February 18, 2019

Mr. Scott Auman, AIA, NCARB
Stark Wilson Duncan Architects, Inc.
315 Nichols Road, Suite 228
Kansas City, MO 64112

Re: City of Lee's Summit, MO
Senior Living Community

Dear Mr. Auman:

An analysis was completed to determine the effect of proposed growth on the South Prairie Lee Interceptor. The proposed growth consists of the development of approximately 10.9 acres located south of Highway 50 and east of Ranson Road.

A proposed development map was submitted for the property at Highway 50 and Ranson Road. The proposed development consists of Memory Care facility, Independent Living facility, and Assisted Living units.

Flows were projected for the existing condition using the City of Lee's Summit Design Criteria with the revised k factors for the South Prairie Lee Watershed established in the 2012 Wastewater Master Plan Update. For the proposed development, flow projections were made utilizing the City of Lee's Summit design criteria. The projected flow for the development is 0.155 MGD, as indicated on the attached worksheet.

It was assumed that the flow would enter the collection system at Manhole 68-164. The South Prairie Lee Interceptor was evaluated from the point of entry to MH 26-298, just prior to its discharge at the Scruggs Road Lift Station. The extents of the analysis are indicated on the attached Figure 1. The model was completed based upon the most recent published GIS data obtained from the City. Not reflected in the GIS data, but updated in the model, was the 2014-2015 improvements completed by the City to upsize segments MH 33-193 to MH 33-195 from 12-inch diameter to 21-inch diameter. This information was verified by the City.

The Scruggs Road Pump Station pumps to the Tudor Road Pump Station. The 2007 Wastewater Master Plan recommended upgrades to the Scruggs Road Pump Station to increase capacity to 16 MGD, as well as improvements to the force main, gravity interceptor,

and excess flow holding basin. The Master Plan also recommended improvements to the Tudor Road Pump Station to expand the capacity to 24 MGD. The Master Plan should be referenced for future planning of these facilities.

In the 2007 Wastewater Master Plan, a significant portion of the South Prairie Lee Interceptor was indicated as necessitating improvements to accommodate the additional flow from future growth. In this analysis, the focus was on identifying improvement alternatives that would offset the projected flow from the future development. The intent of this exercise was to find a solution that would allow the development to move forward but would not cause conditions to worsen in the South Prairie Lee Interceptor. By upsizing/paralleling segments in the South Prairie Lee Interceptor, the hydraulic grade line at the approximate point in the sewer system where the future development would tie-in is reduced to the approximate elevation it was prior to the contribution from the proposed development.

The attached Table 1 compares the hydraulic grade line under existing conditions, which is the baseline, to the hydraulic grade line of the existing condition plus the proposed development. A positive surcharge depth versus the manhole top indicates the hydraulic grade line is above the manhole rim elevation. A number of segments indicate an increase greater than one foot from the hydraulic grade line for existing conditions: MH 68-164 through MH 33-184 and MH 33-228 through MH 33-230.

Table 1 also compares the hydraulic grade line assuming the upsizing of segments to increase capacity versus the baseline. Three segments were identified for upsizing, as indicated on Figure 1: MH 68-010 to MH 68-009, MH 33-184 to MH 33-191, and MH 33-230 to MH 33-370. It is recommended that these segments be upsized to offset the projected flow from the proposed development. A cost estimate is attached. It is our recommendation that the developer be responsible for the construction costs associated with the upsizing of these segments, completed under a future CIP project by the City.

If you have any questions, please feel free to contact me at 816-347-1164.

Sincerely,

Amanda Bagwell

Amanda Bagwell, P.E.
Project Manager

CC: Pat Young, HDR

City of Lee's Summit, Missouri
Senior Living Community
Sanitary Sewer Flow Design Calculations

Total Flow = Peak Base Flow + Peak Infiltration Flow + Peak Inflow

Peak Base Flow

Peak Base Flow = EDU x Building Area x 300 gpd

Estimated Sanitary Demand Projections (North)				
Source	**EDU Ratio**	**Unit**	**Quantity**	**EDU**
1 Bedroom	1	Dwelling Unit	57	57.0
2 Bedroom	2	Dwelling Unit	34	68.0
Hospital Beds	0.8	Bed	62	49.6
			Total EDU	174.6
			Acres	10.9

