, dimensions, and inverts in the field and report any discrepancies to the architect/engineer prior to beginning work.
3. The contractor shall verify the exact location of all existing utilities, take care to protect utilities that are to remain, and repair contractor caused damage according to current local standards and at the contractor's expense. coordinate all construction with the appropriate utility company.
4. The contractor shall comply with all local codes, obtain all permits, and pay all fees prior to beginning work.
5. Prior to installing, constructing, or performing any work in the public right of way or on the public storm sewer line (including concrete pavement or connecting private drainage systems to the storm sewer), contact City of Lee's Summit public works at 816.969.1800 for inspection of the work. Contact must be made at least 24 hours prior to start of the work.
6. Provide a smooth transition between existing pavement and new pavement. Field adjustment of final grades may be necessary. Adjust all utilities prior to installation of pavement.
7. The contractor shall protect all trees to remain, in accordance with the specifications. Do not operate or store heavy equipment, nor handle, nor store materials within the driplines of trees or outside the limit of grading.
8. Concrete walks and pads shall have a broom finish. All concrete shall be 4,000 p.s.i. unless otherwise noted. Curb ramps, sidewalk slopes, and driveway ramps shall be constructed in accordance with all current local requirements. If applicable, the contractor shall request inspection of sidewalk and ramp forms prior to placement of concrete.
9. All damage to existing asphalt pavement to remain which results from new construction shall be replaced with like materials at contractor's expense.
10. Dimensions are to the back of curb, or edge of concrete, unless otherwise noted.
11. Excess material shall be disposed of by the contractor off the owner's property at no additional cost in a legal manner.
12. Maintain one set of as-built drawings on the job site for distribution to the engineer upon completion.
13. Concrete curb at all all concrete paving and both side of drive-in ramps shall be integral.
14. Contractor shall be responsible for mud and debris on public ROW which shall be removed in a timely manner daily.

SITE DATA TABLE

PROPERTY INFO:	
Existing Zoning:	PMIX
Total Land Area:	12.779 Acres, 556,641 sqft
Proposed Street Right-of-Way:	0.00 Acres
Net Land Area:	12.779 Acres, 556,641 sqft
Proposed Use:	Multifamily Residential

BUILDING INFO:	
Building 1:	Type A - N (4/4 - 104 Units)
Buildings 2 & 3:	Type D (4/5 - (2) 51 Units)
Building 4:	Type C (4/5 - 59 Units)
Building 5:	Type B (4/5 - 58 Units)

PARKING INFO:	
Studio Apartment	= 35 Units
1 Bedroom Apartment	= 198 Units
2 Bedroom Apartment	= 123 Units
Total 1-2 Bedroom Apartments	= 356 Units
1.5 Stalls / 1-2 BR Unit	= 418 Spaces
0.5 Stalls / Unit (Visitor)	= 178 Spaces
Total Parking Required	= 596 Spaces
Surface Stalls Provided	= 317 Spaces
Carport Stalls Provided	= 95 Spaces
Detatched Garage Stalls Provided	= 52 Spaces
Attached Garage Stalls Provided	= 93 Spaces
Total Parking Provided	= 557 Spaces
ADA Parking Required	= 11 Spaces
ADA Parking Provided	= 11 Spaces

See NSPJ Letter dated 04/13/18 to Mike Weisenborn.

Total Floor Area	= 1.816 SF
Total Impervious Area	= 3.142 Acres
Floor Area Ratio (FAR)	= 0.142
Dwellings (Units) Per Acre	= 27.86

NORTH
1"=40'
0 20' 40'

Sheet
C02

Final Development Plans
18-0129
Summit Square II
Lee's Summit, Jackson County, Missouri

General Layout

NO.	BY	DATE	REVISION
1	APT	04/13/18	ORIGINAL SUBMITTAL

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MISSOURI CERTIFICATE OF AUTHORITY No. 2010033630

STATE OF MISSOURI
MITCHELL E. SLUTTER
NUMBER PE-2002003418
PROFESSIONAL ENGINEER
MITCHELL E. SLUTTER PE-2002003418

Exhibit C

THHinc Sanitary Sewer Demand Report

OK
DLOHE 3/16/16

SEWER DEMAND REPORT

for

Townsend Capital, LLC

Summit Orchard
Lee's Summit, MO

March 2016

I hereby certify this engineering document was prepared by me or under my direct personal supervision and that I am a duly licensed Professional Engineer under the laws of the State of Missouri.

3/8/16
Date:

John V. Huss, P.E.
License No. E-20579
My renewal date is December 31, 2017

STATE OF MISSOURI
JOHN V. HUSS
NUMBER E-20579
REGISTERED PROFESSIONAL ENGINEER

3/8/16

-2016-039-

RECEIVED
MAR 04 2016
Planning & Codes Admin

PREPARED BY

THHinc McCLURE
ENGINEERING Co

Introduction

This report details the preliminary design of the sewer system to support the Summit Orchard Preliminary Development Plan (PDP), a mixed-use development, at the Summit Technology Campus (STC) located in Lee's Summit, Missouri. See Figure 1 for a site location map.

Project Description

The Summit Orchard is located southeast of the Interstate-470/State Highway 50 interchange. The entire STC development covers approximately 367 acres, and is bordered to the south by Chipman Road, to the north by I-470, to the west by Blue Parkway, and to the east by the Union Pacific Railroad. The Summit Technology Campus is split by Ward Road which was opened to traffic in October 2008.

