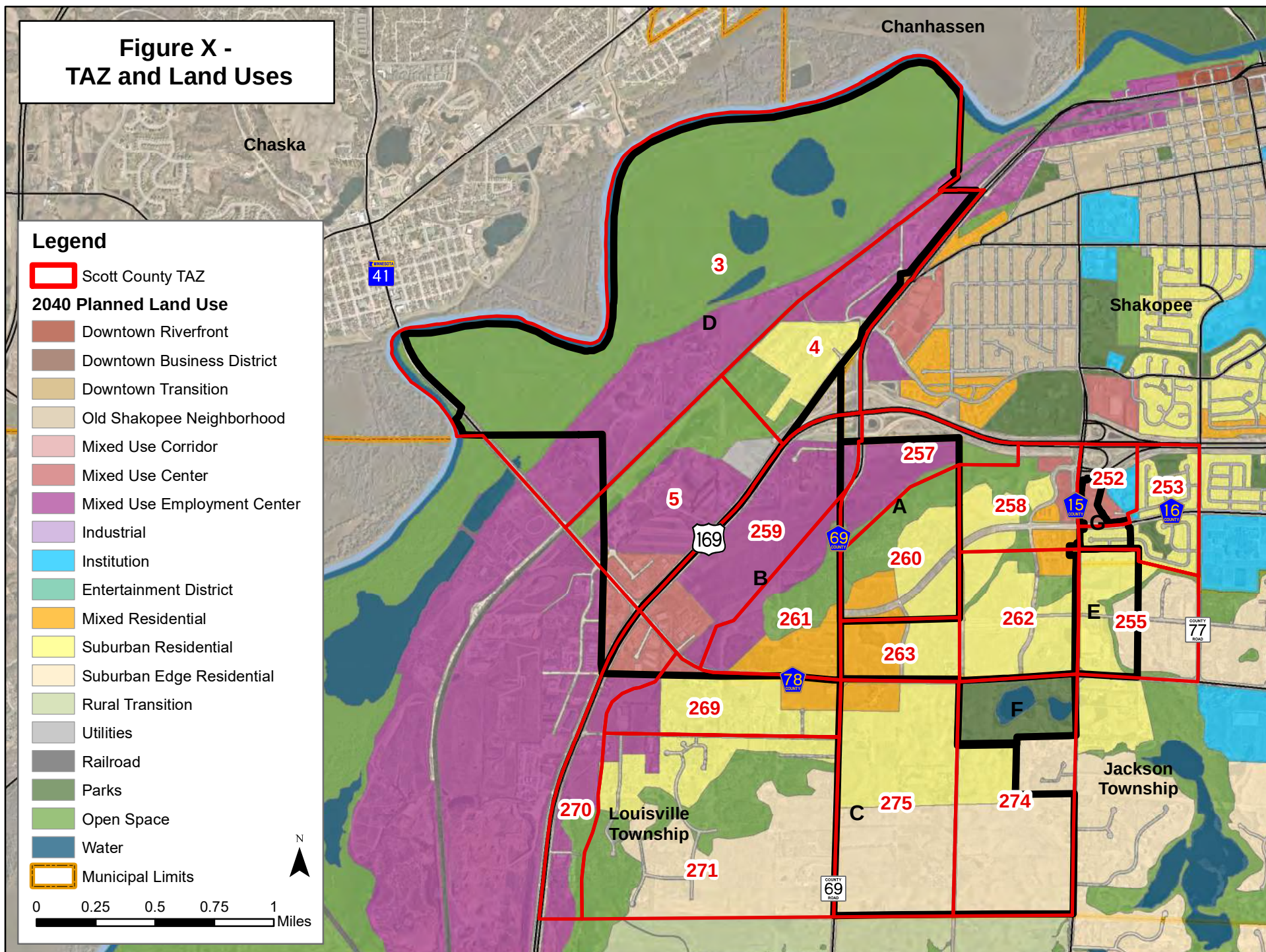


Appendix

**Figure X -
TAZ and Land Uses**



10: Rail Frontage & MN 41 Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.7	0.0	0.1	0.1	0.3
Total Del/Veh (s)	1.8	3.0	26.4	36.0	3.3

20: Dem Con Dr/Frontage Rd & MN 41 Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	0.0	2.5	2.1	0.2
Total Del/Veh (s)	10.4	26.7	18.9	17.6	19.1

25: MN 41/Chestnut Blvd & US 169 Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	0.4	0.8	1.5	0.8
Total Del/Veh (s)	74.0	68.1	42.5	28.8	48.0

30: Chestnut Blvd & Emery Way Performance by approach

Approach	EB	WB	All
Denied Del/Veh (s)	0.0	0.0	0.0
Total Del/Veh (s)	7.2	1.9	4.6

40: CR 69 & Chestnut Blvd/CR 78 Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	0.0	0.2	0.0	0.0
Total Del/Veh (s)	2.5	1.3	9.0	6.7	3.8

50: CR 73 & CR 78 Performance by approach

Approach	EB	WB	NB	All
Denied Del/Veh (s)	0.0	0.0	0.1	0.0
Total Del/Veh (s)	1.7	5.2	1.5	3.6

60: CSAH 15/CR 15 & CR 78 Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	0.0	0.2	0.0	0.1
Total Del/Veh (s)	11.6	10.0	10.5	6.4	10.0

70: CR 78 & CR 77 Performance by approach

Approach	EB	WB	SB	All
Denied Del/Veh (s)	0.0	0.0	0.1	0.0
Total Del/Veh (s)	5.5	6.5	3.7	6.0

80: CR 79 & CR 78 Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	0.4	0.2	0.2	0.2
Total Del/Veh (s)	11.2	13.0	9.5	7.4	11.2

100: CR 69 & 10th Ave Performance by approach

Approach	WB	NB	SB	All
Denied Del/Veh (s)	0.5	0.0	0.4	0.1
Total Del/Veh (s)	6.3	0.2	0.5	0.9

101: CR 69 & Chaparral Ave Performance by approach

Approach	EB	NB	SB	All
Denied Del/Veh (s)	0.1	0.0	0.0	0.0
Total Del/Veh (s)	3.8	0.6	0.3	0.6

105: CR 69 & Vierling Dr Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	1.1	3.0	0.0	0.0	0.4
Total Del/Veh (s)	6.5	9.1	0.8	0.6	2.1

110: CR 69 & US 169 N Ramp Performance by approach

Approach	WB	NB	SB	All
Denied Del/Veh (s)	2.9	0.0	0.1	0.4
Total Del/Veh (s)	4.7	0.8	0.4	1.2

120: CR 69 & US 169 S Ramp Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.1	3.3	0.0	0.0	1.9
Total Del/Veh (s)	5.0	4.1	0.4	0.9	2.8

130: CR 69 Performance by approach

Approach	EB	NB	SB	All
Denied Del/Veh (s)	0.1	0.0	0.0	0.0
Total Del/Veh (s)	4.3	4.1	0.0	3.1

200: CR 15 & US 169 N Ramp Performance by approach

Approach	WB	NB	SB	All
Denied Del/Veh (s)	2.6	0.0	0.8	1.0
Total Del/Veh (s)	6.6	0.9	1.2	2.6

210: CR 15 & US 169 S Ramp Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	1.4	2.3	0.0	0.0	0.4
Total Del/Veh (s)	14.2	13.9	1.2	2.4	3.9

220: CR 15 & CR 16 Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	1.4	1.3	0.0	0.0	0.4
Total Del/Veh (s)	10.7	6.6	1.4	3.0	3.8

230: CR 15 & 128th St W Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	4.1	0.1	0.0	0.0	0.1
Total Del/Veh (s)	5.7	3.8	4.7	0.7	3.3

Total Network Performance

Denied Del/Veh (s)	1.2
Total Del/Veh (s)	42.0

Intersection: 10: Rail Frontage & MN 41

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (ft)	124	131	81	157
Average Queue (ft)	7	7	19	47
95th Queue (ft)	56	46	62	121
Link Distance (ft)	1181	580	856	971
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 20: Dem Con Dr/Frontage Rd & MN 41

Movement	EB	EB	EB	B7	WB	WB	WB	WB	NB	NB	SB	SB
Directions Served	L	T	R	T	L	T	T	R	LT	R	L	T
Maximum Queue (ft)	30	342	15	18	166	459	390	75	72	64	71	23
Average Queue (ft)	6	135	2	1	19	175	60	4	22	22	25	3
95th Queue (ft)	22	274	10	17	91	387	247	57	56	49	60	14
Link Distance (ft)		480		580		1235	1235		575			440
Upstream Blk Time (%)		0										
Queuing Penalty (veh)		1										
Storage Bay Dist (ft)	285		275		250			250		60	125	
Storage Blk Time (%)		1				4	0		2	1		
Queuing Penalty (veh)		0				1	0		1	0		

Intersection: 20: Dem Con Dr/Frontage Rd & MN 41

Movement	SB
Directions Served	R
Maximum Queue (ft)	47
Average Queue (ft)	13
95th Queue (ft)	34
Link Distance (ft)	440
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 25: MN 41/Chestnut Blvd & US 169

Movement	EB	EB	EB	WB	WB	WB	NB	NB	NB	NB	NB	SB
Directions Served	L	L	T	L	T	R	L	L	T	T	R	L
Maximum Queue (ft)	502	503	247	201	371	196	228	472	623	575	80	63
Average Queue (ft)	311	328	103	38	202	39	129	99	309	284	3	11
95th Queue (ft)	529	538	206	109	333	123	198	256	518	486	69	37
Link Distance (ft)			1235		1147				1527	1527		
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	725	725		180		230	375	375			330	250
Storage Blk Time (%)	0	0			21			0	5	6		
Queuing Penalty (veh)	1	1			17			0	10	4		

Intersection: 25: MN 41/Chestnut Blvd & US 169

Movement	SB	SB	SB
Directions Served	T	T	R
Maximum Queue (ft)	359	361	301
Average Queue (ft)	221	204	61
95th Queue (ft)	333	327	236
Link Distance (ft)	1877	1877	
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)			575
Storage Blk Time (%)	6		
Queuing Penalty (veh)	1		

Intersection: 30: Chestnut Blvd & Emery Way

Movement	EB
Directions Served	LT
Maximum Queue (ft)	28
Average Queue (ft)	1
95th Queue (ft)	10
Link Distance (ft)	1147
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 40: CR 69 & Chestnut Blvd/CR 78

Movement	EB	WB	WB	NB	SB
Directions Served	L	L	TR	LTR	LTR
Maximum Queue (ft)	25	21	3	72	44
Average Queue (ft)	2	1	0	35	19
95th Queue (ft)	13	11	3	57	43
Link Distance (ft)			2579	810	4022
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)	300	300			
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 50: CR 73 & CR 78

Movement	NB
Directions Served	LR
Maximum Queue (ft)	26
Average Queue (ft)	4
95th Queue (ft)	18
Link Distance (ft)	794
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 60: CSAH 15/CR 15 & CR 78

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (ft)	124	83	75	54
Average Queue (ft)	48	43	40	30
95th Queue (ft)	88	68	64	46
Link Distance (ft)	2562	2623	970	1262
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 70: CR 78 & CR 77

Movement	EB	SB
Directions Served	LT	LR
Maximum Queue (ft)	34	42
Average Queue (ft)	5	18
95th Queue (ft)	22	38
Link Distance (ft)	2623	971
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 80: CR 79 & CR 78

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (ft)	84	148	74	74
Average Queue (ft)	42	67	39	34
95th Queue (ft)	69	115	62	55
Link Distance (ft)	2623	2332	631	1187
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 100: CR 69 & 10th Ave

Movement	WB	WB	SB
Directions Served	L	R	L
Maximum Queue (ft)	57	51	29
Average Queue (ft)	18	17	3
95th Queue (ft)	43	40	18
Link Distance (ft)		2044	
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)	125		430
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 101: CR 69 & Chaparral Ave

Movement	EB	NB
Directions Served	LR	L
Maximum Queue (ft)	52	25
Average Queue (ft)	10	3
95th Queue (ft)	36	15
Link Distance (ft)	1078	
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		225
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 105: CR 69 & Vierling Dr

Movement	EB	EB	WB	WB	WB	NB	NB	SB	SB
Directions Served	L	TR	L	T	R	L	R	L	R
Maximum Queue (ft)	42	58	56	25	29	19	21	18	3
Average Queue (ft)	16	21	21	7	11	3	1	1	0
95th Queue (ft)	38	43	49	25	29	13	7	9	3
Link Distance (ft)		1182		1063					
Upstream Blk Time (%)									
Queuing Penalty (veh)									
Storage Bay Dist (ft)	150		265		175	380	380	270	260
Storage Blk Time (%)									
Queuing Penalty (veh)									

Intersection: 110: CR 69 & US 169 N Ramp

Movement	WB	WB	NB
Directions Served	LT	R	L
Maximum Queue (ft)	41	76	21
Average Queue (ft)	11	34	1
95th Queue (ft)	36	60	11
Link Distance (ft)	1153		
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)		300	340
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 120: CR 69 & US 169 S Ramp

Movement	EB	WB	WB	SB
Directions Served	LTR	LT	R	L
Maximum Queue (ft)	26	23	95	40
Average Queue (ft)	12	3	47	6
95th Queue (ft)	30	15	79	26
Link Distance (ft)	1005	1008		
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)			300	340
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 130: CR 69

Movement	EB
Directions Served	LTR
Maximum Queue (ft)	28
Average Queue (ft)	5
95th Queue (ft)	22
Link Distance (ft)	964
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 200: CR 15 & US 169 N Ramp

Movement	WB	WB	SB
Directions Served	LT	R	L
Maximum Queue (ft)	88	76	40
Average Queue (ft)	35	36	12
95th Queue (ft)	69	58	32
Link Distance (ft)	1485		
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)		210	200
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 210: CR 15 & US 169 S Ramp

Movement	EB	EB	WB	WB	NB	NB	SB
Directions Served	LT	R	LT	R	L	R	L
Maximum Queue (ft)	52	24	110	56	11	16	90
Average Queue (ft)	13	5	35	21	1	2	34
95th Queue (ft)	37	20	84	39	8	11	70
Link Distance (ft)	1041		1220				
Upstream Blk Time (%)							
Queuing Penalty (veh)							
Storage Bay Dist (ft)		115		250	165	270	370
Storage Blk Time (%)							
Queuing Penalty (veh)							

Intersection: 220: CR 15 & CR 16

Movement	EB	EB	EB	EB	WB	WB	WB	WB	NB	SB
Directions Served	L	T	T	R	L	T	T	R	R	L
Maximum Queue (ft)	28	25	11	17	59	21	4	100	4	98
Average Queue (ft)	6	3	0	3	19	3	0	42	0	32
95th Queue (ft)	24	16	3	13	47	16	4	75	2	71
Link Distance (ft)		1783	1783			2699	2699			
Upstream Blk Time (%)										
Queuing Penalty (veh)										
Storage Bay Dist (ft)	265			265	415			285	215	430
Storage Blk Time (%)										
Queuing Penalty (veh)										

Intersection: 230: CR 15 & 128th St W

Movement	EB	WB	NB	SB
Directions Served	L	LTR	LTR	LT
Maximum Queue (ft)	26	31	17	24
Average Queue (ft)	8	16	1	2
95th Queue (ft)	27	40	8	12
Link Distance (ft)		769	1262	1900
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)	100			
Storage Blk Time (%)				
Queuing Penalty (veh)				

Network Summary

Network wide Queuing Penalty: 37

10: Rail Frontage & MN 41 Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.9	0.0	0.1	0.1	0.4
Total Del/Veh (s)	3.8	2.7	32.1	41.2	4.1

20: Dem Con Dr/Frontage Rd & MN 41 Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.1	0.0	2.3	1.5	0.2
Total Del/Veh (s)	11.5	21.8	19.9	14.7	16.5

25: MN 41/Chestnut Blvd & US 169 Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	0.0	0.9	1.3	0.8
Total Del/Veh (s)	56.6	58.3	34.9	31.3	40.2

30: Chestnut Blvd & Emery Way Performance by approach

Approach	EB	WB	SB	All
Denied Del/Veh (s)	0.0	0.0	0.1	0.0
Total Del/Veh (s)	7.2	1.7	3.5	5.0

40: CR 69 & Chestnut Blvd/CR 78 Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	0.0	0.2	0.0	0.0
Total Del/Veh (s)	4.3	1.3	7.0	10.8	4.8

50: CR 73 & CR 78 Performance by approach

Approach	EB	WB	All
Denied Del/Veh (s)	0.0	0.0	0.0
Total Del/Veh (s)	2.4	4.6	3.5

60: CSAH 15/CR 15 & CR 78 Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	0.0	0.2	0.0	0.0
Total Del/Veh (s)	13.3	9.4	7.8	8.5	10.1

70: CR 78 & CR 77 Performance by approach

Approach	EB	WB	SB	All
Denied Del/Veh (s)	0.0	0.0	0.1	0.0
Total Del/Veh (s)	5.9	5.4	4.2	5.4

80: CR 79 & CR 78 Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	0.2	0.1	0.2	0.1
Total Del/Veh (s)	11.8	10.2	6.9	9.0	10.1

100: CR 69 & 10th Ave Performance by approach

Approach	WB	NB	SB	All
Denied Del/Veh (s)	0.7	0.0	0.5	0.4
Total Del/Veh (s)	8.1	0.2	0.8	1.6

101: CR 69 & Chaparral Ave Performance by approach

Approach	EB	NB	SB	All
Denied Del/Veh (s)	0.1	0.0	0.0	0.0
Total Del/Veh (s)	4.8	0.6	0.4	0.8

105: CR 69 & Vierling Dr Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	1.4	2.7	0.0	0.0	0.4
Total Del/Veh (s)	8.9	10.5	0.8	0.9	2.5

110: CR 69 & US 169 N Ramp Performance by approach

Approach	WB	NB	SB	All
Denied Del/Veh (s)	2.2	0.0	0.0	0.4
Total Del/Veh (s)	4.6	0.8	1.0	1.5

120: CR 69 & US 169 S Ramp Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.1	3.2	0.0	0.0	1.0
Total Del/Veh (s)	7.8	3.1	0.3	0.7	1.6

130: CR 69 Performance by approach

Approach	EB	NB	SB	All
Denied Del/Veh (s)	0.1	0.0	0.0	0.0
Total Del/Veh (s)	5.2	3.0	0.1	1.3

200: CR 15 & US 169 N Ramp Performance by approach

Approach	WB	NB	SB	All
Denied Del/Veh (s)	2.6	0.0	1.0	1.4
Total Del/Veh (s)	12.4	1.5	1.8	5.6

210: CR 15 & US 169 S Ramp Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	1.2	3.3	0.0	0.0	0.5
Total Del/Veh (s)	14.1	6.9	1.2	2.4	3.0

220: CR 15 & CR 16 Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	1.5	1.3	0.0	0.0	0.4
Total Del/Veh (s)	7.5	4.8	1.2	1.3	2.5

230: CR 15 & 128th St W Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	3.0	0.1	0.0	0.0	0.2
Total Del/Veh (s)	4.9	5.0	3.9	0.9	2.3

Total Network Performance

Denied Del/Veh (s)	1.2
Total Del/Veh (s)	36.5

Intersection: 10: Rail Frontage & MN 41

Movement	EB	WB	B7	NB	SB
Directions Served	LTR	LTR	T	LTR	LTR
Maximum Queue (ft)	320	184	53	81	153
Average Queue (ft)	31	13	2	15	47
95th Queue (ft)	164	85	54	57	113
Link Distance (ft)	1181	585	474	856	971
Upstream Blk Time (%)			0		
Queuing Penalty (veh)			0		
Storage Bay Dist (ft)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 20: Dem Con Dr/Frontage Rd & MN 41

Movement	EB	EB	EB	B7	WB	WB	WB	WB	NB	NB	SB	SB
Directions Served	L	T	R	T	L	T	T	R	LT	R	L	T
Maximum Queue (ft)	34	404	15	46	76	360	295	13	58	68	61	38
Average Queue (ft)	8	149	1	3	10	130	27	2	19	19	23	6
95th Queue (ft)	27	320	9	60	54	269	139	8	49	47	52	25
Link Distance (ft)		474		585		1235	1235		575			440
Upstream Blk Time (%)		0										
Queuing Penalty (veh)		4										
Storage Bay Dist (ft)	285		275		250			250		60	125	
Storage Blk Time (%)		2				1	0		1	1		
Queuing Penalty (veh)		0				0	0		0	0		

Intersection: 20: Dem Con Dr/Frontage Rd & MN 41

Movement	SB
Directions Served	R
Maximum Queue (ft)	54
Average Queue (ft)	17
95th Queue (ft)	39
Link Distance (ft)	440
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 25: MN 41/Chestnut Blvd & US 169

Movement	EB	EB	EB	WB	WB	WB	NB	NB	NB	NB	SB	SB
Directions Served	L	L	T	L	T	R	L	L	T	T	L	T
Maximum Queue (ft)	387	384	347	98	219	69	194	168	314	289	268	575
Average Queue (ft)	237	250	182	34	107	27	107	62	160	139	28	339
95th Queue (ft)	360	365	303	81	191	58	172	136	279	255	130	524
Link Distance (ft)			1235		1147				1527	1527		1877
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	725	725		180		230	375	375			250	
Storage Blk Time (%)			0		4				0	0		22
Queuing Penalty (veh)			2		3				0	0		3

Intersection: 25: MN 41/Chestnut Blvd & US 169

Movement	SB	SB
Directions Served	T	R
Maximum Queue (ft)	551	278
Average Queue (ft)	323	20
95th Queue (ft)	513	140
Link Distance (ft)	1877	
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		575
Storage Blk Time (%)	0	
Queuing Penalty (veh)	2	

Intersection: 30: Chestnut Blvd & Emery Way

Movement	SB
Directions Served	LR
Maximum Queue (ft)	33
Average Queue (ft)	14
95th Queue (ft)	39
Link Distance (ft)	720
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 40: CR 69 & Chestnut Blvd/CR 78

Movement	EB	EB	WB	NB	SB
Directions Served	L	TR	L	LTR	LTR
Maximum Queue (ft)	21	6	32	60	81
Average Queue (ft)	2	0	4	30	38
95th Queue (ft)	11	3	21	49	67
Link Distance (ft)		3693		810	4022
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)	300		300		
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 50: CR 73 & CR 78

Movement	WB
Directions Served	LT
Maximum Queue (ft)	12
Average Queue (ft)	1
95th Queue (ft)	6
Link Distance (ft)	2562
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 60: CSAH 15/CR 15 & CR 78

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (ft)	129	76	62	73
Average Queue (ft)	58	41	32	38
95th Queue (ft)	103	65	51	60
Link Distance (ft)	2562	2623	970	1262
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 70: CR 78 & CR 77

Movement	EB	SB
Directions Served	LT	LR
Maximum Queue (ft)	28	54
Average Queue (ft)	1	27
95th Queue (ft)	11	45
Link Distance (ft)	2623	971
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 80: CR 79 & CR 78

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (ft)	102	87	57	75
Average Queue (ft)	49	45	29	42
95th Queue (ft)	83	71	47	65
Link Distance (ft)	2623	2332	631	1187
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 100: CR 69 & 10th Ave

Movement	WB	WB	SB
Directions Served	L	R	L
Maximum Queue (ft)	71	47	33
Average Queue (ft)	30	15	6
95th Queue (ft)	56	36	25
Link Distance (ft)		2044	
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)	125		430
Storage Blk Time (%)	0		
Queuing Penalty (veh)	0		

Intersection: 101: CR 69 & Chaparral Ave

Movement	EB	NB
Directions Served	LR	L
Maximum Queue (ft)	53	26
Average Queue (ft)	21	2
95th Queue (ft)	42	15
Link Distance (ft)	1078	
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		225
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 105: CR 69 & Vierling Dr

Movement	EB	EB	WB	WB	WB	NB	NB	SB	SB
Directions Served	L	TR	L	T	R	L	R	L	R
Maximum Queue (ft)	40	50	65	48	30	23	4	18	7
Average Queue (ft)	13	17	28	13	12	5	0	3	0
95th Queue (ft)	35	36	54	37	30	19	4	14	6
Link Distance (ft)		1182		1063					
Upstream Blk Time (%)									
Queuing Penalty (veh)									
Storage Bay Dist (ft)	150		265		175	380	380	270	260
Storage Blk Time (%)									
Queuing Penalty (veh)									

Intersection: 110: CR 69 & US 169 N Ramp

Movement	WB	WB	NB	SB
Directions Served	LT	R	L	R
Maximum Queue (ft)	56	63	27	3
Average Queue (ft)	27	34	5	0
95th Queue (ft)	50	57	21	2
Link Distance (ft)	1153			
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)		300	340	300
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 120: CR 69 & US 169 S Ramp

Movement	EB	WB	WB	NB	SB	SB
Directions Served	LTR	LT	R	R	L	R
Maximum Queue (ft)	30	26	64	6	33	1
Average Queue (ft)	9	8	26	0	5	0
95th Queue (ft)	28	26	48	5	21	1
Link Distance (ft)	1005	1008				
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)			300	285	340	105
Storage Blk Time (%)						
Queuing Penalty (veh)						

Intersection: 130: CR 69

Movement	EB
Directions Served	LTR
Maximum Queue (ft)	28
Average Queue (ft)	4
95th Queue (ft)	20
Link Distance (ft)	964
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 200: CR 15 & US 169 N Ramp

Movement	WB	WB	NB	SB
Directions Served	LT	R	R	L
Maximum Queue (ft)	149	157	6	59
Average Queue (ft)	59	64	0	21
95th Queue (ft)	120	115	4	47
Link Distance (ft)	1485			
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)		210	320	200
Storage Blk Time (%)	0			
Queuing Penalty (veh)	1			

Intersection: 210: CR 15 & US 169 S Ramp

Movement	EB	EB	WB	WB	NB	NB	SB
Directions Served	LT	R	LT	R	L	R	L
Maximum Queue (ft)	30	20	59	56	19	13	81
Average Queue (ft)	9	3	18	24	2	0	33
95th Queue (ft)	29	16	43	39	12	5	65
Link Distance (ft)	1041		1220				
Upstream Blk Time (%)							
Queuing Penalty (veh)							
Storage Bay Dist (ft)		115		250	165	270	370
Storage Blk Time (%)							
Queuing Penalty (veh)							

Intersection: 220: CR 15 & CR 16

Movement	EB	EB	EB	EB	WB	WB	WB	WB	NB	SB
Directions Served	L	T	T	R	L	T	T	R	L	L
Maximum Queue (ft)	27	22	4	21	49	29	11	60	4	47
Average Queue (ft)	8	3	0	4	18	5	0	33	0	14
95th Queue (ft)	26	15	3	15	42	21	6	52	3	39
Link Distance (ft)		1783	1783			2699	2699			
Upstream Blk Time (%)										
Queuing Penalty (veh)										
Storage Bay Dist (ft)	265			265	415			285	215	430
Storage Blk Time (%)										
Queuing Penalty (veh)										

Intersection: 230: CR 15 & 128th St W

Movement	EB	EB	WB	SB
Directions Served	L	TR	LTR	LT
Maximum Queue (ft)	26	24	34	22
Average Queue (ft)	10	4	11	1
95th Queue (ft)	30	17	35	11
Link Distance (ft)		689	769	1900
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)	100			
Storage Blk Time (%)				
Queuing Penalty (veh)				

Network Summary

Network wide Queuing Penalty: 16

10: Rail Frontage & MN 41 Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	1.0	0.1	0.2	0.2	0.5
Total Del/Veh (s)	17.4	11.0	272.2	164.2	20.4

20: Dem Con Dr/Frontage Rd & MN 41 Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	0.5	2.3	2.2	0.4
Total Del/Veh (s)	12.0	119.6	20.8	23.1	66.7

30: Chestnut Blvd & Emery Way Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	0.0	0.6	0.1	0.1
Total Del/Veh (s)	4.9	1.0	16.1	10.3	6.0

40: CR 69 & Chestnut Blvd/CR 78 Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	0.0	0.2	0.0	0.0
Total Del/Veh (s)	3.1	3.7	18.6	14.1	7.2

50: CR 73 & CR 78 Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	0.0	0.1	0.2	0.0
Total Del/Veh (s)	2.6	5.3	4.8	9.1	5.0

60: CSAH 15/CR 15 & CR 78 Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	0.0	0.2	0.0	0.0
Total Del/Veh (s)	18.0	16.0	13.9	12.8	15.3

70: CR 78 & CR 77 Performance by approach

Approach	EB	WB	SB	All
Denied Del/Veh (s)	0.0	0.0	0.1	0.0
Total Del/Veh (s)	5.8	7.3	5.3	6.5

80: CR 79 & CR 78 Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	0.9	0.2	0.2	0.5
Total Del/Veh (s)	16.0	117.3	9.2	9.4	64.4

100: CR 69 & 10th Ave Performance by approach

Approach	WB	NB	SB	All
Denied Del/Veh (s)	0.6	0.0	1.0	0.3
Total Del/Veh (s)	12.0	0.3	1.7	2.2

101: CR 69 & Chaparral Ave Performance by approach

Approach	EB	NB	SB	All
Denied Del/Veh (s)	0.1	0.0	0.0	0.0
Total Del/Veh (s)	5.5	1.1	0.4	1.1

105: CR 69 & Vierling Dr Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	1.1	2.7	0.0	0.0	0.4
Total Del/Veh (s)	12.0	11.6	1.4	1.2	3.6

110: CR 69 & US 169 N Ramp Performance by approach

Approach	WB	NB	SB	All
Denied Del/Veh (s)	0.8	0.0	0.0	0.2
Total Del/Veh (s)	10.2	1.2	0.8	3.2

120: CR 69 & US 169 S Ramp Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.1	1.2	0.0	0.0	0.4
Total Del/Veh (s)	9.1	7.1	0.7	1.9	3.5

130: CR 69 & Subdistrict B North Access/Subdistrict A North Access Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	3.2	0.7	0.0	0.0	0.2
Total Del/Veh (s)	8.9	5.9	2.3	1.6	2.7

140: CR 69 & Subdistrict B South Access/Subdistrict A South Access Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.8	1.0	0.0	0.0	0.2
Total Del/Veh (s)	6.6	6.5	3.0	2.4	3.8

200: CR 15 & US 169 N Ramp Performance by approach

Approach	WB	NB	SB	All
Denied Del/Veh (s)	1.1	0.0	0.5	0.5
Total Del/Veh (s)	50.6	1.3	2.1	18.5

210: CR 15 & US 169 S Ramp Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	2.1	0.9	0.0	0.0	0.3
Total Del/Veh (s)	591.2	519.0	2.5	4.6	121.5

220: CR 15 & CR 16 Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.1	1.0	0.1	0.0	0.2
Total Del/Veh (s)	429.5	29.9	3.4	3.9	85.8

230: CR 15 & 128th St W Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	1.2	0.5	0.0	0.0	0.2
Total Del/Veh (s)	8.8	6.8	4.2	2.0	4.3

Total Zone Performance

Denied Del/Veh (s)	1.0
Total Del/Veh (s)	1322.3

Intersection: 10: Rail Frontage & MN 41

Movement	EB	WB	B7	B7	NB	SB
Directions Served	LTR	LTR	T		LTR	LTR
Maximum Queue (ft)	868	541	296	96	234	256
Average Queue (ft)	147	106	34	3	82	83
95th Queue (ft)	850	425	228	70	245	245
Link Distance (ft)	3202	585	474	474	856	971
Upstream Blk Time (%)	0	4	2	0		
Queuing Penalty (veh)	0	42	10	1		
Storage Bay Dist (ft)						
Storage Blk Time (%)						
Queuing Penalty (veh)						

Intersection: 20: Dem Con Dr/Frontage Rd & MN 41

Movement	EB	EB	EB	EB	WB	WB	WB	WB	NB	NB	SB	SB
Directions Served	L	T	T	R	L	T	T	R	LT	R	L	T
Maximum Queue (ft)	85	363	229	20	615	1235	1191	430	87	59	73	31
Average Queue (ft)	27	139	58	2	267	827	747	54	29	23	32	6
95th Queue (ft)	66	286	157	13	749	1507	1485	276	66	51	66	22
Link Distance (ft)		474	474			1192	1192		563			440
Upstream Blk Time (%)			0			29	15					
Queuing Penalty (veh)			0			174	87					
Storage Bay Dist (ft)	285			275	440			230		60	125	
Storage Blk Time (%)		1	0			58	7		2	1		
Queuing Penalty (veh)		0	0			26	3		1	0		

Intersection: 20: Dem Con Dr/Frontage Rd & MN 41

Movement	SB
Directions Served	R
Maximum Queue (ft)	48
Average Queue (ft)	13
95th Queue (ft)	34
Link Distance (ft)	440
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 30: Chestnut Blvd & Emery Way

Movement	EB	EB	WB	NB	NB	SB
Directions Served	L	R	L	LT	R	LTR
Maximum Queue (ft)	24	4	27	160	25	65
Average Queue (ft)	3	0	6	65	11	25
95th Queue (ft)	17	3	22	127	27	51
Link Distance (ft)				1183		1778
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)	300	300	490		250	
Storage Blk Time (%)				0		
Queuing Penalty (veh)				0		

Intersection: 40: CR 69 & Chestnut Blvd/CR 78

Movement	EB	EB	WB	WB	NB	SB
Directions Served	L	TR	L	TR	LTR	LTR
Maximum Queue (ft)	65	4	25	29	145	134
Average Queue (ft)	28	0	5	3	57	58
95th Queue (ft)	55	3	21	18	109	104
Link Distance (ft)		2634		2585	2610	1600
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)	300		300			
Storage Blk Time (%)						
Queuing Penalty (veh)						

Intersection: 50: CR 73 & CR 78

Movement	EB	NB	SB
Directions Served	LTR	LTR	LTR
Maximum Queue (ft)	41	41	105
Average Queue (ft)	6	15	52
95th Queue (ft)	27	38	87
Link Distance (ft)	2585	2596	1489
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 60: CSAH 15/CR 15 & CR 78

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (ft)	200	167	129	166
Average Queue (ft)	86	77	62	74
95th Queue (ft)	153	131	104	133
Link Distance (ft)	2556	2622	2760	1263
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 70: CR 78 & CR 77

Movement	EB	WB	SB
Directions Served	LT	TR	LR
Maximum Queue (ft)	65	2	55
Average Queue (ft)	19	0	23
95th Queue (ft)	50	2	45
Link Distance (ft)	2622	2623	1536
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 80: CR 79 & CR 78

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (ft)	150	1318	96	91
Average Queue (ft)	67	697	49	46
95th Queue (ft)	116	1746	78	73
Link Distance (ft)	2623	2332	2421	2744
Upstream Blk Time (%)		1		
Queuing Penalty (veh)		0		
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 100: CR 69 & 10th Ave

Movement	WB	WB	NB	SB
Directions Served	L	R	R	L
Maximum Queue (ft)	84	51	9	53
Average Queue (ft)	34	20	1	19
95th Queue (ft)	68	40	6	44
Link Distance (ft)		2044	213	
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)	125			430
Storage Blk Time (%)	0			
Queuing Penalty (veh)	0			

Intersection: 101: CR 69 & Chaparral Ave

Movement	EB	NB
Directions Served	LR	L
Maximum Queue (ft)	52	29
Average Queue (ft)	20	5
95th Queue (ft)	41	21
Link Distance (ft)	1078	
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		225
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 105: CR 69 & Vierling Dr

Movement	EB	EB	WB	WB	WB	NB	NB	NB	SB	SB
Directions Served	L	TR	L	T	R	L	T	R	L	R
Maximum Queue (ft)	64	73	66	43	53	36	2	19	32	5
Average Queue (ft)	20	26	24	15	24	9	0	1	8	0
95th Queue (ft)	48	53	55	38	44	27	2	10	25	3
Link Distance (ft)		1182		1063			1442			
Upstream Blk Time (%)										
Queuing Penalty (veh)										
Storage Bay Dist (ft)	150		265		175	380		380	270	260
Storage Blk Time (%)										
Queuing Penalty (veh)										

Intersection: 110: CR 69 & US 169 N Ramp

Movement	WB	WB	NB	NB	SB
Directions Served	LT	R	L	T	R
Maximum Queue (ft)	119	89	47	2	11
Average Queue (ft)	53	44	15	0	0
95th Queue (ft)	92	72	39	2	7
Link Distance (ft)	1985			900	
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)		300	340		300
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 120: CR 69 & US 169 S Ramp

Movement	EB	WB	WB	NB	NB	NB	SB
Directions Served	LTR	LT	R	L	T	R	L
Maximum Queue (ft)	42	70	110	19	2	22	64
Average Queue (ft)	13	28	52	1	0	2	18
95th Queue (ft)	34	55	86	11	2	12	46
Link Distance (ft)	1005	1905			1017		
Upstream Blk Time (%)							
Queuing Penalty (veh)							
Storage Bay Dist (ft)			300	210		285	340
Storage Blk Time (%)							
Queuing Penalty (veh)							

Intersection: 130: CR 69 & Subdistrict B North Access/Subdistrict A North Access

Movement	EB	WB	WB	NB	SB
Directions Served	L	L	TR	LTR	LTR
Maximum Queue (ft)	38	40	70	25	60
Average Queue (ft)	9	16	33	2	17
95th Queue (ft)	33	41	58	15	47
Link Distance (ft)			1279	2362	305
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)	150	150			
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 140: CR 69 & Subdistrict B South Access/Subdistrict A South Access

Movement	EB	EB	WB	WB	NB	SB
Directions Served	L	TR	L	TR	LTR	LTR
Maximum Queue (ft)	51	40	60	69	25	53
Average Queue (ft)	16	17	30	34	1	12
95th Queue (ft)	43	43	55	58	12	40
Link Distance (ft)		1693		1651	1600	2362
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)	150		150			
Storage Blk Time (%)						
Queuing Penalty (veh)						

Intersection: 200: CR 15 & US 169 N Ramp

Movement	WB	WB	NB	SB
Directions Served	LT	R	R	L
Maximum Queue (ft)	548	280	10	56
Average Queue (ft)	219	98	0	17
95th Queue (ft)	540	264	6	43
Link Distance (ft)	2423			
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)		210	320	200
Storage Blk Time (%)	21			
Queuing Penalty (veh)	48			

Intersection: 210: CR 15 & US 169 S Ramp

Movement	EB	EB	WB	WB	NB	NB	NB	SB	SB
Directions Served	LT	R	LT	R	L	T	R	L	R
Maximum Queue (ft)	1153	175	1459	350	34	2	55	190	10
Average Queue (ft)	601	51	789	179	11	0	12	68	0
95th Queue (ft)	1291	178	1662	457	31	2	34	141	5
Link Distance (ft)	1640		2627			1171			
Upstream Blk Time (%)	3								
Queuing Penalty (veh)	0								
Storage Bay Dist (ft)		115		250	165		270	370	175
Storage Blk Time (%)	87		72					0	
Queuing Penalty (veh)	22		65					0	

Intersection: 220: CR 15 & CR 16

Movement	EB	EB	EB	EB	WB	WB	WB	WB	NB	NB	NB	SB
Directions Served	L	T	T	R	L	T	T	R	L	T	R	L
Maximum Queue (ft)	445	1534	1314	64	128	66	56	150	62	3	8	107
Average Queue (ft)	389	777	222	23	45	26	16	67	19	0	0	48
95th Queue (ft)	558	1752	1070	46	108	55	43	117	48	2	4	85
Link Distance (ft)		3122	3122			2699	2699			1900		
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	265			265	415			285	215		215	430
Storage Blk Time (%)	82											
Queuing Penalty (veh)	24											

Intersection: 220: CR 15 & CR 16

Movement	SB	SB
Directions Served	T	R
Maximum Queue (ft)	2	8
Average Queue (ft)	0	0
95th Queue (ft)	2	4
Link Distance (ft)	1171	1171
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 230: CR 15 & 128th St W

Movement	EB	EB	WB	WB	NB	SB
Directions Served	L	TR	L	TR	LTR	LT
Maximum Queue (ft)	86	65	35	42	44	54
Average Queue (ft)	34	25	8	15	6	5
95th Queue (ft)	65	48	31	41	27	27
Link Distance (ft)		1661		1957	1263	1900
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)	100		100			
Storage Blk Time (%)	0	0				
Queuing Penalty (veh)	0	0				

Zone Summary

Zone wide Queuing Penalty: 505

10: Rail Frontage & MN 41 Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	3.2	0.9	0.1	148.4	5.1
Total Del/Veh (s)	34.0	26.2	807.2	1067.3	64.3

20: Dem Con Dr/Frontage Rd & MN 41 Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	0.6	2.1	2.2	0.4
Total Del/Veh (s)	13.9	134.1	33.0	25.2	66.9

30: Chestnut Blvd & Emery Way Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	0.0	0.7	0.1	0.1
Total Del/Veh (s)	3.8	0.9	13.2	7.0	4.1

40: CR 69 & Chestnut Blvd/CR 78 Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	0.0	0.2	0.0	0.0
Total Del/Veh (s)	3.7	3.2	13.5	33.1	12.8

50: CR 73 & CR 78 Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	0.0	0.1	0.1	0.0
Total Del/Veh (s)	4.0	5.1	5.8	8.9	4.9

60: CSAH 15/CR 15 & CR 78 Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	0.0	0.2	0.0	0.0
Total Del/Veh (s)	27.1	16.8	12.6	23.8	21.6

70: CR 78 & CR 77 Performance by approach

Approach	EB	WB	SB	All
Denied Del/Veh (s)	0.0	0.0	0.2	0.0
Total Del/Veh (s)	5.6	6.7	8.3	6.5