Peak Base Flow = 175 x 300 gpd
Peak Base Flow = 52,380 gpd

Peak Infiltration

Peak Infiltration = 250 gpd x Acres

Peak Infiltration = 10.9 acres x 250 gpd
Peak Infiltration = 2,718 gpd

Peak Inflow

Peak Inflow (Q) = kiA

Where:

Q = Peak Inflow (cfs)
k = Inflow factor (0.003 for non-residential)
i = Rainfall intensity (iph for a 50 year storm, from Section 6501.C.1.d)
A = Acres

Use the following to find rainfall intensity:

$Tc = 18.56 (A)^{0.2524}$

Where:

Tc = Time of Concentration (minutes)
A = Acres

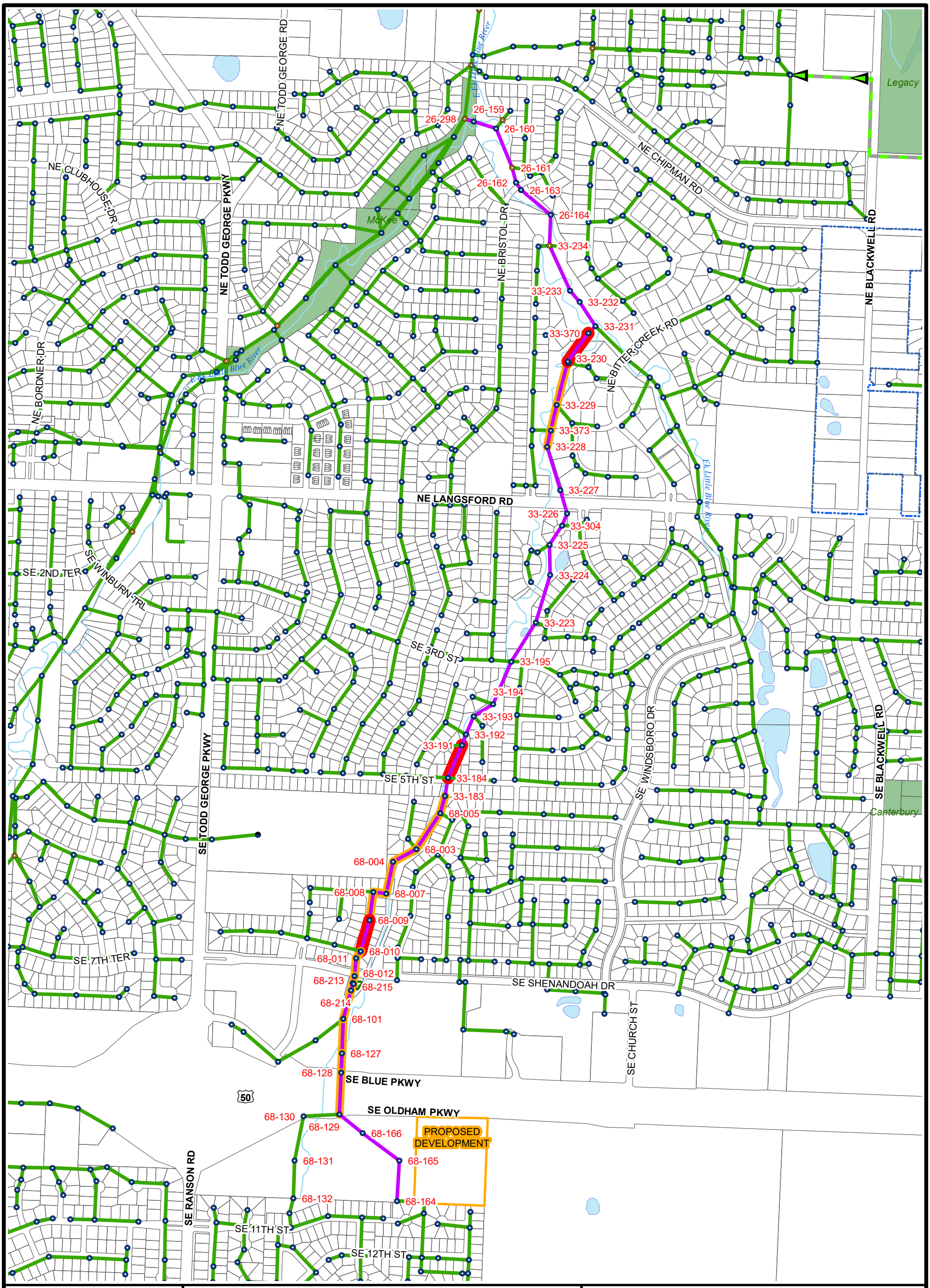
$Tc = 18.56 (10.9)^{0.2524}$
Tc = 33.9 minutes

i = 4.75 iph

Peak Inflow (Q) = 0.006 x 3.84 iph x 10.9 acres
Peak Inflow = 0.1548975 cfs
Peak Inflow = 100,100 gpd