Townsend Capital LLC proposes improvements to the existing Summit Technology Campus, including the addition of a variety of mixed business commercial and residential uses along Ward Road. In this report, the site for these improvements will be referred to as the "50 Acre Tract." The current proposed building layout for the 50 Acre Tract can be found in the PDP.

Existing Sewer System

There is an existing sewer connection available along the South edge of Tudor Road, while the sewer is deep enough to serve the proposed development, extending the sewer would require existing sewer to have nearly thirty feet of cover.

The sewer demand for the existing development, within the Little Cedar Creek Watershed, was evaluated. In this analysis, it is assumed the projected flow pumped from the Tudor Road Pump Station to the Little Cedar Creek Interceptor is capped at 4 MGD. This analysis can be seen in Table 2 located in the Appendix.

Proposed Sewer Facilities:

To serve this development, we propose a new 8" PVC sewer line. The proposed 8" sewer will extend from an existing connection point East of the 50 Acre Tract at Manhole 23-120. The new sewer will run Westerly beneath existing railroad to a new manhole on Lot 4, West of the 50 Acre Tract property line.

The system includes two 8" PVC sewer lines extending from the new manhole located in Lot 4. One line runs Northerly and turns Westerly to Lot 1 to serve future development on the 50 Acre Tract. A second 8" PVC sewer line runs Southwesterly across the proposed Donovan Road onto and across Lot 3 to serve future developments on the 50 Acre Tract.

All sewer facilities will be constructed in accordance with MoDNR and Lee's Summit standards and specifications.

Design and Methodology:

The total peak flow from the developed 50 Acre Tract is calculated using methods outlined in section 6500 of the City of Lee's Summit, Missouri Design Criteria. Once PBF is determined, additional demand is added to account for inflow & infiltration. Peak infiltration is assumed to be 250-gpd/acre for non-residential land use and 500-gpd/acre for residential areas. Peak inflow is calculated using the Q=KiA method.

Table 1 shows the peak flows that are estimated for development of the 50 Acre Tract.

Table 1: Estimated Sewer Peak Flow 40 Acre Tract

Tract/Lot	Peak Base Flow (GPD)	Peak Infiltration (GPD)	Sewer Inflow (GPD)	Peak Flow (GPD)
Lot 1	9,450	2,025	77,543	89,018
Lot 2	17,426	2,153	95,636	115,215
Lot 3	32,970	1,870	87,236	122,076
Lot 4	20,415	6,805	245,552	272,772
Lot 5	5,400	1,165	45,233	51,798
Total Estimated Peak Flow				**650,879**

*See Figure 2 for tract/lot locations
** Sewer Inflow Interpolated from the table in Section 6501.C.1.d of the City of Lee's Summit, Missouri Design Criteria

Results of Analysis:

Combining the results of Table 1 yields a peak flow of 650,879 gpd, or 1.0 cfs. This peak flow is added to the existing system downstream analysis shown in Table ~~3~~ 2 and the resulting analysis is shown in Table ~~4~~ 3 also located in the Appendix. The existing conditions plus the proposed development downstream analysis indicate that no pipes will be operating under surcharge.

Manning's Equation supports that a 8" PVC pipe at minimum grade has sufficient pipe flow capacity to carry this flow. The remainder of sewer lines serving various future developments is sized at 8" PVC.

Figure 3 in the Appendix shows the proposed route of the main 8" PVC sewer as well as the additional 8" PVC sewer services.