80: CR 79 & CR 78 Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	0.5	0.2	0.3	0.3
Total Del/Veh (s)	28.5	134.3	10.1	22.3	66.9

100: CR 69 & 10th Ave Performance by approach

Approach	WB	NB	SB	All
Denied Del/Veh (s)	0.7	0.0	0.6	0.4
Total Del/Veh (s)	20.9	0.3	1.4	4.4

101: CR 69 & Chaparral Ave Performance by approach

Approach	EB	NB	SB	All
Denied Del/Veh (s)	0.1	0.0	0.0	0.0
Total Del/Veh (s)	7.2	1.1	0.5	1.3

105: CR 69 & Vierling Dr Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	1.5	2.7	0.0	0.0	0.4
Total Del/Veh (s)	22.5	23.4	1.3	1.4	6.1

110: CR 69 & US 169 N Ramp Performance by approach

Approach	WB	NB	SB	All
Denied Del/Veh (s)	0.6	0.0	0.0	0.2
Total Del/Veh (s)	13.5	1.6	1.6	4.5

120: CR 69 & US 169 S Ramp Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.1	0.9	0.0	0.0	0.3
Total Del/Veh (s)	15.4	17.7	0.7	2.2	6.5

130: CR 69 & Subdistrict B North Access/Subdistrict A North Access Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	1.5	1.1	0.0	0.0	0.2
Total Del/Veh (s)	8.0	6.9	2.0	1.6	2.7

140: CR 69 & Subdistrict B South Access/Subdistrict A South Access Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	1.0	1.0	0.0	0.0	0.2
Total Del/Veh (s)	8.5	6.7	2.4	3.4	3.9

200: CR 15 & US 169 N Ramp Performance by approach

Approach	WB	NB	SB	All
Denied Del/Veh (s)	593.9	0.1	0.6	267.0
Total Del/Veh (s)	543.7	1.3	2.7	205.4

210: CR 15 & US 169 S Ramp Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	85.0	264.0	0.0	0.0	51.2
Total Del/Veh (s)	1023.9	1315.8	2.3	5.4	271.7

220: CR 15 & CR 16 Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.1	1.0	0.0	0.0	0.2
Total Del/Veh (s)	164.4	35.0	3.4	2.4	40.4

230: CR 15 & 128th St W Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.5	0.8	0.0	0.0	0.1
Total Del/Veh (s)	7.3	9.7	3.8	2.7	3.9

Total Zone Performance

Denied Del/Veh (s)	75.1
Total Del/Veh (s)	1849.9

Intersection: 10: Rail Frontage & MN 41

Movement	EB	WB	B7	B7	NB	SB
Directions Served	LTR	LTR	T		LTR	LTR
Maximum Queue (ft)	1527	659	470	248	480	818
Average Queue (ft)	270	245	105	28	220	446
95th Queue (ft)	1306	689	425	212	558	1001
Link Distance (ft)	2857	585	474	474	856	971
Upstream Blk Time (%)	1	14	10	3		18
Queuing Penalty (veh)	0	161	55	18		0
Storage Bay Dist (ft)						
Storage Blk Time (%)						
Queuing Penalty (veh)						

Intersection: 20: Dem Con Dr/Frontage Rd & MN 41

Movement	EB	EB	EB	EB	WB	WB	WB	WB	NB	NB	SB	SB
Directions Served	L	T	T	R	L	T	T	R	LT	R	L	T
Maximum Queue (ft)	54	341	327	17	560	1158	1130	347	127	79	107	74
Average Queue (ft)	14	151	119	3	166	746	666	35	32	18	43	8
95th Queue (ft)	41	293	249	14	590	1466	1472	221	99	50	87	50
Link Distance (ft)		474	474			1192	1192		563			440
Upstream Blk Time (%)		0	0			32	25					
Queuing Penalty (veh)		0	0			179	138					
Storage Bay Dist (ft)	285			275	440			230		60	125	
Storage Blk Time (%)		1	1			51	5		7	0	1	
Queuing Penalty (veh)		0	0			20	2		3	0	0	

Intersection: 20: Dem Con Dr/Frontage Rd & MN 41

Movement	SB
Directions Served	R
Maximum Queue (ft)	79
Average Queue (ft)	22
95th Queue (ft)	58
Link Distance (ft)	440
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 30: Chestnut Blvd & Emery Way

Movement	EB	EB	WB	WB	NB	NB	SB
Directions Served	L	R	L	R	LT	R	LTR
Maximum Queue (ft)	31	20	31	1	102	29	59
Average Queue (ft)	5	1	8	0	42	10	21
95th Queue (ft)	22	10	25	1	77	26	44
Link Distance (ft)					1183		1778
Upstream Blk Time (%)							
Queuing Penalty (veh)							
Storage Bay Dist (ft)	300	300	490	490		250	
Storage Blk Time (%)							
Queuing Penalty (veh)							

Intersection: 40: CR 69 & Chestnut Blvd/CR 78

Movement	EB	EB	WB	WB	NB	SB
Directions Served	L	TR	L	TR	LTR	LTR
Maximum Queue (ft)	62	19	34	15	85	321
Average Queue (ft)	23	1	7	1	39	140
95th Queue (ft)	51	8	26	7	70	292
Link Distance (ft)		2634		2585	2610	1600
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)	300		300			
Storage Blk Time (%)						
Queuing Penalty (veh)						

Intersection: 50: CR 73 & CR 78

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (ft)	66	44	36	73
Average Queue (ft)	17	5	15	35
95th Queue (ft)	52	25	38	64
Link Distance (ft)	2585	2555	2596	1626
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 60: CSAH 15/CR 15 & CR 78

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (ft)	308	198	99	272
Average Queue (ft)	125	86	50	128
95th Queue (ft)	271	157	83	242
Link Distance (ft)	2555	2622	2760	1262
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 70: CR 78 & CR 77

Movement	EB	WB	SB
Directions Served	LT	TR	LR
Maximum Queue (ft)	45	2	84
Average Queue (ft)	9	0	41
95th Queue (ft)	32	2	70
Link Distance (ft)	2622	2623	1602
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 80: CR 79 & CR 78

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (ft)	278	1216	93	230
Average Queue (ft)	119	641	45	101
95th Queue (ft)	227	1346	75	205
Link Distance (ft)	2623	2332	2421	2744
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 100: CR 69 & 10th Ave

Movement	WB	WB	NB	SB
Directions Served	L	R	R	L
Maximum Queue (ft)	144	127	13	54
Average Queue (ft)	63	23	0	18
95th Queue (ft)	119	86	6	44
Link Distance (ft)		2044	213	
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)	125			430
Storage Blk Time (%)	2			
Queuing Penalty (veh)	1			

Intersection: 101: CR 69 & Chaparral Ave

Movement	EB	NB
Directions Served	LR	L
Maximum Queue (ft)	70	32
Average Queue (ft)	28	8
95th Queue (ft)	53	28
Link Distance (ft)	1078	
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		225
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 105: CR 69 & Vierling Dr

Movement	EB	EB	WB	WB	WB	NB	NB	NB	SB	SB	SB
Directions Served	L	TR	L	T	R	L	T	R	L	T	R
Maximum Queue (ft)	101	102	107	59	46	40	2	10	35	1	12
Average Queue (ft)	35	35	42	17	15	9	0	0	8	0	1
95th Queue (ft)	74	76	83	45	36	28	2	5	26	1	7
Link Distance (ft)		1182		1063			1442			1219	
Upstream Blk Time (%)											
Queuing Penalty (veh)											
Storage Bay Dist (ft)	150		265		175	380		380	270		260
Storage Blk Time (%)	0	0									
Queuing Penalty (veh)	0	0									

Intersection: 110: CR 69 & US 169 N Ramp

Movement	WB	WB	NB	SB	SB
Directions Served	LT	R	L	T	R
Maximum Queue (ft)	188	82	53	1	19
Average Queue (ft)	75	40	20	0	2
95th Queue (ft)	143	67	45	1	10
Link Distance (ft)	1985			1442	
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)		300	340		300
Storage Blk Time (%)	0				
Queuing Penalty (veh)	0				

Intersection: 120: CR 69 & US 169 S Ramp

Movement	EB	WB	WB	NB	NB	SB
Directions Served	LTR	LT	R	L	R	L
Maximum Queue (ft)	55	174	116	23	29	69
Average Queue (ft)	20	67	39	2	3	26
95th Queue (ft)	45	146	101	13	16	55
Link Distance (ft)	1005	1907				
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)			300	210	285	340
Storage Blk Time (%)		0				
Queuing Penalty (veh)		1				

Intersection: 130: CR 69 & Subdistrict B North Access/Subdistrict A North Access

Movement	EB	EB	WB	WB	NB	SB
Directions Served	L	TR	L	TR	LTR	LTR
Maximum Queue (ft)	45	26	62	70	5	63
Average Queue (ft)	13	7	26	32	0	18
95th Queue (ft)	38	25	53	54	3	50
Link Distance (ft)		1494		1278	2365	307
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)	150		150			
Storage Blk Time (%)						
Queuing Penalty (veh)						

Intersection: 140: CR 69 & Subdistrict B South Access/Subdistrict A South Access

Movement	EB	EB	WB	WB	NB	SB
Directions Served	L	TR	L	TR	LTR	LTR
Maximum Queue (ft)	42	48	73	67	37	59
Average Queue (ft)	14	16	31	34	3	14
95th Queue (ft)	40	44	59	58	20	44
Link Distance (ft)		1693		1651	1600	2365
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)	150		150			
Storage Blk Time (%)						
Queuing Penalty (veh)						

Intersection: 200: CR 15 & US 169 N Ramp

Movement	WB	WB	NB	SB
Directions Served	LT	R	R	L
Maximum Queue (ft)	2475	280	16	60
Average Queue (ft)	2367	276	1	22
95th Queue (ft)	2770	327	7	50
Link Distance (ft)	2423			
Upstream Blk Time (%)	86			
Queuing Penalty (veh)	0			
Storage Bay Dist (ft)		210	320	200
Storage Blk Time (%)	99	0		
Queuing Penalty (veh)	405	0		

Intersection: 210: CR 15 & US 169 S Ramp

Movement	EB	EB	WB	WB	NB	NB	NB	SB	SB	SB
Directions Served	LT	R	LT	R	L	T	R	L	T	R
Maximum Queue (ft)	1667	175	2670	350	38	5	43	162	2	19
Average Queue (ft)	1075	68	2007	201	9	0	11	72	0	1
95th Queue (ft)	1972	208	3316	484	29	3	31	132	2	10
Link Distance (ft)	1640		2641			1171			988	
Upstream Blk Time (%)	25		48							
Queuing Penalty (veh)	0		0							
Storage Bay Dist (ft)		115		250	165		270	370		175
Storage Blk Time (%)	97	0	99							
Queuing Penalty (veh)	39	0	124							

Intersection: 220: CR 15 & CR 16

Movement	EB	EB	EB	EB	WB	WB	WB	WB	NB	NB	NB	SB
Directions Served	L	T	T	R	L	T	T	R	L	T	R	L
Maximum Queue (ft)	419	569	53	65	217	54	56	123	69	4	6	64
Average Queue (ft)	274	204	18	27	80	24	17	54	25	0	0	25
95th Queue (ft)	517	713	45	53	179	49	46	94	55	3	3	51
Link Distance (ft)		3122	3122			2699	2699			1900		
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	265			265	415			285	215		215	430
Storage Blk Time (%)	50											
Queuing Penalty (veh)	15											

Intersection: 220: CR 15 & CR 16

Movement	SB	SB
Directions Served	T	R
Maximum Queue (ft)	1	10
Average Queue (ft)	0	1
95th Queue (ft)	1	7
Link Distance (ft)	1171	1171
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 230: CR 15 & 128th St W

Movement	EB	EB	WB	WB	NB	SB	SB
Directions Served	L	TR	L	TR	LTR	LT	R
Maximum Queue (ft)	58	67	34	48	71	58	4
Average Queue (ft)	18	31	9	13	14	10	0
95th Queue (ft)	45	55	31	39	48	38	3
Link Distance (ft)		1770		1683	1262	1900	
Upstream Blk Time (%)							
Queuing Penalty (veh)							
Storage Bay Dist (ft)	100		100			300	
Storage Blk Time (%)	0						
Queuing Penalty (veh)	0						

Zone Summary

Zone wide Queuing Penalty: 1163

40: CR 69 & Chestnut Blvd/CR 78 Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	0.0	0.2	0.0	0.0
Total Del/Veh (s)	3.2	3.9	19.2	16.0	7.6

50: CR 73 & CR 78 Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	0.0	0.1	0.2	0.0
Total Del/Veh (s)	2.6	5.3	6.1	9.6	5.2

60: CSAH 15/CR 15 & CR 78 Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	0.0	0.2	0.0	0.0
Total Del/Veh (s)	19.9	19.5	14.7	14.5	17.4

70: CR 78 & CR 77 Performance by approach

Approach	EB	WB	SB	All
Denied Del/Veh (s)	0.0	0.0	0.1	0.0
Total Del/Veh (s)	5.9	7.5	6.0	6.8

80: CR 79 & CR 78 Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	0.6	0.2	0.2	0.4
Total Del/Veh (s)	16.4	113.8	9.6	9.5	63.0

230: CR 15 & 128th St W Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	1.1	0.5	0.0	0.0	0.2
Total Del/Veh (s)	8.0	7.5	4.1	2.8	4.4

Total Zone Performance

Denied Del/Veh (s)	0.4
Total Del/Veh (s)	1341.5

Intersection: 40: CR 69 & Chestnut Blvd/CR 78

Movement	EB	EB	WB	WB	NB	SB
Directions Served	L	TR	L	TR	LTR	LTR
Maximum Queue (ft)	71	4	36	34	148	150
Average Queue (ft)	30	0	6	4	61	58
95th Queue (ft)	57	3	24	20	111	117
Link Distance (ft)		2634		2585	2610	1600
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)	300		300			
Storage Blk Time (%)						
Queuing Penalty (veh)						

Intersection: 50: CR 73 & CR 78

Movement	EB	NB	SB
Directions Served	LTR	LTR	LTR
Maximum Queue (ft)	63	38	127
Average Queue (ft)	8	13	53
95th Queue (ft)	36	36	93
Link Distance (ft)	2585	2596	1489
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 60: CSAH 15/CR 15 & CR 78

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (ft)	221	212	146	191
Average Queue (ft)	87	90	63	79
95th Queue (ft)	169	177	113	152
Link Distance (ft)	2556	2622	2760	1263
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 70: CR 78 & CR 77

Movement	EB	WB	SB
Directions Served	LT	TR	LR
Maximum Queue (ft)	69	2	60
Average Queue (ft)	21	0	24
95th Queue (ft)	54	2	46
Link Distance (ft)	2622	2623	1536
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 80: CR 79 & CR 78

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (ft)	152	1215	106	103
Average Queue (ft)	69	677	52	48
95th Queue (ft)	117	1317	87	81
Link Distance (ft)	2623	2332	2421	2744
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 230: CR 15 & 128th St W

Movement	EB	EB	WB	WB	NB	SB
Directions Served	L	TR	L	TR	LTR	LT
Maximum Queue (ft)	67	62	31	38	64	40
Average Queue (ft)	32	25	9	15	6	4
95th Queue (ft)	58	45	31	40	33	21
Link Distance (ft)		1661		1957	1263	1900
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)	100		100			
Storage Blk Time (%)		0				
Queuing Penalty (veh)		0				

Zone Summary

Zone wide Queuing Penalty: 0

40: CR 69 & Chestnut Blvd/CR 78 Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	0.0	0.2	0.0	0.0
Total Del/Veh (s)	3.8	3.3	15.2	42.2	15.1

50: CR 73 & CR 78 Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	0.0	0.1	0.1	0.0
Total Del/Veh (s)	4.0	4.8	6.1	8.6	4.8

60: CSAH 15/CR 15 & CR 78 Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	0.0	0.2	0.0	0.0
Total Del/Veh (s)	33.0	16.6	13.1	129.0	62.6

70: CR 78 & CR 77 Performance by approach

Approach	EB	WB	SB	All
Denied Del/Veh (s)	0.0	0.0	0.2	0.0
Total Del/Veh (s)	5.5	6.6	8.4	6.3

80: CR 79 & CR 78 Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	1.4	0.2	0.3	0.6
Total Del/Veh (s)	46.2	165.7	10.2	19.4	82.9

230: CR 15 & 128th St W Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.6	0.9	0.0	0.0	0.1
Total Del/Veh (s)	17.1	17.1	4.6	6.6	7.2

Total Zone Performance

Denied Del/Veh (s)	0.7
Total Del/Veh (s)	1447.0

Intersection: 40: CR 69 & Chestnut Blvd/CR 78

Movement	EB	EB	WB	WB	NB	SB
Directions Served	L	TR	L	TR	LTR	LTR
Maximum Queue (ft)	70	10	30	25	101	382
Average Queue (ft)	25	0	6	1	42	161
95th Queue (ft)	54	4	24	11	76	350
Link Distance (ft)		2634		2585	2610	1600
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)	300		300			
Storage Blk Time (%)						
Queuing Penalty (veh)						

Intersection: 50: CR 73 & CR 78

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (ft)	85	39	45	78
Average Queue (ft)	20	5	16	36
95th Queue (ft)	58	23	40	62
Link Distance (ft)	2585	2555	2596	1626
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 60: CSAH 15/CR 15 & CR 78

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (ft)	327	175	101	1053
Average Queue (ft)	146	82	49	597
95th Queue (ft)	305	137	82	1190
Link Distance (ft)	2555	2622	2760	1262
Upstream Blk Time (%)				1
Queuing Penalty (veh)				5
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 70: CR 78 & CR 77

Movement	EB	SB
Directions Served	LT	LR
Maximum Queue (ft)	48	89
Average Queue (ft)	11	39
95th Queue (ft)	35	70
Link Distance (ft)	2622	1602
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 80: CR 79 & CR 78

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (ft)	427	1397	89	188
Average Queue (ft)	192	774	45	93
95th Queue (ft)	452	1747	75	163
Link Distance (ft)	2623	2332	2421	2744
Upstream Blk Time (%)		3		
Queuing Penalty (veh)		0		
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 230: CR 15 & 128th St W

Movement	EB	EB	WB	WB	NB	SB	SB
Directions Served	L	TR	L	TR	LTR	LT	R
Maximum Queue (ft)	82	128	39	40	138	145	10
Average Queue (ft)	22	40	10	12	25	23	0
95th Queue (ft)	58	106	35	37	81	96	5
Link Distance (ft)		1770		1683	1262	1900	
Upstream Blk Time (%)							
Queuing Penalty (veh)							
Storage Bay Dist (ft)	100		100				300
Storage Blk Time (%)	0	2				0	
Queuing Penalty (veh)	0	1				0	

Zone Summary

Zone wide Queuing Penalty: 6

10: Rail Frontage & MN 41 Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.3	0.0	2.5	2.8	0.2
Total Del/Veh (s)	2.7	4.9	25.9	37.0	4.7

20: Dem Con Dr/Frontage Rd & MN 41 Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	0.0	2.5	2.0	0.2
Total Del/Veh (s)	12.1	18.4	16.6	22.1	15.9

30: Chestnut Blvd & Emery Way Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	0.0	0.6	0.1	0.1
Total Del/Veh (s)	5.0	1.0	16.4	10.5	6.0

40: CR 69 & Chestnut Blvd/CR 78 Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	0.0	0.8	0.0	0.1
Total Del/Veh (s)	3.4	3.9	16.4	12.0	6.7

50: CR 73 & CR 78 Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	0.0	0.1	0.2	0.0
Total Del/Veh (s)	2.7	5.1	5.2	9.7	5.1

60: CSAH 15/CR 15 & CR 78 Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	0.0	0.4	0.0	0.1
Total Del/Veh (s)	13.4	21.4	14.1	9.4	14.7

70: CR 78 & CR 77 Performance by approach

Approach	EB	WB	SB	All
Denied Del/Veh (s)	0.0	0.0	0.1	0.0
Total Del/Veh (s)	5.9	7.4	5.8	6.7

80: CR 79 & CR 78 Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	0.9	0.6	1.3	0.7
Total Del/Veh (s)	16.6	42.1	9.7	8.6	27.1

100: CR 69 & 10th Ave Performance by approach

Approach	WB	NB	SB	All
Denied Del/Veh (s)	0.6	0.0	0.9	0.3
Total Del/Veh (s)	11.9	0.3	1.6	2.2

101: CR 69 & Chaparral Ave Performance by approach

Approach	EB	NB	SB	All
Denied Del/Veh (s)	0.1	0.0	0.0	0.0
Total Del/Veh (s)	4.3	1.0	0.4	1.1

105: CR 69 & Vierling Dr Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	1.2	2.6	0.0	0.0	0.4
Total Del/Veh (s)	12.6	12.4	1.4	1.3	3.8

110: CR 69 & US 169 N Ramp Performance by approach

Approach	WB	NB	SB	All
Denied Del/Veh (s)	0.8	0.0	0.0	0.2
Total Del/Veh (s)	10.3	1.2	0.8	3.2

120: CR 69 & US 169 S Ramp Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.1	1.2	0.0	0.0	0.4
Total Del/Veh (s)	8.5	7.4	0.8	2.0	3.6

130: CR 69 & Subdistrict B North Access/Subdistrict A North Access Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	3.2	0.7	0.0	0.0	0.2
Total Del/Veh (s)	9.7	6.5	2.5	1.6	2.9

140: CR 69 & Subdistrict B South Access/Subdistrict A South Access Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.8	1.0	0.0	0.0	0.2
Total Del/Veh (s)	6.3	7.0	3.1	2.6	4.0

200: CR 15 & US 169 N Ramp Performance by approach

Approach	WB	NB	SB	All
Denied Del/Veh (s)	1.4	0.0	0.5	0.6
Total Del/Veh (s)	17.4	5.1	9.7	10.8

210: CR 15 & US 169 S Ramp Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	1.3	1.0	0.0	0.0	0.2
Total Del/Veh (s)	23.9	19.4	8.7	11.8	12.5

220: CR 15 & CR 16 Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.1	1.3	0.1	0.0	0.3
Total Del/Veh (s)	22.2	12.3	14.7	14.2	15.5

230: CR 15 & 128th St W Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	1.1	0.5	0.0	0.0	0.2
Total Del/Veh (s)	9.0	7.5	4.1	2.7	4.6

Total Zone Performance

Denied Del/Veh (s)	0.9
Total Del/Veh (s)	689.1

Intersection: 10: Rail Frontage & MN 41

Movement	EB	EB	WB	NB	NB	SB	SB
Directions Served	L	T	L	LT	R	LT	R
Maximum Queue (ft)	41	5	37	52	28	77	97
Average Queue (ft)	5	0	7	11	10	17	26
95th Queue (ft)	26	4	25	36	29	56	71
Link Distance (ft)	3193		822		937		
Upstream Blk Time (%)							
Queuing Penalty (veh)							
Storage Bay Dist (ft)	200	200		100		100	
Storage Blk Time (%)				0	1		0
Queuing Penalty (veh)				0	0		0

Intersection: 20: Dem Con Dr/Frontage Rd & MN 41

Movement	EB	EB	EB	EB	WB	WB	WB	WB	NB	NB	SB	SB
Directions Served	L	T	T	R	L	T	T	R	LT	R	L	T
Maximum Queue (ft)	69	291	172	20	94	222	242	36	72	60	80	41
Average Queue (ft)	24	126	59	3	27	93	115	5	24	22	32	7
95th Queue (ft)	58	236	136	13	67	182	205	20	55	47	69	26
Link Distance (ft)	1103		1103			1192	1192	563		440		
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	285		275		440		230		60		125	
Storage Blk Time (%)	0						0		1		1	
Queuing Penalty (veh)	0						0		0		0	

Intersection: 20: Dem Con Dr/Frontage Rd & MN 41

Movement	SB
Directions Served	R
Maximum Queue (ft)	60
Average Queue (ft)	15
95th Queue (ft)	40
Link Distance (ft)	440
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 30: Chestnut Blvd & Emery Way

Movement	EB	EB	WB	NB	NB	SB
Directions Served	L	R	L	LT	R	LTR
Maximum Queue (ft)	27	15	33	156	26	66
Average Queue (ft)	3	1	6	65	9	25
95th Queue (ft)	15	8	23	123	26	51
Link Distance (ft)				1183		1778
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)	300	300	490		250	
Storage Blk Time (%)						
Queuing Penalty (veh)						

Intersection: 40: CR 69 & Chestnut Blvd/CR 78

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	TR	L	TR	L	TR	L	TR
Maximum Queue (ft)	72	5	35	33	57	116	82	84
Average Queue (ft)	31	0	5	4	23	49	34	39
95th Queue (ft)	61	2	24	19	48	90	65	67
Link Distance (ft)		2628		2579		2610		1599
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)	300		300		300		300	
Storage Blk Time (%)								
Queuing Penalty (veh)								

Intersection: 50: CR 73 & CR 78

Movement	EB	NB	SB
Directions Served	LTR	LTR	LTR
Maximum Queue (ft)	50	37	122
Average Queue (ft)	9	12	52
95th Queue (ft)	32	34	92
Link Distance (ft)	2579	2596	1489
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 60: CSAH 15/CR 15 & CR 78

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	TR	L	TR	L	TR	L	TR
Maximum Queue (ft)	108	107	33	219	54	136	80	104
Average Queue (ft)	48	50	8	96	18	59	42	50
95th Queue (ft)	89	85	29	196	44	101	70	86
Link Distance (ft)	2549		2617		2754		1257	
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)	300		300		300		300	
Storage Blk Time (%)					1			
Queuing Penalty (veh)					0			

Intersection: 70: CR 78 & CR 77

Movement	EB	WB	SB
Directions Served	LT	TR	LR
Maximum Queue (ft)	74	10	56
Average Queue (ft)	21	0	26
95th Queue (ft)	56	6	46
Link Distance (ft)	2617	2617	1530
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 80: CR 79 & CR 78

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	TR	L	TR	L	TR	L	TR
Maximum Queue (ft)	38	144	399	673	51	114	69	80
Average Queue (ft)	12	68	83	259	21	47	37	33
95th Queue (ft)	35	116	312	635	46	82	59	60
Link Distance (ft)	2617		2326		2415		2738	
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)	300		300		200		200	
Storage Blk Time (%)					21		0	
Queuing Penalty (veh)					17		0	

Intersection: 100: CR 69 & 10th Ave

Movement	WB	WB	NB	SB
Directions Served	L	R	R	L
Maximum Queue (ft)	83	58	14	52
Average Queue (ft)	34	20	0	19
95th Queue (ft)	67	44	6	43
Link Distance (ft)		2044	213	
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)	125			430
Storage Blk Time (%)	0			
Queuing Penalty (veh)	0			

Intersection: 101: CR 69 & Chaparral Ave

Movement	EB	NB	SB
Directions Served	LR	L	R
Maximum Queue (ft)	47	29	3
Average Queue (ft)	20	5	0
95th Queue (ft)	38	22	3
Link Distance (ft)	1078		213
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)		225	
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 105: CR 69 & Vierling Dr

Movement	EB	EB	WB	WB	WB	NB	NB	SB	SB	SB
Directions Served	L	TR	L	T	R	L	R	L	T	R
Maximum Queue (ft)	51	82	67	44	58	48	22	43	1	4
Average Queue (ft)	20	28	25	15	25	10	1	8	0	0
95th Queue (ft)	45	59	54	38	44	32	10	27	1	3
Link Distance (ft)		1182		1063					1219	
Upstream Blk Time (%)										
Queuing Penalty (veh)										
Storage Bay Dist (ft)	150		265		175	380	380	270		260
Storage Blk Time (%)										
Queuing Penalty (veh)										

Intersection: 110: CR 69 & US 169 N Ramp

Movement	WB	WB	NB	SB
Directions Served	LT	R	L	R
Maximum Queue (ft)	107	87	46	3
Average Queue (ft)	51	43	16	0
95th Queue (ft)	88	69	41	2
Link Distance (ft)	1985			
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)		300	340	300
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 120: CR 69 & US 169 S Ramp

Movement	EB	WB	WB	NB	NB	SB
Directions Served	LTR	LT	R	L	R	L
Maximum Queue (ft)	41	75	131	21	23	59
Average Queue (ft)	13	30	56	2	3	19
95th Queue (ft)	34	59	97	11	16	47
Link Distance (ft)	1005	1905				
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)			300	210	285	340
Storage Blk Time (%)						
Queuing Penalty (veh)						

Intersection: 130: CR 69 & Subdistrict B North Access/Subdistrict A North Access

Movement	EB	WB	WB	NB	SB
Directions Served	L	L	TR	LTR	LTR
Maximum Queue (ft)	34	40	75	26	51
Average Queue (ft)	10	15	33	1	17
95th Queue (ft)	34	40	59	13	43
Link Distance (ft)			1278	2361	305
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)	150	150			
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 140: CR 69 & Subdistrict B South Access/Subdistrict A South Access

Movement	EB	EB	WB	WB	NB	SB
Directions Served	L	TR	L	TR	LTR	LTR
Maximum Queue (ft)	44	42	69	70	26	68
Average Queue (ft)	14	20	33	34	2	14
95th Queue (ft)	40	45	60	57	14	45
Link Distance (ft)		1687		1646	1599	2361
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)	150		150			
Storage Blk Time (%)						
Queuing Penalty (veh)						

Intersection: 200: CR 15 & US 169 N Ramp

Movement	WB	WB	NB	NB	NB	SB	SB	SB
Directions Served	L	TR	T	T	R	L	T	T
Maximum Queue (ft)	223	91	67	65	58	87	182	95
Average Queue (ft)	119	44	20	20	18	35	76	28
95th Queue (ft)	186	75	51	52	45	72	146	69
Link Distance (ft)		2424	986	986			2079	2079
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)	210				320	200		
Storage Blk Time (%)	0						0	
Queuing Penalty (veh)	1						0	

Intersection: 210: CR 15 & US 169 S Ramp

Movement	EB	EB	WB	WB	NB	NB	NB	NB	SB	SB	SB	SB
Directions Served	L	TR	L	TR	L	T	T	R	L	T	T	R
Maximum Queue (ft)	95	83	113	88	68	60	86	110	247	74	39	51
Average Queue (ft)	40	30	54	24	21	20	28	52	102	22	7	10
95th Queue (ft)	81	69	99	59	52	47	63	93	206	61	28	34
Link Distance (ft)		1640		2626		1171	1171			986	986	
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	115		250		165		270	370				175
Storage Blk Time (%)	0	0							1			
Queuing Penalty (veh)	0	0							2			

Intersection: 220: CR 15 & CR 16

Movement	EB	EB	EB	EB	WB	WB	WB	WB	NB	NB	NB	SB
Directions Served	L	T	T	R	L	T	T	R	L	T	R	L
Maximum Queue (ft)	175	53	60	67	73	60	45	119	112	186	35	205
Average Queue (ft)	78	17	13	23	23	20	11	53	49	89	13	101
95th Queue (ft)	147	40	39	50	55	48	35	91	92	161	31	178
Link Distance (ft)		3122	3122			2699	2699			1900		
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	265			265	415			285	215		215	430
Storage Blk Time (%)	0									0		
Queuing Penalty (veh)	0									0		

Intersection: 220: CR 15 & CR 16

Movement	SB	SB
Directions Served	T	R
Maximum Queue (ft)	74	44
Average Queue (ft)	25	13
95th Queue (ft)	61	34
Link Distance (ft)	1171	1171
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 230: CR 15 & 128th St W

Movement	EB	EB	WB	WB	NB	SB
Directions Served	L	TR	L	TR	LTR	LT
Maximum Queue (ft)	83	55	36	45	42	40
Average Queue (ft)	34	24	9	17	6	4
95th Queue (ft)	63	47	33	43	26	23
Link Distance (ft)		1661		1957	1257	1900
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)	100		100			
Storage Blk Time (%)	0	0				
Queuing Penalty (veh)	0	0				

Zone Summary

Zone wide Queuing Penalty: 21

10: Rail Frontage & MN 41 Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.3	0.0	2.1	1.8	0.2
Total Del/Veh (s)	2.8	4.6	63.0	51.7	5.7

20: Dem Con Dr/Frontage Rd & MN 41 Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	0.0	2.2	2.2	0.2
Total Del/Veh (s)	12.2	17.6	19.2	21.0	15.3

30: Chestnut Blvd & Emery Way Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	0.0	0.7	0.1	0.1
Total Del/Veh (s)	3.8	0.9	13.4	6.5	4.1

40: CR 69 & Chestnut Blvd/CR 78 Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	0.0	0.6	0.0	0.1
Total Del/Veh (s)	3.6	3.3	12.9	16.5	7.8

50: CR 73 & CR 78 Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	0.0	0.1	0.1	0.0
Total Del/Veh (s)	4.2	4.8	7.2	10.4	5.1

60: CSAH 15/CR 15 & CR 78 Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	0.0	0.7	0.0	0.1
Total Del/Veh (s)	15.7	18.1	12.7	17.7	16.7

70: CR 78 & CR 77 Performance by approach

Approach	EB	WB	SB	All
Denied Del/Veh (s)	0.0	0.0	0.2	0.0
Total Del/Veh (s)	5.6	6.7	9.7	6.6

80: CR 79 & CR 78 Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	1.2	0.5	1.3	0.8
Total Del/Veh (s)	61.9	25.1	11.2	14.3	32.3

100: CR 69 & 10th Ave Performance by approach

Approach	WB	NB	SB	All
Denied Del/Veh (s)	0.8	0.0	0.5	0.4
Total Del/Veh (s)	21.7	0.3	1.4	4.5

101: CR 69 & Chaparral Ave Performance by approach

Approach	EB	NB	SB	All
Denied Del/Veh (s)	0.1	0.0	0.0	0.0
Total Del/Veh (s)	8.2	1.1	0.5	1.4

105: CR 69 & Vierling Dr Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	1.4	2.5	0.0	0.0	0.4
Total Del/Veh (s)	20.6	26.5	1.4	1.5	6.2

110: CR 69 & US 169 N Ramp Performance by approach

Approach	WB	NB	SB	All
Denied Del/Veh (s)	0.7	0.0	0.0	0.2
Total Del/Veh (s)	13.9	1.7	1.7	4.6

120: CR 69 & US 169 S Ramp Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.1	0.9	0.0	0.0	0.3
Total Del/Veh (s)	13.8	14.5	0.7	2.2	5.6

130: CR 69 & Subdistrict B North Access/Subdistrict A North Access Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	1.4	1.0	0.0	0.0	0.2
Total Del/Veh (s)	9.8	6.8	2.1	1.7	2.9

140: CR 69 & Subdistrict B South Access/Subdistrict A South Access Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.7	1.0	0.0	0.0	0.2
Total Del/Veh (s)	7.7	6.9	2.5	3.6	4.0

200: CR 15 & US 169 N Ramp Performance by approach

Approach	WB	NB	SB	All
Denied Del/Veh (s)	1.6	0.0	0.6	0.9
Total Del/Veh (s)	16.3	9.4	22.2	16.4

210: CR 15 & US 169 S Ramp Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	1.3	1.1	0.0	0.0	0.3
Total Del/Veh (s)	20.7	19.3	9.7	13.8	14.0

220: CR 15 & CR 16 Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.1	1.3	0.0	0.0	0.2
Total Del/Veh (s)	20.5	14.2	13.8	10.9	13.8

230: CR 15 & 128th St W Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.5	0.6	0.0	0.0	0.1
Total Del/Veh (s)	10.0	13.7	4.3	4.8	5.3

Total Zone Performance

Denied Del/Veh (s)	0.9
Total Del/Veh (s)	805.7

Intersection: 10: Rail Frontage & MN 41

Movement	EB	EB	WB	WB	WB	WB	NB	NB	SB	SB
Directions Served	L	T	L	T	T	R	LT	R	LT	R
Maximum Queue (ft)	63	2	42	1	1	5	78	55	107	90
Average Queue (ft)	10	0	10	0	0	0	26	13	32	25
95th Queue (ft)	39	1	29	1	1	4	75	44	78	68
Link Distance (ft)	2846		1103		1103	822			937	
Upstream Blk Time (%)										
Queuing Penalty (veh)										
Storage Bay Dist (ft)	200		200		200			100		100
Storage Blk Time (%)							2	0		0
Queuing Penalty (veh)							1	0		0

Intersection: 20: Dem Con Dr/Frontage Rd & MN 41

Movement	EB	EB	EB	EB	WB	WB	WB	WB	NB	NB	SB	SB
Directions Served	L	T	T	R	L	T	T	R	LT	R	L	T
Maximum Queue (ft)	56	273	224	28	69	172	187	23	87	56	95	34
Average Queue (ft)	14	126	94	3	23	74	96	4	24	19	45	6
95th Queue (ft)	42	224	178	16	54	138	167	16	56	44	85	23
Link Distance (ft)	1103		1103	1192			1192	563		440		
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	285		275		440		230			60		125
Storage Blk Time (%)	0		0		0			1		0		0
Queuing Penalty (veh)	0		0		0			1		0		0

Intersection: 20: Dem Con Dr/Frontage Rd & MN 41

Movement	SB
Directions Served	R
Maximum Queue (ft)	69
Average Queue (ft)	21
95th Queue (ft)	50
Link Distance (ft)	440
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 30: Chestnut Blvd & Emery Way

Movement	EB	EB	WB	NB	NB	SB
Directions Served	L	R	L	LT	R	LTR
Maximum Queue (ft)	30	15	30	104	24	48
Average Queue (ft)	5	1	8	44	9	19
95th Queue (ft)	22	7	25	81	25	39
Link Distance (ft)				1183		1778
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)	300	300	490		250	
Storage Blk Time (%)						
Queuing Penalty (veh)						

Intersection: 40: CR 69 & Chestnut Blvd/CR 78

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	TR	L	TR	L	TR	L	TR
Maximum Queue (ft)	63	6	33	20	53	77	130	155
Average Queue (ft)	26	0	7	1	17	36	54	64
95th Queue (ft)	54	3	27	9	42	64	98	118
Link Distance (ft)		2628		2579		2610		1599
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)	300		300		300		300	
Storage Blk Time (%)								
Queuing Penalty (veh)								

Intersection: 50: CR 73 & CR 78

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (ft)	71	37	41	86
Average Queue (ft)	20	4	15	36
95th Queue (ft)	54	22	38	68
Link Distance (ft)	2579	2549	2596	1626
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 60: CSAH 15/CR 15 & CR 78

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	TR	L	TR	L	TR	L	TR
Maximum Queue (ft)	108	130	52	195	54	103	124	234
Average Queue (ft)	54	61	22	87	23	44	55	99
95th Queue (ft)	92	100	48	158	45	78	96	184
Link Distance (ft)		2549		2616		2754		1257
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)	300		300		300		300	
Storage Blk Time (%)								0
Queuing Penalty (veh)								0

Intersection: 70: CR 78 & CR 77

Movement	EB	SB
Directions Served	LT	LR
Maximum Queue (ft)	54	118
Average Queue (ft)	10	42
95th Queue (ft)	36	80
Link Distance (ft)	2616	1595
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 80: CR 79 & CR 78

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	TR	L	TR	L	TR	L	TR
Maximum Queue (ft)	333	550	146	356	43	87	135	94
Average Queue (ft)	41	246	54	136	16	45	59	47
95th Queue (ft)	199	510	141	284	40	74	103	78
Link Distance (ft)		2617		2326		2415		2738
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)	300		300		200		200	
Storage Blk Time (%)		22		3				
Queuing Penalty (veh)		7		4				

Intersection: 100: CR 69 & 10th Ave

Movement	WB	WB	NB	SB
Directions Served	L	R	R	L
Maximum Queue (ft)	148	98	13	57
Average Queue (ft)	66	21	0	17
95th Queue (ft)	125	65	5	43
Link Distance (ft)		2044	213	
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)	125			430
Storage Blk Time (%)	3	0		
Queuing Penalty (veh)	1	0		

Intersection: 101: CR 69 & Chaparral Ave

Movement	EB	NB
Directions Served	LR	L
Maximum Queue (ft)	93	28
Average Queue (ft)	28	5
95th Queue (ft)	63	22
Link Distance (ft)	1078	
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		225
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 105: CR 69 & Vierling Dr

Movement	EB	EB	WB	WB	WB	NB	NB	SB	SB
Directions Served	L	TR	L	T	R	L	R	L	R
Maximum Queue (ft)	89	91	132	61	50	53	14	46	25
Average Queue (ft)	34	32	43	21	16	10	1	9	1
95th Queue (ft)	70	67	94	49	40	30	8	28	11
Link Distance (ft)		1182		1063					
Upstream Blk Time (%)									
Queuing Penalty (veh)									
Storage Bay Dist (ft)	150		265		175	380	380	270	260
Storage Blk Time (%)									
Queuing Penalty (veh)									

Intersection: 110: CR 69 & US 169 N Ramp

Movement	WB	WB	NB	SB
Directions Served	LT	R	L	R
Maximum Queue (ft)	181	74	61	20
Average Queue (ft)	73	39	23	2
95th Queue (ft)	137	61	48	10
Link Distance (ft)	1985			
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)		300	340	300
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 120: CR 69 & US 169 S Ramp

Movement	EB	WB	WB	NB	NB	SB	SB
Directions Served	LTR	LT	R	L	R	L	R
Maximum Queue (ft)	62	154	84	19	35	69	2
Average Queue (ft)	19	62	38	2	3	26	0
95th Queue (ft)	43	124	67	11	18	56	2
Link Distance (ft)	1005	1907					
Upstream Blk Time (%)							
Queuing Penalty (veh)							
Storage Bay Dist (ft)			300	210	285	340	105
Storage Blk Time (%)							
Queuing Penalty (veh)							