Total Design Flow

Total Flow = Peak Base Flow + Peak Infiltration Flow + Peak Inflow
Total Flow = 155,200 gpd



Legend

- Project_Location
- Access Tee
- Drop
- Standard
- Manholes Buried
- Pump Stations
- Forced Mains

Gravity Mains

- Segments Identified for Capacity Increase
- Capacity Impacted Segments
- Analyzed Sections
- Unanalyzed Sections

City of Lee's Summit, Missouri
South Prairie Lee Watershed

Figure 1
Senior Living Community Analysis

Table 1A
City of Lee's Summit, Missouri
South Prairie Lee Interceptor Improvements

						Ex Condition		Existing Condition with Senior Living Community		Phase I with Improvements	
Upstream ID	Downstream ID	Diameter (in)	Upstream Invert Elevation (ft)	Upstream Manhole Rim Elevation (ft)	Manhole Depth (ft)	Existing Diameter	Surcharge Depth vs Manhole Top (ft)	Existing Diameter	Surcharge Depth vs Manhole Top (ft)	Revised Diameter	Surcharge Depth vs Manhole Top (ft)
26-159*	26-298*	24	887.09	899.63	12.54	24	-10.35	24	-10.34	24	-10.34
26-160*	26-159*	24	888.83	902.62	13.79	24	-12.85	24	-12.82	24	-12.82
26-161*	26-160*	24	890.49	902.24	11.75	24	-11.58	24	-11.51	24	-11.51
26-162*	26-161*	24	891.67	909.00	17.33	24	-17.33	24	-17.33	24	-17.33
26-163*	26-162*	24	892.15	909.50	17.35	24	-17.35	24	-17.35	24	-17.35
26-164*	26-163*	24	893.38	909.92	16.54	24	-16.54	24	-16.54	24	-16.54
33-234	26-164*	24	898.06	912.56	14.50	24	-14.50	24	-14.50	24	-14.50
33-233	33-234	24	903.07	915.60	12.53	24	-12.53	24	-12.53	24	-12.53
33-232	33-233	15	904.72	918.26	13.54	15	-10.83	15	-10.59	15	-10.59
33-231	33-232	15	907.45	921.90	14.45	15	-9.05	15	-8.51	15	-8.51
33-370	33-231	15	910.78	920.30	9.52	15	-6.64	15	-6.02	15	-6.02
33-230	33-370	15	910.78	920.65	9.87	15	-4.82	15	-3.99	18	-5.47
33-229	33-230	15	915.49	926.72	11.23	15	-7.99	15	-6.90	15	-8.38
33-373	33-229	15	920.48	927.73	7.25	15	-7.25	15	-5.98	15	-7.25
33-228	33-373	15	920.48	929.32	8.84	15	-7.86	15	-6.50	15	-7.77
33-227	33-228	15	925.14	932.70	7.56	15	-7.56	15	-7.16	15	-7.56
33-226	33-227	15	934.38	940.90	6.52	15	-6.52	15	-6.52	15	-6.52
33-304	33-226	15	934.70	943.03	8.33	15	-7.90	15	-7.82	15	-7.82
33-225	33-304	15	937.81	943.00	5.19	15	-5.19	15	-5.19	15	-5.19
33-224	33-225	15	939.81	949.20	9.39	15	-9.15	15	-8.90	15	-8.90
33-223	33-224	15	941.00	949.50	8.50	15	-7.18	15	-6.69	15	-6.69
33-195	33-223	15	941.00	949.50	8.50	15	-5.29	15	-4.57	15	-4.57
33-194 †	33-195 †	21	944.60	952.00	7.40	21	-7.40	21	-6.77	21	-6.77
33-193 †	33-194 †	21	946.19	953.45	7.26	21	-7.26	21	-7.26	21	-7.26
33-192	33-193	12	948.35	954.00	5.65	12	-5.65	12	-5.65	12	-5.65
33-191	33-192	12	947.97	955.07	7.10	12	-5.41	12	-5.22	12	-5.22
33-184	33-191	12	950.41	957.66	7.25	12	-4.57	12	-3.89	15	-6.62
33-183	33-184	12	952.17	958.50	6.33	12	-3.80	12	-2.88	12	-5.61
68-005	33-183	10	953.23	962.87	9.64	10	-4.21	10	-2.68	12	-8.25
68-003	68-005	10	959.47	968.70	9.23	10	-7.71	10	-5.42	10	-9.23
68-004	68-003	8	962.63	972.00	9.37	8	-6.52	8	-2.72	10	-9.37
68-007	68-004	8	967.62	975.63	8.01	8	-5.01	8	0.58	8	-6.07
68-008	68-007	8	969.90	977.76	7.86	8	-5.49	8	0.75	8	-5.90
68-009	68-008	8	973.01	982.95	9.94	8	-7.26	8	0.36	8	-6.29
68-010	68-009	8	975.96	985.30	9.34	8	-6.35	8	2.72	12	-8.10
68-011	68-010	8	977.03	987.11	10.08	8	-7.35	8	2.08	8	-8.74
68-012	68-011	8	978.86	987.38	8.52	8	-5.87	8	4.35	8	-6.47
68-213	68-012	8	980.11	988.07	7.96	8	-5.86	8	4.68	8	-6.13
68-214	68-213	8	980.44	989.50	9.06	8	-6.61	8	4.25	8	-6.57
68-101	68-214	8	983.14	992.64	9.50	8	-7.10	8	5.02	8	-5.80
68-127	68-101	8	984.93	995.88	10.95	8	-8.03	8	5.34	8	-5.48
68-128	68-127	8	988.42	999.30	10.88	8	-10.17	8	3.92	8	-6.89
68-129	68-128	8	991.08	1010.51	19.43	8	-18.80	8	-3.19	8	-14.01
68-166	68-129	8	992.95	1017.39	24.44	8	-24.44	8	-8.92	8	-19.74
68-165	68-166	8	995.47	1024.10	28.63	8	-28.63	8	-14.05	8	-24.87
68-164	68-165	8	997.81	1027.51	29.70	8	-29.70	8	-16.16	8	-26.98