APPENDIX

Table 2 - Existing Little Cedar Creek Watershed Downstream Sewer Analysis

Upstream MH	Downstream MH	Diameter (in.)	Slope (ft/ft)	Capacity (mgd)	Projected Flow (MGD)	Q/q	Capacity (cfs)	Projected Flow (cfs)
23-120	23-036	10	0.01	1.53	0.46	0.299	2.37	0.71
23-036	23-035	10	0.016	1.94	0.46	0.236	3.00	0.71
23-035	23-034	10	0.02	2.17	0.46	0.211	3.36	0.71
23-034	23-024	12	0.02	3.53	0.46	0.130	5.46	0.71
23-024	23-023	12	0.01	2.49	0.92	0.368	3.86	1.42
23-023	23-022	12	0.02	3.53	0.92	0.260	5.46	1.42
23-022	23-021	12	0.02	3.53	0.92	0.260	5.46	1.42
23-021	23-007	12	0.01	2.49	0.92	0.368	3.86	1.42
23-007	23-006	30	0.035	53.73	8.14	0.151	83.13	12.59
23-006	23-118	36	0.0034	27.23	8.14	0.299	42.13	12.59
23-118	23-117	24	0.0058	15.06	8.14	0.623	20.21	12.59
23-117	23-002	36	0.0061	36.47	8.14	0.223	56.43	12.59
23-002	23-001	36	0.0061	36.47	8.14	0.223	56.43	12.59
23-001	22-044	36	0.018	62.65	8.14	0.130	96.94	12.59
22-044	22-043	36	0.0315	82.88	8.14	0.098	128.24	12.59
22-043	22-042	36	0.0088	43.81	10.41	0.238	67.78	16.11
22-042	22-041	36	0.0043	30.62	10.41	0.340	47.38	16.11
22-041	22-040	36	0.038	91.03	10.41	0.114	140.85	16.11
22-040	22-039	36	0.0091	44.55	10.41	0.234	68.93	16.11
22-039	22-038	36	0.0118	50.73	10.41	0.205	78.49	16.11
22-038	00-001	36	0.0106	48.08	10.41	0.217	74.39	16.11
00-001	00-002	36	0.0138	54.86	10.41	0.190	84.88	16.11
00-002	00-003	36	0.076	128.74	10.41	0.081	199.19	16.11
00-003	00-004	36	0.0285	78.84	14.95	0.190	121.93	23.13
00-004	00-005	30	0.024	44.49	14.95	0.336	68.84	23.13
00-005	00-006	30	0.0074	24.70	14.95	0.605	38.22	23.13
00-006	00-007	30	0.0092	27.55	14.95	0.543	42.62	23.13
00-007	00-008	30	0.0043	18.83	14.95	0.794	29.14	23.13
00-008	00-009	30	0.0047	19.69	14.95	0.759	30.46	23.13
00-009	00-010	30	0.0033	16.50	14.95	0.906	25.53	23.13
00-010	00-011	30	0.0115	30.80	14.95	0.485	47.65	23.13
00-011	00-012	30	0.0084	26.32	14.95	0.568	40.72	23.13
00-012	00-013	30	0.0084	26.32	16.34	0.621	40.72	25.28
00-013	00-014	30	0.0144	34.46	16.34	0.474	53.32	25.28
00-014	00-015	30	0.0093	27.70	16.34	0.590	42.85	25.28
00-015	00-016	30	0.0099	28.57	16.34	0.572	44.21	25.28
00-016	00-017	30	0.0101	28.86	16.34	0.566	44.66	25.28
00-017	00-018	30	0.0184	38.96	16.34	0.419	60.27	25.28
00-018	00-019	30	0.0053	20.91	16.34	0.781	32.35	25.28
00-019	00-020	30	0.0053	20.91	16.34	0.781	32.35	25.28
00-020	00-021	30	0.0161	36.44	16.34	0.448	56.38	25.28
00-021	00-022	30	0.0222	42.79	16.34	0.382	66.21	25.28
00-022	00-023	30	0.0169	37.33	16.34	0.438	57.76	25.28
00-023	00-024	30	0.0096	28.14	16.34	0.581	43.54	25.28
00-024	00-025	30	0.0096	28.14	16.34	0.581	43.54	25.28
00-025	00-026	30	0.0096	28.14	16.34	0.581	43.54	25.28
00-026	00-027	30	0.0099	28.57	16.34	0.572	44.21	25.28
00-027	00-028	36	0.0047	32.02	16.34	0.510	49.54	25.28
00-028	00-030	36	0.0037	28.41	16.34	0.575	43.95	25.28
00-030	00-031	36	0.0039	29.16	16.34	0.560	45.12	25.28
00-031	00-032	36	0.0086	43.31	16.34	0.377	67.01	25.28
00-032	00-033	36	0.0258	75.01	16.34	0.218	116.06	25.28
00-033	00-034	36	0.0128	52.83	16.34	0.309	81.75	25.28
00-034	00-035	36	0.0044	30.98	16.34	0.527	47.93	25.28
00-035	00-036	36	0.0045	31.33	16.34	0.521	48.47	25.28
00-036	00-037	36	0.0043	30.62	16.34	0.533	47.98	25.28
00-037	00-038	42	0.002	31.50	16.34	0.519	48.74	25.28
00-038	00-039	42	0.0022	33.04	16.34	0.494	51.12	25.28
00-039	00-040	42	0.002	31.50	16.34	0.519	48.74	25.28
00-040	00-041	42	0.0022	33.04	16.34	0.494	51.12	25.28
00-041	00-042	42	0.002	31.50	16.34	0.519	48.74	25.28
00-042	00-043	42	0.0019	30.71	16.34	0.532	47.51	25.28
00-043	00-044	42	0.002	31.50	16.34	0.519	48.74	25.28
00-044	00-045	42	0.002	31.50	16.34	0.519	48.74	25.28
00-045	00-046	42	0.002	31.50	16.34	0.519	48.74	25.28
00-046	00-001MS	42	0.0019	30.71	16.34	0.532	47.51	25.28