Intersection: 130: CR 69 & Subdistrict B North Access/Subdistrict A North Access

Movement	EB	EB	WB	WB	SB
Directions Served	L	TR	L	TR	LTR
Maximum Queue (ft)	43	28	52	67	71
Average Queue (ft)	15	7	23	32	18
95th Queue (ft)	39	26	50	55	52
Link Distance (ft)		1494		1278	307
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)	150		150		
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 140: CR 69 & Subdistrict B South Access/Subdistrict A South Access

Movement	EB	EB	WB	WB	NB	SB
Directions Served	L	TR	L	TR	LTR	LTR
Maximum Queue (ft)	44	40	72	76	22	63
Average Queue (ft)	16	16	32	36	2	17
95th Queue (ft)	43	41	61	60	13	50
Link Distance (ft)		1687		1646	1599	2364
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)	150		150			
Storage Blk Time (%)						
Queuing Penalty (veh)						

Intersection: 200: CR 15 & US 169 N Ramp

Movement	WB	WB	NB	NB	NB	SB	SB	SB
Directions Served	L	TR	T	T	R	L	T	T
Maximum Queue (ft)	250	181	91	96	76	177	244	179
Average Queue (ft)	154	73	44	40	27	77	117	51
95th Queue (ft)	238	134	82	82	60	150	200	120
Link Distance (ft)		2424	986	986			2182	2182
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)	210				320	200		
Storage Blk Time (%)	1	0				1	1	0
Queuing Penalty (veh)	6	0				2	1	0

Intersection: 210: CR 15 & US 169 S Ramp

Movement	EB	EB	WB	WB	NB	NB	NB	NB	SB	SB	SB	SB
Directions Served	L	TR	L	TR	L	T	T	R	L	T	T	R
Maximum Queue (ft)	117	74	148	104	62	65	85	119	225	114	66	56
Average Queue (ft)	51	29	71	35	17	24	35	50	119	39	11	12
95th Queue (ft)	97	62	125	75	46	55	72	93	199	86	43	39
Link Distance (ft)		1640		2640		1173	1173			986	986	
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	115		250		165		270	370				175
Storage Blk Time (%)	1											
Queuing Penalty (veh)	0											

Intersection: 220: CR 15 & CR 16

Movement	EB	EB	EB	EB	WB	WB	WB	WB	NB	NB	NB	SB
Directions Served	L	T	T	R	L	T	T	R	L	T	R	L
Maximum Queue (ft)	137	43	41	75	107	51	49	95	164	148	46	163
Average Queue (ft)	70	15	10	26	47	18	10	44	55	60	9	67
95th Queue (ft)	120	36	31	55	90	45	36	77	113	116	29	124
Link Distance (ft)		3122	3122			2699	2699			1900		
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	265			265	415			285	215		215	430
Storage Blk Time (%)									0	0		
Queuing Penalty (veh)									0	0		

Intersection: 220: CR 15 & CR 16

Movement	SB	SB
Directions Served	T	R
Maximum Queue (ft)	170	42
Average Queue (ft)	69	14
95th Queue (ft)	139	32
Link Distance (ft)	1173	1173
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 230: CR 15 & 128th St W

Movement	EB	EB	WB	WB	NB	SB	SB
Directions Served	L	TR	L	TR	LTR	LT	R
Maximum Queue (ft)	62	81	44	43	99	114	9
Average Queue (ft)	17	32	9	13	21	16	0
95th Queue (ft)	44	60	33	38	66	60	4
Link Distance (ft)		1770		1683	1257	1900	
Upstream Blk Time (%)							
Queuing Penalty (veh)							
Storage Bay Dist (ft)	100		100			300	
Storage Blk Time (%)	0	0					
Queuing Penalty (veh)	0	0					

Zone Summary

Zone wide Queuing Penalty: 24

10: Rail Frontage & MN 41 Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.4	0.1	2.3	1135.0	59.7
Total Del/Veh (s)	6.0	8.4	377.1	1767.8	47.0

20: Dem Con Dr/Frontage Rd & MN 41 Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.2	0.0	2.5	2.6	0.4
Total Del/Veh (s)	29.2	32.5	20.9	31.4	30.6

30: Chestnut Blvd & Emery Way Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	0.0	232.3	0.2	30.5
Total Del/Veh (s)	9.8	1.7	730.2	241.3	115.0

40: CR 69 & Chestnut Blvd/CR 78 Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	0.0	2.1	0.0	0.3
Total Del/Veh (s)	5.0	6.3	354.6	92.1	77.7

50: CR 73 & CR 78 Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	0.0	0.2	0.2	0.0
Total Del/Veh (s)	3.7	6.3	18.3	17.0	8.1

60: CSAH 15/CR 15 & CR 78 Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	0.1	0.5	0.0	0.1
Total Del/Veh (s)	22.4	184.8	26.9	19.0	64.2

70: CR 78 & CR 77 Performance by approach

Approach	EB	WB	SB	All
Denied Del/Veh (s)	0.0	0.0	0.1	0.0
Total Del/Veh (s)	7.6	8.2	8.8	8.0

80: CR 79 & CR 78 Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	109.4	0.6	1.3	55.2
Total Del/Veh (s)	24.2	300.9	10.0	9.3	155.6

100: CR 69 & 10th Ave Performance by approach

Approach	WB	NB	SB	All
Denied Del/Veh (s)	0.7	0.0	1.0	0.3
Total Del/Veh (s)	34.0	0.4	2.4	5.0

101: CR 69 & Chaparral Ave Performance by approach

Approach	EB	NB	SB	All
Denied Del/Veh (s)	0.2	0.0	0.0	0.0
Total Del/Veh (s)	11.3	1.3	0.5	2.0

105: CR 69 & Vierling Dr Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	1.2	2.7	0.0	0.0	0.4
Total Del/Veh (s)	38.9	37.5	1.8	1.6	11.0

110: CR 69 & US 169 N Ramp Performance by approach

Approach	WB	NB	SB	All
Denied Del/Veh (s)	0.8	0.0	0.0	0.2
Total Del/Veh (s)	195.7	1.8	1.3	45.1

120: CR 69 & US 169 S Ramp Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.1	1.2	0.0	0.0	0.3
Total Del/Veh (s)	29.5	22.2	1.3	2.9	9.0

130: CR 69 & Subdistrict B North Access/Subdistrict A North Access Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	2.1	0.8	0.0	0.0	0.4
Total Del/Veh (s)	54.6	42.0	7.0	3.5	18.4

140: CR 69 & Subdistrict B South Access/Subdistrict A South Access Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.9	0.9	0.0	0.0	0.4
Total Del/Veh (s)	17.2	15.4	4.9	4.0	9.6

200: CR 15 & US 169 N Ramp Performance by approach

Approach	WB	NB	SB	All
Denied Del/Veh (s)	1.4	0.0	0.5	0.6
Total Del/Veh (s)	17.7	5.5	11.0	11.3

210: CR 15 & US 169 S Ramp Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	1.1	1.1	0.0	0.0	0.2
Total Del/Veh (s)	22.5	22.9	10.7	12.6	13.9

220: CR 15 & CR 16 Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.2	1.3	0.1	0.0	0.3
Total Del/Veh (s)	39.3	13.7	21.4	17.8	21.8

230: CR 15 & 128th St W Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	1.1	0.4	0.0	0.0	0.2
Total Del/Veh (s)	12.9	10.1	5.1	4.5	6.5

Total Zone Performance

Denied Del/Veh (s)	33.1
Total Del/Veh (s)	1549.0

Intersection: 10: Rail Frontage & MN 41

Movement	EB	EB	WB	WB	WB	WB	NB	NB	SB	SB
Directions Served	L	T	L	T	T	R	LT	R	LT	R
Maximum Queue (ft)	182	70	37	4	1	31	242	118	992	150
Average Queue (ft)	56	3	9	0	0	1	110	29	918	30
95th Queue (ft)	131	43	26	5	1	11	280	108	1106	126
Link Distance (ft)		3193		1103	1103		822		937	
Upstream Blk Time (%)									84	
Queuing Penalty (veh)									0	
Storage Bay Dist (ft)	200		200			200		100		100
Storage Blk Time (%)	0	0					39		100	0
Queuing Penalty (veh)	1	0					8		45	0

Intersection: 20: Dem Con Dr/Frontage Rd & MN 41

Movement	EB	EB	EB	EB	WB	WB	WB	WB	NB	NB	SB	SB
Directions Served	L	T	T	R	L	T	T	R	LT	R	L	T
Maximum Queue (ft)	325	629	557	20	140	446	468	249	95	91	164	194
Average Queue (ft)	102	291	182	4	35	220	248	35	33	33	104	27
95th Queue (ft)	256	563	443	15	120	377	409	163	75	70	164	117
Link Distance (ft)		1103	1103			1192	1192		563			440
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	285			275	440			230		60	125	
Storage Blk Time (%)	0	11	1			1	10		4	3	8	0
Queuing Penalty (veh)	0	12	0			0	15		3	1	2	0

Intersection: 20: Dem Con Dr/Frontage Rd & MN 41

Movement	SB
Directions Served	R
Maximum Queue (ft)	74
Average Queue (ft)	25
95th Queue (ft)	57
Link Distance (ft)	440
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 30: Chestnut Blvd & Emery Way

Movement	EB	EB	WB	WB	WB	NB	NB	SB
Directions Served	L	R	L	T	R	LT	R	LTR
Maximum Queue (ft)	160	2	25	7	23	1217	350	815
Average Queue (ft)	72	0	6	0	2	916	91	392
95th Queue (ft)	134	2	22	3	12	1545	340	940
Link Distance (ft)				1024		1183		1778
Upstream Blk Time (%)						55		
Queuing Penalty (veh)						0		
Storage Bay Dist (ft)	300	300	490		490		250	
Storage Blk Time (%)						90		
Queuing Penalty (veh)						18		

Intersection: 40: CR 69 & Chestnut Blvd/CR 78

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	TR	L	TR	L	TR	L	TR
Maximum Queue (ft)	110	7	37	50	450	1289	349	330
Average Queue (ft)	43	0	8	13	189	657	180	85
95th Queue (ft)	80	6	29	36	521	1596	362	226
Link Distance (ft)		2628		2579		2610		1599
Upstream Blk Time (%)						1		
Queuing Penalty (veh)						0		
Storage Bay Dist (ft)	300		300		300		300	
Storage Blk Time (%)						63	12	0
Queuing Penalty (veh)						40	19	1

Intersection: 50: CR 73 & CR 78

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (ft)	71	62	148	132
Average Queue (ft)	12	7	61	60
95th Queue (ft)	42	34	119	107
Link Distance (ft)	2579	2549	2596	1489
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 60: CSAH 15/CR 15 & CR 78

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	TR	L	TR	L	TR	L	TR
Maximum Queue (ft)	136	198	408	1192	56	225	138	213
Average Queue (ft)	63	91	89	618	26	96	52	88
95th Queue (ft)	116	159	371	1351	51	200	85	184
Link Distance (ft)		2549		2617		2754		1257
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)	300		300		300		300	
Storage Blk Time (%)				61		1		1
Queuing Penalty (veh)				12		1		2

Intersection: 70: CR 78 & CR 77

Movement	EB	WB	SB
Directions Served	LT	TR	LR
Maximum Queue (ft)	113	20	85
Average Queue (ft)	33	1	30
95th Queue (ft)	81	9	59
Link Distance (ft)	2617	2617	1530
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 80: CR 79 & CR 78

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	TR	L	TR	L	TR	L	TR
Maximum Queue (ft)	47	243	450	2384	46	94	71	64
Average Queue (ft)	16	109	387	1905	23	48	38	34
95th Queue (ft)	42	207	640	2951	45	78	62	54
Link Distance (ft)		2617		2326		2415		2738
Upstream Blk Time (%)				57				
Queuing Penalty (veh)				0				
Storage Bay Dist (ft)	300		300		200		200	
Storage Blk Time (%)		1		99				
Queuing Penalty (veh)		0		79				

Intersection: 100: CR 69 & 10th Ave

Movement	WB	WB	NB	SB
Directions Served	L	R	R	L
Maximum Queue (ft)	162	152	11	83
Average Queue (ft)	60	32	1	29
95th Queue (ft)	133	109	8	64
Link Distance (ft)		2044	213	
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)	125			430
Storage Blk Time (%)	6	0		
Queuing Penalty (veh)	4	0		

Intersection: 101: CR 69 & Chaparral Ave

Movement	EB	NB	SB
Directions Served	LR	L	R
Maximum Queue (ft)	120	41	2
Average Queue (ft)	37	8	0
95th Queue (ft)	82	30	2
Link Distance (ft)	1078		213
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)		225	
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 105: CR 69 & Vierling Dr

Movement	EB	EB	WB	WB	WB	NB	NB	NB	SB	SB
Directions Served	L	TR	L	T	R	L	T	R	L	R
Maximum Queue (ft)	209	288	127	59	68	62	6	26	34	17
Average Queue (ft)	50	90	48	19	23	18	0	2	7	1
95th Queue (ft)	127	213	111	49	47	43	5	13	24	8
Link Distance (ft)		1182		1063			1442			
Upstream Blk Time (%)										
Queuing Penalty (veh)										
Storage Bay Dist (ft)	150		265		175	380		380	270	260
Storage Blk Time (%)	0	9	0							
Queuing Penalty (veh)	1	8	0							

Intersection: 110: CR 69 & US 169 N Ramp

Movement	WB	WB	NB	NB	SB
Directions Served	LT	R	L	T	R
Maximum Queue (ft)	1114	375	64	2	10
Average Queue (ft)	547	200	26	0	1
95th Queue (ft)	1283	474	52	2	5
Link Distance (ft)	1985			900	
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)		300	340		300
Storage Blk Time (%)	53				
Queuing Penalty (veh)	77				

Intersection: 120: CR 69 & US 169 S Ramp

Movement	EB	WB	WB	NB	NB	NB	SB	SB
Directions Served	LTR	LT	R	L	T	R	L	R
Maximum Queue (ft)	142	259	224	43	2	35	90	7
Average Queue (ft)	44	82	80	11	0	6	32	0
95th Queue (ft)	104	209	161	34	2	24	69	2
Link Distance (ft)	1005	1905			1017			
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)			300	210		285	340	105
Storage Blk Time (%)		1						
Queuing Penalty (veh)		4						

Intersection: 130: CR 69 & Subdistrict B North Access/Subdistrict A North Access

Movement	EB	EB	WB	WB	NB	SB
Directions Served	L	TR	L	TR	LTR	LTR
Maximum Queue (ft)	225	247	148	265	139	110
Average Queue (ft)	107	56	42	106	42	40
95th Queue (ft)	211	161	120	228	95	83
Link Distance (ft)		1059		1278	2361	305
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)	150		150			
Storage Blk Time (%)	16	0	0	13		
Queuing Penalty (veh)	12	0	0	7		

Intersection: 140: CR 69 & Subdistrict B South Access/Subdistrict A South Access

Movement	EB	EB	WB	WB	NB	SB
Directions Served	L	TR	L	TR	LTR	LTR
Maximum Queue (ft)	151	141	88	140	73	66
Average Queue (ft)	61	58	42	63	16	18
95th Queue (ft)	117	103	74	112	50	52
Link Distance (ft)		1687		1646	1599	2361
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)	150		150			
Storage Blk Time (%)	1	0	0	0		
Queuing Penalty (veh)	2	0	0	0		

Intersection: 200: CR 15 & US 169 N Ramp

Movement	WB	WB	NB	NB	NB	SB	SB	SB
Directions Served	L	TR	T	T	R	L	T	T
Maximum Queue (ft)	226	120	72	68	70	98	203	125
Average Queue (ft)	131	45	22	23	23	39	87	34
95th Queue (ft)	200	89	55	57	54	78	158	86
Link Distance (ft)		2424	986	986			2079	2079
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)	210				320	200		
Storage Blk Time (%)	1						0	
Queuing Penalty (veh)	1						0	

Intersection: 210: CR 15 & US 169 S Ramp

Movement	EB	EB	WB	WB	NB	NB	NB	NB	SB	SB	SB	SB
Directions Served	L	TR	L	TR	L	T	T	R	L	T	T	R
Maximum Queue (ft)	95	93	184	90	76	64	113	151	261	112	50	44
Average Queue (ft)	40	32	82	26	23	26	42	71	107	32	9	9
95th Queue (ft)	78	72	149	63	55	54	89	128	201	78	35	33
Link Distance (ft)		1640		2626		1171	1171			986	986	
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	115		250		165			270	370			175
Storage Blk Time (%)	0	0	0	0								
Queuing Penalty (veh)	0	0	0	0								

Intersection: 220: CR 15 & CR 16

Movement	EB	EB	EB	EB	WB	WB	WB	WB	NB	NB	NB	SB
Directions Served	L	T	T	R	L	T	T	R	L	T	R	L
Maximum Queue (ft)	268	124	51	60	84	61	50	154	149	226	51	263
Average Queue (ft)	136	19	15	22	30	21	11	72	66	124	20	126
95th Queue (ft)	272	83	40	49	69	49	37	124	122	201	41	224
Link Distance (ft)		3122	3122			2699	2699			1900		
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	265			265	415			285	215		215	430
Storage Blk Time (%)	5								0	1		
Queuing Penalty (veh)	2								0	1		

Intersection: 220: CR 15 & CR 16

Movement	SB	SB
Directions Served	T	R
Maximum Queue (ft)	137	60
Average Queue (ft)	53	21
95th Queue (ft)	110	47
Link Distance (ft)	1171	1171
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 230: CR 15 & 128th St W

Movement	EB	EB	WB	WB	NB	SB
Directions Served	L	TR	L	TR	LTR	LT
Maximum Queue (ft)	87	69	49	81	56	74
Average Queue (ft)	36	27	21	40	7	14
95th Queue (ft)	66	52	48	69	29	48
Link Distance (ft)		1661		1957	1257	1900
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)	100		100			
Storage Blk Time (%)	0	0		0		
Queuing Penalty (veh)	0	0		0		

Zone Summary

Zone wide Queuing Penalty: 378

10: Rail Frontage & MN 41 Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.4	0.1	2.2	1337.8	100.6
Total Del/Veh (s)	4.0	7.6	289.1	1516.6	52.3

20: Dem Con Dr/Frontage Rd & MN 41 Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	0.0	2.0	2.2	0.3
Total Del/Veh (s)	24.9	29.7	20.6	25.2	26.9

30: Chestnut Blvd & Emery Way Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	0.0	0.6	205.5	44.1
Total Del/Veh (s)	6.1	1.8	135.9	569.9	125.6

40: CR 69 & Chestnut Blvd/CR 78 Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	0.0	0.6	1.1	0.3
Total Del/Veh (s)	5.3	5.5	69.8	450.4	122.8

50: CR 73 & CR 78 Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	0.0	0.2	0.1	0.0
Total Del/Veh (s)	5.8	7.6	20.0	20.2	8.5

60: CSAH 15/CR 15 & CR 78 Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	3.5	0.8	0.0	1.0
Total Del/Veh (s)	25.2	418.1	15.5	184.6	183.4

70: CR 78 & CR 77 Performance by approach

Approach	EB	WB	SB	All
Denied Del/Veh (s)	0.0	0.0	50.8	10.6
Total Del/Veh (s)	21.0	9.6	300.4	71.4

80: CR 79 & CR 78 Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	2.0	24.1	0.5	1.3	10.8
Total Del/Veh (s)	432.8	210.1	11.9	15.3	225.6

100: CR 69 & 10th Ave Performance by approach

Approach	WB	NB	SB	All
Denied Del/Veh (s)	0.8	0.0	0.7	0.4
Total Del/Veh (s)	281.3	0.4	2.0	47.4

101: CR 69 & Chaparral Ave Performance by approach

Approach	EB	NB	SB	All
Denied Del/Veh (s)	0.2	0.0	0.0	0.0
Total Del/Veh (s)	25.4	1.3	0.8	5.0

105: CR 69 & Vierling Dr Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	29.3	2.3	0.0	0.0	5.0
Total Del/Veh (s)	300.2	89.6	2.0	2.1	58.6

110: CR 69 & US 169 N Ramp Performance by approach

Approach	WB	NB	SB	All
Denied Del/Veh (s)	1.6	0.0	0.0	0.4
Total Del/Veh (s)	182.0	2.3	2.3	48.6

120: CR 69 & US 169 S Ramp Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	178.1	590.4	0.0	0.0	136.7
Total Del/Veh (s)	794.9	1035.4	1.3	3.6	215.5

130: CR 69 & Subdistrict B North Access/Subdistrict A North Access Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	1.4	1.1	0.0	0.0	0.4
Total Del/Veh (s)	240.2	45.1	5.5	8.2	54.5

140: CR 69 & Subdistrict B South Access/Subdistrict A South Access Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	76.0	47.0	0.0	0.4	23.2
Total Del/Veh (s)	395.5	367.8	5.0	203.0	205.2

200: CR 15 & US 169 N Ramp Performance by approach

Approach	WB	NB	SB	All
Denied Del/Veh (s)	1.7	0.0	0.6	0.9
Total Del/Veh (s)	17.1	9.9	25.3	18.0

210: CR 15 & US 169 S Ramp Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	1.2	1.1	0.0	0.0	0.3
Total Del/Veh (s)	20.8	20.3	11.7	15.6	15.5

220: CR 15 & CR 16 Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.1	1.3	0.0	0.0	0.2
Total Del/Veh (s)	23.6	15.2	19.8	13.5	17.1

230: CR 15 & 128th St W Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.6	0.9	0.0	0.0	0.1
Total Del/Veh (s)	113.5	159.0	5.7	32.7	40.1

Total Zone Performance

Denied Del/Veh (s)	64.5
Total Del/Veh (s)	1876.6

Intersection: 10: Rail Frontage & MN 41

Movement	EB	EB	WB	WB	WB	NB	NB	SB	SB
Directions Served	L	R	L	T	R	LT	R	LT	R
Maximum Queue (ft)	82	1	53	2	12	205	103	992	150
Average Queue (ft)	20	0	12	0	0	88	24	943	43
95th Queue (ft)	60	1	36	1	8	212	92	1031	152
Link Distance (ft)				1103		822		937	
Upstream Blk Time (%)								93	
Queuing Penalty (veh)								0	
Storage Bay Dist (ft)	200	200	200		200		100		100
Storage Blk Time (%)						30	0	99	1
Queuing Penalty (veh)						6	0	80	2

Intersection: 20: Dem Con Dr/Frontage Rd & MN 41

Movement	EB	EB	EB	EB	WB	WB	WB	WB	NB	NB	SB	SB
Directions Served	L	T	T	R	L	T	T	R	LT	R	L	T
Maximum Queue (ft)	200	472	427	21	70	380	415	168	80	62	160	180
Average Queue (ft)	45	246	187	4	25	180	212	20	27	19	97	25
95th Queue (ft)	148	433	368	15	60	324	362	104	62	47	156	92
Link Distance (ft)		1103	1103			1192	1192		563			440
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	285			275	440			230		60	125	
Storage Blk Time (%)		7	2			0	6		2	1	5	0
Queuing Penalty (veh)		4	0			0	6		1	0	1	0

Intersection: 20: Dem Con Dr/Frontage Rd & MN 41

Movement	SB
Directions Served	R
Maximum Queue (ft)	111
Average Queue (ft)	42
95th Queue (ft)	88
Link Distance (ft)	440
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 30: Chestnut Blvd & Emery Way

Movement	EB	EB	EB	WB	WB	WB	NB	NB	SB
Directions Served	L	T	R	L	T	R	LT	R	LTR
Maximum Queue (ft)	103	4	21	39	3	18	372	162	1818
Average Queue (ft)	44	0	1	9	0	1	181	32	1418
95th Queue (ft)	81	3	13	28	1	8	384	170	2251
Link Distance (ft)		968			1024		1183		1778
Upstream Blk Time (%)									51
Queuing Penalty (veh)									0
Storage Bay Dist (ft)	300		300	490		490		250	
Storage Blk Time (%)							19		
Queuing Penalty (veh)							4		

Intersection: 40: CR 69 & Chestnut Blvd/CR 78

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	TR	L	TR	L	TR	L	TR
Maximum Queue (ft)	93	8	36	34	115	287	450	1613
Average Queue (ft)	44	0	9	7	29	111	422	1243
95th Queue (ft)	79	5	31	26	98	264	536	2157
Link Distance (ft)		2628		2579		2610		1599
Upstream Blk Time (%)								30
Queuing Penalty (veh)								182
Storage Bay Dist (ft)	300		300		300		300	
Storage Blk Time (%)						3	88	5
Queuing Penalty (veh)						1	310	13

Intersection: 50: CR 73 & CR 78

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (ft)	124	104	117	101
Average Queue (ft)	29	35	49	44
95th Queue (ft)	84	80	92	85
Link Distance (ft)	2579	2549	2596	1626
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 60: CSAH 15/CR 15 & CR 78

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	TR	L	TR	L	TR	L	TR
Maximum Queue (ft)	172	228	450	2341	71	94	450	1207
Average Queue (ft)	72	106	340	1584	32	50	364	887
95th Queue (ft)	141	206	651	2678	57	83	630	1555
Link Distance (ft)		2549		2616		2754		1257
Upstream Blk Time (%)				1				5
Queuing Penalty (veh)				8				35
Storage Bay Dist (ft)	300		300		300		300	
Storage Blk Time (%)		1		97				85
Queuing Penalty (veh)		3		68				170

Intersection: 70: CR 78 & CR 77

Movement	EB	WB	SB
Directions Served	LT	TR	LR
Maximum Queue (ft)	255	74	1337
Average Queue (ft)	74	8	536
95th Queue (ft)	340	72	1394
Link Distance (ft)	2616	2617	1595
Upstream Blk Time (%)			10
Queuing Penalty (veh)			0
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 80: CR 79 & CR 78

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	TR	L	TR	L	TR	L	TR
Maximum Queue (ft)	450	2550	450	1886	50	96	148	96
Average Queue (ft)	210	1789	356	1209	18	45	62	50
95th Queue (ft)	576	3123	637	2432	44	76	112	83
Link Distance (ft)		2617		2326		2415		2738
Upstream Blk Time (%)		5		15				
Queuing Penalty (veh)		37		0				
Storage Bay Dist (ft)	300		300		200		200	
Storage Blk Time (%)		96		85			0	
Queuing Penalty (veh)		29		136			0	

Intersection: 100: CR 69 & 10th Ave

Movement	WB	WB	NB	SB
Directions Served	L	R	R	L
Maximum Queue (ft)	190	865	9	62
Average Queue (ft)	152	445	1	27
95th Queue (ft)	239	1200	7	55
Link Distance (ft)		2044	213	
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)	125			430
Storage Blk Time (%)	64	0		
Queuing Penalty (veh)	42	0		

Intersection: 101: CR 69 & Chaparral Ave

Movement	EB	NB	SB
Directions Served	LR	L	R
Maximum Queue (ft)	273	40	4
Average Queue (ft)	92	10	0
95th Queue (ft)	212	32	3
Link Distance (ft)	1078		213
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)		225	
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 105: CR 69 & Vierling Dr

Movement	EB	EB	WB	WB	WB	NB	NB	NB	NB	SB	SB	SB
Directions Served	L	TR	L	T	R	L	T	T	R	L	T	R
Maximum Queue (ft)	244	948	207	174	51	61	3	4	16	32	8	23
Average Queue (ft)	184	527	85	49	17	19	0	0	1	9	0	2
95th Queue (ft)	317	1233	191	125	40	44	2	3	7	26	5	12
Link Distance (ft)		1182		1063			1442	1442			1219	
Upstream Blk Time (%)		14										
Queuing Penalty (veh)		0										
Storage Bay Dist (ft)	150		265		175	380			380	270		260
Storage Blk Time (%)	42	47	2	0								
Queuing Penalty (veh)	69	52	1	0								

Intersection: 110: CR 69 & US 169 N Ramp

Movement	WB	WB	NB	SB	SB
Directions Served	LT	R	L	T	R
Maximum Queue (ft)	1213	375	70	4	23
Average Queue (ft)	633	223	29	0	3
95th Queue (ft)	1454	500	58	1	13
Link Distance (ft)	1985			1442	
Upstream Blk Time (%)	2				
Queuing Penalty (veh)	0				
Storage Bay Dist (ft)		300	340		300
Storage Blk Time (%)	61				
Queuing Penalty (veh)	73				

Intersection: 120: CR 69 & US 169 S Ramp

Movement	EB	WB	WB	NB	NB	SB	SB
Directions Served	LTR	LT	R	L	R	L	R
Maximum Queue (ft)	1036	1955	350	35	40	113	2
Average Queue (ft)	778	1650	241	13	9	49	0
95th Queue (ft)	1263	2459	504	34	29	91	2
Link Distance (ft)	1005	1907					
Upstream Blk Time (%)	43	69					
Queuing Penalty (veh)	0	0					
Storage Bay Dist (ft)			300	210	285	340	105
Storage Blk Time (%)		97	0				
Queuing Penalty (veh)		184	0				

Intersection: 130: CR 69 & Subdistrict B North Access/Subdistrict A North Access

Movement	EB	EB	WB	WB	NB	SB	B121
Directions Served	L	TR	L	TR	LTR	LTR	T
Maximum Queue (ft)	250	930	164	231	98	298	199
Average Queue (ft)	209	434	50	85	27	67	9
95th Queue (ft)	311	1109	117	178	73	195	104
Link Distance (ft)		1494		1278	2364	307	1015
Upstream Blk Time (%)		1				3	
Queuing Penalty (veh)		0				22	
Storage Bay Dist (ft)	150		150				
Storage Blk Time (%)	72	3	1	5			
Queuing Penalty (veh)	76	6	2	3			

Intersection: 140: CR 69 & Subdistrict B South Access/Subdistrict A South Access

Movement	EB	EB	WB	WB	NB	SB
Directions Served	L	TR	L	TR	LTR	LTR
Maximum Queue (ft)	250	1592	246	1383	118	2126
Average Queue (ft)	107	703	155	554	26	770
95th Queue (ft)	266	1790	297	1570	75	2132
Link Distance (ft)		1687		1646	1599	2364
Upstream Blk Time (%)		20		13		4
Queuing Penalty (veh)		0		0		23
Storage Bay Dist (ft)	150		150			
Storage Blk Time (%)	4	58	51	3		
Queuing Penalty (veh)	6	74	80	2		

Intersection: 200: CR 15 & US 169 N Ramp

Movement	WB	WB	NB	NB	NB	SB	SB	SB
Directions Served	L	TR	T	T	R	L	T	T
Maximum Queue (ft)	270	251	113	104	71	214	310	226
Average Queue (ft)	167	79	48	43	30	82	144	69
95th Queue (ft)	254	167	92	84	60	167	255	160
Link Distance (ft)		2424	986	986			2182	2182
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)	210				320	200		
Storage Blk Time (%)	2	0				1	2	0
Queuing Penalty (veh)	10	0				5	2	0

Intersection: 210: CR 15 & US 169 S Ramp

Movement	EB	EB	WB	WB	NB	NB	NB	NB	SB	SB	SB	SB
Directions Served	L	TR	L	TR	L	T	T	R	L	T	T	R
Maximum Queue (ft)	104	83	156	104	69	78	116	152	252	136	96	51
Average Queue (ft)	50	30	82	37	20	27	43	70	136	52	18	11
95th Queue (ft)	91	64	136	78	53	62	88	130	221	108	58	36
Link Distance (ft)		1640		2640		1173	1173			986	986	
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	115		250		165		270	370				175
Storage Blk Time (%)	0	0										0
Queuing Penalty (veh)	0	0										0

Intersection: 220: CR 15 & CR 16

Movement	EB	EB	EB	EB	WB	WB	WB	WB	NB	NB	NB	SB
Directions Served	L	T	T	R	L	T	T	R	L	T	R	L
Maximum Queue (ft)	180	47	60	94	122	53	49	120	190	175	37	181
Average Queue (ft)	89	16	15	35	53	23	14	52	67	79	10	81
95th Queue (ft)	155	39	42	74	99	49	41	94	140	145	29	146
Link Distance (ft)		3122	3122			2699	2699			1900		
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	265			265	415			285	215		215	430
Storage Blk Time (%)									1	0		
Queuing Penalty (veh)									4	0		

Intersection: 220: CR 15 & CR 16

Movement	SB	SB
Directions Served	T	R
Maximum Queue (ft)	208	63
Average Queue (ft)	95	21
95th Queue (ft)	175	46
Link Distance (ft)	1173	1173
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 230: CR 15 & 128th St W

Movement	EB	EB	WB	WB	NB	SB	SB
Directions Served	L	TR	L	TR	LTR	LT	R
Maximum Queue (ft)	140	395	166	353	165	702	234
Average Queue (ft)	36	121	78	107	26	199	46
95th Queue (ft)	108	435	185	382	96	718	268
Link Distance (ft)		1770		1683	1257	1900	
Upstream Blk Time (%)							
Queuing Penalty (veh)							
Storage Bay Dist (ft)	100		100				300
Storage Blk Time (%)	0	20	28	1		13	
Queuing Penalty (veh)	0	7	15	0		11	

Zone Summary

Zone wide Queuing Penalty: 1869

10: Rail Frontage & MN 41 Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.4	0.0	0.1	2.5	0.3
Total Del/Veh (s)	16.0	13.6	25.6	33.0	15.8

20: Dem Con Dr/Frontage Rd & MN 41 Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	0.0	2.6	2.2	0.3
Total Del/Veh (s)	24.1	26.5	24.6	43.1	26.8

30: Chestnut Blvd & Emery Way Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	0.0	0.5	1.6	0.3
Total Del/Veh (s)	13.2	14.7	30.2	12.8	15.7

40: CR 69 & Chestnut Blvd/CR 78 Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	0.0	0.7	0.0	0.1
Total Del/Veh (s)	17.4	18.1	29.4	21.1	20.0

50: CR 73 & CR 78 Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	0.0	0.2	0.2	0.0
Total Del/Veh (s)	5.8	6.9	20.8	23.7	10.0

60: CSAH 15/CR 15 & CR 78 Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	0.0	0.6	0.0	0.1
Total Del/Veh (s)	20.0	25.3	32.2	17.5	22.9

70: CR 78 & CR 77 Performance by approach

Approach	EB	WB	SB	All
Denied Del/Veh (s)	0.0	0.0	2.2	0.1
Total Del/Veh (s)	5.6	8.9	10.6	7.6

80: CR 79 & CR 78 Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	1.6	0.6	1.3	1.0
Total Del/Veh (s)	14.4	11.5	15.3	25.1	14.3

100: CR 69 & Chaparral Ave/10th Ave Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	1.6	0.7	0.0	1.2	0.5
Total Del/Veh (s)	15.4	18.7	3.4	5.3	6.4

105: CR 69 & Vierling Dr Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	1.2	1.6	0.0	0.0	0.3
Total Del/Veh (s)	17.6	19.7	5.4	5.5	8.6

110: CR 69 & US 169 N Ramp Performance by approach

Approach	WB	NB	SB	All
Denied Del/Veh (s)	1.5	0.0	0.0	0.3
Total Del/Veh (s)	17.0	8.3	5.2	9.4

120: CR 69 & US 169 S Ramp Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.1	2.8	0.0	0.0	0.8
Total Del/Veh (s)	10.0	9.2	8.3	7.5	8.4

130: CR 69 & Subdistrict B North Access/Subdistrict A North Access Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	2.4	0.8	0.0	0.0	0.4
Total Del/Veh (s)	21.9	14.4	13.8	8.9	13.7

140: CR 69 & Subdistrict B South Access/Subdistrict A South Access Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	1.0	0.8	0.0	0.0	0.4
Total Del/Veh (s)	13.9	12.4	12.6	10.4	12.4

200: CR 15 & US 169 N Ramp Performance by approach

Approach	WB	NB	SB	All
Denied Del/Veh (s)	1.7	0.0	0.5	0.7
Total Del/Veh (s)	8.9	9.0	11.6	9.9

210: CR 15 & US 169 S Ramp Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.8	1.5	0.0	0.0	0.2
Total Del/Veh (s)	18.3	18.3	12.6	10.9	13.0

220: CR 15 & CR 16 Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	1.2	1.3	0.1	0.0	0.5
Total Del/Veh (s)	51.6	14.1	21.9	12.8	22.4

230: CR 15 & 128th St W Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	1.1	0.4	0.0	0.0	0.2
Total Del/Veh (s)	12.6	11.4	4.6	4.1	6.1

Total Zone Performance

Denied Del/Veh (s)	1.2
Total Del/Veh (s)	1077.9

Intersection: 10: Rail Frontage & MN 41

Movement	EB	EB	EB	EB	WB	WB	WB	WB	NB	SB	SB
Directions Served	L	T	T	R	L	T	T	R	LTR	L	TR
Maximum Queue (ft)	153	397	376	23	56	183	202	54	74	131	87
Average Queue (ft)	53	137	91	3	17	77	84	15	25	63	30
95th Queue (ft)	96	284	240	14	45	167	176	42	60	118	68
Link Distance (ft)		3200	3200			1116	1116		821		937
Upstream Blk Time (%)											
Queuing Penalty (veh)											
Storage Bay Dist (ft)	250			250	250			250		150	
Storage Blk Time (%)		1	1				0			0	
Queuing Penalty (veh)		1	0				0			0	

Intersection: 20: Dem Con Dr/Frontage Rd & MN 41

Movement	EB	EB	EB	EB	WB	WB	WB	WB	NB	NB	SB	SB
Directions Served	L	T	T	R	L	T	T	R	LT	R	L	T
Maximum Queue (ft)	268	459	398	20	89	345	357	73	114	98	164	247
Average Queue (ft)	86	179	105	2	27	168	197	21	38	36	116	50
95th Queue (ft)	194	379	266	12	63	289	314	51	84	75	177	188
Link Distance (ft)		1116	1116			1192	1192		563			1248
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	285			275	440			230		60	125	
Storage Blk Time (%)		5	1			0	5		4	3	14	
Queuing Penalty (veh)		6	0			0	8		3	2	3	

Intersection: 20: Dem Con Dr/Frontage Rd & MN 41

Movement	SB
Directions Served	R
Maximum Queue (ft)	87
Average Queue (ft)	28
95th Queue (ft)	64
Link Distance (ft)	1248
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 30: Chestnut Blvd & Emery Way

Movement	EB	EB	EB	EB	WB	WB	WB	WB	NB	NB	SB	SB
Directions Served	L	T	T	R	L	T	T	R	LT	R	LT	R
Maximum Queue (ft)	245	94	71	20	54	135	185	54	218	24	89	89
Average Queue (ft)	92	32	5	4	14	63	85	18	106	7	35	39
95th Queue (ft)	181	76	31	15	37	120	156	40	178	23	75	74
Link Distance (ft)		956	956			1024	1024		1183		1779	
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	300			300	490			490		250		250
Storage Blk Time (%)	0								0			
Queuing Penalty (veh)	0								0			

Intersection: 40: CR 69 & Chestnut Blvd/CR 78

Movement	EB	EB	WB	WB	WB	NB	NB	SB	SB
Directions Served	L	TR	L	T	R	L	TR	L	TR
Maximum Queue (ft)	151	249	48	280	137	84	214	134	151
Average Queue (ft)	65	95	16	136	54	34	98	59	56
95th Queue (ft)	119	189	41	238	102	68	176	108	114
Link Distance (ft)		2628		2579			2610		1589
Upstream Blk Time (%)									
Queuing Penalty (veh)									
Storage Bay Dist (ft)	300		300		300	300		300	
Storage Blk Time (%)		0		0			0		
Queuing Penalty (veh)		0		0			0		

Intersection: 50: CR 73 & CR 78

Movement	EB	WB	NB	SB
Directions Served	L	L	LTR	LTR
Maximum Queue (ft)	48	28	181	179
Average Queue (ft)	9	6	64	72
95th Queue (ft)	33	23	132	138
Link Distance (ft)			2596	1489
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)	300	300		
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 60: CSAH 15/CR 15 & CR 78

Movement	EB	EB	WB	WB	WB	NB	NB	SB	SB	SB
Directions Served	L	TR	L	T	R	L	TR	L	T	R
Maximum Queue (ft)	173	208	52	324	147	91	282	154	135	121
Average Queue (ft)	86	99	12	150	46	30	134	65	52	42
95th Queue (ft)	149	176	38	257	104	65	233	124	105	90
Link Distance (ft)		2539		2604			2754		1244	
Upstream Blk Time (%)										
Queuing Penalty (veh)										
Storage Bay Dist (ft)	300		300		300	300		300		300
Storage Blk Time (%)				1			0			
Queuing Penalty (veh)				1			0			

Intersection: 70: CR 78 & CR 77

Movement	EB	WB	SB	SB
Directions Served	L	TR	L	R
Maximum Queue (ft)	77	33	56	58
Average Queue (ft)	28	3	17	20
95th Queue (ft)	60	17	44	44
Link Distance (ft)		2617	1617	
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)	300		100	
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 80: CR 79 & CR 78

Movement	EB	EB	WB	WB	WB	NB	NB	SB	SB
Directions Served	L	TR	L	T	R	L	TR	L	TR
Maximum Queue (ft)	47	222	69	262	85	82	148	141	74
Average Queue (ft)	14	100	32	108	39	23	64	60	27
95th Queue (ft)	38	185	64	200	68	58	117	112	58
Link Distance (ft)		2617		2326			2415		2726
Upstream Blk Time (%)									
Queuing Penalty (veh)									
Storage Bay Dist (ft)	300		300		300	300		300	
Storage Blk Time (%)		0		0					
Queuing Penalty (veh)		0		1					