*Manhole ID's were taken from GIS and vary from Manhole ID's from record drawings, which were, respectively, from downstream to upstream: 26-048, 26-298, 26-041, 26-044, 26-083, 26-084, and 26-085

† Pipes upsized as part of improvement project in 2014-2015.

Recommended improvement

Surcharge increase greater than 1 foot from existing condition

ENGINEER'S PRELIMINARY COST ESTIMATE OF PROBABLE CONSTRUCTION COSTS
SENIOR LIVING COMMUNITY
LEE'S SUMMIT, MO

February 18, 2019

Item No.	Description	Quantity	Unit	Unit Price $	Price $
1.	Mobilization (3% max of total bid)	1	LS	$6,000.00	$6,000.00
2.	Demolition, Clearing & Grubbing	1	LS	$5,000.00	$5,000.00
3.	18" Sanitary Sewer (PVC)	293	LF	$178.00	$52,154.00
4.	15" Sanitary Sewer (PVC)	318	LF	$166.00	$52,788.00
5.	12" Sanitary Sewer (PVC)	289	LF	$153.00	$44,217.00
6.	4' Dia. Manhole (8'-12' Depth)	6	EA	$4,800.00	$28,800.00
7.	Connection to Existing Sewer Lateral	10	EA	$600.00	$6,000.00
8.	Sod	100	SY	$5.00	$500.00
9.	Seed and Mulch	1	AC	$2,000.00	$2,000.00
10.	Bypass Pumping	1	LS	$30,000.00	$30,000.00
11.	Erosion Control	1	LS	$5,000.00	$5,000.00
				SUBTOTAL:	**$232,459.00**
				CONTINGENCY (15%):	$34,900.00
				TOTAL CONSTRUCTION:	**$268,000.00**
				Legal, Easements, Engineering, Inspection (20%):	$53,600.00
				PROJECT TOTAL:	**$321,000.00**