Table 3 - Existing Little Cedar Creek Watershed Downstream Sewer Analysis

Upstream MH	Downstream MH	Diameter (in.)	Slope (ft/ft)	Capacity (mgd)	Projected Flow (MGD)	Q/q	Capacity (cfs)	Projected Flow (cfs)
23-120	23-036	10	0.01	1.53	1.10	0.720	2.37	1.71
23-036	23-035	10	0.016	1.94	1.10	0.569	3.00	1.71
23-035	23-034	10	0.02	2.17	1.10	0.509	3.36	1.71
23-034	23-024	12	0.02	3.53	1.10	0.313	5.46	1.71
23-024	23-023	12	0.01	2.49	1.56	0.627	3.86	2.42
23-023	23-022	12	0.02	3.53	1.56	0.443	5.46	2.42
23-022	23-021	12	0.02	3.53	1.56	0.443	5.46	2.42
23-021	23-007	12	0.01	2.49	1.56	0.627	3.86	2.42
23-007	23-006	30	0.035	53.73	8.78	0.163	83.13	13.59
23-006	23-118	36	0.0034	27.23	8.78	0.323	42.13	13.59
23-118	23-117	24	0.0068	13.06	8.78	0.672	20.21	13.59
23-117	23-002	36	0.0061	36.47	8.78	0.241	56.43	13.59
23-002	23-001	36	0.0061	36.47	8.78	0.241	56.43	13.59
23-001	22-044	36	0.018	62.65	8.78	0.140	96.94	13.59
22-044	22-043	36	0.0315	82.88	8.78	0.106	128.24	13.59
22-043	22-042	36	0.0088	43.81	11.06	0.252	67.78	17.11
22-042	22-041	36	0.0043	30.62	11.06	0.361	47.38	17.11
22-041	22-040	36	0.038	91.03	11.06	0.121	140.85	17.11
22-040	22-039	36	0.0091	44.55	11.06	0.248	68.93	17.11
22-039	22-038	36	0.0118	50.73	11.06	0.218	78.49	17.11
22-038	00-001	36	0.0106	48.08	11.06	0.230	74.39	17.11
00-001	00-002	36	0.0138	54.86	11.06	0.202	84.88	17.11
00-002	00-003	36	0.076	128.74	11.06	0.086	199.19	17.11
00-003	00-004	36	0.0285	78.84	15.59	0.198	121.98	24.13
00-004	00-005	30	0.024	44.49	15.59	0.350	68.84	24.13
00-005	00-006	30	0.0074	24.70	15.59	0.631	38.22	24.13
00-006	00-007	30	0.0092	27.55	15.59	0.566	42.62	24.13
00-007	00-008	30	0.0043	18.83	15.59	0.828	29.14	24.13
00-008	00-009	30	0.0047	19.69	15.59	0.792	30.46	24.13
00-009	00-010	30	0.0083	26.50	15.59	0.945	25.53	24.13
00-010	00-011	30	0.0115	30.80	15.59	0.506	47.65	24.13
00-011	00-012	30	0.0084	26.32	16.98	0.645	40.72	26.28
00-012	00-013	30	0.0084	26.32	16.98	0.645	40.72	26.28
00-013	00-014	30	0.0144	34.46	16.98	0.493	53.32	26.28
00-014	00-015	30	0.0093	27.70	16.98	0.613	42.85	26.28
00-015	00-016	30	0.0099	28.57	16.98	0.594	44.21	26.28
00-016	00-017	30	0.0101	28.86	16.98	0.588	44.66	26.28
00-017	00-018	30	0.0184	38.96	16.98	0.436	60.27	26.28
00-018	00-019	30	0.0053	20.91	16.98	0.812	32.35	26.28
00-019	00-020	30	0.0053	20.91	16.98	0.812	32.35	26.28
00-020	00-021	30	0.0161	36.44	16.98	0.466	56.38	26.28
00-021	00-022	30	0.0222	42.79	16.98	0.397	66.21	26.28
00-022	00-023	30	0.0169	37.33	16.98	0.455	57.76	26.28
00-023	00-024	30	0.0096	28.14	16.98	0.604	43.54	26.28
00-024	00-025	30	0.0096	28.14	16.98	0.604	43.54	26.28
00-025	00-026	30	0.0096	28.14	16.98	0.604	43.54	26.28
00-026	00-027	30	0.0099	28.57	16.98	0.594	44.21	26.28
00-027	00-028	36	0.0047	32.02	16.98	0.530	49.54	26.28
00-028	00-030	36	0.0037	28.41	16.98	0.598	43.95	26.28
00-030	00-031	36	0.0039	29.16	16.98	0.582	45.12	26.28
00-031	00-032	36	0.0086	43.31	16.98	0.392	67.01	26.28
00-032	00-033	36	0.0258	75.01	16.98	0.226	116.06	26.28
00-033	00-034	36	0.0128	52.83	16.98	0.321	81.75	26.28
00-034	00-035	36	0.0044	30.98	16.98	0.548	47.93	26.28
00-035	00-036	36	0.0045	31.33	16.98	0.542	48.47	26.28
00-036	00-037	36	0.0043	30.62	16.98	0.555	47.38	26.28
00-037	00-038	42	0.002	31.50	16.98	0.539	48.74	26.28
00-038	00-039	42	0.0022	33.04	16.98	0.514	51.12	26.28
00-039	00-040	42	0.002	31.50	16.98	0.539	48.74	26.28
00-040	00-041	42	0.0022	33.04	16.98	0.514	51.12	26.28
00-041	00-042	42	0.002	31.50	16.98	0.539	48.74	26.28
00-042	00-043	42	0.0019	30.71	16.98	0.553	47.51	26.28
00-043	00-044	42	0.002	31.50	16.98	0.539	48.74	26.28
00-044	00-045	42	0.002	31.50	16.98	0.539	48.74	26.28
00-045	00-046	42	0.002	31.50	16.98	0.539	48.74	26.28
00-046	00-001MS	42	0.0019	30.71	16.98	0.553	47.51	26.28