Intersection: 100: CR 69 & Chaparral Ave/10th Ave

Movement	EB	EB	WB	WB	NB	NB	NB	NB	SB	SB	SB	SB
Directions Served	L	TR	L	TR	L	T	T	R	L	T	T	R
Maximum Queue (ft)	80	61	107	61	46	49	60	44	75	50	62	44
Average Queue (ft)	35	24	42	22	10	10	22	11	29	11	14	8
95th Queue (ft)	68	48	81	45	33	35	54	34	58	35	43	30
Link Distance (ft)	1171		2044		1500		1500		2074		2074	
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	125		125		300			300	430			300
Storage Blk Time (%)	0											
Queuing Penalty (veh)	0											

Intersection: 105: CR 69 & Vierling Dr

Movement	EB	EB	WB	WB	NB	NB	NB	NB	SB	SB	SB	SB	
Directions Served	L	TR	L	TR	L	T	T	R	L	T	T	R	
Maximum Queue (ft)	106	135	79	88	66	60	71	38	45	64	80	56	
Average Queue (ft)	40	52	36	33	22	10	27	7	13	18	21	13	
95th Queue (ft)	85	107	68	65	48	38	60	26	36	48	59	39	
Link Distance (ft)	1182		1063		1442		1442		1500		1500		
Upstream Blk Time (%)													
Queuing Penalty (veh)													
Storage Bay Dist (ft)	150		265		380		380		270		260		
Storage Blk Time (%)	0												
Queuing Penalty (veh)	0												

Intersection: 110: CR 69 & US 169 N Ramp

Movement	WB	WB	NB	NB	NB	SB	SB	SB
Directions Served	LT	R	L	T	T	T	T	R
Maximum Queue (ft)	202	88	104	112	123	111	56	60
Average Queue (ft)	103	46	45	48	60	31	11	19
95th Queue (ft)	174	77	88	95	106	77	38	46
Link Distance (ft)	1153			899	899	1442	1442	
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)		300	340				300	
Storage Blk Time (%)								
Queuing Penalty (veh)								

Intersection: 120: CR 69 & US 169 S Ramp

Movement	EB	WB	WB	NB	NB	NB	NB	SB	SB	SB	SB
Directions Served	LTR	LT	R	L	T	T	R	L	T	T	R
Maximum Queue (ft)	75	110	163	64	116	91	91	105	124	73	47
Average Queue (ft)	27	41	78	23	56	44	45	35	40	8	12
95th Queue (ft)	59	85	134	55	98	81	76	75	91	39	33
Link Distance (ft)	1005	1008			940	940			899	899	
Upstream Blk Time (%)											
Queuing Penalty (veh)											
Storage Bay Dist (ft)			300	210			285	340			105
Storage Blk Time (%)										0	
Queuing Penalty (veh)										0	

Intersection: 130: CR 69 & Subdistrict B North Access/Subdistrict A North Access

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	TR	L	TR	L	TR	L	TR
Maximum Queue (ft)	143	112	76	148	90	196	118	122
Average Queue (ft)	74	35	29	65	41	94	45	49
95th Queue (ft)	129	78	64	115	78	169	92	99
Link Distance (ft)		1053		1272		2361		384
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)	150		150		300		300	
Storage Blk Time (%)	1	0		0				
Queuing Penalty (veh)	1	0		0				

Intersection: 140: CR 69 & Subdistrict B South Access/Subdistrict A South Access

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	TR	L	TR	L	TR	L	TR
Maximum Queue (ft)	120	125	107	134	73	178	72	110
Average Queue (ft)	55	54	45	53	31	89	26	42
95th Queue (ft)	100	101	89	100	64	150	59	83
Link Distance (ft)		1687		1645		1589		2361
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)	150		150		300		300	
Storage Blk Time (%)	0	0	0	0				
Queuing Penalty (veh)	0	0	0	0				

Intersection: 200: CR 15 & US 169 N Ramp

Movement	WB	WB	NB	NB	NB	SB	SB	SB
Directions Served	LT	R	T	T	R	L	T	T
Maximum Queue (ft)	157	81	88	84	76	96	154	76
Average Queue (ft)	80	42	38	37	33	34	69	24
95th Queue (ft)	131	71	71	71	60	71	124	52
Link Distance (ft)	1485		985	985			2024	2024
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)		210			320	200		
Storage Blk Time (%)								
Queuing Penalty (veh)								

Intersection: 210: CR 15 & US 169 S Ramp

Movement	EB	EB	WB	WB	NB	NB	NB	NB	SB	SB	SB	SB
Directions Served	LT	R	LT	R	L	T	T	R	L	T	T	R
Maximum Queue (ft)	119	47	180	53	64	67	108	154	157	113	80	45
Average Queue (ft)	51	9	74	21	21	28	51	73	78	52	19	12
95th Queue (ft)	99	30	138	41	50	56	95	130	138	97	53	32
Link Distance (ft)	1041		1220			1171	1171			985	985	
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)		115		250	165			270	370			175
Storage Blk Time (%)	1		0									
Queuing Penalty (veh)	0		0									

Intersection: 220: CR 15 & CR 16

Movement	EB	EB	EB	EB	WB	WB	WB	WB	NB	NB	NB	SB
Directions Served	L	T	T	R	L	T	T	R	L	T	R	L
Maximum Queue (ft)	314	180	179	66	78	50	56	157	133	261	52	197
Average Queue (ft)	158	31	15	24	28	22	13	74	59	136	21	95
95th Queue (ft)	314	145	99	51	62	48	40	125	111	234	41	161
Link Distance (ft)		1783	1783			2699	2699			1899		
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	265			265	415			285	215		215	430
Storage Blk Time (%)	7									2		
Queuing Penalty (veh)	3									5		

Intersection: 220: CR 15 & CR 16

Movement	SB	SB
Directions Served	T	R
Maximum Queue (ft)	133	61
Average Queue (ft)	46	21
95th Queue (ft)	101	46
Link Distance (ft)	1171	1171
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 230: CR 15 & 128th St W

Movement	EB	EB	WB	WB	NB	NB	SB
Directions Served	L	TR	L	TR	L	TR	L
Maximum Queue (ft)	96	88	58	106	32	11	40
Average Queue (ft)	37	28	22	43	6	0	10
95th Queue (ft)	76	56	51	81	24	6	32
Link Distance (ft)		1661		1957		1244	
Upstream Blk Time (%)							
Queuing Penalty (veh)							
Storage Bay Dist (ft)	100		100		300		300
Storage Blk Time (%)	1	0	0	1			
Queuing Penalty (veh)	1	0	0	0			

Zone Summary

Zone wide Queuing Penalty: 36

10: Rail Frontage & MN 41 Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.3	0.0	0.1	2.2	0.3
Total Del/Veh (s)	15.4	11.8	26.6	33.0	15.1

20: Dem Con Dr/Frontage Rd & MN 41 Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	0.0	1.9	1.7	0.2
Total Del/Veh (s)	18.4	24.1	27.0	39.5	23.3

30: Chestnut Blvd & Emery Way Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	0.0	0.6	1.7	0.4
Total Del/Veh (s)	11.4	9.5	28.2	15.1	12.9

40: CR 69 & Chestnut Blvd/CR 78 Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	0.0	0.6	0.0	0.0
Total Del/Veh (s)	30.6	26.7	34.5	30.9	29.9

50: CR 73 & CR 78 Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	0.0	0.1	0.1	0.0
Total Del/Veh (s)	7.4	7.2	25.9	23.1	9.2

60: CSAH 15/CR 15 & CR 78 Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	0.0	0.8	0.0	0.1
Total Del/Veh (s)	25.1	23.9	32.0	22.0	24.5

70: CR 78 & CR 77 Performance by approach

Approach	EB	WB	SB	All
Denied Del/Veh (s)	0.0	0.0	1.6	0.3
Total Del/Veh (s)	6.2	7.4	28.9	11.1

80: CR 79 & CR 78 Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	1.5	0.6	1.3	0.9
Total Del/Veh (s)	26.0	14.0	23.6	37.8	23.5

100: CR 69 & Chaparral Ave/10th Ave Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	1.1	1.0	0.0	0.8	0.6
Total Del/Veh (s)	12.6	25.1	6.9	7.5	10.2

105: CR 69 & Vierling Dr Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	1.5	1.8	0.0	0.0	0.3
Total Del/Veh (s)	23.7	25.0	9.8	7.4	11.9

110: CR 69 & US 169 N Ramp Performance by approach

Approach	WB	NB	SB	All
Denied Del/Veh (s)	1.2	0.0	0.0	0.3
Total Del/Veh (s)	19.3	11.2	6.9	11.1

120: CR 69 & US 169 S Ramp Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.2	2.0	0.0	0.0	0.4
Total Del/Veh (s)	21.1	16.9	10.4	11.6	13.0

130: CR 69 & Subdistrict B North Access/Subdistrict A North Access Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	2.3	1.2	0.0	0.0	0.5
Total Del/Veh (s)	27.9	18.3	13.3	9.8	14.7

140: CR 69 & Subdistrict B South Access/Subdistrict A South Access Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	1.1	1.0	0.0	0.0	0.4
Total Del/Veh (s)	18.1	16.4	13.5	15.1	15.4

200: CR 15 & US 169 N Ramp Performance by approach

Approach	WB	NB	SB	All
Denied Del/Veh (s)	2.1	0.0	0.7	1.1
Total Del/Veh (s)	15.3	12.1	33.2	20.4

210: CR 15 & US 169 S Ramp Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	1.0	1.7	0.0	0.1	0.4
Total Del/Veh (s)	21.4	19.6	13.5	17.9	17.0

220: CR 15 & CR 16 Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	1.5	1.3	0.0	0.0	0.5
Total Del/Veh (s)	37.7	19.2	22.0	11.8	20.2

230: CR 15 & 128th St W Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.7	0.8	0.0	0.0	0.1
Total Del/Veh (s)	15.7	23.4	4.0	5.0	6.8

Total Zone Performance

Denied Del/Veh (s)			1.2		
Total Del/Veh (s)			1201.1		

Intersection: 10: Rail Frontage & MN 41

Movement	EB	EB	EB	EB	WB	WB	WB	WB	NB	SB	SB
Directions Served	L	T	T	R	L	T	T	R	LTR	L	TR
Maximum Queue (ft)	76	312	295	26	80	203	208	54	77	171	150
Average Queue (ft)	25	143	126	4	27	81	88	16	26	78	53
95th Queue (ft)	58	260	239	17	64	167	168	43	59	137	109
Link Distance (ft)		3200	3200			1116	1116		821		937
Upstream Blk Time (%)											
Queuing Penalty (veh)											
Storage Bay Dist (ft)	250			250	250			250		150	
Storage Blk Time (%)		1	0			0	0			1	0
Queuing Penalty (veh)		0	0			0	0			1	0

Intersection: 20: Dem Con Dr/Frontage Rd & MN 41

Movement	EB	EB	EB	EB	WB	WB	WB	WB	NB	NB	SB	SB
Directions Served	L	T	T	R	L	T	T	R	LT	R	L	T
Maximum Queue (ft)	130	325	295	21	87	287	317	58	99	64	164	271
Average Queue (ft)	39	138	109	3	29	147	180	15	31	19	116	61
95th Queue (ft)	95	270	236	13	69	251	285	40	72	48	179	220
Link Distance (ft)		1116	1116			1192	1192		563			1248
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	285			275	440			230		60	125	
Storage Blk Time (%)		1	1				2		3	1	17	0
Queuing Penalty (veh)		1	0				2		1	0	5	0

Intersection: 20: Dem Con Dr/Frontage Rd & MN 41

Movement	SB
Directions Served	R
Maximum Queue (ft)	115
Average Queue (ft)	43
95th Queue (ft)	87
Link Distance (ft)	1248
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 30: Chestnut Blvd & Emery Way

Movement	EB	EB	EB	EB	WB	WB	WB	WB	NB	NB	SB	SB
Directions Served	L	T	T	R	L	T	T	R	LT	R	LT	R
Maximum Queue (ft)	157	112	79	35	56	106	137	38	163	30	134	164
Average Queue (ft)	65	30	8	6	16	37	48	9	75	8	54	72
95th Queue (ft)	126	80	44	22	42	86	109	27	140	25	106	129
Link Distance (ft)		956	956			1024	1024		1183		1779	
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	300			300	490			490		250		250
Storage Blk Time (%)												0
Queuing Penalty (veh)												0

Intersection: 40: CR 69 & Chestnut Blvd/CR 78

Movement	EB	EB	WB	WB	WB	NB	NB	SB	SB
Directions Served	L	TR	L	T	R	L	TR	L	TR
Maximum Queue (ft)	224	323	76	346	120	62	196	240	288
Average Queue (ft)	110	163	24	181	41	23	85	115	146
95th Queue (ft)	189	290	59	299	91	56	156	196	251
Link Distance (ft)		2628		2579			2610		1589
Upstream Blk Time (%)									
Queuing Penalty (veh)									
Storage Bay Dist (ft)	300		300		300	300		300	
Storage Blk Time (%)	0	1		1					0
Queuing Penalty (veh)	0	2		2					1

Intersection: 50: CR 73 & CR 78

Movement	EB	EB	WB	WB	NB	SB
Directions Served	L	TR	L	TR	LTR	LTR
Maximum Queue (ft)	53	12	69	8	134	110
Average Queue (ft)	21	1	28	0	51	48
95th Queue (ft)	47	7	57	5	104	88
Link Distance (ft)		2579		2539	2596	1489
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)	300		300			
Storage Blk Time (%)						
Queuing Penalty (veh)						

Intersection: 60: CSAH 15/CR 15 & CR 78

Movement	EB	EB	WB	WB	WB	NB	NB	SB	SB	SB
Directions Served	L	TR	L	T	R	L	TR	L	T	R
Maximum Queue (ft)	241	297	82	275	126	103	173	189	206	145
Average Queue (ft)	109	135	33	150	51	42	84	89	102	57
95th Queue (ft)	193	243	69	247	96	83	149	156	178	111
Link Distance (ft)		2539		2604			2754		1244	
Upstream Blk Time (%)										
Queuing Penalty (veh)										
Storage Bay Dist (ft)	300		300		300	300		300		300
Storage Blk Time (%)	0	0		0						
Queuing Penalty (veh)	0	1		1						

Intersection: 70: CR 78 & CR 77

Movement	EB	WB	SB	SB
Directions Served	L	TR	L	R
Maximum Queue (ft)	57	20	240	168
Average Queue (ft)	18	1	93	48
95th Queue (ft)	46	9	198	117
Link Distance (ft)		2617	1617	
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)	300			100
Storage Blk Time (%)			16	0
Queuing Penalty (veh)			17	0

Intersection: 80: CR 79 & CR 78

Movement	EB	EB	WB	WB	WB	NB	NB	SB	SB
Directions Served	L	TR	L	T	R	L	TR	L	TR
Maximum Queue (ft)	133	387	169	219	57	71	143	266	191
Average Queue (ft)	20	215	71	105	23	21	62	126	70
95th Queue (ft)	85	354	125	185	49	54	117	225	150
Link Distance (ft)		2617		2326			2415		2726
Upstream Blk Time (%)									
Queuing Penalty (veh)									
Storage Bay Dist (ft)	300		300		300	300		300	
Storage Blk Time (%)		3						1	0
Queuing Penalty (veh)		1						1	0

Intersection: 100: CR 69 & Chaparral Ave/10th Ave

Movement	EB	EB	WB	WB	NB	NB	NB	NB	SB	SB	SB	SB
Directions Served	L	TR	L	TR	L	T	T	R	L	T	T	R
Maximum Queue (ft)	94	115	168	161	54	101	126	55	96	93	112	42
Average Queue (ft)	39	44	85	24	15	26	43	18	37	35	46	12
95th Queue (ft)	81	85	146	76	43	74	97	46	75	79	93	35
Link Distance (ft)	1171		2044		1500		1500		2074		2074	
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	125		125		300			300	430			300
Storage Blk Time (%)	0	0	3	0								
Queuing Penalty (veh)	0	0	2	0								

Intersection: 105: CR 69 & Vierling Dr

Movement	EB	EB	WB	WB	NB	NB	NB	NB	SB	SB	SB	SB
Directions Served	L	TR	L	TR	L	T	T	R	L	T	T	R
Maximum Queue (ft)	134	157	104	103	102	89	120	53	57	106	119	45
Average Queue (ft)	59	60	41	36	34	30	50	17	15	37	53	15
95th Queue (ft)	109	119	83	76	75	72	96	43	44	80	102	38
Link Distance (ft)	1182		1063		1442		1442		1500		1500	
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	150		265		380			380	270			260
Storage Blk Time (%)	0	0										
Queuing Penalty (veh)	0	1										

Intersection: 110: CR 69 & US 169 N Ramp

Movement	WB	WB	NB	NB	NB	SB	SB	SB
Directions Served	LT	R	L	T	T	T	T	R
Maximum Queue (ft)	267	83	145	92	115	120	49	121
Average Queue (ft)	140	40	53	29	45	42	9	43
95th Queue (ft)	222	69	111	69	92	93	31	90
Link Distance (ft)	1153			899	899	1442	1442	
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)		300	340				300	
Storage Blk Time (%)	0							
Queuing Penalty (veh)	0							

Intersection: 120: CR 69 & US 169 S Ramp

Movement	EB	WB	WB	NB	NB	NB	NB	SB	SB	SB	SB
Directions Served	LTR	LT	R	L	T	T	R	L	T	T	R
Maximum Queue (ft)	158	199	126	88	107	113	128	170	118	85	17
Average Queue (ft)	67	90	42	28	51	43	52	77	41	15	2
95th Queue (ft)	126	159	90	68	98	92	99	140	93	52	10
Link Distance (ft)	1005	1008			940	940			899	899	
Upstream Blk Time (%)											
Queuing Penalty (veh)											
Storage Bay Dist (ft)			300	210			285	340			105
Storage Blk Time (%)		0								0	
Queuing Penalty (veh)		0								0	

Intersection: 130: CR 69 & Subdistrict B North Access/Subdistrict A North Access

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	TR	L	TR	L	TR	L	TR
Maximum Queue (ft)	195	154	87	114	78	198	147	233
Average Queue (ft)	99	52	37	48	28	89	56	87
95th Queue (ft)	164	111	74	91	60	169	115	180
Link Distance (ft)		1053		1272		2361		384
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)	150		150		300		300	
Storage Blk Time (%)	2	0		0				0
Queuing Penalty (veh)	3	0		0				0

Intersection: 140: CR 69 & Subdistrict B South Access/Subdistrict A South Access

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	TR	L	TR	L	TR	L	TR
Maximum Queue (ft)	140	159	113	162	113	180	102	238
Average Queue (ft)	65	64	51	59	44	79	38	106
95th Queue (ft)	115	114	92	117	87	150	77	193
Link Distance (ft)		1687		1645		1589		2361
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)	150		150		300		300	
Storage Blk Time (%)	0	0	0	0				0
Queuing Penalty (veh)	1	0	0	0				0

Intersection: 200: CR 15 & US 169 N Ramp

Movement	WB	WB	NB	NB	NB	SB	SB	SB
Directions Served	LT	R	T	T	R	L	T	T
Maximum Queue (ft)	323	252	119	112	78	224	363	306
Average Queue (ft)	163	81	55	51	34	95	173	92
95th Queue (ft)	268	169	100	94	66	208	353	274
Link Distance (ft)	1485		985	985			2024	2024
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)		210			320	200		
Storage Blk Time (%)	2	0				8	4	0
Queuing Penalty (veh)	10	0				24	5	0

Intersection: 210: CR 15 & US 169 S Ramp

Movement	EB	EB	WB	WB	NB	NB	NB	NB	SB	SB	SB	SB
Directions Served	LT	R	LT	R	L	T	T	R	L	T	T	R
Maximum Queue (ft)	155	77	177	67	70	75	112	169	334	204	162	34
Average Queue (ft)	63	18	90	27	20	27	41	71	146	76	32	8
95th Queue (ft)	123	54	152	52	54	60	90	136	268	153	88	24
Link Distance (ft)	1041		1220			1171	1171			985	985	
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)		115		250	165			270	370			175
Storage Blk Time (%)	2	0							0		0	
Queuing Penalty (veh)	1	0							1		0	

Intersection: 220: CR 15 & CR 16

Movement	EB	EB	EB	EB	WB	WB	WB	WB	NB	NB	NB	SB
Directions Served	L	T	T	R	L	T	T	R	L	T	R	L
Maximum Queue (ft)	261	109	56	98	138	61	52	118	248	274	42	150
Average Queue (ft)	122	24	14	38	62	25	18	54	89	93	12	68
95th Queue (ft)	239	72	39	78	116	53	45	96	200	217	32	129
Link Distance (ft)		1783	1783			2699	2699			1899		
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	265			265	415			285	215		215	430
Storage Blk Time (%)	3	0							3	0		
Queuing Penalty (veh)	1	0							15	0		

Intersection: 220: CR 15 & CR 16

Movement	SB	SB
Directions Served	T	R
Maximum Queue (ft)	175	46
Average Queue (ft)	70	13
95th Queue (ft)	144	34
Link Distance (ft)	1171	1171
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 230: CR 15 & 128th St W

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	TR	L	TR	L	TR	L	R
Maximum Queue (ft)	76	103	100	83	39	6	76	2
Average Queue (ft)	22	36	39	31	13	0	32	0
95th Queue (ft)	56	77	82	63	36	5	62	2
Link Distance (ft)		1661		1957		1244		
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)	100		100		300		300	300
Storage Blk Time (%)		1	2	0				
Queuing Penalty (veh)		0	1	0				

Zone Summary

Zone wide Queuing Penalty: 104

Attachment G

Water Use Memo and Comprehensive Water System Plan Update



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MEMORANDUM

TO: Shakopee Public Utilities

FROM: Chad T. Katzenberger

DATE: August 19, 2019

RE: Jackson Township AUAR – Water System Demand Projections
SEH No. SHPUC 140940 14.00

BACKGROUND

This memo provides an estimate of projected water use for the land area to be developed in the identified AUAR Study area. Land use projections and study area information was provided by the City of Shakopee and SRF Consulting Group in August of 2019. Additional, per capita water use figures developed as part of SPUC's 2018 Compressive water plan were utilized for residential water use projections. The land use areas contained in the AUAR are broken down into seven sub-districts and represent anticipated development through the year 2040. The demand projections presented in this memo represent the expected Average Daily and Maximum Daily municipal water demand potential for the AUAR study area.

PROPOSED LAND USE & DEMAND PROJECTIONS

A breakdown of projected land use for the AUAR study area was provided by the City of Shakopee, included in attachment A. This information includes land use development characteristics, developable acreage and other applicable information such as commercial building square footage. This information was then applied to the water use projection calculations provided in Attachment B.

PROJECTED WATER SYSTEM DEMAND

Results of the land used base water demand projections are presented in Attachment B. The time at which this expected development occurs will be strongly dependent on market forces. These water use projections are based on anticipated land use and help to understand the total ultimate water system needs, independent of time. Assuming total build out of the AUAR study area, the study area has a projected **Average Daily Demand of 1.2 MGD** (Million Gallons per Day) and a **Maximum Daily Demand of 3.4 MGD**

SUMMARY

The information documented above provides for a reasonable estimate of future water system demands. These demands can be updated further as additional development information is available.

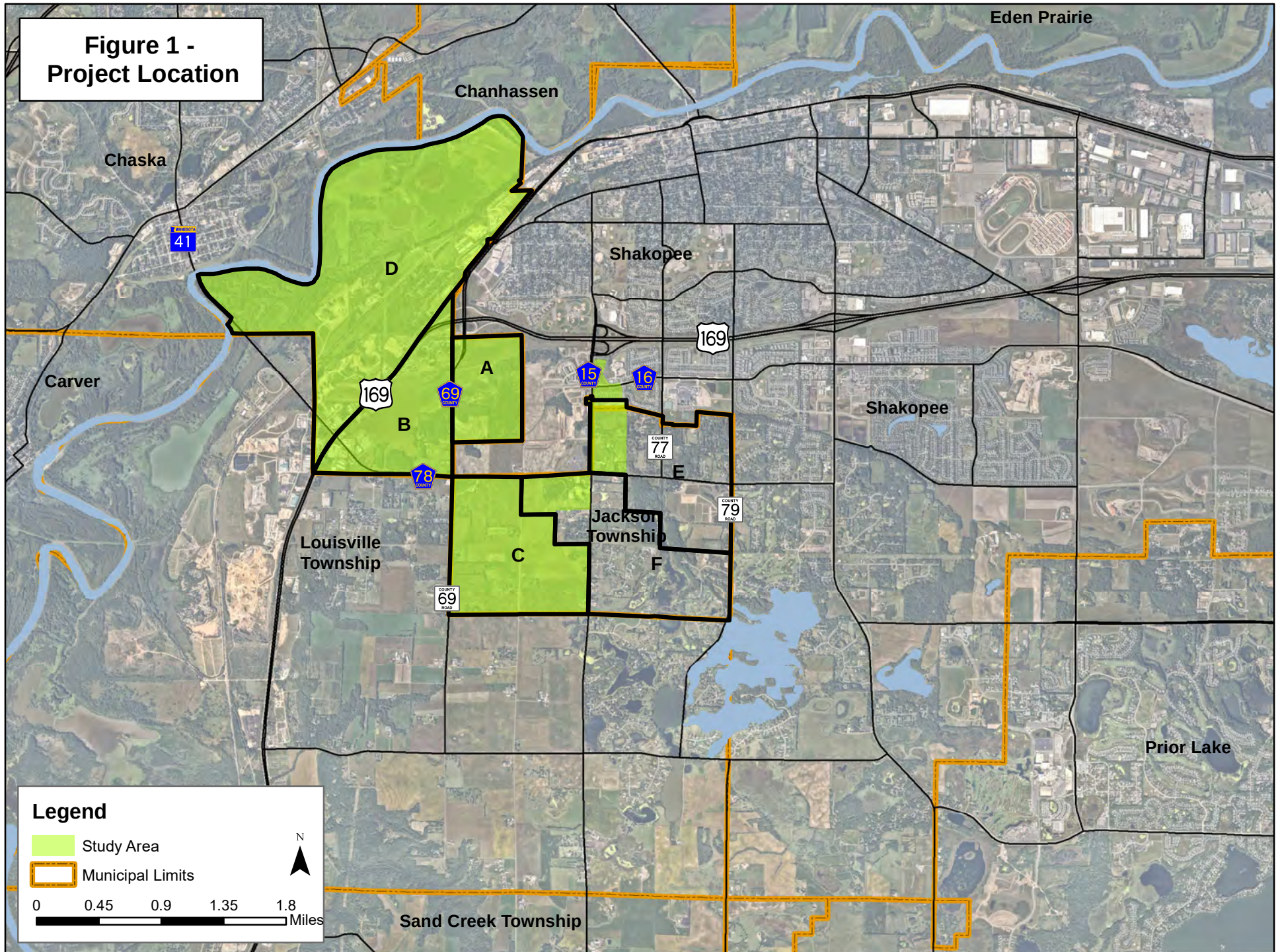
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Attachment

c: Miles Jensen, SEH

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**Figure 1 -
Project Location**



Attachment A
Jackson Township AUAR Development Area

Sub Area	2040 Land Use	Acres	Res. Units (EA)	N'Hood Retail (SF)	HWY Retail (SF)	Office (SF)	W-house (SF)	Mfg. (SF)
A	Mixed Residential	22	91	81,991				
A	Mixed Use Center	38			594,646	84,091		
A	Mixed Use Employment Center	25	31		41,706	159,240	90,994	90,994
A	Suburban Edge Residential	0						
A	Suburban Residential	67	161					
B	Mixed Residential	47	165	219,195				
B	Mixed Use Center	45			691,370	97,769		
B	Mixed Use Employment Center	214	257		350,955	1,340,008	765,719	765,719
B	Suburban Edge Residential	0						
B	Suburban Residential	0						
C	Mixed Residential	18	64	83486				
C	Mixed Use Center	0						
C	Mixed Use Employment Center	0						
C	Suburban Edge Residential	300	120					
C	Suburban Residential	166	266					
D	Mixed Residential	0						
D	Mixed Use Center	34			523,795	74,072		
D	Mixed Use Employment Center	247			212,672	1,353,369	1,082,695	1,082,695
D	Suburban Edge Residential	0						
D	Suburban Residential	57	230					
E	Mixed Residential	3	11	15007				
E	Mixed Use Center	0						
E	Mixed Use Employment Center	0						
E	Suburban Edge Residential	14	6					
E	Suburban Residential	48	96					
F	Mixed Residential	0						
F	Mixed Use Center	0						
F	Mixed Use Employment Center	0						
F	Suburban Edge Residential	0						
F	Suburban Residential	0						
G	Mixed Residential	0						
G	Mixed Use Center	10	156		112,122			
G	Mixed Use Employment Center	0						
G	Suburban Edge Residential	0						
G	Suburban Residential	10	28					

Data provided by the City of Shakopee 8/6/2019

Attachment B
Future Water Supply Needs - AUAR Area

Sub Area	2040 Land Use	Acres	Res. Units (EA)	N'Hood Retail (SF)	HWY Retail (SF)	Office (SF)	W-house (SF)	Mfg. (SF)	Avg. Day Demand (gpd)
A	Mixed Residential	22	91	81,991					31,827
A	Mixed Use Center	38			594,646	84,091			62,421
A	Mixed Use Employment Center	25	31		41,706	159,240	90,994	90,994	37,821
A	Suburban Residential	67	161						43,277
B	Mixed Residential	47	165	219,195					64,044
B	Mixed Use Center	45			691,370	97,769			72,574
B	Mixed Use Employment Center	214	257		350,955	1,340,008	765,719	765,719	317,227
C	Mixed Residential	18	64	83486					24,703
C	Suburban Edge Residential	300	120						32,256
C	Suburban Residential	166	266						71,501
D	Mixed Use Center	34			523,795	74,072			54,984
D	Mixed Use Employment Center	247			212,672	1,353,369	1,082,695	1,082,695	267,452
D	Suburban Residential	57	230						61,824
E	Mixed Residential	3	11	15007					4,305
E	Suburban Edge Residential	14	6						1,613
E	Suburban Residential	48	96						25,805
G	Mixed Use Center	10	156		112,122				52,005
G	Suburban Residential	10	28						7,526
Totals			1,682	399,679	2,527,266	3,108,549	1,939,408	1,939,408	1,230,000
*Maximum Day Demand (2.77 Multiplier)									3,410,000

Demand Assumptions		
**Persons per housing unit	3.2	persons
*Residential per capita AD water use	84	gpc/d
Retail water Use	0.090	gpd/sf
Office Water Use	0.107	gpd/sf
Warehouse	0.039	gpd/sf
Manufacturing	0.056	gpd/sf

*Based on SPUC 2012 Historical Data (dry year)

**Figure provided by City of Shakopee

Non-Residential Water Use Figures Estimated from Met Council SAC City Determination Worksheet



Comprehensive Water System Plan Update

Comprehensive Water Plan - 2019 Supplement

Shakopee, Minnesota

SHPUC 140940 | October 4, 2019



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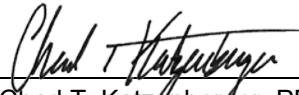
Comprehensive Water System Plan Update

Comprehensive Water Plan - 2019 Supplement
Shakopee, Minnesota

SEH No. SHPUC 140940

October 4, 2019

I hereby certify that this report was prepared by me or under my direct supervision, and that I am a duly Licensed Professional Engineer under the laws of the State of Minnesota.



Chad T. Katzenberger, PE

Date: October 4, 2019

License No.: 46613

Short Elliott Hendrickson Inc.
3535 Vadnais Center Drive
St. Paul, MN 55110-5196
651.490.2000



Executive Summary

The purpose of this report is to provide information regarding the Shakopee PUC existing and anticipated water system conditions to aid in capital planning. This report serves as an update to the 2004 Comprehensive Water Plan Update, as population and water use projections have changed since 2004 projections. Existing water supplies, storage tanks and the distribution system were analyzed to establish the current conditions of the water system. Trends from historical water use data were used to determine projection estimates through the year 2040.

The existing Shakopee PUC water system includes groundwater wells, storage tanks, and distribution facilities. This report evaluates each category to determine existing and projected water usage.

Existing Facilities Include:

- Eighteen groundwater wells that pump water from multiple aquifers. Combined the wells have a total supply capacity of 24.4 million gallons a day (MGD) and a reliable supply capacity of 20.3 MGD.
- Four elevated storage tanks with a total storage capacity of 4.25 million gallons (MG).
- Three ground storage tanks with a total storage capacity of 7.0 MG.
- Four pumping stations that supply water to four different pressure zones within the system.

Water facilities are often designed to meet maximum day demands. Historical data shows that over the last 10 years maximum day demands ranged from 9.94 to 16.26. The maximum day demands are often impacted by seasonal conditions such as dry and hot summers, land use patterns and population.

Population projections indicate a large increase in population by the year 2040. This is partially due to the annexation of Jackson Township into the Shakopee City limits. Projected maximum daily demands indicate that additional water supplies and interconnections between pressure zones will be needed to meet future maximum day demands.

Recommended Improvements Include:

- Construction of additional supply wells No. 22, No. 23 & No. 24.
- Upgrading Well No. 9 Booster Station with a flow control valve to allow water to move from First High Zone to Normal Zone.
- Construction of a 750,000 gallon elevated storage tank be constructed in the western portion of the Second High Pressure Zone
- A 250,000 gallon elevated storage tank be constructed in the central portion of the Second High Pressure Zone
- Construction of new booster station facility to provide redundant water transfer between the Normal pressure zone and 1st High Pressure Zone utilizing booster pumping and pressure reducing flow control.
- Trunk water main construction and other water distribution features to accommodate water system expansion and development.

Contents

Certification Page
Executive Summary
Table of Contents

1	Introduction	1
1.1	Scope	1
2	Existing Water System	2
3	Population & Community Growth	2
3.1	Population Forecast.....	2
4	Water Requirements	3
4.1	Water Consumption History.....	3
4.2	Water Demands By Customer Category	3
4.3	Per Capita Usage	5
4.4	Water Consumption & Pumpage Projections.....	5
4.5	Potential Expansion Area – Louisville Township	10
5	Water System Evaluation	10
5.1	Water Supply Sources and Water Quality	10
5.2	Total System Reliable Supply Capacity.....	13
5.3	Reliable Pumping Capacity & Storage.....	15
5.4	Water Distribution System Analysis.....	18
6	Recommended Improvements	19
6.1	Supply Improvements.....	19
6.2	Interzone Transfer Improvements.....	21
6.3	Water Quality Improvements	23
6.4	Storage Improvements	24
6.5	Water Main Improvements	25
6.6	System Planning.....	26
7	Capital Improvements Plan	26
7.1	Supply	27
7.2	Treatment.....	27
7.3	Storage	27
7.4	Water Booster Stations and Flow Control.....	27

Contents (continued)

7.5	Distribution.....	27
7.6	CIP Costs	28
7.7	Trigger Chart	29

List of Tables

Table 3-1 – Projected Population Data.....	2
Table 4-1 – Historical Water Use	3
Table 4-2 – Historical Average Water Sales by Customer Class	4
Table 4-3 – Historical Per Capita Water Use by Customer Class	5
Table 4-4 – Future Water Needs Projections	6
Table 4-5 – Projected Water Use – By Population	6
Table 4-6 – Summary of Water Needs Projections per Service Zone	7
Table 4-7 – Projected Water Ultimate Consumption By Land Use	9
Table 5-1 – Existing Water Production Wells	15
Table 5-2 – Existing Water Storage Facilities.....	16
Table 5-3 – Summary of Future Water Storage Needs - By Pressure Zone	17
Table 5-4 – Summary of Interzone Pumping/Transfer Needs	18
Table 7-1 – Proposed Water System Improvements – Through 2040.....	28

List of Figures

Figure 2-1 – Existing Water System Model Map
Figure 4-1 – Future Land Use Planning
Figure 6-1 – Proposed 2040 Water System Improvements
Figure 6-2 – 2040 Water System Static Pressures
Figure 6-3 – 2040 Water System Calculated Available Fire Flow

List of Appendices

Appendix A	Water Quality Data
Appendix B	AUAR Water Use Projections
Appendix C	Water Supply and Storage Calculations

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Comprehensive Water System Plan Update

Comprehensive Water Plan - 2019 Supplement

Prepared for Shakopee Public Utilities Commission

1 Introduction

In the year 2018, Shakopee Public Utilities (SPUC) completed a comprehensive water system evaluation which was summarized in the 2018 Comprehensive Water System Plan, published September 13, 2018. Since this system evaluation was published, the City of Shakopee has been making progress on the City's overall Comprehensive Plan. Through this process, new population projections have been developed and anticipated land use mapping has been developed. More specifically, an AUAR (Alternative Urban Areawide Review) has been in process to evaluate the development of areas along the western edge of the City that will be annexed into Shakopee from Jackson Township. The AUAR development has resulted in updated land use estimated that can be used to inform water demand estimates and projections. In addition, new population forecasts can be utilized to project corresponding water use growth.

In a similar fashion to the 2018 plan, present and future water needs of the SPUC water system have been evaluated, and recommendations made concerning improvements necessary to maintain an adequate level of water service. Current and future water needs were evaluated over a planning period extending to the year 2040. This report will serve as a plan to guide future expansion and redevelopment of the water system.

1.1 Scope

The primary purpose of this report is to update the previous 2018 plan in light of new planning information. In general, work completed in the previous report that is still valid will remain unchanged. Below is a summary of the outlined scope items that this plan supplement intends on addressing.

1. **Provide Updated Water System Demand Projections:** In conjunction with new population forecasts and land use projections, anticipated water system demand projections can be updated with new supporting data.
2. **Complement The City of Shakopee 2040 Comprehensive Plan:** Update of water use projections from data generated though the City's comprehensive planning process will help assure that the projected growth will be served by a reliable water supply.
3. **Update Projected Water System Facility Needs:** In light of water use forecast changes, the required facilities to support the growth are reviewed and developed to meet the projected need.
4. **Update Cost Estimates for Projected Water Facilities:** Updated costs for proposed facilities are provided to help guide future financial decisions.
5. **Support Water Connection Fee Study:** A parallel study will be conducted to develop recommended water system fees for future water system users. The foundation of these fees is related to the costs of the required water system facilities. This study will be the first step to inform that process.

As noted in the 2018 water system plan, water needs change with time, and municipal water system planning is a continuous function. Therefore, the longer term projections and improvements discussed in this report should be reviewed, re-evaluated and modified as necessary, to assure the adequacy of future planning efforts. Proper future planning will help assure that system expansion is coordinated and constructed in the most effective manner.

2 Existing Water System

A summary of the existing water system is summarized in the 2018 comprehensive water system plan. In short, the SPUC water system has grown to include seven storage tanks, 18 groundwater supply wells and four pumping stations. The system utilizes four pressure zones: the Normal Zone, First High Zone, East Zone and the Second High Zone. The East Zone has the same hydraulic grade line as the Second High Zone. The Second High Zone is also separated out into separate sections. The separation is due to how development has occurred with respect to the elevation of the landscape.

3 Population & Community Growth

This section summarizes the planning assumptions made regarding future service area characteristics for SPUC water service area. Since 2018, new population projections and land use information is available, below is a summary of the new data which will be utilized for this report.

3.1 Population Forecast

There is generally a close relationship between a community's population and total water consumption volumes. Future water sales can be expected to generally reflect future changes in service area population. Similarly, commercial, public, and industrial water consumption will also tend to vary proportionally.

The City's estimated population in 2018 was 41,506 according to the State of Minnesota Demographer. Table 3-1 below summarizes projected future population of the City as provided from the City's 2040 Comprehensive Plan. These population projections will inform the future water use projections

Table 3-1 – Projected Population Data

Year	Population	Annual Growth Rate (%)
2020	47,800	1.7%
2025	51,850	1.7%
2030	55,900	1.6%
2035	59,250	1.2%
2040	62,600	1.1%

Source: City of Shakopee 2040 Comprehensive Plan

Projections noted above indicate SPUC's service area total population is expected to increase to approximately 62,600 people by the year 2040. For this study, in calculating per capita water use, it is estimated that approximately 3,000 people are served by private wells in rural residential areas. It is assumed that as the boundaries of the City grow and rural areas are annexed, a similar percentage of residents (7%) may remain on private wells through the planning period. As a result, future water users are expected to grow at a rate similar to the population growth.

4 Water Requirements

This section updates water use history with current information and provides for new water use projections based on new population data.

4.1 Water Consumption History

As previously completed in the Water Comprehensive Plan, an analysis was made of past water consumption characteristics by reviewing annual pumpage and water sales records for the period from 2000 to 2018. Average and maximum day water consumption during this period, together with the amount of water sold in each customer category, was analyzed. Projections of future water requirements are based on the results of this analysis, coupled with estimates of population and community growth.

4.2 Water Demands By Customer Category

A historical summary of utility customers served is provided in Table 4-2. Residential customers, over the past five years, have accounted for 60 percent of the SPUC's sales while commercial and Industrial customers have accounted for 40 percent of the sales.

Table 4-1 – Historical Water Use

Year	Estimated City Population	Estimated Water Service Population	Average Day (AD) Water Pumped (MGD)	Maximum Day (MD) Water Pumped (MGD)	MD:AD Ratio	AD Per Capita Water Use (gpd)	MD Per Capita Water Use (gpd)
2007	33,022	30,020	5.56	14.68	2.64	185	489
2008	33,748	30,748	5.09	13.59	2.67	165	442
2009	34,525	31,525	5.12	12.83	2.51	162	407
2010	37,366	34,366	4.71	10.62	2.26	137	309
2011	38,000	35,000	4.81	10.80	2.25	137	309
2012	38,730	35,730	5.87	16.26	2.77	164	455
2013	39,167	36,167	4.94	13.38	2.71	137	370
2014	39,448	36,448	4.59	10.88	2.37	126	298
2015	39,981	36,981	4.52	9.94	2.20	122	269
2016	40,743	37,743	4.74	11.58	2.44	126	307
2017	41,125	38,125	4.87	13.23	2.71	128	347
2018	41,506	38,506	5.05	10.57	2.09	131	275
5 Year Average			4.79	11.48	2.40	128	301
<i>Maximum</i>			<i>5.87</i>	<i>16.26</i>	<i>2.77</i>	<i>185</i>	<i>489</i>

Service Population = City population less 3,000+ rural residential residents on private wells.

Source: DNR Water Use Records, State demographer

Table 4-2 – Historical Average Water Sales by Customer Class

Year	Water Sold			Water Pumped	
	Average Day Residential Water Sold (MGD)	Average Day Commercial-Industrial Water Sold (MGD)	Total Average Day Water Sold (MGD)	Average Day Water Pumped (MGD)	Unmetered & Unaccounted Water (%)
2007	3.11	2.10	5.21	5.56	6.3%
2008	2.94	1.88	4.82	5.09	5.2%
2009	3.09	1.82	4.92	5.12	3.9%
2010	2.68	1.72	4.40	4.71	6.5%
2011	2.81	1.80	4.61	4.81	4.1%
2012	3.25	2.06	5.31	5.87	9.5%
2013	2.85	1.78	4.66	4.94	5.7%
2014	2.64	1.63	4.31	4.59	6.1%
2015	2.50	1.68	4.22	4.52	6.8%
2016	2.68	1.76	4.48	4.74	5.6%
2017	2.50	1.80	4.31	4.83	4.6%
2018	2.67	1.88	4.54	5.05	5.1%
5-Year Average	2.63	1.76	4.41	4.76	5.4%
% of Total	59%	41%	100%		

Source: DNR Water Use Records, City Records

4.3 Per Capita Usage

Historical per capita water use, including 2017 and 2018 production years is summarized below.

Table 4-3 – Historical Per Capita Water Use by Customer Class

Year	Sales			Water Pumped	
	Residential Daily Per Capita Water Use (gpcd)	Commercial-Industrial Daily Per Capita Water Use (gpcd)	Total Average Day Water Sold (gpcd)	Total Average Day Water Pumped (gpcd)	Total Maximum Day Water Pumped (gpcd)
2007	103	70	174	185	489
2008	96	61	157	165	442
2009	98	58	156	162	407
2010	78	50	128	137	309
2011	80	52	132	137	309
2012	91	58	149	164	455
2013	79	49	128	137	370
2014	72	45	117	126	298
2015	68	45	113	122	269
2016	71	47	118	126	307
2017	66	47	113	128	347
2018	69	49	118	131	275
5-Year Average	71	47	118	128	301
% of Total	60%	40%	100%		

Per capita water use accounts for 3,000 residents not connected to municipal water.

Source: DNR Water Use Records, City Records

4.4 Water Consumption & Pumpage Projections

Population growth, development, customer water needs, conservation, and climate all affect future water needs. This section provides a projection of water needs to the year 2040 based on these factors. One projection is based on anticipated population growth and conservation. A second projection is based on buildout of all service areas, which represents ultimate system demand potential.

4.4.1 System Wide Water Needs Projections

4.4.1.1 Projected Water Use By Population

Table 4-4 summarizes the population based water needs projections for current water use in a drought year. Projects were solely based on the values from year 2012, as 2012 represents a hot and dry year when the system would be stressed for water. With the assumptions shown in the table, by 2040, SPUC could experience a maximum day demand of 25.0 mgd if year 2040 were a drought year. Table 4-5 summarizes the same data and tabulates it in a simple format.

Table 4-4 – Future Water Needs Projections

Demand Type	Year	2020	2030	2040
	<i>City Population</i>	<i>47,800</i>	<i>55,900</i>	<i>62,600</i>
	<i>Service Population</i>	<i>44,311</i>	<i>51,819</i>	<i>58,030</i>
	Current Practices for Drought Year (Based on Drought Year 2012)			
	Assumption	Demand (MGD)		
Residential	91 gpcd	4.03	4.72	5.28
Non-Residential				
Largest Customers	0.72 MGD	0.72	0.72	0.72
Other Population Based	35 gpcd	1.67	1.95	2.18
<i>Average Day Sales</i>		<i>6.42</i>	<i>7.38</i>	<i>8.18</i>
Unaccounted Water	9.5%	0.68	0.78	0.86
Projected Average Day Demand		7.1	8.2	9.1
Projected Maximum Day Demand	277%	19.6	22.6	25.0
Previously estimated per capita use applied to anticipated service population.				

Table 4-5 – Projected Water Use – By Population

Year	Population	Projected (AD)	Maximum Day (MD) Water Pumped (MGD)
2020	47,800	7.1	19.6
2025	51,850	7.6	21.1
2030	55,900	8.2	22.6
2035	59,250	8.6	23.8
2040	62,600	9.0	25.0

4.4.1.2 Projected Water Use By Pressure Zone (Population Based Projection)

Similar to the system wide water needs projection, each supply service area was projected for its individual water needs. This analysis was based on population and also by land use. Historical water use billing data from meters was used to estimate water use in each pressure zone. Then, existing and planned land use was determined for each pressure zone and was used to allocate demands based on land area.

The planned pressure zones are shown in Figure 6-1. The pressure zones were shaped in a manner consistent with utility planning, also in a way where zones could be reasonably connected by water mains.

Table 4-6 – Summary of Water Needs Projections per Service Zone

Zone	Average Day Demand (MGD)	Maximum Day Demand (MGD)	Portion of Total Demand
2020			
Main Zone	5.00	13.86	70.6%
1st High Zone	1.69	4.67	23.8%
2nd High Zone Central	0.09	0.25	1.3%
2nd High Zone West	0.27	0.75	3.8%
2nd High Zone East	0.08	0.22	1.1%
Total	7.1	19.6	100%
2030			
Main Zone	5.37	14.87	65.9%
1st High Zone	1.91	5.29	23.4%
2nd High Zone Central	0.14	0.38	1.7%
2nd High Zone West	0.67	1.85	8.2%
2nd High Zone East	0.11	0.30	1.3%
Total	8.1	22.6	100%
2040			
Main Zone	5.63	15.60	62.4%
1st High Zone	2.09	5.79	23.1%
2nd High Zone Central	0.18	0.50	2.0%
2nd High Zone West	1.03	2.87	11.5%
2nd High Zone East	0.13	0.37	1.5%
Total	9.0	25.0	100%

4.4.1.3 Projected Water Use By Future Land Use

Due to the uncertainty with population growth projections and water use projections, it is useful to estimate future water system demands from multiple perspectives to find a range of potential outcomes. In addition to the population-based method used in the previous section, projected land uses were also examined for this plan, and water demands projected based on an assumed unit demand per area for varying land uses.

Results of the land used base water demand projections are presented in Table 4-7. The time at which this expected development occurs will be strongly dependent on market forces, therefore the yearly water use projections provide a reasonable estimate of planning period demand while the land use projections help to understand the total ultimate water system needs independent of time.

Apart from anticipated population growth, SPUC must be aware of all future potential water needs as development occurs and the City expands into new areas. The potential for future development exists as the City expands and grows to the south and west. The City of Shakopee plans to annex portions of the Jackson Township which have been outlined in the City's 2040 Comprehensive Plan and Jackson Township AUAR. Understanding the potential water needs for these areas is imperative for proper City and utility planning. Water use needs specifically for the AUAR study area are outlined in Appendix B and then fully tabulated in the overall land use water projections shown in table 4-7. The hypothetical water needs for these areas are represented in Table 4-7. Based on drought year 2012, average day water demand with full buildout could reach a potential 9.0 MGD, with a maximum day demand of approximately 25 MGD (ratio of 2.77). The development of this parallel land use based water use projection revealed estimated demands that are in line with the population based water use projections.

Table 4-7 – Projected Water Ultimate Consumption By Land Use

Land Use ¹	Existing Acres	Full Buildout Acres ¹	Estimated 2012 AD Water Use (gpd/acre)	Estimated 2012 AD Water Use (MGD)	Projected Full Buildout AD Water Use (MGD)	Projected Full Buildout MD Water Use (MGD)
Existing City Limits						
Residential						
Low Density Residential	2,644	7,118	540	1.43	3.84	10.64
Medium Density Residential	517	621	2,000	1.03	1.24	3.44
High Density Residential	88	94	5,400	0.47	0.51	1.40
Non-Residential						
Business Park	108	129	675	0.07	0.09	0.24
Commercial	547	625	675	0.37	0.42	1.17
Entertainment	356	543	500	0.18	0.27	0.75
Industrial	1,136	1,541	675	0.77	1.04	2.88
Institutional	344	368	675	0.23	0.25	0.69
Mix Use	68	99	675	0.05	0.07	0.19
Open Space	124	1,700	0	0.00	0.00	0.00
Parks	222	483	100	0.02	0.05	0.13
Existing City Limits Total	6,153	13,322	--	4.62	7.8	21.5
AUAR Study Area (Jackson Township) - See Appendix B					AD	MD
Area A					0.118	0.33
Area B					0.269	0.74
Area C					0.124	0.34
Area D					0.219	0.61
Area E					0.031	0.09
Area F					0.000	0.00
Area G					0.053	0.15
Total AUAR Study Area					0.81	2.25
Additional Sections of Jackson Township					AD	MD
Area E					0.209	0.58
Area F					0.238	0.66
Total AUAR Study Area					0.45	1.24
Total Ultimate Water Use					9.0	25.0
*Estimates based on typical historical usage						

1. 20 percent of future areas assumed to be streets and open areas. Calculated by $[(\text{Future} - \text{Existing}) \times 0.8] + \text{Existing}$.

4.5 Potential Expansion Area – Louisville Township

As part of the overall comprehensive plan effort, a preliminary high level estimate of additional water needs for the Louisville Township was completed. Though this area is not included in the near term plan, it is important to understand the implications of demand if this area was to develop. This sections will provide a brief analysis of Louisville Township ultimate demand potential.

The potential **developable area** of expansion in the township comprises **6,400 acres**. The Township includes an additional 2,900 acres of wetlands which are not assumed to be developable. The following assumptions will be used for this analysis:

1. Development Assumed: Single family residential with ½ acre lots (Low Density Residential).
2. 80 percent of the developable area will be developed as single family residential. 20 percent will be roads or undevelopable.
3. Demand Load of 540 gpd/acre from Table 4-7.
4. MD:AD ratio of 2.77 from Table 4-7.

With the above assumptions, the potential service area in the Louisville Township could add an additional average day demand of 2.8 mgd with a maximum day demand of 7.7 mgd at full buildout. These volumes are not included in any other analysis in this water comprehensive plan up to this point, nor are they included in any other analysis or recommendation in this report.

5 Water System Evaluation

In the previous comprehensive water plan, the water system was evaluated in regards to numerous system criteria. In light of the updated water system demands, the system has been re-evaluated to provide for an updated set of recommended alternatives.

5.1 Water Supply Sources and Water Quality

A summary of water supply quality concerns was outlined in the previous Water Comprehensive Plan. The recommendation for addressing water quality concerns developed in this plan are based on previous water treatment studies as well as recent water quality trends. Some new information has been developed with regards to water quality assessments for this supplement. However, in the future there may be emerging issues at both existing and new well sites related to water quality.

In summary, the Utility utilizes three different aquifers as the water source for their public water supply. These aquifers are the Prairie du Chien-Jordan Sandstone, Tunnel City-Wonewoc, and Mt. Simon/Hinckley bedrock.

In the Shakopee area the Prairie du Chien-Jordan sandstone aquifer is close to the ground surface and is soft in structure. Wells constructed in this area have removed sandstone surrounding the well to prevent large quantities of sand from entering the well with the water.

Prairie du Chien-Jordan sandstone aquifer

The Prairie du Chien-Jordan sandstone aquifer supplies a significant quantity of water to the City's water system, and is expected to provide the majority of the water in the future. Wells No. 4 - No. 9, No. 11 - No. 13, No. 15- No. 17 and No. 20, No. 21 utilize water from the Prairie du Chien-Jordan sandstone aquifer.

Tunnel City-Wonewoc

Wells No. 2 and No. 14 utilize water from the Tunnel City-Wonewoc aquifer. This aquifer also supplied water to Well No. 1 before it was abandoned and sealed.

Mt. Simon

Wells No. 3 and No. 10 utilize water from the Mt. Simon aquifer. This aquifer also supplied water to Well No. 1 before it was abandoned and sealed. Portions of Well No.3 also access portions of the St. Lawrence aquifer.

5.1.1 Water Supply Challenges

Water use restrictions have been placed on the Mt. Simon/Hinckley bedrock aquifer. These restrictions only allow usage of the Mt. Simon/Hinckley bedrock aquifer when there is no alternate water supply available, and the water may only be used for drinking water purposes. Wells No. 3 and No. 10 are supplied with water from this aquifer. Well No. 10 has low nitrate concentrations and was established to dilute the moderate levels of nitrates in water from Wells No. 6 and No. 7.

Multiple aquifer wells are wells that utilize water from multiple aquifers. These types of wells are no longer allowed to be constructed in Minnesota because of the increased potential for spreading contamination to multiple aquifers. Well No. 3 is a multiple aquifer well and was once supplied with water from all three aquifers. Eventually the Prairie du Chien-Jordan sandstone aquifer was cased off due to the large quantity of sand that was entering into No. 3. Well No. 2 was also a multiple aquifer well that received water from all three aquifers. Two of the aquifers have been cased off and it currently only receive water from the Tunnel City-Wonewoc aquifer.

5.1.2 Water Quality

Health Concerns

Under existing operating conditions the system receives their drinking water from eighteen groundwater wells. At each well house chlorine and fluoride are added to the water for disinfection and public health purposes. The City monitors their wells to insure they stay in compliance with the National Primary Drinking Water Regulations (NPDWRs), National Secondary Drinking Water Regulations (NSDWRs) and other water quality standards. Water from these wells is considered a good quality, however, there are some elements present in the water which require monitoring.

Well No. 10 has a history of containing moderate concentrations of nitrate, radon and radium 226/228. SPUC has been proactive in monitoring all regulated contaminate levels. Data collected has revealed that these levels have been steadily dropping over time. The Utility will continue to sample and monitor water production wells to ensure they are staying under the NPDWR MCLs.

Well No.3, which is not currently operated, has had a history of containing radionuclides, most recent monitoring levels have been at 5.8 pCi/L for Radium 226 and 5.7 pCi/L for Radium 228 with a gross alpha level of 9.9 pCi/L. This well is available to the SPUC water system for emergency purposes only.

Aesthetics

The Utility also monitors the aesthetic conditions of the water they are supplying related to NSDWRs. EPA believes that if these contaminants are present in water at levels above these standards, the contaminants may cause the water to appear cloudy or colored, or to taste or smell bad. This may cause a great number of people to stop using water from their public water system even though the water is actually safe to drink. Secondary standards are set to give public water systems some guidance on removing these chemicals to levels that are below what most people will find to be noticeable, and are not legally enforceable.

The problems associated with NSDWRs include:

- Aesthetic effects — undesirable tastes or odors;
- Cosmetic effects — effects which do not damage the body but are still undesirable
- Technical effects — damage to water equipment or reduced effectiveness of treatment for other contaminants

Monitoring indicates that total hardness is the most common nuisance for NSDWSs. Impacts from total hardness can be offset by implementing hardness removal at the well house, which ultimately may be very costly or the addition of an in-home water softener.

A few of the wells also had moderate levels of manganese. Manganese is associated with aesthetic issues which include taste and water coloring. SPUC is currently able to successfully address the aesthetic issues related to manganese through chemical treatment (sequestration with polyphosphate).

5.1.3 Potential Water Treatment Needs

Historically, the SPUC water system wells have not required more advanced water treatment beyond simple chemical feed (disinfection, sequestration). However, there is the potential for more advanced water treatment needs in the future. These potential needs are described further in the sections below.

5.1.3.1 Nitrate Removal

Wells No. 5 historically been the most problematic wells related to water quality with monitored levels ranging from 6.3 – 7.7 mg/L. The EPA has set the MCL at 10 mg/L. SPUC has managed the use of this well by blending water pumped from this well with Well No.4 which has a monitored level of nitrate ranging from 2.8 – 6.3 mg/L. Both wells have been trending downward with regards to monitored nitrate levels. However, if levels in these wells eventually rise or the enforceable MCL is lowered, decisions will need to be made with regard to the use of Well No.5. Given its importance to the SPUC water system as a primary water producer, water treatment for the removal of nitrate may be needed. Budget numbers are presented later in this report, set aside to address potential future water treatment needs related to nitrate removal.

5.1.3.2 Iron & Manganese Treatment

In general the existing SPUC water production wells have minimal levels of iron and manganese. As noted earlier in this report, the EPA does not enforce these secondary MCLs as they are established as guidelines to assist public water systems in managing their drinking water for aesthetic considerations, such as taste, color, and odor. These contaminants are not considered to present a risk to human health at the secondary levels. The secondary MCL for iron is 0.3 mg/L and 0.05 mg/L for manganese.

5.1.3.2.1 Iron

Only two of SPUC's existing wells have monitored iron levels (see Appendix A) above the secondary standard for iron. Well No.14, with iron levels of 0.63 mg/L is not run on a regular basis as it is available for emergency use. Additionally, when this well is operated, the water is blended with water from Well No.12 or Well No.13 which have very low levels of iron. This allows for the water to be combined to produce a finished water effluent with very minimal iron concentration. Later in this report, it is noted that Well No.14 is still utilized in the reliable supply capacity analysis. It is assumed that it would be a suitable backup for a short period of time if another well were to be out of operation.

Well No.10 has iron levels at 0.42 mg/L. This well is considered a peaking well, meaning it is used sparingly, and is only operated to supplement large water use days. Additionally, when this well is operated it is blended with water from either Well No.6 or Well No.7. This type of well use management limits the use of the wells that contain iron, though they are still available to supplement quantity shortages during large water use days. Even with elevated iron levels, the iron content in these wells is relatively low, and at levels that can be managed by limiting well use and chemical treatment (sequestration with a polyphosphate) and blending with other low iron concentration wells.

5.1.3.2.2 Manganese

Manganese does not have an enforceable MCL, but the Minnesota Department of Health (MDH) has issued a health-based value of 0.1 mg/L. "Infants less than 1 year old are more sensitive to manganese and it is recommended that they only drink water, or water mixed with formula, that is 0.1 mg/L or less to avoid negative health effects," per the Health Risk Assessment Unit at MDH. MDH also suggest that adults and older children should drink water with less than 0.3 mg/L to prevent negative health effects. The 0.3 mg/L limit is a health advisory set by the EPA. Health-based values can serve as a guideline for goals in regards to use management of the wells. The presence of manganese in the SPU wells will be considered moving forward in light of the information above.

In regards to manganese, Well No.15 at 0.092 mg/L and Well No. 12 at 0.08 mg/L are the only wells that currently have moderate levels of Manganese. **None of the existing wells exceed the health advisory limit** for Manganese. These wells are used on a somewhat regular basis, but more sparingly than the more favorable wells. As the water system expands west, there has been an indication that potential future well sites may have elevated levels of manganese. If long terms water supply facilities were to be located at one of these well sites, with elevated manganese levels above the MCL, it is recommended that a filtration plant be constructed to remove the manganese. Budget numbers are presented later in this report, set aside to address potential future water treatment needs related to manganese removal.

5.2 Total System Reliable Supply Capacity

The reliable supply capacity of a water system is the total available delivery rate with the largest pumping unit(s) out of service. The reliable supply capacity is less than the total supply capacity because well and other supply pumps must be periodically taken out of service for maintenance. These water supply pumps can be off-line for periods of several days to several weeks, depending on the nature of the maintenance being performed. For a system as large as Shakopee with 18 high capacity wells, it is somewhat likely for two wells to be offline at the same time, comprising approximately 10 percent of the total supply capacity. Because of this, system wide well supply requirements will assume that the SPUC water supply system should be capable of meeting maximum day demands with the Utilities' largest two wells out of service.

The current reliable water supply capacity is given in Table 5-1. Under present operating conditions, the existing wells have a combined total capacity of about 24.4 MGD when operating 24 hours per day. However, the reliable capacity of the supply wells is approximately 20.3 MGD with the two highest yielding wells out of service. The availability of this reliable supply capacity assumes that there will be no significant declines or changes in the water supply capacity over the next 20 years.

To determine if SPUC should plan for additional supply, the demands of the system can be compared to supply capacity. The projected drought-year average day and maximum day demands are set against total and reliable supply capacities in Figure 5-1. The results in Figure 5-1 indicated a potential need for approximately **4.0 – 5.0 MGD** or more in reliable supply capacity to meet projected water system demand growth. This would equate to roughly three new wells. The suggested location for these wells on a zone by zone basis is discussed later in this section. It should also be noted that future demands are estimated projections (not records) and thus should be re-evaluated frequently (every five years $\pm$) as water use trends can change over time.

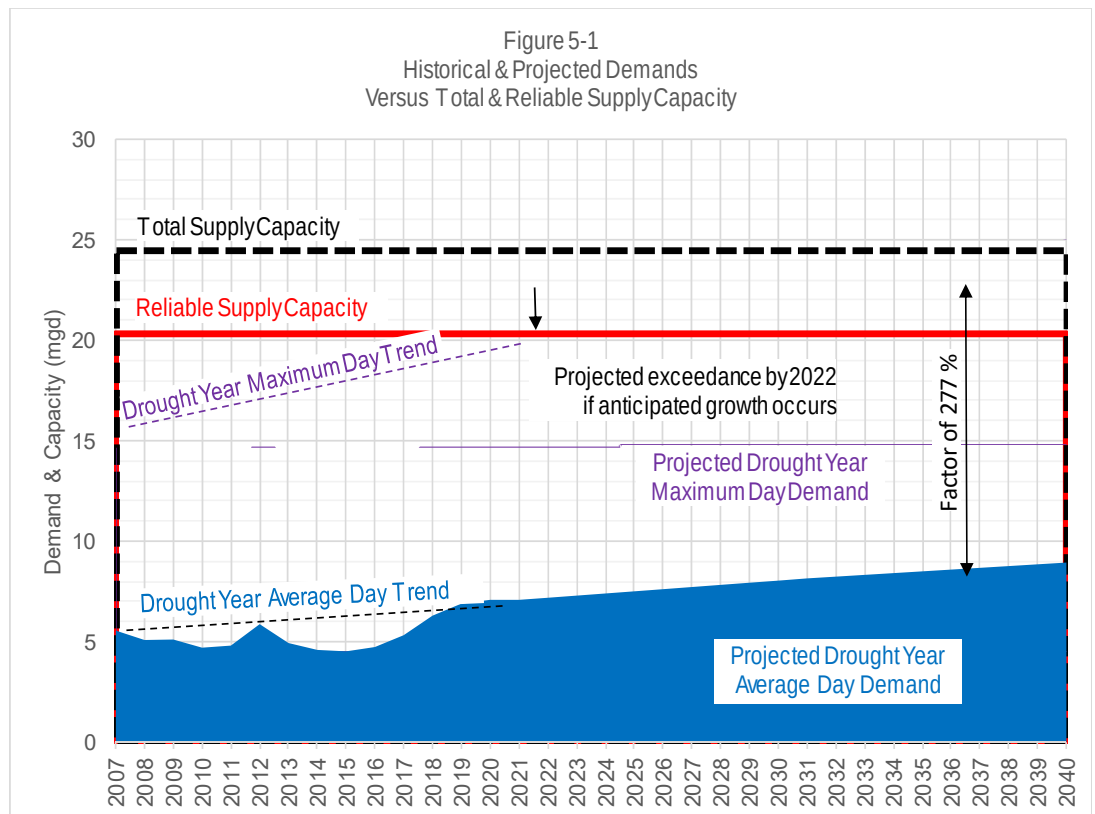


Table 5-1 – Existing Water Production Wells

Well Name	Pressure Zone	Unique Well Number	Normal Operational Capacity (gpm)	Allowed Pumping Time per Day (Hours)	Daily Capacity (MGD)
Well No.2	Normal	206803	300	24	0.4
Well No.3	Normal	205978	825	Emergency	1.2
Well No.4	Normal	206854	715	24	1.0
Well No.5	Normal	206855	850	24	1.2
Well No.6	Normal	180922	1,175	24	1.7
Well No.7	Normal	415975	1,100	24	1.6
Well No.8	Normal	500657	1,100	24	1.6
Well No.9	Normal	554214	1,050	24	1.5
Well No.10	Normal	578948	1,125	24	1.6
Well No.11	Normal	611084	1,000	24	1.4
Well No.12	1st High	626775	810	24	1.2
Well No.13	1st High	674456	1,036	24	1.5
*Well No.14	1st High	694904	381	24	0.5
Well No.15	Normal	694921	1,150	24	1.7
Well No.16	Normal	731139	1,450	24	2.1
Well No.17	Normal	731140	1,400	24	2.0
Well No.20	1st High	722624	1,142	24	1.6
Well No.21	1st High	722625	1,175	24	1.7
Total			17,784	--	24.4
Two Highest Yielding Wells (Well No. 16 & 17)					4.1
Firm Capacity (Minus Two Wells)					20.3

*Well No.14 is only operated if needed and is factored into the firm capacity analysis.

Source: City Records

5.3 Reliable Pumping Capacity & Storage

The previous comprehensive water plan developed sizing criteria for reliable pumping capacity. This supplement updates that analysis in relation to revised projected water demands.

To determine the water supply and storage needs of a community, average daily demands, peak demands, and emergency needs must be considered. In the sections below, calculations are used to determine future water supply and storage volume requirements for the SPUC water system. Water storage facilities should be capable of supplying the desired rate of fire flow for the required length of time during peak demands when the water system is already impacted by other uses and with the largest supply pump out of service.

The calculations below assume that maximum day demands are occurring on the system, storage volume is reduced by peak demands greater than firm supply pumping rate (i.e. equalization storage is expended). For purposes of this analysis, it is assumed that the “firm capacity” of the water supply wells and booster pumps (largest pump out of service) is capable of supplying maximum day demands.

Because there are multiple pressure zones in the SPUC water system, served by elevated storage, it is important to evaluate the needs of each zone separately. The previous calculations were revisited in light of new demand projections. The result of these updated calculations are updated in the tables below.

5.3.1 Total System Pumping and Storage

The previous Water Comprehensive Plan evaluated the total water system storage needs as well as each individual pressure zone. The plan did not identify any total water system storage needs, meaning when analyzed as a complete system, additional storage is not recommended. Rather each individual pressure zone needs to be analyze for storage needs within that zone. To determine the water storage needs of a community, average daily demands, peak demands, and emergency needs must be considered. The storage tanks of the water system are listed in Table 5-2. The volumes in Table 5-2 are compared to the projected storage needs within each pressure zone. The documented calculations for the System are included in Appendix A, with a summary of the results documented below.

Table 5-2 – Existing Water Storage Facilities

Facility Name	Capacity (gal)	Useable Volume (gal)	Overflow Elev.	Headrange (ft)	Construction Style
Main Zone					
Tank 1	2,000,000	2,000,000	933.0	43.0	Stand Pipe
Tank 2	250,000	250,000	933.0	24.0	Pedestal Sphere
Tank 3	1,500,000	1,500,000	933.0	35.0	Hydropillar
Tank 5	2,500,000	2,000,000	933.0	35.0	Ground
Tank 6	2,500,000	2,000,000	933.0	35.0	Ground
1st High Zone					
Tank 4	500,000	500,000	1015.0	28.0	Pedestal Spheroid
Tank 7	2,500,000	2,000,000	1015.0	34.5	Ground
Total	11,750,000	10,250,000			

5.3.2 Individual Pressure Storage Analysis Summary

Appendix C contains the revised supply and storage calculation. Water pumping/transfer needs as well as water storage needs were calculated for each pressure zone. In essence, each pressure zone was analyzed individually in relation to water pumping and storage needs. For example, if a pressure zone is short on transfer/pumping capacity, it is feasible that it can “borrow” water from a neighboring zone via gravity(see main zone calculations below). The primary purpose of the summarized calculations below is to assure that each pressure zone has sufficient storage capacity as well as supply capacity whether it be an internal zone supply well or pumping station.

Table 5-3 – Summary of Future Water Storage Needs - By Pressure Zone

	Main	1st High	*2nd High Central	*2nd High Zone West	Combined 2nd High	2nd High Zone East
Existing Firm Pump Cap. (MGD)	12.8	4.9	1.4	1.4	4.3	1.4
Existing Storage Volume MG)	6.8	2.5	-	-	-	-
2020 Planning Period						
Assumed Firm Pump Cap. (MGD)**	15.8	4.9	1.4	1.4	4.3	1.4
Average Day Demand (MGD)	5.0	1.7	0.09	0.27	0.4	0.08
Max Day Demand (MGD)	13.9	4.7	0.25	0.75	1.0	0.22
Additional Storage Recommended (MG)	-	-	0.2	0.5	0.6	N/A
2040 Planning Period						
Assumed Firm Pump Cap. (MGD)**	15.8	4.9	1.4	4.3	5.8	1.4
Average Day Demand (MGD)	5.6	2.1	0.2	1.0	1.2	0.13
Max Day Demand (MGD)	15.6	5.8	0.5	2.9	3.4	0.37
Additional Storage Recommended (MG)	-	-	0.3	1.1	1.0	N/A
*The long term water system plan includes the connection of the 2nd High Central and West zones to form the Combined second high zone, which will influence redundancy and water storage requirements. **Assumed firm pump capacity accounts for additional supply sources added to zone in the future. See Appendix C for storage calculations						

5.3.3 Pressure Zone Pumping/Transfer Analysis

This section summarizes the pumping capacity needs of each pressure zone as they relate to both supply and inter-zone pumping. While the total supply section determines the adequacy of supply at a total system level, this section aims to assure each pressure zone can move water internally to satisfy the system demand from either an internal supply source or through transfer of water from a neighboring zone. An individual pressure zone analysis for pumping capacity is included in Tale 5-4 below. The table below summarizes the assumed firm pumping capacities for each pressure zone including unit wells and booster pumping station units which deliver water to water demand within each pressure zone.

Table 5-4 – Summary of Interzone Pumping/Transfer Needs

	Main	1st High	2nd High Central	2nd High Zone West	Combined 2nd High (C+W)	2nd High Zone East
Existing Firm Pump Cap. (MGD)	15.8	4.9	1.4	1.4	4.3	1.4
2020 Planning Period						
Max Day Demand (MGD)	13.9	4.7	0.1	0.7	0.8	0.3
Pumping/Transfer Surplus/Shortfall	1.9	0.2	1.4	0.7	3.5	1.2
Additional Transfer/Pumping Recommended (MGD)	0	0	0	0	0	0
2040 Planning Period						
Max Day Demand (MGD)	15.6	5.8	0.3	2.9	3.2	0.4
Pumping/Transfer Surplus/Shortfall	0.2	-0.9	1.1	-1.4	1.1	1.0
Additional Transfer/Pumping Recommended (MGD)	0	0.9	0	1.4	0	0
Table Notes: Negative value indicates supply shortfall, Interzone Supply/Pumping Recommended represents water that would need to flow from a higher elevation zone.						

5.4 Water Distribution System Analysis

The previous water system plan provided a comprehensive review of the water distribution system through the use of a calibrated water distribution system model. The assessment of the existing water system is still valid in light of this update. Information revealed through this prior analysis will be accounted for in the recommended improvements section.

6 Recommended Improvements

With updated water use projections and new ultimate land use planning information, the recommended short and long term water system improvement recommendations have been revisited and summarized below. Many of the improvements previously identified have been confirmed and a more exhaustive list of improvements has been developed.

The purpose of this section of the report is to review and recommend facility improvement priorities for the water system moving forward. With growth of the City, and therefore the water system expected during the next planning period, additional water system to facilities should be planned for so that all customers receive exceptional water service. As previously mentioned, the new growth and expansion of the water system is expected to occur in the western portions of the first and second high pressure zones. While it is impossible to know exactly how the area will grow in terms of specific users and road alignment, some general estimates in relation to future land-use can be made and facilities planned for based on these assumptions.

The ultimate water system planning map, presented in Figure 6-1 represents a guiding document for the growth and expansion of the water supply, distribution and storage systems. Expansion of the water system in a manner as outlined in this document will help to assure that exceptional and robust water system is provided to all customers in the future.

This section will provide recommendations to remediate deficiencies and to prepare the system for future growth. A map of planned improvements is shown in Figure 6-1 and will be reference throughout this section.

6.1 Supply Improvements

A community's water supply capacity is sized to meet maximum day demands reliably. The industry standard is to provide enough pumping capacity to meet the maximum day demand rate with the largest two pumps out of service (i.e. firm capacity). Current well supply capacity in Shakopee is 24.4 MGD, and the firm pumping capacity is 20.3 MGD. Maximum day demands reached a peak of 16.3 MGD in 2012. That rate has fluctuated since then, but could reach that level during an extreme drought year.

Based upon the peak demand projections in Table 4-4 and the well analysis discussed in section 5.2, it is estimated that projected maximum daily demand may exceed firm/reliable well supply capacity. For that reason, additional capacity is recommended in the future. The previous section of this report identified the need for approximately **4.0 – 5.0 MGD** or more in reliable supply capacity to meet projected water system demand growth through the 2040 planning period

Before recommendations on supply can be made, regulations regarding supply must be first reviewed. The requirements of Minnesota state code apply, as well as any special requirements placed upon Shakopee. There is a concern in the Eastern portions of the City regarding the influence of groundwater drawdown on the nearby Fen wetland. While working with the Minnesota Department of Natural Resources (DNR), it has become apparent that the construction of any new wells east of the easternmost well in the City will not be permitted. Thus, new well construction is not permissible east of County Road 83, and no future wells will be planned east of Well 5.

A deficiency in overall water supply capacity was shown to be possible in Figure 5-1. The system has 18 wells in total. It is not unreasonable to assume that up to two wells may be offline at a time, as in Figure 5-1. Supply calculations completed in Appendix C show that both the Normal Zone and/or the First High Zone could have a supply deficiency in the coming years, depending on growth.

A cost effective solution to dealing with the firm capacity in separate pressure zones is to provide water supply sources which benefit multiple pressure zones. As development occurs and when the firm capacity of the system is exceeded by the maximum day demand, It is recommended that the City construct additional supply wells which are capable of serving multiple pressure zones.

6.1.1 New Water Production Wells

Figure 6-1 shows potential locations for up to four future wells. Long term, it is anticipated that three new wells may be needed to satisfy water demands across the entire system. Previous analysis showed that the Normal and 1st high pressure zones may eventually have supply deficits. Additionally, it is beneficial to have supply sources in each of the major pressure zones to reduce dependency on booster stations and support diverse redundant operation. In regards to potential well location, SPUC has identified multiple potential well sites which could all be feasible site options. When considering overall system redundancy and system zone transfer, it would be beneficial to locate the long term wells in growing zones that are absent of supply (2nd High West) or the Normal or 1st high pressure zones.

Well No.22

The construction of new well No.22 next to existing will No.3 provides for an option to gain additional capacity beyond the new well. As noted previously in the report, existing Well No.3 is not operated due to subpar water quality associated with Radionuclides. The construction of a new water production well would allow water from the new well to be blended with water from Well No.3 and producing an effluent that meets the primary drinking water standards. By constructing such a well, the capacity of Well No.3 could then be utilized to reduce the need for additional supply. Additionally, the construction of this well would not require an additional building and the new well could be piped into Pump house 3, becoming a joint facility to facilitate blending and chemical addition.

Well No.23 + Well No.24

Well No.23 and Well No.24, would be located in the Second High Zone (West) and would work in conjunction with a new water tower serving the Second High Zone. These wells would normally serve the Second High Zone, but due to their location in a higher pressure zone, they could also easily feed water to the lower pressure zones by gravity. Additionally, the construction of these wells near each other would allow for them to share a common pump house facility.

Additional well sites

SPUC has additional potential well sites to facilitate the construction of new wells if needed. Well No. 18 and Well No.19 have potential sites located in the vicinity of the Shakopee Soccer Association soccer fields. Additional reserve well sites include the Church Addition and Wood Duck Trail near tank No.7. Though these sites are not identified in the current planning period, they may be needed if development patterns change or of existing wells fail and additional supply is required.

6.1.2 Existing Well Maintenance

6.1.2.1 Pump House Reconstruction

Maintaining existing facilities will reduce the need for additional wells as existing facilities can be optimized. SPUC has been proactive about maintenance and restoration of ageing facilities. Currently the pump house that serves Well No.2 and Well No.8 is in need of major upgrades. This upgrade will require the complete razing of the existing building which includes electrical and control equipment, metering, chemicals and chemical feed equipment. The completion of this work will require the existing facility to be taken offline for about a year which will make these wells unavailable for use. The upgrade and modernization of this facility is much needed due to the limited size of the existing facility and antiquated equipment within the building. Since Wells No.2 and No.8 will need to be taken offline to complete this work, it is recommended to have a new water supply source be online and available to replace the lost capacity.

Additionally, the pump house that serves Well No. 4 and Well No.5 will eventually need rehabilitation and replacement, though there are not near term plans, it can be assumed that this work will be completed during the current 20 year planning period.

6.1.2.2 Production Well Maintenance

At existing well locations where the aquifer produces good well capacity and acceptable water quality, as the well declines in capacity and condition it should be rehabilitated and returned to normal service to take advantage of the investment of surrounding transmission capacity. Wells in this category should be identified by future well assessments that are outside the scope of this study.

6.2 Interzone Transfer Improvements

6.2.1 East Zone – Riverview Booster Station - Online

The East Zone is planned to be raised to the hydraulic grade line of the Second High Zone. In order to accomplish this, the East Zone would need a booster station. A future booster station containing two 1,000 gpm pumps was shown to be suitable for the East Zone. This booster station is now online. – This facility is now online and operational.

6.2.2 East Zone – Secondary Booster Station

It was previously thought that the East pressure zone may someday be served by an elevated water storage tank. However recent land use trends indicate that total connections in this area may be limited, therefore will be served by a booster station long term. Because of this it is recommended that a second redundant booster station be constructed to boost system pressure to this zone in the event of the failure of the primary booster station. While the primary station is being designed and constructed with two 1,000 gpm service pumps, to account for fire protection, it would be reasonable to design the secondary station on a smaller scale to accommodate typical system demands. Therefore a small scale booster station with two 100 gpm pumps is recommended. Such a station is small enough that it could be installed in a below grade vault or small flip top enclosure. Construction of a secondary booster station would allow the pressure zone to be supplied with water from two different entry points which would aid in system redundancy and water circulation.

6.2.3 Windermere Booster Station - Online

The Second High West Zone is planned to be constructed with the same hydraulic grade line of the Second High Central Zone. In order to accomplish this, the Second High West Zone would need a booster station, which is currently underway. A booster station containing two 1,000 gpm pumps was shown to be suitable for the Second High Central Zone. This Station will be going online soon. – This facility is now online and operational.

6.2.4 Upgrade Well 9 Booster Station with Flow Control Valve

SPUC currently owns a booster station at Well 9 which moves water from the Normal Zone to the First High Zone. It is recommended that a flow control valve be added to the Well 9 booster station to allow water to move from the First High Zone to the Normal Zone. This will allow for operational flexibility as needed to control water flow from zone to zone. Without this improvement, water could still be moved from zone to zone, through PRV's or manual valve operation, however, the flow rate could not be controlled nor the volume of water accounted for.

6.2.5 Church Addition Booster Station

Long range planning indicates that only a few more wells will be needed to accommodate future growth through the 2040 planning period. With this in mind, a focus on system redundancy can be a long term goal. If the Utility were to lose the ability to safely operate multiple wells in the 1st High Zone, additional water transfer ability from the Normal Zone would be beneficial. The interzone transfer/pumping analysis revealed a potential 0.9 mgd supply shortfall if a well was taken offline. While a portion of this shortfall could be accommodated by pumping from the main pressure zone through the well No.9 booster station, a second booster feed into this pressure zone would be beneficial. The Utility currently owns a portion of property near the Church Addition Development. Since this site borders the Normal and 1st high pressure zones, it would be a prime site to serve a multiple purpose function of two direction water transfer. Such a facility would supplement emergency water supplies to the 1st high zone by the addition of a high service booster pump and interconnecting water main. In a like manner, the facility would provide emergency water supplies to the Normal pressure zone via of pressure-reducing/pressure-sustaining control valve to allow water to flow from the 1st High Zone to the Normal Zone.

While there is not a short term need for this facility, as the high pressures zones expand, and water supply is needed, the investment in multifunction water supply and transfer facilities will help SPUC to maintain a high level of service. The need for this facility is decreased if additional wells are placed in the higher pressures zones as system pumping redundancy would be accomplished with these wells.