SITE LOCATION MAP

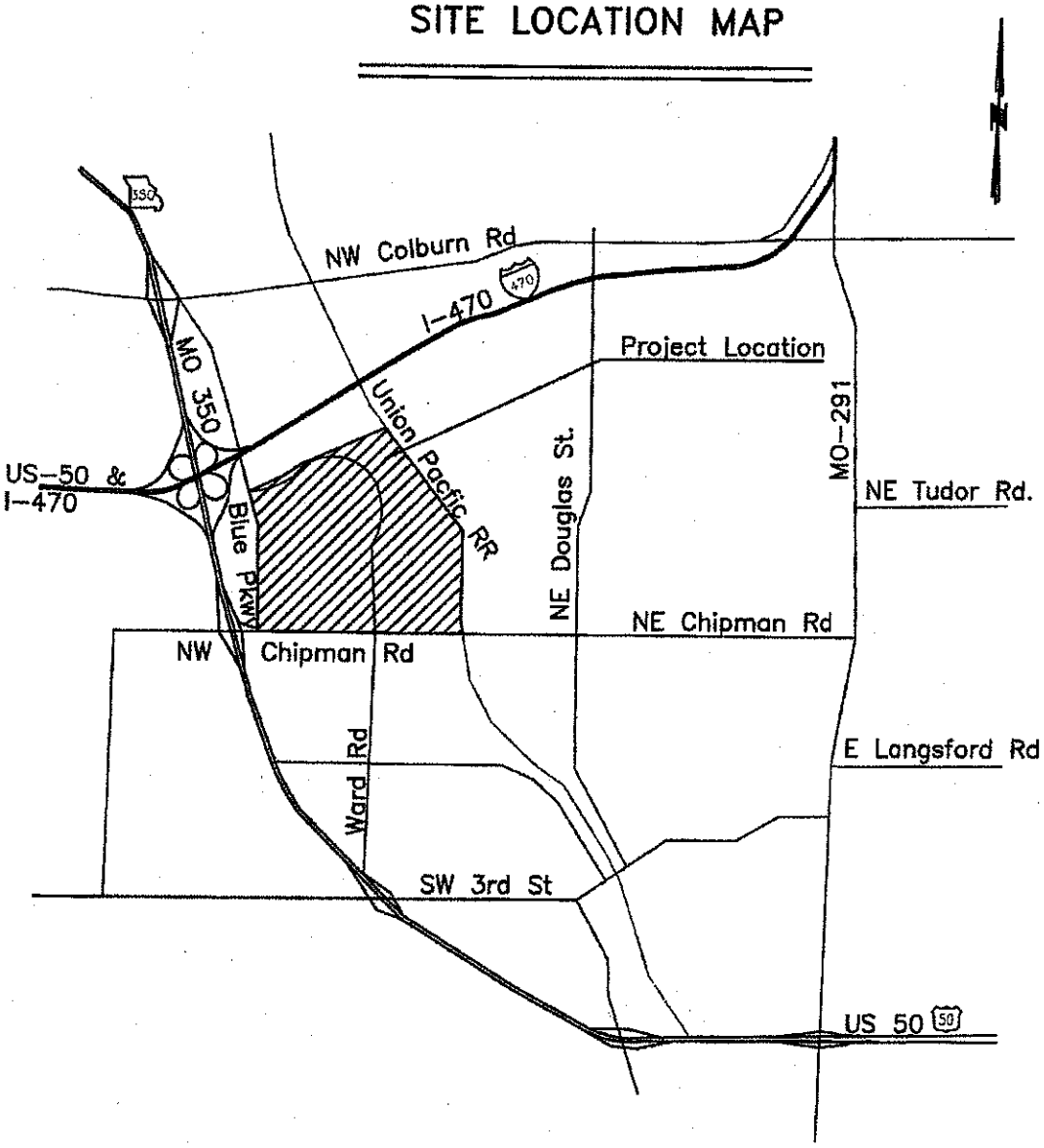

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FIGURE 1

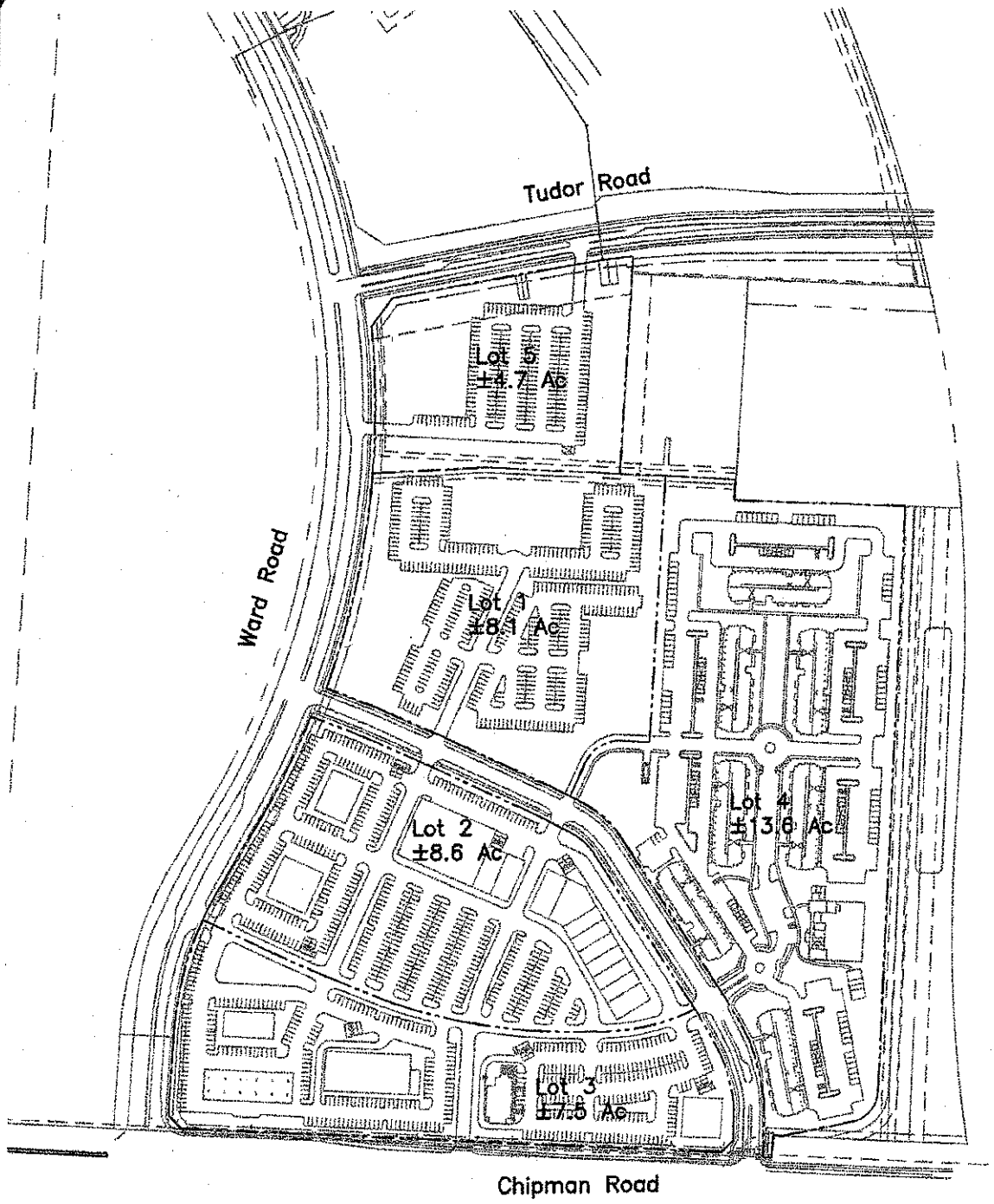

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FIGURE 2

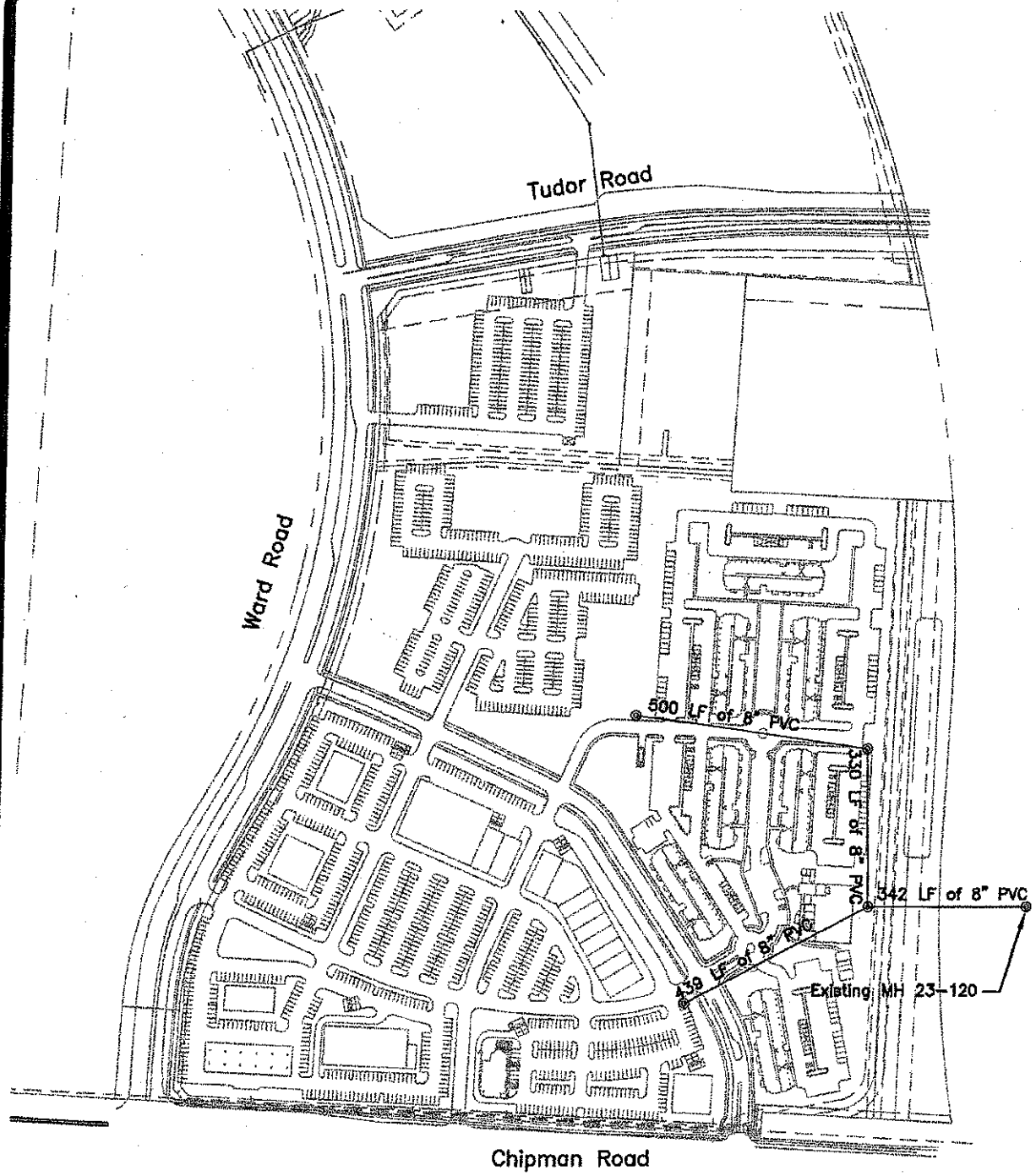

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FIGURE 3

Exhibit D
Peak Flow Calculations

Peak Base Flow

From 6501.C.1.a.i, the peak base flow for residential land is calculated as 1,500 gallons per day per acre (gpd/ac) of the proposed residential property.

Thus, Lot 1 of the proposed property (8.1 acres) yields a peak base flow of:

$$PBF\ (Lot\ 1) = \ 1{,}500\frac{gpd}{ac} * 8.1\ ac = 12{,}150\ gpd$$

Lot 5 of the proposed property (4.7 acres) yields a peak base flow of:

$$PBF\ (Lot\ 5) = \ 1{,}500\frac{gpd}{ac} * 4.7\ ac = 7{,}050\ gpd$$

Peak Infiltration

From 6501.C.1.b.i, the peak infiltration for residential land is calculated as 500 gallons per day per acre (gpd/ac).

Thus, Lot 1 of the proposed property (8.1 acres) yields a peak infiltration:

$$Peak\ Infiltration\ (Lot\ 1) = 500\frac{gpd}{ac} * 8.1\ ac = 4{,}050\ \ gpd$$

Lot 5 of the proposed property (4.7 acres) yields a peak infiltration:

$$Peak\ Infiltration\ (Lot\ 1) = 500\frac{gpd}{ac} * 4.7\ ac = 2{,}350\ \ gpd$$

Peak Inflow

From 6501.C.1.c, the peak inflow is calculated by the following equation:

$$Q = KiA$$

Where:
Q = peak inflow (cfs); 1 cfs = 646,317 gpd
K = inflow factor (0.006 for residential land)
i = rainfall intensity corresponding to the tributary area's time of concentration (iph)
T_c (min) = 18.56 $(A)^{0.2524}$
A = tributary area (ac)

The time of concentration for the Lot 1 (8.1 acres) has been determined as:

$$T_c = 18.56 * 8.1^{0.2524} = 31.47\ min.$$

The time of concentration for the Lot 5 (4.7 acres) has been determined as:

$$T_c = 18.56 * 4.7^{0.2524} = 27.43\ min.$$

Based on the time of concentrations calculated above, the rainfall intensity has been interpolated using the information provided in the table in 6501.C.1.d of the LS DCM. The 50-year rainfall intensity for lots 1 and 5 are 4.90

and 5.31 inches per hour, respectively. From this information, the peak inflow is calculated as follows:

$$Q\ (Lot\ 1) = KiA * 646{,}317 = 0.006 * 4.90iph * 8.1ac * 646{,}317\frac{gpd}{ac} = 153{,}914\ gpd$$

$$Q\ (Lot\ 5) = KiA * 646{,}317 = 0.006 * 5.31iph * 4.7ac * 646{,}317\frac{gpd}{ac} = 96{,}781\ gpd$$