6.2.6 Highway 169 West Return Flow Valve

Highway 169 bisects the existing water system and acts as a barrier between pressure zones, with limited crossings. To increase redundancy in the system, connections between pressure zones would promote the ability to move water between the Normal Zone and the First High Zone. While not an immediate need, if development leads to the construction of a trunk water main crossing highway 169, it is recommended that a Pressure Reducing Valve (PRV) with flow control capabilities be installed along the zone boundary. This would allow for a controlled amount of flow to be transferred from the First High Zone to the Normal Zone. This crossing would add redundancy to the system as growth occurs to the west, and the controlled flow valve would assist the Normal Zone in case two wells were offline in the Normal Pressure Zone.

6.3 Water Quality Improvements

6.3.1 Nitrate Removal

As previously mentioned in the report, SPUC is currently successfully managing nitrate levels through the use of water blending with other wells with low nitrate levels. Nonetheless, for the purposes of this report, a nitrate removal plant is being budgeted if the need for the plant becomes a reality. For the estimate, a 3.0 MGD plant is assumed, capable of treating water from two typical SPUC wells concurrently.

6.3.2 Manganese Filtration

The emergence of manganese as a potential water quality issue in new and existing wells has presented the possibility of the need for a manganese (&iron) filtration plant. As new water sources are pursued in the South and western parts of the City (Expansion areas) early indications have revealed the potential for manganese to be present in the water. As a result, a filtration plant is budgeted to address potential iron and manganese issues. A 3.0 MGD plant, capable of treating water from two typical SPUC wells is presented as a budgetary placeholder.

6.3.3 Unidirectional Flushing

Unidirectional Water Main Flushing (UDF) has been gaining popularity across the water industry to help improve the effectiveness of flushing. Standard water main flushing has traditionally been considered an effective method to help clean water distribution system piping to help reduce unwanted tastes, odors or discolorations of the water, and to improve chlorine residual. UDF, a more sequential and planned activity, provides greater cleaning of pipes and uses less water than traditional flushing. The main goal of UDF implementation is to isolate sections of pipe by closing specific valves and opening specific hydrants sequentially, which assures optimal flushing velocity is achieved throughout the entire water distribution system. Sustaining a minimum flow velocity of 5 fps in a water main is key to effectively scouring the main to deliver desired flushing results.

UDF plan is a proven effective tool for maintaining water distribution water quality. A UDF plan can reduce water quality complaints, improve taste and odor, increase disinfectant residuals, improve hydraulic capacity, and reduce levels of biological growth within the water distribution system. The UDF plan improves flushing effectiveness by increasing flushing velocity. Higher velocities allow for scouring of the water main which more effectively removes sediments such as iron, manganese, sand, rust, and other mineral deposits that can accumulate within the water mains.

Given the desire to deliver high quality water, the SPUC water system may benefit from the development of a UDF program. Over time, minerals and sediment can build up in water mains. Traditional flushing may not always properly scour mains and may stir up sediment, leading to water quality complaints. The development and implementation of a UDF program will help to keep distribution system piping clean to provide high quality water. Given the development of the update computer water system model and advanced GIS mapping, these tool can be leveraged to provide an effective, low cost water distributions quality investment.

6.4 Storage Improvements

The need for water storage was summarized in great detail within the previous report. This supplement reviews previous findings and produces consistent recommendations. Since the last publication, SPUC has moved forward with the option to build the 750,000 gallon tank in the 2nd High West zone to meet near and long term storage needs in the 2nd high zone.

Much of the future population growth is expected to occur in the second high pressure zone. As this pressure zone grows, so will the water that is demanded. Standalone water booster stations will be capable of serving these areas for a time, however, as the system grows, additional elevated water storage tanks will need to be added to these pressures zones. The west and central portions of the second high pressure zone are expected to see the first sustained growth and expansion. Currently these portions of the second high pressure zone are not connected, it is unknown as to when they may eventually connect since it will depend on system development and growth. The water storage analysis previously completed in this report indicated that ultimately 1,000,000 gallons of elevated water storage should be added to the water system and the second high pressure zone to sustain and support ultimate water system demand projections. Currently developers are active in the western portions of the second type pressure zone, with potential water tower sites now being discussed. With current developments now underway, the natural choice for the construction of a storage tank would be in this area to serve in new customers. It may not be prudent to place all of the 1,000,000 gallons of needed water storage at one location. Since a water tank best serves customers within a reasonable proximity depending on connected trunk water main, a single tank placed in the west would not be well positioned to serve the central portion of the second high pressure zone. Therefore it is ultimately recommended that two elevated water tanks be constructed with in the second high-pressure zone (West and central)

6.4.1.1 Construct 250,000 & 750,000 Gallon Elevated Tank for Second High Zone(s)

The section above documented the case and need for water storage to serve the Second high pressure zone. With initial development anticipated to be concentrated in the Western portions of the Second high pressure zone, there would be the option to construct a 750,000 gallon tank at this location and a 250,000 gallon tank at the Central location. With this rational, one tank will be suitable to serve a large portion of the development built out. As long term development plans become clearer, and the central part of the second high zone is connected to the west, the proposed second water tower size can be reevaluated. The construction of the first 750,000 gallon water tower will initially benefit the western portions of the second high zone as well as the first high zone as it will supplier flows via inter-zone flow through PRV stations.

6.5 Water Main Improvements

As development progresses into the expansion areas, a trunk water main system must be constructed to deliver adequate flows for various conditions including emergency fire flow. A trunk water main is defined as a pipe sized such that it can supply water for nearby users as well as serve a greater function by transporting water across the system to meet the demands of the extended water system. The majority of trunk water main improvements identified are outside of the existing service area and should be constructed as development occurs and road improvements are constructed. Figure 6-1 presented the proposed preliminary routing of trunk water mains to serve future development areas. Actual main routing will depend on a variety of local factors as individual projects progress. This map should be seen as a recommendation for the general hydraulic capacity of the distribution system as it is extended to serve new development. Generally speaking, the trunk main layout is comprised of a gridded network of 16-inch and 12-inch diameter water mains. In addition Figure 6-1 shows some key water main improvements to the existing system piping. Some improvements were for system reliability and others were for fire protection. This section will review each existing system improvement in greater detail.

As stated above, the improvements presented in Figure 6-1 represent a conceptual plan for potential long term water system improvements to improve and expand the hydraulic capacity of the water distribution system. These improvements are presented to improve flow capacity, increase system reliability and support long term community development and growth. Although the local knowledge of development patterns was utilized in the preparation of the trunk water main plan, as a conceptual plan, the actual size and location of the improvements will depend upon future planning efforts and the circumstances at the time of the improvement are implemented and may not follow exactly as shown in the figure.

6.5.1 Trunk Water Main Infill

In addition to trunk water main to be constructed in expansion area, there are some section of existing trunk water main backbones that are still in need of final infill. These sections of water main are also outlined in figure 6-1.

6.5.2 Ultimate Trunk Water Main Grid

As development progresses into the expansion areas, a trunk water main system must be constructed to deliver adequate flows for various conditions including emergency fire flow. A trunk water main is defined as a pipe sized such that it can supply water for nearby users as well as serve a greater function by transporting water across the system to meet the demands of the extended water system. The majority of trunk water main improvements identified are outside of the existing service area and should be constructed as development occurs and road improvements are constructed. Figure 6-1 presented the proposed preliminary routing of trunk water mains to serve future development areas. Actual main routing will depend on a variety of local factors as individual projects progress. This map should be seen as a recommendation for the general hydraulic capacity of the distribution system as it is extended to serve new development. Generally speaking, the trunk main layout is comprised of a gridded network of 12-inch water mains (1/2 mile spacing) with some 16-inch main sized for transmission capacity. Where more defined development is in progress, 8-inch water main grids on a tighter installation scale are also included.

In Figure 6-1, a proposed trunk water main layout has been drawn, with 12-inch loops helping to balance the future water system by allowing large volumes of water to flow between supply, storage, and points of use. These trunk main loops will be required to effectively transport water to the extremities of the proposed expansion areas. Looping is recommended wherever possible to minimize dead-ends in the water system.

Dead-ends, or branched water systems are less reliable since water must come from one direction. This forces the utility to shut off water to some customers during repairs or maintenance. In addition, larger head losses (or pressure losses) are experienced on dead-ends than on looped systems. This can limit available flow rates during fire protection activities.

6.6 System Planning

Figure 6-1 illustrates the water system master plan to meet current and projected water system needs through the 2040 planning period. As mentioned previously, these improvements are intended to correct existing deficiencies as well as meet the needs for future growth and development. To demonstrate the effectiveness of the recommended improvements, Figures 6-2 and 6-3 illustrate the anticipated maximum day demand pressures and maximum day fire flows, respectively, with the recommended improvements under projected 2040 demands conditions.

The recommended improvement plan to serve the future service area has been developed as a tool to guide SPUC in the siting and sizing of future system improvements. While the plan may represent the current planned expansion of the SPUC system, future changes in land use, water demands, or customer characteristics could substantially alter the implementation of the plan. For this reason, it is recommended that the plan be periodically reviewed and updated using area planning information to reflect the most current projections of SPUC service area growth and development.

The improvement plan is a guidance document that details existing conditions and recommendations for the future. The plan is based on future conditions as perceived in 2017. As time progresses, additional information will become available and events will shape the development of the SPUC service area. The plan must be dynamic in response; it should be studied and used but also adjusted to conform to the changes and knowledge that will come with time. Updates should be made on a regular basis, probably every five to ten years.

7 Capital Improvements Plan

One of the main objectives of this study was to develop a long-range Capital Improvement Plan (CIP) for water system facilities. The CIP provides information on the anticipated cost and timing of future water supply, storage and distribution improvements.

The previous section summarizes the recommended water system improvements anticipated throughout the planning period. This section summarizes the recommended water system improvements and presents a proposed Water Utility capital improvements program. The recommended Capital Improvements Plan prioritizes system improvements and provides a schedule for the timing of construction. Budget cost estimates for each improvement are also summarized.

7.1 Supply

Based upon the current and projected water system needs, additional wells will be required to provide reliable supply capacity for current and future water demands. While near term water system demands can be supplied by current well capacities, additional wells will be required to support growth and development. Three new wells are identified to support water system growth and replace aging wells through the 2040 planning period.

7.2 Treatment

Two potential treatment plants, an iron and manganese plant as well as a nitrate plant are budgeted as place holders in the event that water quality declines in the existing wells, or if subpar water quality exists at new and proposed well sites.

7.3 Storage

The current water system is supported by robust water storage volumes, however as the water system grows into the Second High pressure zone, elevated water storage should be added to the system in this zone to support system operation and provide the type of water service that is similar to the other pressure zones. Historically, it has been a practice to add elevated storage to a pressure zone when the number of users connected approaches 250 homes. With commercial and residential development now occurring in the Western portions of the second high pressure zone, planning for the next elevated water tank should begin now. A second tank in the second high pressure zone will be eventually needed depending on development for a total of 1, 000,000 gallons of water storage in the second high pressure zone.

7.4 Water Booster Stations and Flow Control

Movement of water between the pressure zones is important from a redundancy standpoint. As new wells are added throughout the system, a demand to move the supplied water from zone to zone will be required. As a result a series of booster stations are planned to move water from the lower service zones to higher zones. In a similar fashion, flow control valves located at the booster station facilities are beneficial to move water in a controlled fashion from the higher zones to lower zones.

7.5 Distribution

Figure 6-1 is the proposed SPUC 2040 Water System Master Plan. The figure illustrates recommended improvements to the existing distribution system to serve the current service area. The improvements have been recommended to strengthen the existing water distribution network, and support system expansion into future service areas. The Figure also shows how long range trunk water mains might be installed. Trunk main looping should be a priority in the expansion of the service area and in water main replacement projects. The proposed layout of trunk water mains in this report would provide water supply and fire protection capabilities to existing and projected service areas. In addition, recommended trunk mains will connect water supply and storage facilities with points of use on the system.

7.6 CIP Costs

The table below provides a high level summary of short and long range water system facility capital costs. These costs are based on recent projected history and anticipated system growth.

Table 7-1 – Proposed Water System Improvements – Through 2040

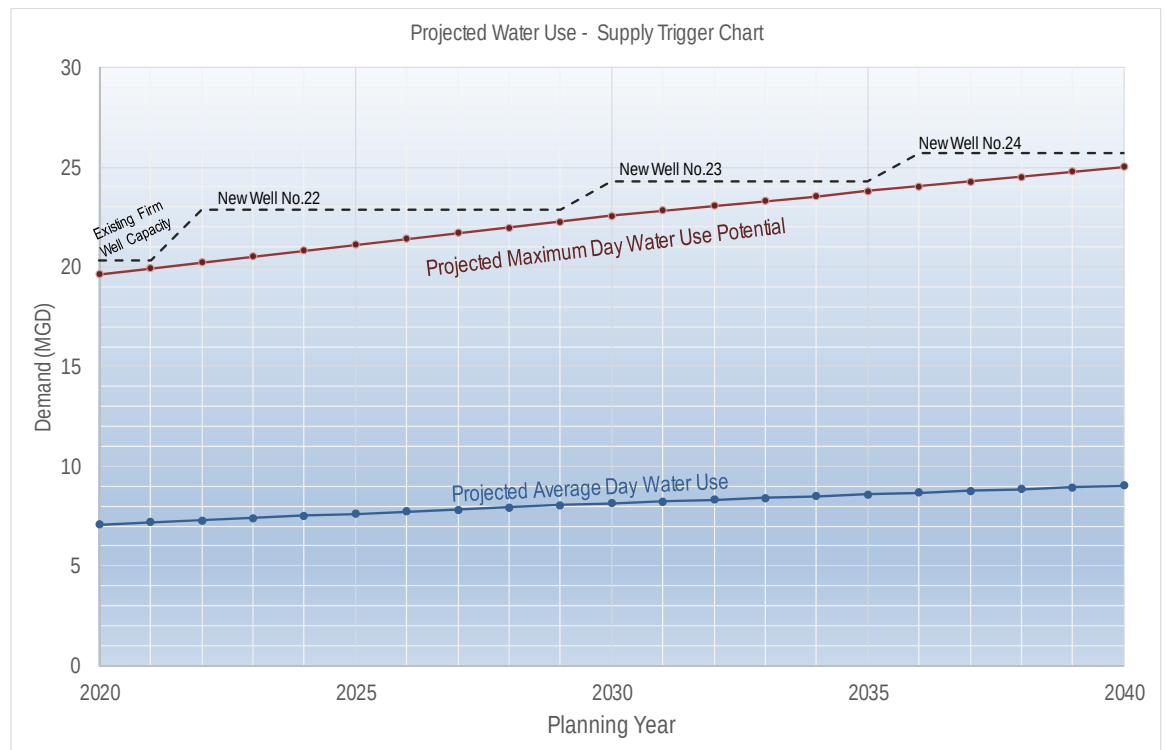
Type	Improvement				Planning Period	Estimated Cost
Supply	Well No.22 - Well, Pump & Connection W/ Well No.3				2020-2025	\$1,400,000
Supply	Well No.23 - Well, Pump, Building and Connections				2025-2030	\$3,000,000
Supply	Well No.24 - Well, Pump, Connections				2035-2040	\$1,400,000
Transfer	Church Addition Booster Station				TBD	\$2,600,000
Transfer	Secondary East Booster Station				TBD	\$550,000
Transfer	Well No.9 Flow Control Valve Upgrades				2025-2030	\$175,000
Transfer	HWY 169 Flow Control Station				TBD	\$350,000
Storage	West 2nd High 750K Tank				2020-2025	\$2,700,000
Storage	Central 2nd High 250 K Tank				2030-2035	\$1,700,000
Treatment	3.0 MGD Nitrate Removal Plant				TBD	\$9,500,000
Treatment	3.0 MGD Manganese Filtration Plant				TBD	\$9,100,000
Type	Improvement	Quantity	Unit	Price	Planning Period	Estimated Cost
Distribution	Upsize 6 to 8-Inch Main	28,700	LF	\$12	TBD	\$351,000
Distribution	Upsize 6 to 12-Inch Trunk Main	144,600	LF	\$48	TBD	\$6,897,000
Distribution	Upsize 6 to 16-Inch Trunk Main	12,600	LF	\$92	TBD	\$1,159,000
Distribution	Upsize 8 to 12-Inch Trunk Main	27,600	LF	\$35	TBD	\$979,000
Distribution	Upsize 8 to 16-Inch Trunk Main	2,700	LF	\$80	TBD	\$215,000
Distribution	Zone Boundary PRV's	7	EA	\$85,000	TBD	\$595,000
Distribution	Highway Crossing / Casing	500	LF	\$700	TBD	\$350,000

7.7 Trigger Chart

The timing of future water improvements will be influenced by a number of parameters. Items such as development pressure in specific areas, aging facilities and/or facilities which are undersized, availability of funds, etc. all play a role in the timing of future improvements.

Because of the factors involved, it is difficult to accurately predict the timing of future improvements, especially those which may occur far into the future.

A trigger chart is presented in below, which correlates well and storage improvements to system demands. Future capital improvement planning can thus be tied to actual system demands and the timeline adjusted as necessary.



Figures

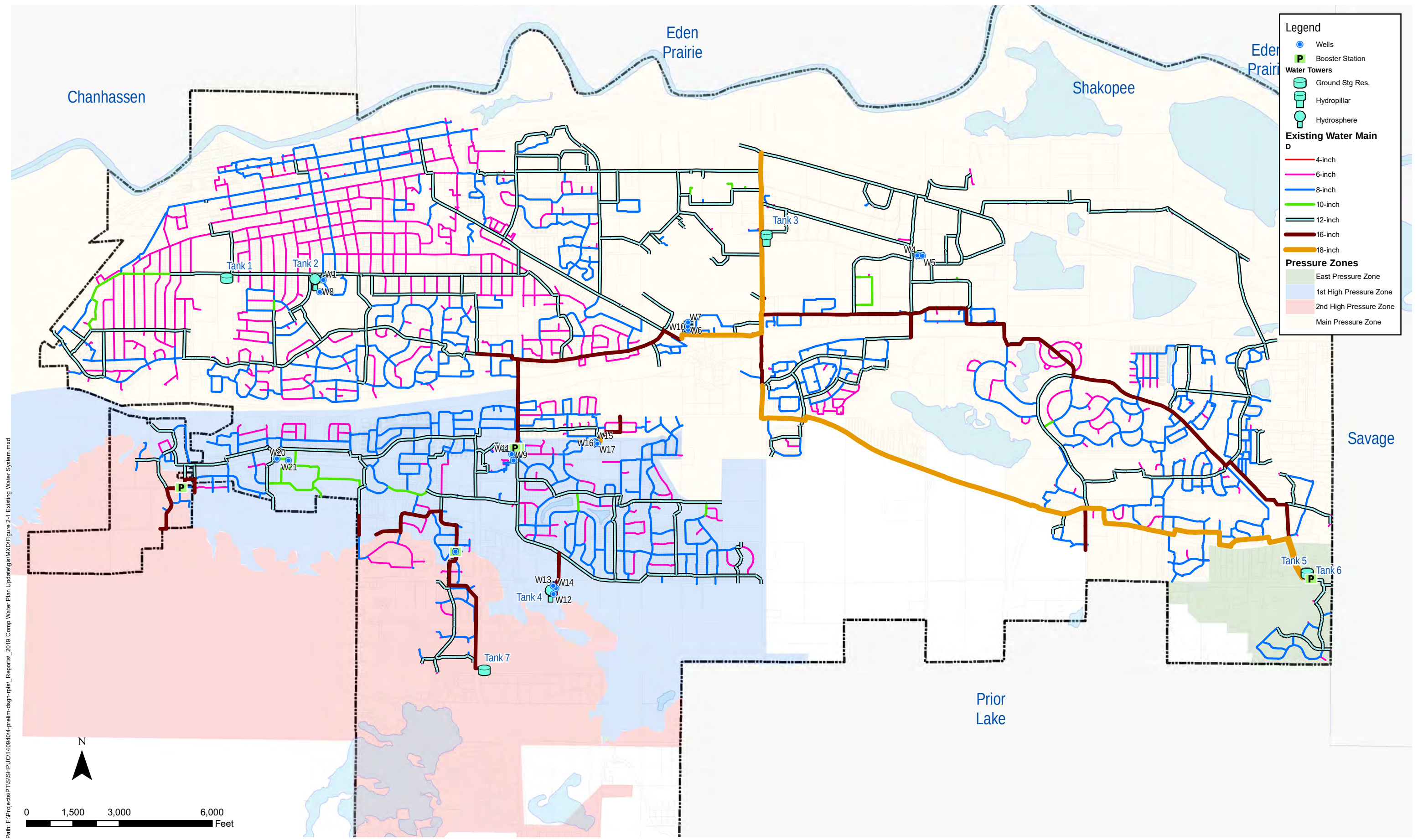
Figure 2-1 – Existing Water System Model Map

Figure 4-1 – Future Land Use Planning

Figure 6-1 – Proposed 2040 Water System Improvements

Figure 6-2 – 2040 Water System Static Pressures

Figure 6-3 – 2040 Water System Calculated Available Fire Flow



Path: F:\Projects\PT\SHUPUC\140940\4-prelim-dsgn-rpts\Report\2019 Comp Water Plan Update\GIS\MXD\Figure 2-1 Existing Water System.mxd



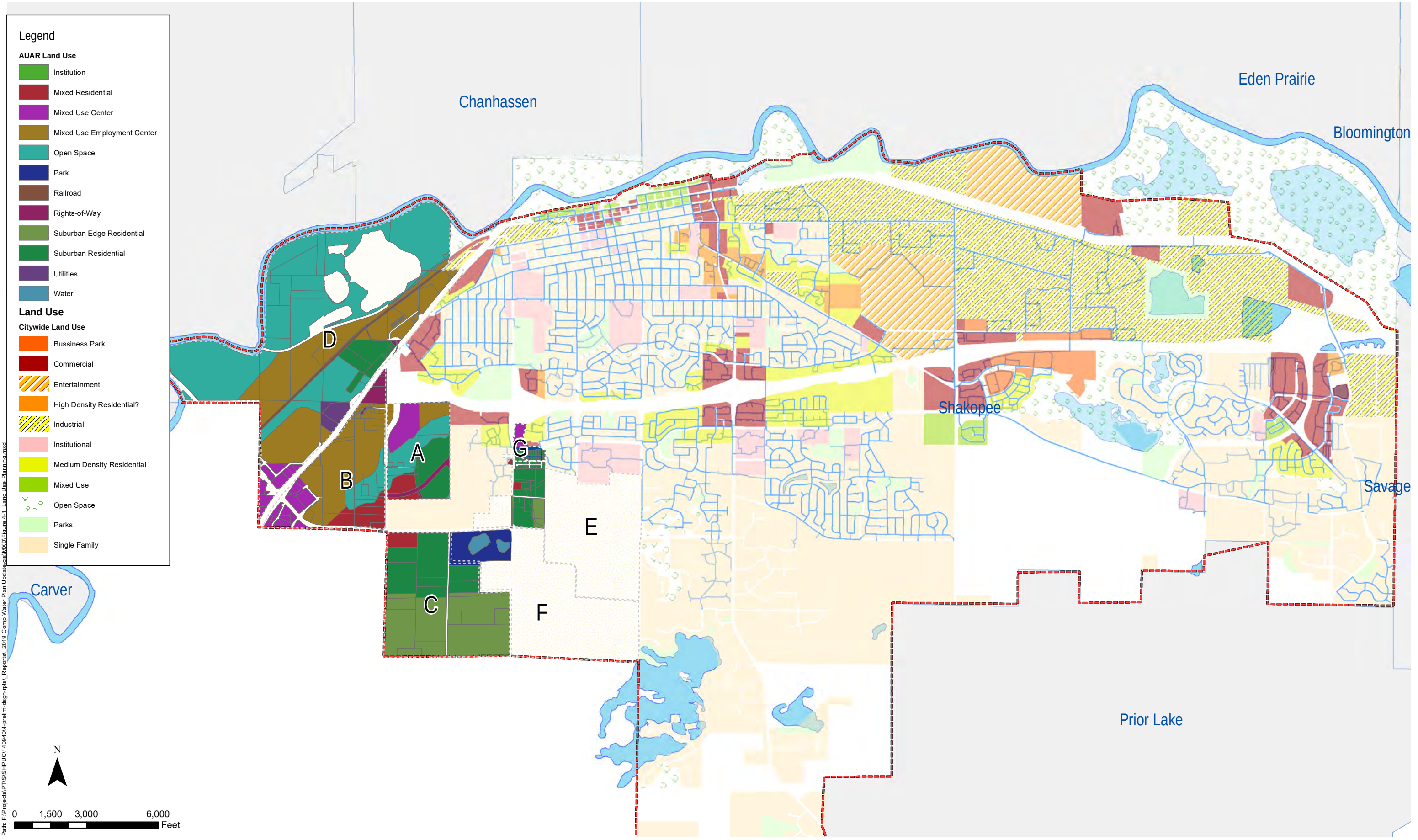
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Print Date: Print Date: 10/21/2019

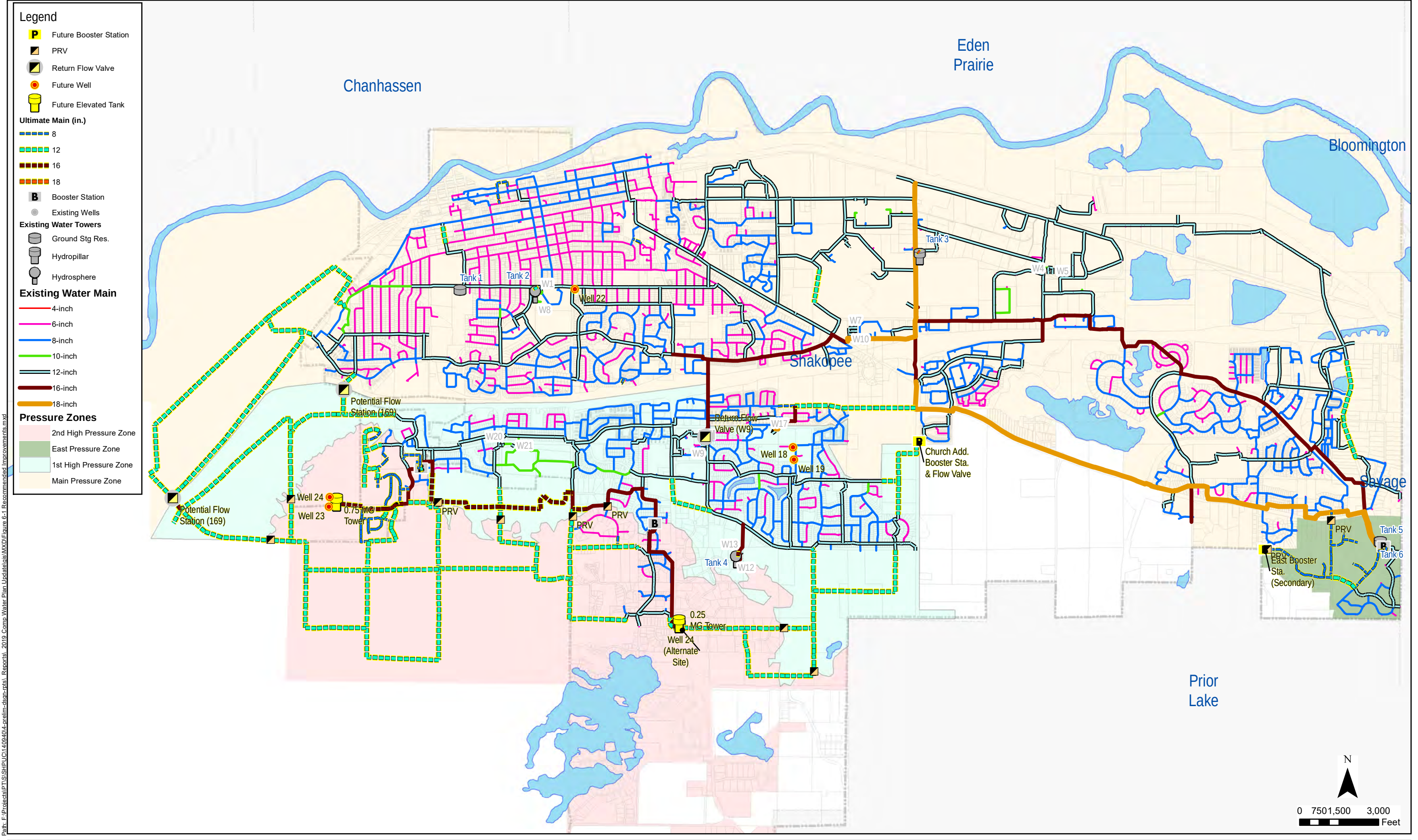
Map by:
Projection:
Source:

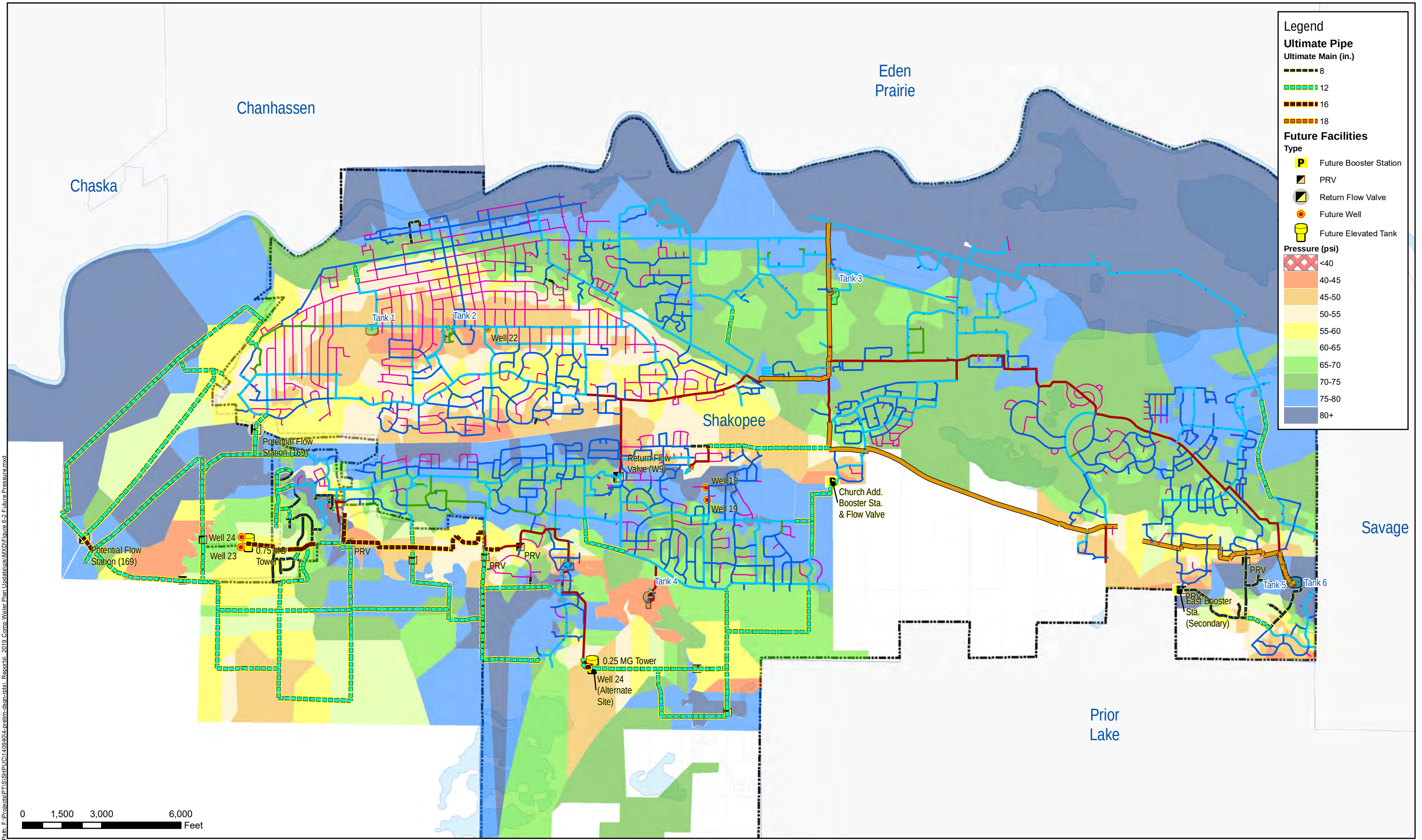


Comprehensive Water Plan Update - 2019 Supplement Shakopee Public Utilities Shakopee, Minnesota

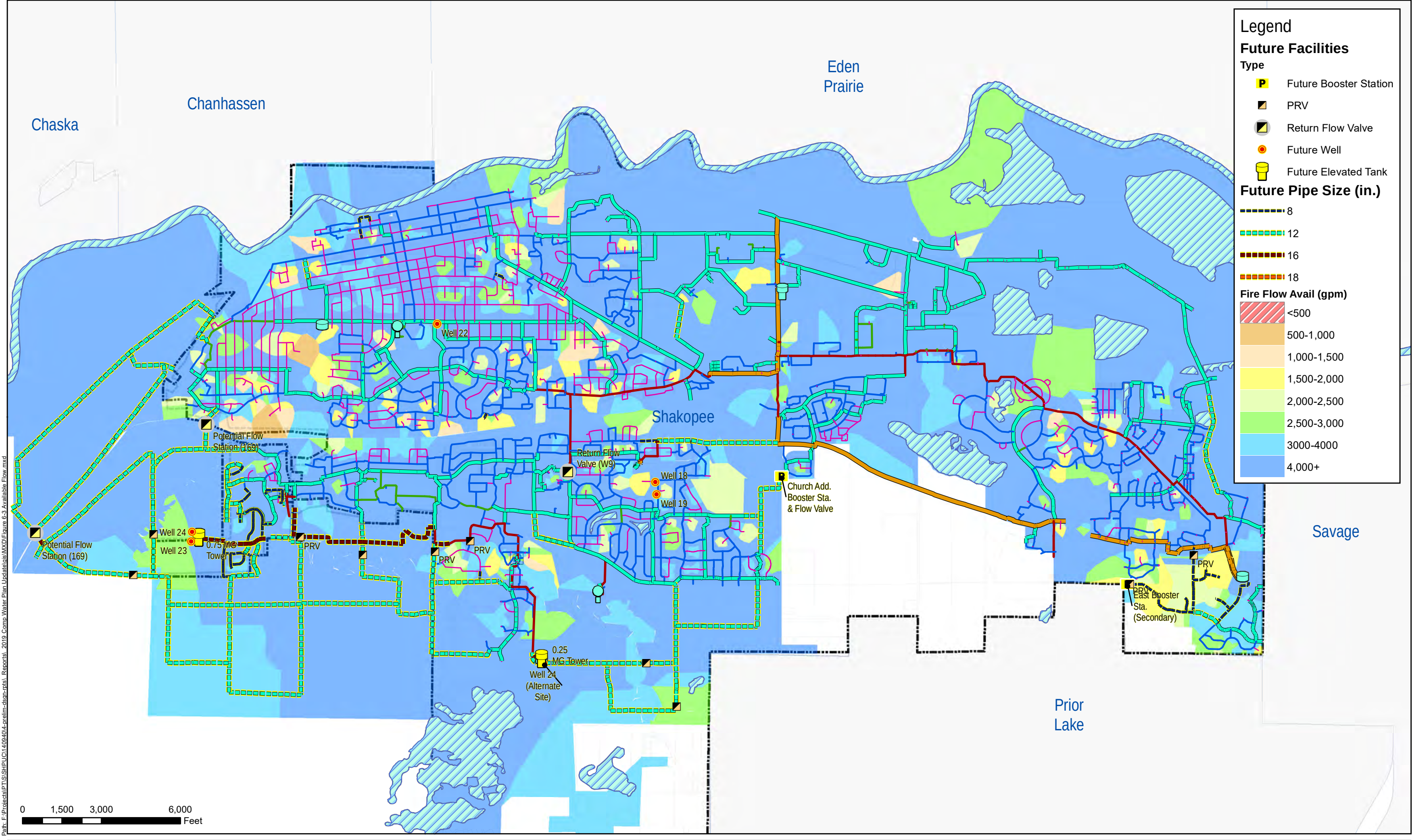
FIGURE 2-1
Existing Water System Model Map







Path: F:\Projects\PT\SHPUC\140940\4-prelim-ds-maps\Report\ 2019 Comp Water Plan Update\Map\Figure 6-2 Future Pressure.mxd



Path: F:\Projects\PT\SHPUC\140940\4-prelim-dsnc-rpt\ Report\ 2019 Comp Water Plan Update\MXD\Figure 6-3 Available Flow.mxd

0 1,500 3,000 6,000 Feet



Project Number: SHPUC 140940
Print Date: Print Date: 10/21/2019
Map by:
Projection:
Source:



Comprehensive Water Plan Update - 2019 Supplement
Shakopee Public Utilities
Shakopee, Minnesota

FIGURE 6-3
2040 Water System
Calc. Available Fire Flow

Appendix A

Water Quality Data

	Well 2		Well 8		Well 20		Well 21		Well 15		Well 16		Well 17		Well 4		Well 5	
	Result	Unit	Result	Unit	Result	Unit	Result	Unit	Result	Unit	Result	Unit	Result	Unit	Result	Unit	Result	Unit
Copper	<	0.005	mg/L	<	0.005	mg/L	<	0.005	mg/L	<	0.01	mg/L	<	0.005	mg/L	<	0.005	mg/L
Arsenic	<	0.5	µg/L	<	0.5	µg/L	<	0.5	µg/L	<	0.5	µg/L	<	0.5	µg/L	<	0.5	µg/L
Chloride	<	37.10	mg/L	<	48.20	mg/L	<	36.20	mg/L	<	43.50	mg/L	<	43.00	mg/L	<	155.00	mg/L
Iron	<	0.03	mg/L	<	0.03	mg/L	<	0.03	mg/L	<	0.015	mg/L	<	0.03	mg/L	<	0.015	mg/L
Manganese	<	0.005	mg/L	<	0.005	mg/L	<	0.005	mg/L	<	0.118	mg/L	<	0.036	mg/L	<	0.005	mg/L
Sulfate																		
Alkalinity, Total*		265	mg/L		261	mg/L		259	mg/L		279	mg/L		295	mg/L		240	mg/L
Calcium		73.70	mg/L		76.80	mg/L		73.60	mg/L		82.20	mg/L		82.90	mg/L		105.00	mg/L
Magnesium		32.60	mg/L		34.40	mg/L		30.00	mg/L		35.40	mg/L		38.50	mg/L		29.60	mg/L
Sodium		14.70	mg/L		15.30	mg/L		12.20	mg/L		17.30	mg/L		16.00	mg/L		34.70	mg/L
Zinc	<	0.01	mg/L	<	0.01	mg/L	<	0.01	mg/L	<	0.01	mg/L	<	0.01	mg/L	<	0.01	mg/L
Hardness, Total		318	mg/L		333	mg/L		307	mg/L		351	mg/L		366	mg/L		330	mg/L

CD - 1

	Well 9		Well 11		Well 6		Well 7		Well 10			
	Result	Unit	Result	Unit	Result	Unit	Result	Unit	Result	Unit		
Copper	<	0.005	mg/L	<	0.005	mg/L	<	0.01	mg/L	<	0.005	mg/L
Arsenic	<	0.5	µg/L	<	0.5	µg/L	<	0.5	µg/L	<	1.95	µg/L
Chloride		63.60	mg/L		42.10	mg/L		124.00	mg/L		12.10	mg/L
Iron	<	0.015	mg/L	<	0.015	mg/L	<	0.015	mg/L	<	0.417	mg/L
Manganese	<	0.005	mg/L	<	0.005	mg/L	<	0.005	mg/L	<	0.006	mg/L
Sulfate			mg/L			mg/L			mg/L			mg/L
Alkalinity, Total*		329	mg/L		338	mg/L		262	mg/L		200	mg/L
Calcium		97.90	mg/L		95.00	mg/L		85.40	mg/L		42.80	mg/L
Magnesium		43.00	mg/L		43.20	mg/L		36.60	mg/L		16.80	mg/L
Sodium		18.20	mg/L		14.70	mg/L		56.30	mg/L		24.90	mg/L
Zinc	<	0.01	mg/L	<	0.01	mg/L	<	0.01	mg/L	<	0.01	mg/L
Hardness, Total		422	mg/L		415	mg/L		364	mg/L		176	mg/L
											2.10	pCi/L
											4.10	pCi/L
											280.00	pCi/L

Radium 226
Radium 228
Radon 222

MCL	
Copper	1.3
Arsenic	10
Chloride	N/A
Iron	N/A
Manganese	N/A
Sulfate	N/A
Alkalinity, Total*	N/A
Calcium	N/A
Magnesium	N/A
Sodium	N/A
Zinc	N/A
Hardness, Total	N/A

* as CaCO₃

< indicates below detection limit for the test method.

Averages System Wide

Chloride	51.65
Sulfate	
Alkalinity	276.35
Calcium	81.06
Magnesium	34.05
Sodium	21.19
Hardness	342.65
grains	20

Alkalinity is a measure of the ability of a solution to neutralize acid without changing the pH. If both controls and maintains water pH. Carbonate **hardness** is measured in degrees (dKH), parts per million of calcium carbonate (ppm CaCO₃), or milliequivalents per liter (meq/L).

Averages by Zone

	Normal	1HES	2HES
Chloride	64.11	21.76	
Sulfate			
Alkalinity	273.67	282.8	
Calcium	82.86	76.76	
Magnesium	34.65	32.62	
Sodium	25.72	10.34	
Hardness	349.58	326	
grains	20	19	

Unit Analogies

Parts per Million
1 inch in 16 miles
1 minute in 2 years
1 second in 11.5 days

Parts per Billion (µg/L)
1 second in 32 years
4 drops in 50,000 gallons
6 people to the population of the earth

Parts per Trillion
1/2 drop in 6 million gallons
1 square inch in 250 square miles
1 second in 32,000 years

Well 14 is emergency run only. When pumped, it pumps to waste and not into the distribution system.

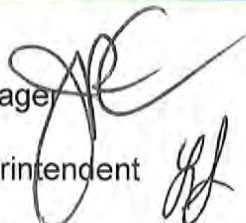
Radium 226
Radium 228
Radon 222



SHAKOPEE PUBLIC UTILITIES COMMISSION

"Lighting the Way - Yesterday, Today and Beyond"

MEMORANDUM

TO: John R. Crooks, Utilities Manager 

FROM: Lon R. Schemel, Water Superintendent 

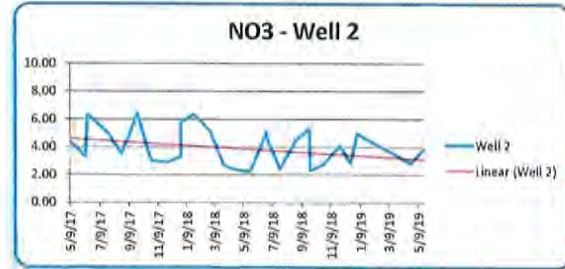
SUBJECT: Nitrate Results Update -- Advisory

DATE: June 24, 2019

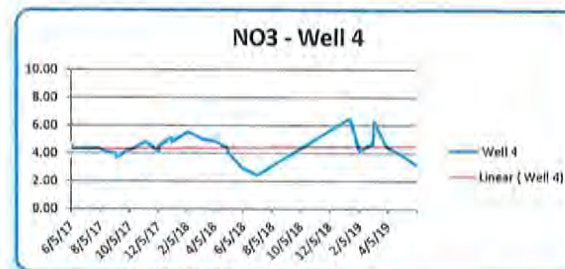
Attached are the latest nitrate test results for the wells. The analyses provided are for the prior 2 years of data collected with trend graphs.

Shakopee Public Utilities Commission
Water Department
Nitrate Results
Reported in mg/L

Location	Sample Collected	Results Received	Results	Lab	Run Time
2	5/9/17	5/25/17	4.33	MVTL	168 hrs prior
2	6/8/17	6/28/17	3.30	MDH	168 hrs prior
2	6/8/17	7/27/17	3.40	MDH	
2	8/13/17	8/20/17	6.28	MVTL	192 hrs prior
2	7/25/17	8/1/17	5.00	MVTL	192 hrs prior
2	8/22/17	8/28/17	3.50	MVTL	168 hrs prior
2	9/26/17	10/4/17	6.42	MVTL	168 hrs prior
2	9/26/17	10/20/17	6.30	MDH	
2	10/24/17	11/17/17	3.00	MVTL	168 hrs prior
2	11/28/17	12/11/17	2.90	MVTL	168 hrs prior
2	12/26/17	1/9/18	3.28	MVTL	168 hrs prior
2	12/26/17	2/20/18	5.70	MDH	
2	1/23/18	2/20/18	6.32	MVTL	168 hrs prior
2	2/27/18	3/9/18	5.14	MVTL	168 hrs prior
2	3/27/18	5/31/18	2.70	MDH	
2	4/3/18	4/10/18	2.55	MVTL	168 hrs prior
2	4/24/18	5/9/18	2.37	MVTL	168 hrs prior
2	5/22/18	5/31/18	2.21	MVTL	168 hrs prior
2	5/22/18	6/14/18	2.20	MDH	
2	6/20/18	7/2/18	5.07	MVTL	312 hrs prior
2	6/26/18	8/17/18	4.70	MDH	
2	7/24/18	8/17/18	2.41	MVTL	264 hrs prior
2	8/28/18	10/15/18	4.57	MVTL	168 hrs prior
2	9/25/18	10/15/18	5.30	MVTL	168 hrs prior
2	9/26/18	10/15/18	2.30	MDH	
2	10/23/18	11/7/18	2.76	MVTL	168 hrs prior
2	11/27/18	12/5/18	4.12	MVTL	168 hrs prior
2	12/18/18	12/26/18	2.89	MVTL	168 hrs prior
2	12/18/18	1/14/19	2.90	MDH	
2	1/2/19	1/14/19	4.97	MVTL	168 hrs prior
2	4/23/19	5/1/19	2.84	MVTL	168 hrs prior
2	4/23/19	5/17/19	2.90	MDH	
2	5/21/19	5/29/19	3.83	MVTL	168 hrs prior

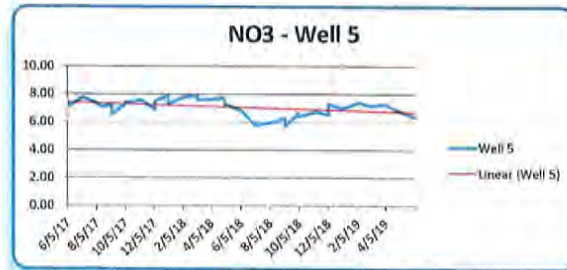


4	6/5/17	7/27/17	4.60	MDH	
4	6/8/17	6/14/17	4.33	MVTL	168 hrs prior
4	7/5/17	7/20/17	4.35	MVTL	168 hrs prior
4	8/1/17	8/7/17	4.35	MVTL	168 hrs prior
4	8/14/17	10/20/17	4.10	MDH	
4	9/5/17	9/26/17	3.99	MVTL	168 hrs prior
4	9/5/17	9/26/17	3.60	MDH	
4	10/3/17	10/20/17	4.29	MVTL	168 hrs prior
4	10/3/17	11/17/17	4.20	MDH	
4	11/7/17	3/2/18	4.83	MVTL	168 hrs prior
4	12/5/17	12/22/17	4.12	MVTL	192 hrs prior
4	12/5/17	1/8/18	4.50	MDH	
4	1/2/18	1/16/18	5.15	MVTL	168 hrs prior
4	1/2/18	2/20/18	4.80	MDH	
4	2/6/18	2/20/18	5.50	MVTL	168 hrs prior
4	3/6/18	3/26/18	5.09	MVTL	168 hrs prior
4	3/6/18	3/26/18	5.00	MDH	
4	4/3/18	4/10/18	4.89	MVTL	168 hrs prior
4	5/1/18	5/9/18	4.40	MVTL	168 hrs prior
4	5/1/18	6/26/18	4.10	MDH	
4	6/5/18	6/14/18	2.80	MVTL	168 hrs prior
4	6/5/18	7/18/18	2.90	MDH	
4	7/3/18	11/19/18	2.40	MDH	168 hrs prior
4	1/15/19	1/29/19	6.50	MVTL	168 hrs prior
4	2/5/19	2/12/19	4.16	MVTL	168 hrs prior
4	3/5/19	3/14/19	4.76	MVTL	168 hrs prior
4	3/5/19	3/29/19	4.80	MDH	
4	3/7/19	3/25/19	6.30	MDH	168 hrs prior
4	4/2/19	4/11/19	4.48	MVTL	168 hrs prior
4	5/7/19	5/14/19	3.82	MVTL	168 hrs prior
4	6/4/19	6/21/19	3.14	MVTL	168 hrs prior

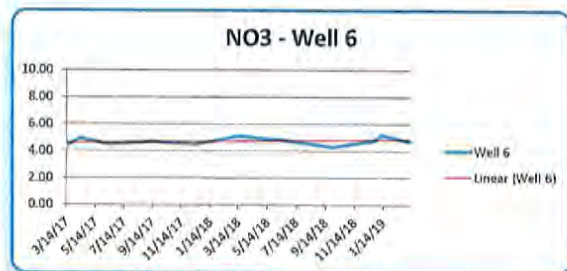


Shakopee Public Utilities Commission
Water Department
Nitrate Results
Reported in mg/L

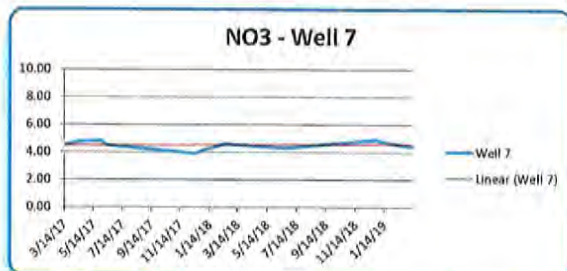
Location	Sample Collected	Results Received	Results	Lab	Run Time
5	6/5/17	7/27/17	7.40	MDH	
5	6/6/17	6/14/17	7.12	MVTL	168 hrs prior
5	7/5/17	7/20/17	7.74	MVTL	168 hrs prior
5	8/1/17	8/7/17	7.40	MVTL	168 hrs prior
5	8/14/17	10/20/17	7.10	MDH	
5	9/5/17	9/26/17	7.27	MVTL	168 hrs prior
5	9/5/17	9/26/17	6.50	MDH	
5	10/3/17	10/20/17	7.33	MVTL	168 hrs prior
5	10/3/17	11/17/17	7.40	MDH	
5	11/7/17	3/2/18	7.57	MVTL	168 hrs prior
5	12/5/17	12/22/17	6.89	MVTL	192 hrs prior
5	12/5/17	1/8/18	7.50	MDH	
5	1/2/18	1/16/18	7.88	MVTL	168 hrs prior
5	1/2/18	2/20/18	7.30	MDH	
5	2/6/18	2/20/18	7.80	MVTL	168 hrs prior
5	3/6/18	3/26/18	7.84	MVTL	168 hrs prior
5	3/6/18	3/26/18	7.60	MDH	
5	4/3/18	4/10/18	7.62	MVTL	168 hrs prior
5	5/1/18	5/9/18	7.75	MVTL	168 hrs prior
5	5/1/18	6/26/18	7.30	MDH	
5	6/5/18	6/14/18	6.83	MVTL	168 hrs prior
5	6/5/18	7/18/18	6.80	MDH	
5	7/3/18	11/19/18	5.80	MDH	
5	8/7/18	8/20/18	5.99	MVTL	168 hrs prior
5	9/4/18	10/15/18	6.32	MVTL	168 hrs prior
5	9/4/18	10/15/18	5.70	MDH	
5	10/2/18	10/15/18	6.67	MVTL	168 hrs prior
5	10/2/18	11/19/18	6.40	MDH	
5	11/6/18	11/19/18	6.74	MVTL	168 hrs prior
5	12/4/18	12/11/18	6.55	MVTL	168 hrs prior
5	12/4/18	12/26/18	7.30	MDH	
5	1/2/19	1/14/19	7.01	MVTL	168 hrs prior
5	1/2/19	3/4/19	7.00	MDH	
5	2/5/19	2/12/19	7.42	MVTL	168 hrs prior
5	3/5/19	3/14/19	7.16	MVTL	168 hrs prior
5	3/5/19	3/29/19	7.20	MDH	
5	4/2/19	4/11/19	7.29	MVTL	168 hrs prior
5	5/7/19	5/14/19	6.73	MVTL	168 hrs prior
5	6/4/19	6/21/19	6.38	MVTL	168 hrs prior



6	3/14/17	4/24/17	4.40	MDH	168 hrs prior
6	4/11/17	4/17/17	4.94	MVTL	168 hrs prior
6	6/8/17	7/27/17	4.50	MDH	168 hrs prior
6	9/12/17	10/20/17	4.70	MDH	168 hrs prior
6	12/12/17	1/8/18	4.50	MDH	168 hrs prior
6	3/13/18	4/10/18	5.10	MDH	168 hrs prior
6	6/19/18	7/18/18	4.80	MDH	456 hrs prior
6	9/25/18	10/15/18	4.30	MDH	192 hrs prior
6	12/27/18	2/5/19	4.80	MDH	168 hrs prior
6	1/8/19	1/14/19	5.21	MVTL	168 hrs prior
6	3/12/19	3/29/19	4.70	MDH	168 hrs prior

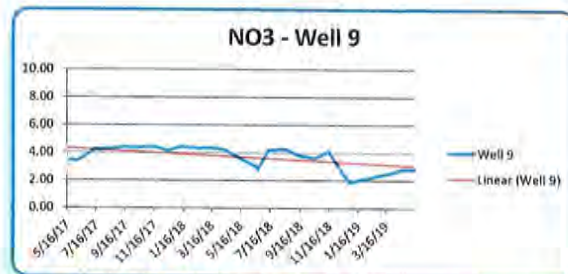
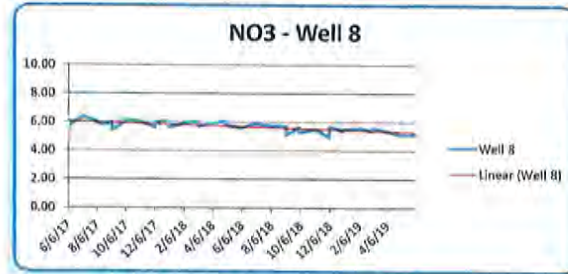


7	3/14/17	4/24/17	4.50	MDH	168 hrs prior
7	4/11/17	4/17/17	4.74	MVTL	168 hrs prior
7	6/1/17	7/27/17	4.80	MDH	168 hrs prior
7	6/8/17	7/27/17	4.50	MDH	168 hrs prior
7	9/12/17	10/3/17	4.20	MDH	168 hrs prior
7	12/12/17	1/8/18	3.90	MDH	168 hrs prior
7	2/13/18	3/26/18	4.60	MDH	168 hrs prior
7	6/19/18	7/18/18	4.30	MDH	456 hrs prior
7	9/18/18	10/15/18	4.60	MDH	216 hrs prior
7	12/27/18	2/5/19	4.90	MDH	168 hrs prior
7	1/8/19	1/14/19	4.78	MVTL	168 hrs prior
7	3/12/19	3/29/19	4.40	MDH	168 hrs prior



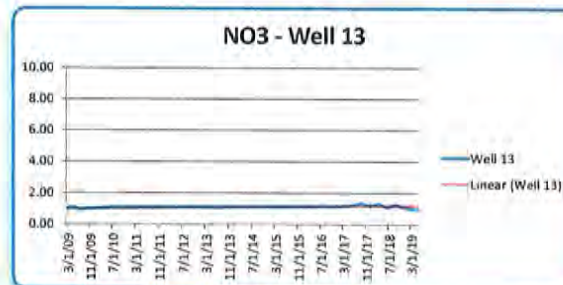
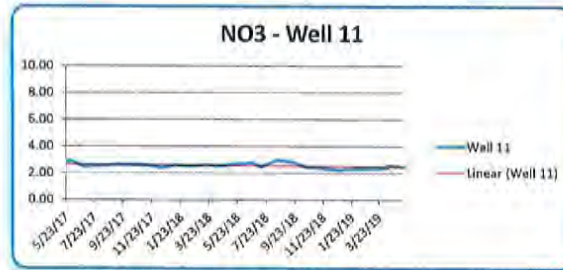
Shakopee Public Utilities Commission
Water Department
Nitrate Results
Reported in mg/L

Location	Sample Collected	Results Received	Results	Lab	Run Time
8	6/5/17	6/14/17	5.71	MVTL	168 hrs prior
8	6/8/17	7/27/17	5.80	MDH	168 hrs prior
8	7/5/17	7/20/17	6.36	MVTL	144 hrs prior
8	8/1/17	8/7/17	6.03	MVTL	216 hrs prior
8	8/14/17	10/20/17	5.80	MDH	
8	9/5/17	9/26/17	5.98	MVTL	216 hrs prior
8	9/5/17	9/26/17	5.40	MDH	
8	10/3/17	10/20/17	6.00	MVTL	168 hrs prior
8	10/3/17	11/17/17	6.20	MDH	
8	11/7/17	3/2/18	5.97	MVTL	168 hrs prior
8	12/5/17	12/22/17	5.61	MVTL	192 hrs prior
8	12/5/17	1/8/18	6.00	MDH	
8	1/2/18	1/16/18	6.07	MVTL	168 hrs prior
8	1/2/18	2/20/18	5.60	MDH	
8	2/6/18	2/20/18	5.94	MVTL	168 hrs prior
8	3/6/18	3/26/18	6.03	MVTL	168 hrs prior
8	3/6/18	3/26/18	5.70	MDH	
8	4/3/18	4/10/18	5.88	MVTL	168 hrs prior
8	5/1/18	5/9/18	6.08	MVTL	168 hrs prior
8	5/1/18	8/26/18	5.80	MDH	
8	6/5/18	8/14/18	5.59	MVTL	168 hrs prior
8	6/5/18	7/18/18	5.60	MDH	
8	7/3/18	11/19/18	5.90	MDH	
8	8/7/18	8/20/18	5.72	MVTL	168 hrs prior
8	9/4/18	10/15/18	5.72	MVTL	168 hrs prior
8	9/4/18	10/15/18	5.10	MDH	
8	10/2/18	10/15/18	5.65	MVTL	168 hrs prior
8	10/2/18	11/19/18	5.30	MDH	
8	11/6/18	11/19/18	5.51	MVTL	168 hrs prior
8	12/4/18	12/11/18	4.89	MVTL	168 hrs prior
8	12/4/18	12/26/18	5.70	MDH	
8	1/2/19	1/14/19	5.41	MVTL	168 hrs prior
8	1/2/19	3/4/19	5.50	MDH	
8	2/5/19	2/12/19	5.58	MVTL	168 hrs prior
8	3/5/19	3/14/19	5.41	MVTL	168 hrs prior
8	3/5/19	3/29/19	5.60	MDH	
8	4/2/19	4/11/19	5.40	MVTL	168 hrs prior
8	5/7/19	5/14/19	5.13	MVTL	168 hrs prior
8	6/4/19	6/21/19	5.12	MVTL	168 hrs prior
9	5/16/17	5/25/17	3.47	MVTL	168 hrs prior
9	6/5/17	8/28/17	3.40	MDH	168 hrs prior
9	6/20/17	8/27/17	3.69	MVTL	168 hrs prior
9	7/11/17	7/20/17	4.23	MVTL	144 hrs prior
9	8/8/17	8/14/17	4.27	MVTL	168 hrs prior
9	9/12/17	9/26/17	4.40	MVTL	132 hrs prior
9	10/10/17	10/20/17	4.38	MVTL	144 hrs prior
9	11/14/17	11/21/17	4.43	MVTL	168 hrs prior
9	12/12/17	12/22/17	4.14	MVTL	168 hrs prior
9	1/9/18	1/16/18	4.45	MVTL	168 hrs prior
9	2/13/18	2/20/18	4.33	MVTL	168 hrs prior
9	3/13/18	3/26/18	4.36	MVTL	168 hrs prior
9	4/10/18	4/18/18	4.23	MVTL	168 hrs prior
9	6/19/18	6/26/18	2.92	MVTL	96 hrs prior
9	6/19/18	7/18/18	2.80	MDH	
9	7/10/18	7/18/18	4.20	MVTL	240 hrs prior
9	8/14/18	8/20/18	4.29	MVTL	168 hrs prior
9	9/11/18	10/15/18	3.83	MVTL	168 hrs prior
9	10/16/18	11/7/18	3.61	MVTL	168 hrs prior
9	11/13/18	11/29/18	4.15	MVTL	168 hrs prior
9	12/27/18	1/14/19	1.87	MVTL	168 hrs prior
9	4/9/19	4/18/19	2.69	MVTL	168 hrs prior
9	4/9/19	5/1/19	2.80	MDH	
9	5/14/19	5/20/19	2.82	MVTL	168 hrs prior



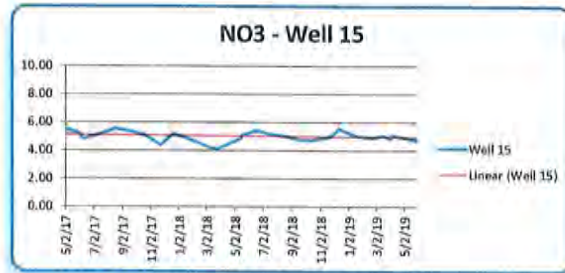
Shakopee Public Utilities Commission
Water Department
Nitrate Results
Reported in mg/L

Location	Sample Collected	Results Received	Results	Lab	Run Time
10	4/17/12	4/20/12	< 1.00	TCWC	158 hrs prior
10	1/21/14	1/29/14	< 1.00	TCWC	144 hrs prior
10	3/25/14	4/1/14	3.61	MVTL	96 hrs prior
10	4/23/14	5/7/14	< 0.20	MVTL	24 hrs prior
10	4/23/14	6/16/14	< 0.05	MDH	*
10	6/16/15	6/26/15	< 0.05	MVTL	144 hrs prior
10	4/11/17	4/17/17	< 0.05	MVTL	168 hrs prior
10	1/8/19	1/14/19	< 0.05	MVTL	168 hrs prior
11	5/23/17	5/30/17	2.83	MVTL	168 hrs prior
11	6/1/17	6/15/17	2.50	MDH	192 hrs prior
11	6/27/17	7/5/17	2.50	MVTL	168 hrs prior
11	7/11/17	7/20/17	2.50	MVTL	168 hrs prior
11	8/8/17	8/14/17	2.55	MVTL	168 hrs prior
11	9/12/17	9/26/17	2.62	MVTL	168 hrs prior
11	10/10/17	10/20/17	2.61	MVTL	144 hrs prior
11	11/14/17	11/21/17	2.57	MVTL	168 hrs prior
11	12/12/17	12/22/17	2.39	MVTL	168 hrs prior
11	1/9/18	1/16/18	2.57	MVTL	168 hrs prior
11	2/13/18	2/20/18	2.54	MVTL	168 hrs prior
11	3/13/18	3/26/18	2.59	MVTL	168 hrs prior
11	4/10/18	4/18/18	2.53	MVTL	168 hrs prior
11	6/22/18	7/18/18	2.80	MDH	24 hrs prior
11	7/10/18	7/18/18	2.48	MVTL	24 hrs prior
11	8/14/18	8/20/18	2.95	MVTL	168 hrs prior
11	9/18/18	10/15/18	2.83	MVTL	168 hrs prior
11	10/16/18	11/7/18	2.45	MVTL	168 hrs prior
11	11/13/18	11/29/18	2.41	MVTL	168 hrs prior
11	12/27/18	1/14/19	2.25	MVTL	168 hrs prior
11	1/8/19	1/14/19	2.31	MVTL	168 hrs prior
11	4/9/19	4/16/19	2.40	MVTL	168 hrs prior
11	4/9/19	5/1/19	2.80	MDH	
11	5/14/19	5/20/19	2.48	MVTL	168 hrs prior
12	4/11/17	4/17/17	0.82	MVTL	168 hrs prior
12	9/5/17	9/26/17	0.72	MVTL	168 hrs prior
12	12/5/17	12/22/17	0.72	MVTL	168 hrs prior
12	9/4/18	10/15/18	0.62	MVTL	168 hrs prior
12	12/4/18	12/11/18	0.58	MVTL	144 hrs prior
12	3/5/19	3/14/19	0.68	MVTL	168 hrs prior
12	5/28/19	6/6/19	0.53	MVTL	
13	3/12/09	3/26/09	0.96	MVTL	46 hrs prior
13	4/14/09	4/27/09	1.10	MVTL	60 hrs prior
13	8/4/09	8/12/09	0.90	MVTL	1013 hrs prior
13	9/24/09	10/5/09	0.98	MVTL	51 hrs prior
13	7/14/10	7/27/10	1.07	MVTL	42 hrs prior
13	3/11/11	3/16/11	1.08	MVTL	100 hrs prior
13	4/11/17	4/17/17	1.19	MVTL	48 hrs prior
13	9/5/17	9/26/17	1.35	MVTL	128 hrs prior
13	12/5/17	12/22/17	1.20	MVTL	168 hrs prior
13	3/6/18	3/26/18	1.32	MVTL	168 hrs prior
13	6/5/18	6/14/18	1.11	MVTL	24 hrs prior
13	9/4/18	10/15/18	1.28	MVTL	168 hrs prior
13	12/4/18	12/11/18	1.08	MVTL	168 hrs prior
13	3/5/19	3/14/19	0.98	MVTL	168 hrs prior
13	5/28/19	6/6/19	0.95	MVTL	168 hrs prior
14	4/23/14	6/16/14	< 0.05	MDH	*
14	4/11/17	4/17/17	< 0.05	MVTL	20 hrs prior
14	9/5/17	9/26/17	< 0.05	MVTL	24 hrs prior
14	12/5/17	12/22/17	< 0.05	MVTL	168 hrs prior
14	3/6/18	3/26/18	< 0.05	MVTL	168 hrs prior
14	6/5/18	6/14/18	< 0.05	MVTL	24 hrs prior

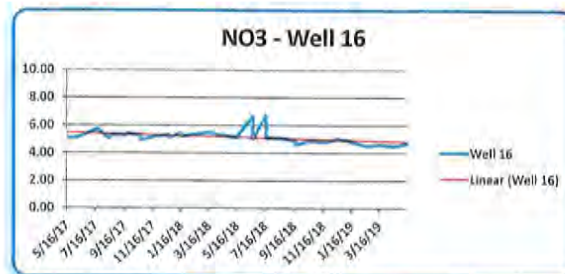


Shakopee Public Utilities Commission
Water Department
Nitrate Results
Reported in mg/L

Location	Sample Collected	Results Received	Results	Lab	Run Time
15	5/2/17	5/10/17	5.50	MVTL	144 hrs prior
15	6/1/17	6/15/17	5.20	MDH	168 hrs prior
15	6/6/17	6/14/17	4.80	MVTL	168 hrs prior
15	7/18/17	7/24/17	5.20	MVTL	168 hrs prior
15	8/15/17	8/21/17	5.54	MVTL	168 hrs prior
15	9/19/17	9/26/17	5.32	MVTL	168 hrs prior
15	10/17/17	11/17/17	5.10	MVTL	168 hrs prior
15	11/21/17	12/11/17	4.36	MVTL	168 hrs prior
15	12/19/17	12/27/17	5.17	MVTL	192 hrs prior
15	1/16/18	2/20/18	4.88	MVTL	168 hrs prior
15	3/20/18	3/27/18	4.04	MVTL	168 hrs prior
15	5/15/18	5/31/18	4.88	MVTL	168 hrs prior
15	5/15/18	5/31/18	5.10	MDH	
15	6/19/18	6/26/18	5.40	MVTL	408 hrs prior
15	7/17/18	8/17/18	5.16	MVTL	120 hrs prior
15	8/21/18	10/15/18	5.02	MVTL	168 hrs prior
15	9/18/18	10/15/18	4.76	MVTL	168 hrs prior
15	10/16/18	11/7/18	4.74	MVTL	168 hrs prior
15	11/20/18	11/29/18	4.98	MVTL	168 hrs prior
15	12/11/18	12/21/18	5.54	MVTL	168 hrs prior
15	1/15/19	1/29/19	5.05	MVTL	168 hrs prior
15	2/19/19	3/4/19	4.91	MVTL	168 hrs prior
15	3/15/19	3/25/19	5.05	MVTL	168 hrs prior
15	4/2/19	4/11/19	4.87	MVTL	168 hrs prior
15	4/2/19	5/1/19	5.10	MDH	
15	5/7/19	5/14/19	4.89	MVTL	168 hrs prior
15	5/28/19	6/6/19	4.70	MVTL	168 hrs prior

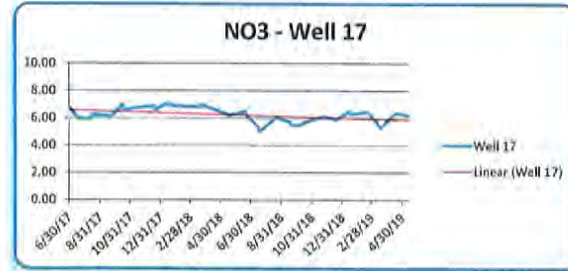


16	5/16/17	5/25/17	5.07	MVTL	168 hrs prior
16	6/8/17	7/27/17	5.10	MDH	168 hrs prior
16	7/18/17	7/24/17	5.72	MVTL	168 hrs prior
16	8/14/17	10/20/17	5.00	MDH	
16	8/15/17	8/21/17	5.28	MVTL	168 hrs prior
16	9/19/17	9/26/17	5.25	MVTL	168 hrs prior
16	9/19/17	10/20/17	5.40	MDH	
16	10/17/17	11/17/17	5.29	MVTL	168 hrs prior
16	10/17/17	3/9/18	4.90	MDH	
16	11/21/17	12/11/17	5.21	MVTL	168 hrs prior
16	12/19/17	12/27/17	5.29	MVTL	192 hrs prior
16	12/19/17	2/20/18	5.10	MDH	
16	1/16/18	2/20/18	5.44	MVTL	168 hrs prior
16	1/16/18	3/9/18	5.20	MDH	
16	3/20/18	3/27/18	5.53	MVTL	168 hrs prior
16	3/20/18	5/31/18	5.40	MDH	
16	5/15/18	5/31/18	5.14	MVTL	168 hrs prior
16	5/15/18	6/26/18	5.20	MDH	
16	6/19/18	6/26/18	6.65	MVTL	408 hrs prior
16	6/19/18	7/18/18	5.00	MDH	
16	7/17/18	8/17/18	6.76	MVTL	408 hrs prior
16	7/17/18	11/19/18	5.10	MDH	
16	9/18/18	10/15/18	4.87	MVTL	168 hrs prior
16	9/18/18	10/15/18	4.60	MDH	
16	10/9/18	10/15/18	4.79	MVTL	168 hrs prior
16	10/9/18	11/19/18	4.90	MDH	
16	8/21/18	10/15/18	5.09	MVTL	192 hrs prior
16	11/20/18	11/29/18	4.81	MVTL	168 hrs prior
16	12/18/18	12/26/18	5.06	MVTL	192 hrs prior
16	12/18/18	1/14/19	5.00	MDH	
16	1/15/19	1/29/19	4.90	MVTL	168 hrs prior
16	1/15/19	3/4/19	4.80	MDH	
16	2/19/19	3/4/19	4.51	MVTL	168 hrs prior
16	3/19/19	3/25/19	4.63	MVTL	168 hrs prior
16	3/19/19	4/4/19	4.60	MDH	
16	4/16/19	4/23/19	4.50	MVTL	168 hrs prior
16	5/14/19	5/20/19	4.68	MVTL	168 hrs prior

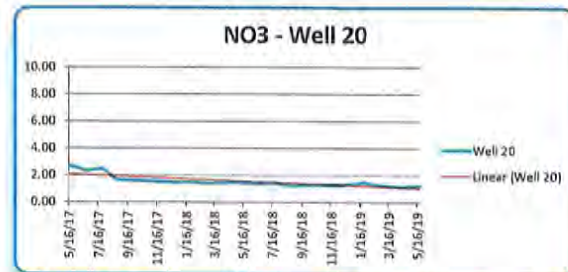


Shakopee Public Utilities Commission
Water Department
Nitrate Results
Reported in mg/L

Location	Sample Collected	Results Received	Results	Lab	Run Time
17	8/30/17	7/27/17	6.80	MDH	168 hrs prior
17	7/18/17	7/24/17	5.97	MVTL	168 hrs prior
17	8/14/17	10/20/17	5.90	MDH	
17	8/15/17	8/21/17	6.27	MVTL	168 hrs prior
17	9/19/17	9/26/17	6.13	MVTL	168 hrs prior
17	9/19/17	10/20/17	6.00	MDH	
17	10/17/17	11/17/17	7.06	MVTL	168 hrs prior
17	10/17/17	3/9/18	6.60	MDH	
17	11/21/17	12/11/17	6.79	MVTL	168 hrs prior
17	12/19/17	12/27/17	6.85	MVTL	192 hrs prior
17	12/19/17	2/20/18	6.60	MDH	
17	1/16/18	2/20/18	7.12	MVTL	168 hrs prior
17	1/16/18	3/9/18	6.90	MDH	
17	3/20/18	5/31/18	6.80	MDH	
17	3/20/18	3/27/18	7.00	MVTL	168 hrs prior
17	5/15/18	5/31/18	6.27	MVTL	168 hrs prior
17	5/15/18	6/26/18	6.20	MDH	
17	6/19/18	6/26/18	6.52	MVTL	408 hrs prior
17	6/19/18	7/18/18	6.30	MDH	
17	7/17/18	8/17/18	5.30	MVTL	408 hrs prior
17	7/17/18	11/19/18	5.00	MDH	
17	8/21/18	10/15/18	6.10	MVTL	168 hrs prior
17	9/18/18	10/15/18	5.70	MVTL	168 hrs prior
17	9/18/18	10/15/18	5.50	MDH	
17	10/9/18	10/15/18	5.50	MVTL	168 hrs prior
17	10/9/18	11/19/18	5.60	MDH	
17	11/20/18	11/29/18	6.13	MVTL	168 hrs prior
17	12/18/18	12/26/18	5.97	MVTL	168 hrs prior
17	12/18/18	1/14/19	5.90	MDH	
17	1/15/19	1/29/19	6.55	MVTL	168 hrs prior
17	1/15/19	3/4/19	6.30	MDH	
17	2/19/19	3/4/19	6.49	MVTL	168 hrs prior
17	3/19/19	3/25/19	5.25	MVTL	168 hrs prior
17	3/19/19	4/4/19	5.40	MDH	
17	4/16/19	4/23/19	6.40	MVTL	168 hrs prior
17	5/14/19	5/20/19	6.19	MVTL	168 hrs prior

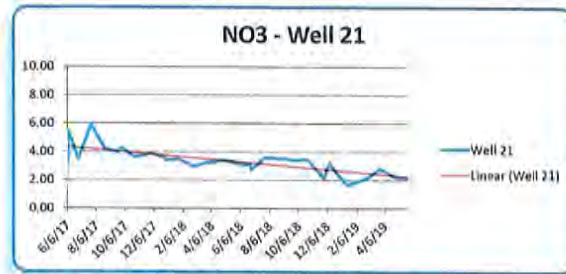


20	5/16/17	5/25/17	2.68	MVTL	168 hrs prior
20	6/5/17	6/28/17	2.50	MDH	144 hrs prior
20	6/20/17	6/27/17	2.30	MVTL	168 hrs prior
20	7/25/17	8/1/17	2.49	MVTL	144 hrs prior
20	8/22/17	8/28/17	1.67	MVTL	192 hrs prior
20	9/26/17	10/4/17	1.61	MVTL	168 hrs prior
20	10/24/17	11/17/17	1.56	MVTL	168 hrs prior
20	11/28/17	12/11/17	1.51	MVTL	168 hrs prior
20	12/26/17	1/9/18	1.46	MVTL	168 hrs prior
20	1/23/18	2/20/18	1.51	MVTL	168 hrs prior
20	2/27/18	3/9/18	1.41	MVTL	168 hrs prior
20	3/27/18	4/10/18	1.43	MVTL	168 hrs prior
20	4/24/18	5/9/18	1.49	MVTL	168 hrs prior
20	5/22/18	5/31/18	1.42	MVTL	168 hrs prior
20	5/22/18	6/14/18	1.40	MDH	
20	6/26/18	7/2/18	1.39	MVTL	72 hrs prior
20	7/24/18	8/17/18	1.42	MVTL	576 hrs prior
20	8/28/18	10/15/18	1.24	MVTL	192 hrs prior
20	9/25/18	10/15/18	1.30	MVTL	168 hrs prior
20	10/23/18	11/7/18	1.30	MVTL	216 hrs prior
20	12/11/18	12/21/18	1.29	MVTL	168 hrs prior
20	1/22/19	2/5/19	1.49	MVTL	168 hrs prior
20	2/26/19	3/6/19	1.25	MVTL	168 hrs prior
20	3/26/19	4/1/19	1.18	MVTL	168 hrs prior
20	4/23/19	5/1/19	1.15	MVTL	168 hrs prior
20	4/23/19	5/17/19	1.20	MDH	
20	5/21/19	5/29/19	1.21	MVTL	168 hrs prior

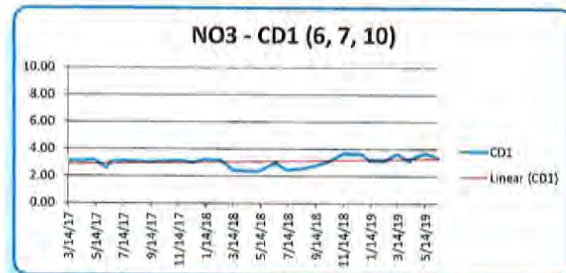


Shakopee Public Utilities Commission
Water Department
Nitrate Results
Reported in mg/L

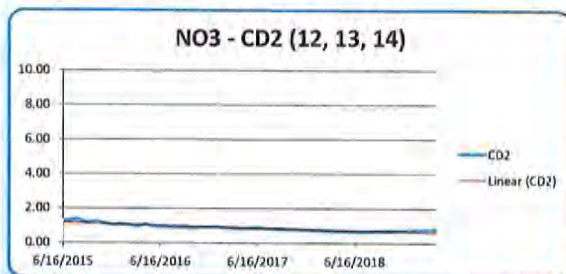
Location	Sample Collected	Results Received	Results	Lab	Run Time
21	6/6/17	6/28/17	3.20	MDH	144 hrs prior
21	6/6/17	7/27/17	5.50	MDH	
21	6/27/17	7/5/17	3.46	MVTL	168 hrs prior
21	7/25/17	8/1/17	5.90	MVTL	144 hrs prior
21	8/22/17	8/28/17	4.16	MVTL	192 hrs prior
21	9/19/17	10/20/17	4.00	MDH	
21	9/26/17	10/4/17	4.29	MVTL	168 hrs prior
21	10/24/17	11/17/17	3.61	MVTL	168 hrs prior
21	11/28/17	12/11/17	3.90	MVTL	168 hrs prior
21	12/26/17	1/9/18	3.58	MVTL	168 hrs prior
21	12/26/17	2/20/18	3.40	MDH	
21	1/23/18	2/20/18	3.49	MVTL	168 hrs prior
21	2/27/18	3/9/18	2.95	MVTL	168 hrs prior
21	3/27/18	4/10/18	3.26	MVTL	168 hrs prior
21	3/27/18	5/31/18	3.20	MDH	
21	4/24/18	5/9/18	3.40	MVTL	168 hrs prior
21	5/22/18	5/31/18	3.30	MVTL	168 hrs prior
21	5/22/18	6/14/18	3.20	MDH	
21	6/26/18	7/2/18	3.07	MVTL	240 hrs prior
21	6/26/18	8/17/18	2.70	MDH	
21	7/24/18	8/17/18	3.60	MVTL	576 hrs prior
21	8/28/18	10/15/18	3.54	MVTL	168 hrs prior
21	9/25/18	10/15/18	3.45	MVTL	216 hrs prior
21	9/26/18	10/15/18	3.40	MDH	
21	10/23/18	11/7/18	3.49	MVTL	168 hrs prior
21	11/27/18	12/5/18	2.13	MVTL	192 hrs prior
21	12/11/18	12/21/18	3.28	MVTL	168 hrs prior
21	12/11/18	1/14/19	3.10	MDH	
21	1/15/19	1/29/19	1.65	MVTL	168 hrs prior
21	2/26/19	3/6/19	2.13	MVTL	168 hrs prior
21	3/26/19	4/1/19	2.82	MVTL	168 hrs prior
21	4/23/19	5/1/19	2.31	MVTL	168 hrs prior
21	4/23/19	5/17/19	2.30	MDH	
21	5/21/19	5/29/19	2.12	MVTL	168 hrs prior



Combined Discharge - Wells 6-7-10					
CD 1	3/14/17	3/23/17	3.11	MVTL	168 hrs prior
CD 1	4/11/17	4/17/17	3.11	MVTL	120 hrs prior
CD 1	5/9/17	5/25/17	3.19	MVTL	212 hrs prior
CD 1	6/5/17	6/28/17	2.60	MDH	
CD 1	6/13/17	6/20/17	3.03	MVTL	168 hrs prior
CD 1	7/11/17	7/20/17	3.12	MVTL	168 hrs prior
CD 1	8/8/17	8/14/17	3.06	MVTL	168 hrs prior
CD 1	9/12/17	9/26/17	3.03	MVTL	168 hrs prior
CD 1	10/10/17	10/20/17	3.09	MVTL	168 hrs prior
CD 1	11/14/17	11/21/17	3.16	MVTL	168 hrs prior
CD 1	12/12/17	12/22/17	3.00	MVTL	168 hrs prior
CD 1	1/9/18	1/16/18	3.23	MVTL	168 hrs prior
CD 1	2/13/18	2/20/18	3.18	MVTL	168 hrs prior
CD 1	3/13/18	3/26/18	2.42	MVTL	168 hrs prior
CD 1	5/8/18	5/31/18	2.36	MVTL	168 hrs prior
CD 1	6/19/18	6/26/18	3.05	MVTL	168 hrs prior
CD 1	6/19/18	7/18/18	2.90	MDH	
CD 1	7/10/18	7/18/18	2.46	MVTL	240 hrs prior
CD 1	8/14/18	8/20/18	2.59	MVTL	168 hrs prior
CD 1	9/11/18	10/15/18	2.78	MVTL	168 hrs prior
CD 1	10/9/18	10/15/18	3.06	MVTL	168 hrs prior
CD 1	11/13/18	11/29/18	3.68	MVTL	168 hrs prior
CD 1	12/27/18	1/14/19	3.63	MVTL	168 hrs prior
CD 1	1/8/19	1/14/19	3.19	MVTL	168 hrs prior
CD 1	2/12/19	2/22/19	3.16	MVTL	168 hrs prior
CD 1	3/12/19	3/18/19	3.67	MVTL	168 hrs prior
CD 1	4/9/19	4/16/19	3.13	MVTL	168 hrs prior
CD 1	4/9/19	5/1/19	3.30	MDH	
CD 1	5/14/19	5/20/19	3.69	MVTL	168 hrs prior
CD 1	6/11/19	6/21/19	3.37	MVTL	168 hrs prior