Taking the summation of the peak base flow, peak infiltration, and peak inflow, the total peak flow for the property developed assuming residential land use is:

$$Peak\ Flow = PBF + Peak\ Infilatration + Peak\ Inflow$$
$$Peak\ Flow\ (Lot\ 1) = 12{,}150\ gpd + 4{,}050\ gpd + 153{,}914\ gpd = 170{,}114\ gpd$$
$$Peak\ Flow\ (Lot\ 5) = 7{,}050\ gpd + 2{,}350\ gpd + 96{,}781\ gpd = 106{,}181\ gpd$$

Proposed Sanitary Sewer Peak Flows:

	Area (Ac.)	Peak Base Flow	Peak Infiltration	Peak Inflow				Peak Flow (gpd)	Calculated in THHinc Report (gpd)	Increase in Estimated Demand (gpd)	Peak Flow Rate (cfs)
				Concentration, T_c (min)	Intensity, i (iph)	Peak Inflow, Q (cfs)	Peak Inflow (gpd)				
Lot 1 (South)	8.1	12,150	4,050	31.47	4.90	0.24	153,914	**170,114**	89,018	81,096	**0.263**
Lot 5 (North)	4.7	7,050	2,350	27.43	5.31	0.15	96,781	**106,181**	51,798	54,383	**0.164**
Total	12.8	19,200	6,400				250,695	**276,295**	140,816	135,479	**0.427**

Existing Sanitary Sewer Flow Capacity:

	US Flowline	DS Flowline	Pipe Lenth (ft)	Pipe Slope (ft/ft)	Pipe Size (in.)	Manning's N	Pipe Area (ft^2)	Wetted Perimeter (ft.)	Hydraulic Radius (ft.)	Flow Capacity (cfs)
North	966.41	964.53	309.29	0.006	12	0.009	0.785	3.140	0.25	4.02
South	992.89	991.94	82.53	0.012	8	0.009	0.349	2.093	0.17	1.88

Exhibit E

Existing Sanitary Sewer Impact

Sanitary Sewer Design Flow (North)

Circular

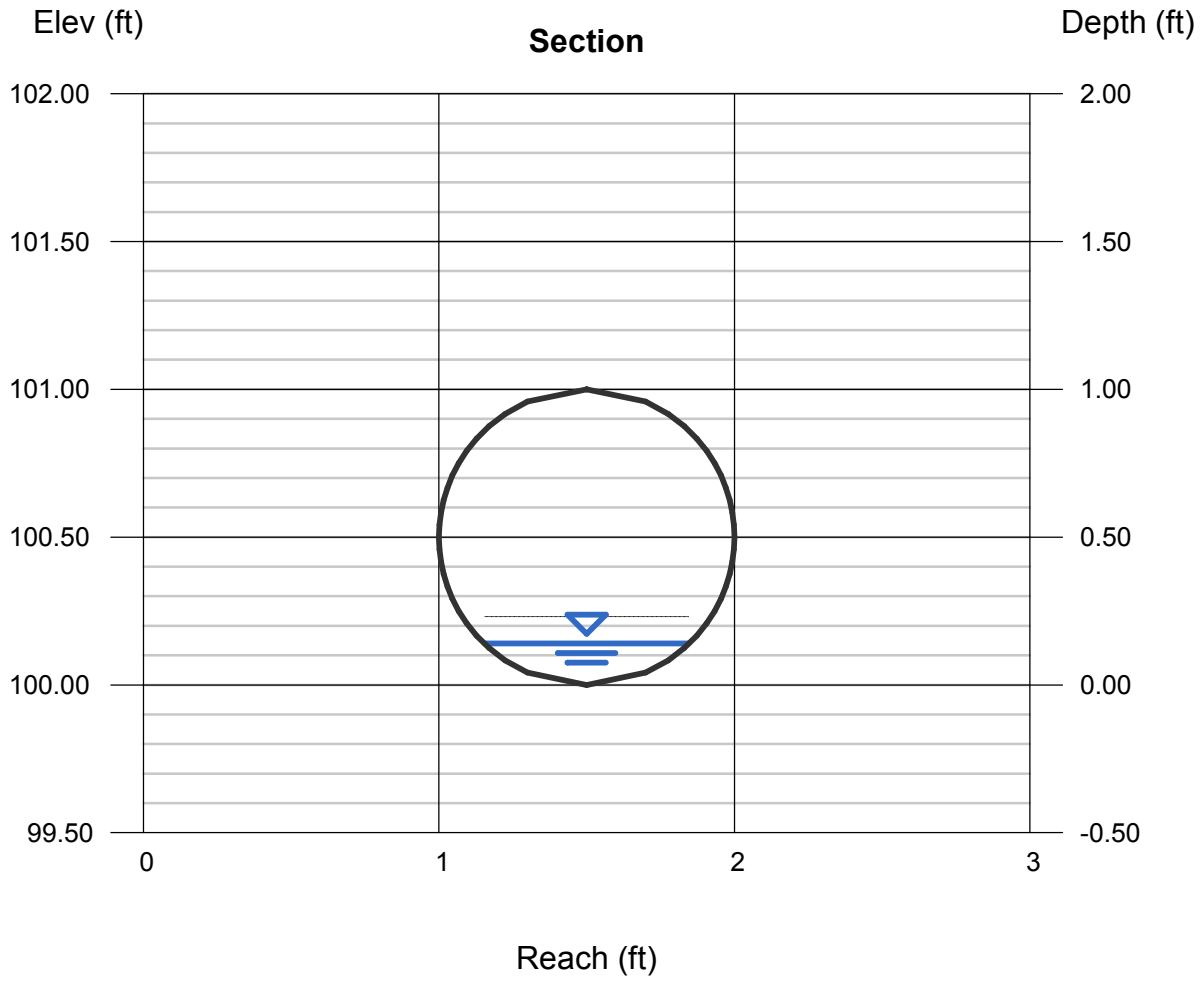
Diameter (ft)	= 1.00
Invert Elev (ft)	= 100.00
Slope (%)	= 0.61
N-Value	= 0.009

Calculations

Compute by:	Known Q
Known Q (cfs)	= 0.16

Highlighted

Depth (ft)	= 0.14
Q (cfs)	= 0.164
Area (sqft)	= 0.07
Velocity (ft/s)	= 2.43
Wetted Perim (ft)	= 0.77
Crit Depth, Yc (ft)	= 0.17
Top Width (ft)	= 0.70
EGL (ft)	= 0.23



Sanitary Sewer Design Flow (South)

Circular

Diameter (ft)	= 0.67
Invert Elev (ft)	= 100.00
Slope (%)	= 1.15
N-Value	= 0.009

Calculations

Compute by:	Known Q
Known Q (cfs)	= 0.26

Highlighted

Depth (ft)	= 0.17
Q (cfs)	= 0.263
Area (sqft)	= 0.07
Velocity (ft/s)	= 3.70
Wetted Perim (ft)	= 0.71
Crit Depth, Yc (ft)	= 0.24
Top Width (ft)	= 0.58
EGL (ft)	= 0.38