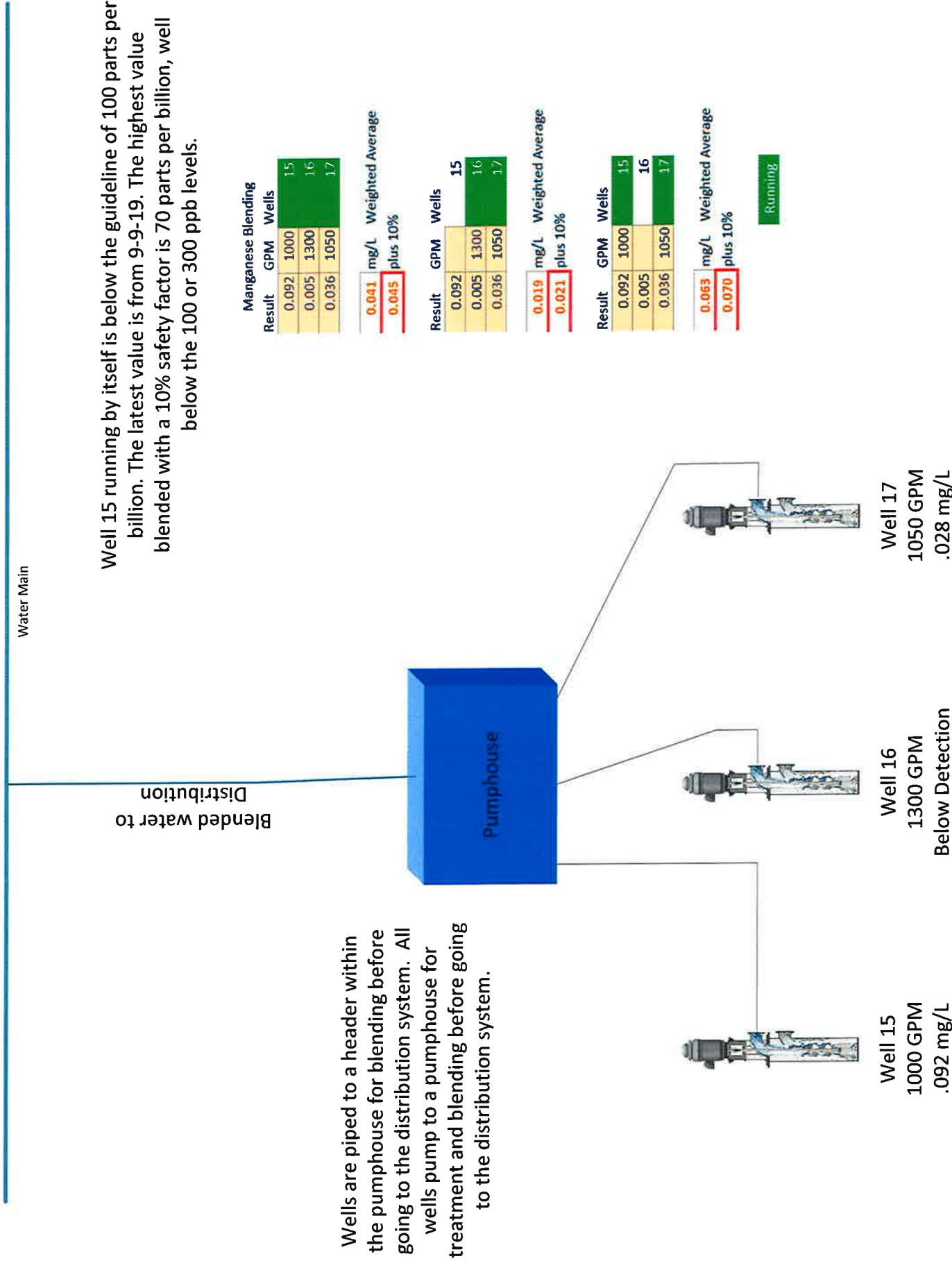


Combined Discharge - Wells 12-13-14					
CD 2	6/16/2015	6/26/2015	1.26	MVTL	126 hrs prior
CD 2	8/4/2015	8/10/2015	1.35	MVTL	168 hrs prior
CD 2	9/15/2015	9/22/2015	1.15	MVTL	144 hrs prior
CD 2	10/6/2015	10/14/2015	1.25	MVTL	208 hrs prior
CD 2	12/22/2015	12/30/2015	1.03	MVTL	168 hrs prior
CD 2	1/5/2016	1/13/2016	1.08	MVTL	192 hrs prior
CD 2	2/23/2016	2/29/2016	1.03	MVTL	208 hrs prior
CD 2	3/22/2016	3/28/2016	0.96	MVTL	288 hrs prior
CD 2	4/12/2016	4/19/2016	1.07	MVTL	120 hrs prior
CD 2	5/10/2016	5/16/2016	0.98	MVTL	165 hrs prior
CD 2	5/10/2016	6/2/2016	0.97	MDH	
CD 2	7/12/2016	7/18/2016	0.93	MVTL	170 hrs prior
CD 2	10/11/2016	10/17/2016	0.87	MVTL	168 hrs prior
CD 2	11/8/2016	11/17/2016	0.91	MVTL	168 hrs prior
CD 2	1/10/2017	1/20/2017	0.92	MVTL	216 hrs prior
CD 2	4/11/2017	4/17/2017	0.85	MVTL	144 hrs prior
CD 2	6/8/2017	6/28/2017	0.86	MDH	144 hrs prior
CD 2	6/22/2018	7/18/2018	0.67	MDH	528 hrs prior
CD 2	4/16/2019	5/1/2019	0.78	MDH	165 hrs prior



MVTL = Minnesota Valley Testing Laboratories
MDH = Minnesota Department of Health
TCWC = Twin City Water Clinic

Wellfield Manganese Levels



Appendix B

AUAR Water Use Projections



Building a Better World
for All of Us®

MEMORANDUM

TO: Shakopee Public Utilities

FROM: Chad T. Katzenberger

DATE: August 19, 2019

RE: Jackson Township AUAR – Water System Demand Projections
SEH No. SHPUC 140940 14.00

BACKGROUND

This memo provides an estimate of projected water use for the land area to be developed in the identified AUAR Study area. Land use projections and study area information was provided by the City of Shakopee and SRF Consulting Group in August of 2019. Additional, per capita water use figures developed as part of SPUC's 2018 Compressive water plan were utilized for residential water use projections. The land use areas contained in the AUAR are broken down into seven sub-districts and represent anticipated development through the year 2040. The demand projections presented in this memo represent the expected Average Daily and Maximum Daily municipal water demand potential for the AUAR study area.

PROPOSED LAND USE & DEMAND PROJETIONS

A breakdown of projected land use for the AUAR study area was provided by the City of Shakopee, included in attachment A. This information includes land use development characteristics, developable acreage and other applicable information such as commercial building square footage. This information was then applied to the water use projection calculations provided in Attachment B.

PROJECTED WATER SYSTEM DEMAND

Results of the land used base water demand projections are presented in Attachment B. The time at which this expected development occurs will be strongly dependent on market forces. These water use projections are based on anticipated land use and help to understand the total ultimate water system needs, independent of time. Assuming total build out of the AUAR study area, the study area has a projected **Average Daily Demand of 1.2 MGD** (Million Gallons per Day) and a **Maximum Daily Demand of 3.4 MGD**

SUMMARY

The information documented above provides for a reasonable estimate of future water system demands. These demands can be updated further as additional development information is available.

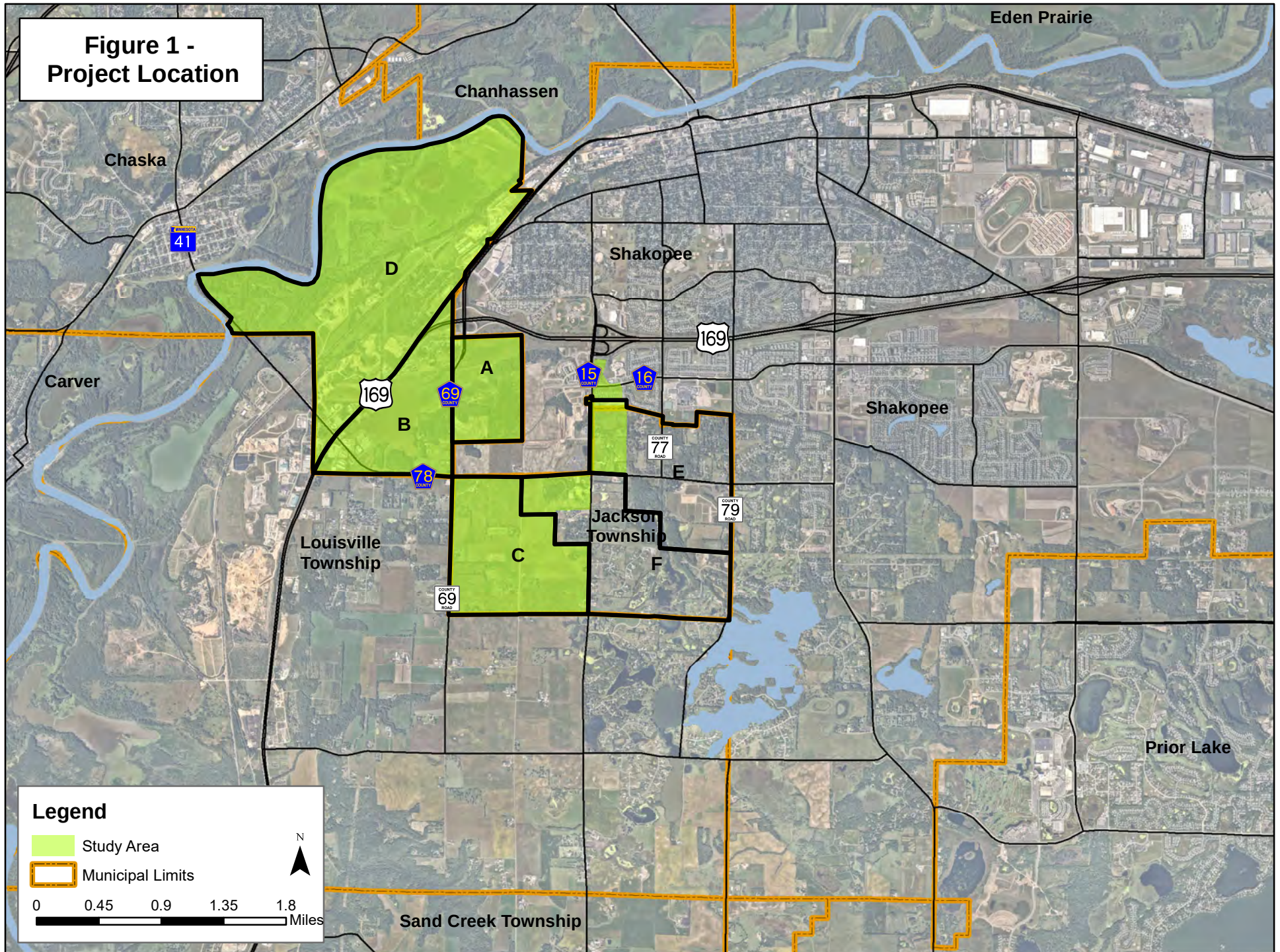
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Attachment

c: Miles Jensen, SEH

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**Figure 1 -
Project Location**



Attachment A
Jackson Township AUAR Development Area

Sub Area	2040 Land Use	Acres	Res. Units (EA)	N'Hood Retail (SF)	HWY Retail (SF)	Office (SF)	W-house (SF)	Mfg. (SF)
A	Mixed Residential	22	91	81,991				
A	Mixed Use Center	38			594,646	84,091		
A	Mixed Use Employment Center	25	31		41,706	159,240	90,994	90,994
A	Suburban Edge Residential	0						
A	Suburban Residential	67	161					
B	Mixed Residential	47	165	219,195				
B	Mixed Use Center	45			691,370	97,769		
B	Mixed Use Employment Center	214	257		350,955	1,340,008	765,719	765,719
B	Suburban Edge Residential	0						
B	Suburban Residential	0						
C	Mixed Residential	18	64	83486				
C	Mixed Use Center	0						
C	Mixed Use Employment Center	0						
C	Suburban Edge Residential	300	120					
C	Suburban Residential	166	266					
D	Mixed Residential	0						
D	Mixed Use Center	34			523,795	74,072		
D	Mixed Use Employment Center	247			212,672	1,353,369	1,082,695	1,082,695
D	Suburban Edge Residential	0						
D	Suburban Residential	57	230					
E	Mixed Residential	3	11	15007				
E	Mixed Use Center	0						
E	Mixed Use Employment Center	0						
E	Suburban Edge Residential	14	6					
E	Suburban Residential	48	96					
F	Mixed Residential	0						
F	Mixed Use Center	0						
F	Mixed Use Employment Center	0						
F	Suburban Edge Residential	0						
F	Suburban Residential	0						
G	Mixed Residential	0						
G	Mixed Use Center	10	156		112,122			
G	Mixed Use Employment Center	0						
G	Suburban Edge Residential	0						
G	Suburban Residential	10	28					

Data provided by the City of Shakopee 8/6/2019

Attachment B
Future Water Supply Needs - AUAR Area

Sub Area	2040 Land Use	Acres	Res. Units (EA)	N'Hood Retail (SF)	HWY Retail (SF)	Office (SF)	W-house (SF)	Mfg. (SF)	Avg. Day Demand (gpd)
A	Mixed Residential	22	91	81,991					31,827
A	Mixed Use Center	38			594,646	84,091			62,421
A	Mixed Use Employment Center	25	31		41,706	159,240	90,994	90,994	37,821
A	Suburban Residential	67	161						43,277
B	Mixed Residential	47	165	219,195					64,044
B	Mixed Use Center	45			691,370	97,769			72,574
B	Mixed Use Employment Center	214	257		350,955	1,340,008	765,719	765,719	317,227
C	Mixed Residential	18	64	83486					24,703
C	Suburban Edge Residential	300	120						32,256
C	Suburban Residential	166	266						71,501
D	Mixed Use Center	34			523,795	74,072			54,984
D	Mixed Use Employment Center	247			212,672	1,353,369	1,082,695	1,082,695	267,452
D	Suburban Residential	57	230						61,824
E	Mixed Residential	3	11	15007					4,305
E	Suburban Edge Residential	14	6						1,613
E	Suburban Residential	48	96						25,805
G	Mixed Use Center	10	156		112,122				52,005
G	Suburban Residential	10	28						7,526
Totals			1,682	399,679	2,527,266	3,108,549	1,939,408	1,939,408	1,230,000
*Maximum Day Demand (2.77 Multiplier)									3,410,000

Demand Assumptions		
**Persons per housing unit	3.2	persons
*Residential per capita AD water use	84	gpc/d
Retail water Use	0.090	gpd/sf
Office Water Use	0.107	gpd/sf
Warehouse	0.039	gpd/sf
Manufacturing	0.056	gpd/sf

*Based on SPUC 2012 Historical Data (dry year)

**Figure provided by City of Shakopee

Non-Residential Water Use Figures Estimated from Met Council SAC City Determination Worksheet

Appendix C

Water Supply and Storage Calculations

Table C-2
Supply Capacity into Normal Zone

Well Name	Pressure Zone	Unique Well Number	Normal Operational Capacity (gpm)	Allowed Pumping Time per Day (Hours)	Daily Capacity (MGD)
Well No.2	Normal	206803	300	24	0.43
Well No.3	Normal	205978	Emergency		
Well No.4	Normal	206854	716	24	1.03
Well No.5	Normal	206855	850	24	1.22
Well No.6	Normal	180922	1,175	24	1.69
Well No.7	Normal	415975	1,100	24	1.58
Well No.8	Normal	500657	1,100	24	1.58
Well No.9	Normal	554214	1,050	24	1.51
Well No.10	Normal	578948	1,125	24	1.62
Well No.11	Normal	611084	1,000	24	1.44
Well No.15	Normal	694921	1,150	24	1.66
Well No.16	Normal	731139	1,450	24	2.09
Well No.17	Normal	731140	1,400	24	2.02
Total			12,416	--	17.88
Highest Yielding Well (Well No. 16)					2.09
Firm Capacity (Minus Well No. 16)					15.79
Table Notes:					

Source: City Records

Table C-1
Pumping Capacity & Storage Analysis for Entire System

<u>Pumping Capacity Analysis</u>	Design Demand Year		
	<u>2020</u>	<u>2030</u>	<u>2040</u>
Maximum Day Demand (mgd) ¹	19.6	22.6	25.0
Average Day Demand	7.1	8.1	9.0
	20.3	20.3	20.3
 <u>Recommended Storage Volume</u>			
Maximum Day Equalization Volume (gallons) ⁴	2,940,000	3,390,000	3,750,000
Fire Protection Volume (gallons) ⁵	630,000	630,000	630,000
Reserve Volume (1/2 of Average Day)	3,542,000	4,075,000	4,516,000
<i>Recommended Total Volume (gallons)</i>	<i>7,112,000</i>	<i>8,095,000</i>	<i>8,896,000</i>
 <u>Existing Storage & Pumping Volume</u>			
Surplus Firm Pump Volume (gallons) ⁷	90,000	(280,000)	(590,000)
Tank 1	1,000,000	1,000,000	1,000,000
Tank 2	250,000	250,000	250,000
Tank 3	1,500,000	1,500,000	1,500,000
Tank 4	500,000	500,000	500,000
Tank 5	2,000,000	2,000,000	2,000,000
Tank 6	2,000,000	2,000,000	2,000,000
Tank 7	2,000,000	2,000,000	2,000,000
<i>Total Existing Volume Available (gallons)</i>	<i>9,250,000</i>	<i>9,250,000</i>	<i>9,250,000</i>
Water Storage Mass Balance	2,138,000	1,155,000	354,000
Additional Storage			
Recommended (gallons)	None	None	None

1. Additional firm pumping capacity may be recommended if the maximum day demand exceeds the existing firm pumping capacity.
2. Maximum Day Equalization Volume is the projected maximum volume depletion during the peak hours of the maximum day assuming the pumping rate into the service zone is equal to the maximum day demand rate. Typical residential diurnal curves were assumed with a peaking factor of 1.65.
3. Fire Protection storage was calculated based on one fire of 3,500 gpm for 3 hours.
4. Reserve Volume is recommended to provide supply in event of a power outage
5. Surplus Firm Pump Volume is the difference between maximum day demand and Firm Pumping Capacity which is available to supplement fire protection for 3 hours.

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Table C-3
Supply & Storage Analysis for Main Zone Dependencies

	Design Demand Year		
	<u>2020</u>	<u>2030</u>	<u>2040</u>
<u>Pumping Capacity Analysis</u>			
Maximum Day Demand (mgd) ¹	13.86	14.87	15.60
Average Day Demand (mgd)	5.00	5.37	5.63
Existing Firm Supply Capacity (mgd) ²	15.79	15.79	15.79
Firm Supply and/or Interzone Transfer Capacity Mass Balance (mgd)³	1.93	0.92	0.19
<u>Recommended Storage Volume</u>			
Maximum Day Equalization Volume (gallons) ⁴	2,080,000	2,230,000	2,340,000
Reserve Storage (1/2 AD)	2,502,000	2,685,000	2,816,000
Fire Protection Volume (gallons) ⁵	630,000	630,000	630,000
<i>Preliminary Recommended Total Volume (gallons)</i>	<i>5,212,000</i>	<i>5,545,000</i>	<i>5,786,000</i>
<u>Existing Storage & Pumping Volume</u>			
Surplus Firm Pump Volume (gallons) ⁷	240,000	110,000	20,000
Tank 1	1,000,000	1,000,000	1,000,000
Tank 2	250,000	250,000	250,000
Tank 3	1,500,000	1,500,000	1,500,000
Tank 5	2,000,000	2,000,000	2,000,000
Tank 6	2,000,000	2,000,000	2,000,000
<i>Total Existing Volume Available (gallons)</i>	<i>6,750,000</i>	<i>6,750,000</i>	<i>6,750,000</i>
Storage or Pumping Volume Mass Balance (gallons)³	1,538,000	1,205,000	964,000
Additional Storage Recommended (gallons)	None	None	None

1. Includes Normal Zone and East Zone

2. See Table 5-1

3. A positive value represents a surplus. A negative value represents a deficiency.

4. Maximum Day Equalization Volume is the projected maximum volume depletion during the peak hours of the maximum day assuming the pumping rate into the service zone is equal to the maximum day demand rate. Typical residential diurnal curves were assumed with a peaking factor of 1.65.

5. Fire Protection storage was calculated based on one fire of 3,500 gpm for 3 hours.

6. Surplus Firm Pump Volume is the difference between maximum day demand and Firm Pumping Capacity which is available to supplement fire protection for 3 hours.

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Table C-4
Supply Capacity into First High Zone

Well/Supply Name	Unique Well Number	Normal Operational Capacity (gpm)	Allowed Pumping Time per Day (Hours)	Daily Capacity (MGD)
Well No.12	626775	810	24	1.17
Well No.13	674456	1,036	24	1.49
Well No.14	694904	381	24	0.55
Well No.20	722624	1,142	24	1.64
Well No.21	722625	1,175	24	1.69
Total		4,544	--	6.54
Highest Yielding Well (Well No. 21)				1.69
Firm Capacity (Minus Well No. 21)				4.85
Table Notes:				

Source: City Records

Table C-5
Supply & Storage Analysis for 1st High Zone Dependencies

	Design Demand Year		
	<u>2020</u>	<u>2030</u>	<u>2040</u>
<u>Pumping Capacity Analysis</u>			
Maximum Day Demand (mgd) ¹	4.67	5.29	5.79
Average Day Demand (mgd)	1.69	1.91	2.09
Existing Firm Supply Capacity (mgd) ²	4.85	4.85	4.85
Firm Supply and/or Interzone Transfer Capacity Mass Balance (mgd)³	0.18	-0.43	-0.93
<u>Recommended Storage Volume</u>			
Maximum Day Equalization Volume (gallons) ⁴	700,000	790,000	870,000
Reserve Storage (1/2 AD)	843,000	954,000	1,044,000
Fire Protection Volume (gallons) ⁵	630,000	630,000	630,000
<i>Recommended Total Volume (gallons)</i>	<i>2,153,000</i>	<i>2,374,000</i>	<i>2,544,000</i>
<u>Existing Storage & Pumping Volume</u>			
Surplus Firm Pump Volume (gallons) ⁶	20,000	(50,000)	(120,000)
Tank 4	500,000	500,000	500,000
Tank 7	2,000,000	2,000,000	2,000,000
<i>Total Existing Volume Available (gallons)</i>	<i>2,500,000</i>	<i>2,500,000</i>	<i>2,500,000</i>
Storage or Pumping Volume Mass Balance (gallons)³	347,000	126,000	-44,000

1. Includes First High and both Second High Zones.

2. See Table 5-1.

3. A positive value represents a surplus. A negative value represents a deficiency.

4. Maximum Day Equalization Volume is the projected maximum volume depletion during the peak hours of the maximum day assuming the pumping rate into the service zone is equal to the maximum day demand rate. Typical residential diurnal curves were assumed with a peaking factor of 1.65.

5. Fire Protection storage was calculated based on one fire of 3,500 gpm for 3 hours.

6. Surplus Firm Pump Volume is the difference between maximum day demand and Firm Pumping Capacity which is available to supplement fire protection for 3 hours.

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Table C-6
Pumping Capacity into 2nd High Central Zone

Pump Name	Normal Operational Capacity (gpm)	Daily Capacity (MGD)
Valley Creek 1	1,000	1.44
Valley Creek 2	1,000	1.44
Total	2,000	2.88
Largest Pump		1.44
Firm Capacity (Largest Pump)		1.44
Table Notes: Shakopee does not have any water treatment.		

Source: City Records

Table C-7
Supply & Storage Analysis for 2nd High Central Zone

	Design Demand Year		
	<u>2020</u>	<u>2030</u>	<u>2040</u>
<u>Pumping Capacity Analysis</u>			
Maximum Day Demand (mgd) ¹	0.25	0.38	0.50
Average Day Demand (mgd)	0.09	0.14	0.18
Existing Firm Supply Capacity (mgd) ²	1.44	1.44	1.44
Firm Supply and/or Interzone Transfer Capacity Mass			
Balance (mgd)³	1.19	1.06	0.94
<u>Recommended Storage Volume</u>			
Maximum Day Equalization Volume (gallons) ⁴	40,000	60,000	70,000
Reserve Storage (1/2 AD)	44,000	68,000	90,000
Fire Protection Volume (gallons) ⁵	300,000	300,000	300,000
<i>Recommended Total Volume (gallons)</i>	<i>234,000</i>	<i>298,000</i>	<i>340,000</i>
<u>Existing Storage & Pumping Volume</u>			
Surplus Firm Pump Volume (gallons) ⁶	150,000	130,000	120,000
No Storage			
<i>Total Existing Volume Available (gallons)</i>	<i>0</i>	<i>0</i>	<i>0</i>
Storage or Pumping Volume	-234,000	-298,000	-340,000
Mass Balance (gallons)³			

1. See Table 4-6

2. See Table 5-1.

3. A positive value represents a surplus. A negative value represents a deficiency.

4. Maximum Day Equalization Volume is the projected maximum volume depletion during the peak hours of the maximum day assuming the pumping rate into the service zone is equal to the maximum day demand rate. Typical residential diurnal curves were assumed with a peaking factor of 1.65.

5. Fire Protection storage was calculated based on one fire of 2,500 gpm for 2 hours.

6. Surplus Firm Pump Volume is the difference between maximum day demand and Firm Pumping Capacity which is available to supplement fire protection for 3 hours.

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Table C-8
Pumping Capacity into 2nd High West Zone

Pump Name	Normal Operational Capacity (gpm)	Daily Capacity (MGD)
Windermere 1	1,000	1.44
Windermere 2	1,000	1.44
Total	2,000	2.88
Largest Pump		1.44
Firm Capacity (Largest Pump)		1.44
Table Notes:		

Source: City Records

Table C-9
Supply & Storage Analysis for 2nd High West Zone

	Design Demand Year		
<u>Pumping Capacity Analysis</u>	<u>2020</u>	<u>2030</u>	<u>2040</u>
Maximum Day Demand (mgd) ¹	0.75	1.85	2.87
Average Day Demand (mgd)	0.27	0.67	1.03
Existing Firm Supply Capacity (mgd) ²	1.44	1.44	4.32
Firm Supply and/or Interzone Transfer Capacity Mass Balance (mgd)³	0.69	-0.41	1.45
<u>Recommended Storage Volume</u>			
Maximum Day Equalization Volume (gallons) ⁴	110,000	280,000	430,000
Reserve Storage (1/2 AD)	134,000	334,000	517,000
Fire Protection Volume (gallons) ⁵	300,000	300,000	300,000
<i>Recommended Total Volume (gallons)</i>	<i>454,000</i>	<i>914,000</i>	<i>1,065,000</i>
<u>Existing Storage & Pumping Volume</u>			
Surplus Firm Pump Volume (gallons) ⁶	90,000	(51,000)	182,000
No Storage			
<i>Total Existing Volume Available (gallons)</i>	<i>0</i>	<i>0</i>	<i>0</i>
Storage or Pumping Volume Mass Balance (gallons)³	-454,000	-914,000	-1,065,000

1. See Table 4-6
2. Assumes addition of booster stations and supply wells
3. A positive value represents a surplus. A negative value represents a deficiency.
4. Maximum Day Equalization Volume is the projected maximum volume depletion during the peak hours of the maximum day assuming the pumping rate into the service zone is equal to the maximum day demand rate. Typical residential diurnal curves were assumed with a peaking factor of 1.65.
5. Fire Protection storage was calculated based on one fire of 2,500 gpm for 2 hours.
6. Surplus Firm Pump Volume is the difference between maximum day demand and Firm Pumping Capacity which is available to supplement fire protection for 3 hours.

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Table C-10
Supply & Storage Analysis for 2nd High West + Central Zones

	Design Demand Year		
<u>Pumping Capacity Analysis</u>	<u>2020</u>	<u>2030</u>	<u>2040</u>
Maximum Day Demand (mgd) ¹	0.99	2.23	3.36
Average Day Demand (mgd)	0.36	0.80	1.21
Existing Firm Supply Capacity (mgd) ²	1.44	2.88	5.76
Firm Supply and/or Interzone Transfer Capacity Mass Balance (mgd)³	0.45	0.65	2.40
<u>Recommended Storage Volume</u>			
Maximum Day Equalization Volume (gallons) ⁴	150,000	330,000	500,000
Reserve Storage (1/2 AD)	179,000	402,000	607,000
Fire Protection Volume (gallons) ⁵	300,000	240,000	240,000
<i>Recommended Total Volume (gallons)</i>	<i>569,000</i>	<i>891,000</i>	<i>1,048,000</i>
<u>Existing Storage & Pumping Volume</u>			
Surplus Firm Pump Volume (gallons) ⁶	60,000	81,000	299,000
No Storage			
<i>Total Existing Volume Available (gallons)</i>	<i>0</i>	<i>0</i>	<i>0</i>
Storage or Pumping Volume Mass Balance (gallons)³	-569,000	-891,000	-1,048,000

1. See Table 4-6

2. Assumes addition of booster stations and supply wells

3. A positive value represents a surplus. A negative value represents a deficiency.

4. Maximum Day Equalization Volume is the projected maximum volume depletion during the peak hours of the maximum day assuming the pumping rate into the service zone is equal to the maximum day demand rate. Typical residential diurnal curves were assumed with a peaking factor of 1.65.

5. Fire Protection storage was calculated based on one fire of 2,500 gpm for 2 hours.

6. Surplus Firm Pump Volume is the difference between maximum day demand and Firm Pumping Capacity which is available to supplement fire protection for 3 hours.

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Table C-11
Pumping Capacity into East Zone

Pump Name	Normal Operational Capacity (gpm)	Daily Capacity (MGD)
River View 1	1,000	1.44
River View 2	1,000	1.44
Total	2,000	2.88
Largest Pump		1.44
Firm Capacity (Largest Pump)		1.44
Table Notes:		

Source: City Records

Table C-12
Supply & Storage Analysis for East Zone

	Design Demand Year		
<u>Pumping Capacity Analysis</u>	<u>2020</u>	<u>2030</u>	<u>2040</u>
Maximum Day Demand (mgd) ¹	0.22	0.30	0.37
Existing Firm Supply Capacity (mgd) ²	1.44	1.44	1.44
Firm Supply and/or Interzone Transfer Capacity Mass Balance (mgd)³	1.22	1.14	1.07
<u>Recommended Storage Volume</u>			
Maximum Day Equalization Volume (gallons) ⁴	30,000	50,000	60,000
Fire Protection Volume (gallons) ⁵	180,000	180,000	180,000
<i>Recommended Total Volume (gallons)</i>	<i>60,000</i>	<i>90,000</i>	<i>110,000</i>
<u>Existing Storage & Pumping Volume</u>			
Surplus Firm Pump Volume (gallons) ⁷	150,000	140,000	130,000
No Storage			
<i>Total Existing Volume Available (gallons)</i>	<i>150,000</i>	<i>140,000</i>	<i>130,000</i>
Storage or Pumping Volume Mass Balance (gallons)³	90,000	50,000	20,000

1. See Table 4-6

2. One pump offline

3. A positive value represents a surplus. A negative value represents a deficiency.

4. Maximum Day Equalization Volume is the projected maximum volume depletion during the peak hours of the maximum day assuming the pumping rate into the service zone is equal to the maximum day demand rate. Typical residential diurnal curves were assumed with a peaking factor of 1.65.

5. Fire Protection storage was calculated based on one fire of 1,500 gpm for 2 hours.

6. Surplus Firm Pump Volume is the difference between maximum day demand and Firm Pumping Capacity which is available to supplement fire protection for 3 hours.

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Building a Better World for All of Us[®]

Sustainable buildings, sound infrastructure, safe transportation systems, clean water, renewable energy and a balanced environment. Building a Better World for All of Us communicates a companywide commitment to act in the best interests of our clients and the world around us.

We're confident in our ability to balance these requirements.



Attachment H

Responses to Comments on the Draft AUAR Document

Commenter	Section		Comment	Response
Jackson Township	21	Traffic	The AUAR also fails to analyze additional development scenarios as required under the Rules to prevent significant adverse environmental impacts.	As stated in the <i>Guide to Minnesota Environmental Review Rules (pg 36)</i> , Alternative Urban Areawide Review’s on development scenarios “More than one scenario can be reviewed, providing at least one is consistent with the existing adopted comprehensive plan. A maximum development, “worst case” scenario is usually included.” Also stated in the Minnesota Rules 4410.3610. Subp. 3 (Alternative Urban Areawide Review Process), “The RGU may specify more than one scenario of anticipated development provided that at least one scenario is consistent with the adopted comprehensive plan” Therefore, one scenario was based on the City of Shakopee/Scott County’s adopted 2040 Comprehensive plans, and one scenario was based on the max build, or full-build out. No intermediate scenario was analyzed due to the unknown nature of development. It should be noted that the traffic analysis should be reevaluated when the AUAR is updated approximately every five (5) years.
Jackson Township	9	Land Use	Figure 5 of the AUAR provides a general plan for designated land uses within the Jackson development area. The document shows high intensity development in the TH 169 mixed use corridor and mixed use center designations in planning areas A and D. Higher intensity residential uses are identified in planning areas B and C in and around the intersection of County Roads 69 and 78. The document explains that densities in this area could be as high as 6 to 30 dwelling units per acre. Jackson is previously on record with the city of Shakopee that the Jackson Supervisors strongly disfavor the previously developed medium density residential projects in the TH 169 corridor within the City of Shakopee. The Township has previously made it clear that the monotonous, cookie cutter, uninspired design of these projects within Shakopee are not acceptable within the Jackson development area. This subject must be addressed.	Thank you for your comment. The land use discussed throughout the AUAR align with the city's 2040 Comprehensive Plan, which was approved by the Metropolitan Council and adopted by the City of Shakopee. As development is pursued, the city will utilize its zoning ordinance and commercial/residential design standards to regulate the form of development.
Jackson Township	17	Water Quality - Stormwater Runoff	Section 17 of the AUAR contains the discussion of stormwater management. This critical element of the AUAR is wholly inadequate. This section fails to provide any analysis of a stormwater management system, fails to consider the potential urbanization that warrant further analysis and fails to adhere mitigation measures necessary to prevent significant environmental impacts in the study area. The stormwater analysis of the Study Area should be based upon the latest NOAA Atlas 14 precipitation frequency estimates. The stormwater element of the AUAR is not complete and further information/analysis is required.	Thank you for your comment. Updates were made to the stormwater section to provide additional detail about required mitigation requirements. As land is annexed into the City and development is proposed, the City's stormwater standards and policies must be applied and considered during development review.
Jackson Township	21	Traffic	Table 16. The traffic analysis identifies mitigation measures for recommended roadway improvements to support the development of the AUAR Study Area. Critically absent to these identified mitigation efforts are timing and sources of funding for the identified mitigation measures.	Thank you for the comment. The timing of the mitigation efforts is dependent on the timing of development throughout the study area, which is not yet known. As development projects are pursued, the magnitude of development will be analyzed to understand the potential mitigation needs. The funding of the measures will structured using existing jurisdictional agreements with potential collaboration from the developer.
Jackson Township	21	Traffic	Table 15 identifies the Intersection Capacity Analysis at critical intersections and locations in the Jackson Development Area along corridors TH141, CR 48, CR69 and CR 15. Most of these critical intersections are forecasted to operate at levels of services D, E, and F under the "maximum build" assumptions. These designations identify congested conditions.	Thank you for your comment. It is understood that LOS designations of D, E, and F identify congestion and mitigation measures have been identified to mitigate identified congestion.
Jackson Township	All	All	Item 30, Summary of Issues: this section needs to discuss Sensitive Resources in particular the cultural resources. There are a number of resources identified within the study area including a burial mound site that will need further coordination.	Cultural resources coordination was added to the summary of issues. A Phase 1 archeological study should be considered as development is pursued.
Jackson Township	All	All	The document provides a table in the appendices that provides the resource type, summary of impacts, mitigation and responsible party. This table needs to be updated to minimally include physical impacts to water resources, erosion & sedimentation, and sensitive resources.	Thank you for your comment. The mitigation measures that can be defined using the level of development known at this time has been identified and included within the mitigation table.
Jackson Township	All	All	The purpose of an AUAR document is to provide an analysis of environmental impacts in a proposed development scenario. The level of effort of an AUAR is between an EAW and EIS. The prepared document appears to have less information than an EAW. There is inconsistency within the text portion of the document in providing mitigation strategies for each of the items. Some items receive a full discussion including mitigation while other are identification only.	Thank you for your comment. The AUAR has been updated to respond to comments received from the various review agencies.

Commenter	Section		Comment	Response
Jackson Township	All	All	Some items only identify the resources within the study area, similar to an environmental screening document. Items that are only identified include: geologic hazard & soil conditions (bedrock, geologic hazards, soil conditions, contaminated properties), sensitive resources (cultural resources, farmland, parkland).	Thank you for your comment. The AUAR has been updated to respond to comments received from the various review agencies.
Jackson Township	All	All	Jackson Township has a strong desire to maintain compatible land uses and minimize the adverse environmental impacts within the Study Area. Consistent with Minnesota Rules 4410.3610 Subp. 5.b, the Township states that they wish to be notified in a timely manner by the RGU upon receipt of applications for specific development projects within the Study Area.	Thank you for your comment. The City will continue to coordinate with the Township regarding development within the study area. Any City action within the study area will first require annexation through the process identified within the OAA.
Jackson Township	All	All	The transportation section goes into detail of the LOS of intersections for no-build, 2040 and max build, however, other items do not discuss mitigation strategies.	Thank you for your comment. The mitigation measures that can be defined using the level of development known at this time has been identified. The traffic study, along with other elements will required additional review as development proposals are defined.
Jackson Township	All	All	Any potential resources identified within the study area need to have a discussion of those resources and how the impacts will be resolved or mitigated. The applicant also needs to include if the mitigation will include coordination with any agencies and how they will review the plans.	Thank you for your comment. The mitigation measures that can be defined using the level of development known at this time has been identified and included within the mitigation table.
Met Council	21	Traffic	For development within the 2040 planning period, the City expects to prepare a comprehensive plan amendment. That amendment should explicitly discuss revision to the communitywide forecast and TAZ forecast allocations, and the Council can consider the request.	Thank you for the comment. As noted, the 2040 Comprehensive Plan traffic analysis utilized the regional model inputs that align with the Comprehensive Plan process. The City understands that changes in development assumptions within the growth area, within the 2040 horizon may warrant a Comprehensive Plan amendment.
Met Council	7	Project Magnitude Data	The AUAR describes 1,753 housing units and 9.9 Million sq. ft. of commercial, industrial and office floorspace added on a subtotal of 1,364 acres. These results far exceed Metropolitan Council's 2040 forecast for this area. The City explains: "For the purposes of the AUAR, the analysis assumed the full build of each development scenario. Therefore, the resulting socio-economic total utilized within the AUAR are higher than those assumed within the 2030 and 2040 Comprehensive Plans."	Thank you for your comment. The AUAR reviews a max build scenario of the land uses defined within the 2040 plan. The City will utilize the 2040 staging planning to inform phased planning which align with the 2040 forecasts.
Met Council	9	Land Use	The City of Shakopee's 2040 Plan was authorized by the Metropolitan Council on October 23, 2019 and is awaiting final adoption by the City Council. As the Draft AUAR mentions, the build-out scenario is consistent with the direction of the 2040 Plan. However, if the City decided to move forward with the No Build scenario, as noted under item 26, a comprehensive plan amendment to the 2040 Plan will be necessary to reflect the change in land use guiding based on the AUAR.	Thank you for your comment. The City understands that that development that aligned with the no build scenario would require an amendment to the comprehensive plan. The no build scenario references the 2030 Comprehensive Plan, which was the adopted plan at the time the AUAR was drafted.
Met Council	9	Land Use	The AUAR describes the proposed land uses of each subdistrict on page 9. It should be noted that subdistrict A also includes a Mixed-Use Center area in the City's 2040 Planned Land Use. Moreover, subdistrict E is described as having a thin strip of open space, which is not included in the 2040 Planned Land Use, and it also includes a small Mixed Residential area in the middle. A comprehensive plan amendment to the 2040 Plan may be necessary to reflect changes in land use guiding based on the AUAR.	The land uses in subdistrict A and subdistrict E were updated to reflect the land uses shown in the 2040 Comprehensive Plan.
Met Council	18	Water Quality - Wastewater	When Interceptor (9206) was constructed in 1995, a cost sharing agreement was entered into between the Metropolitan Council and the City covering additional trunk sewer capacity costs for the City. In accordance with the agreement, the City must purchase additional capacity in the interceptor, after flows within the interceptor, at Townline Avenue, reach 3 cubic feet per second peak flow, or 571,000 gallons per day (gpd) averaged. The AUAR reflects the proposed development of an Orderly Annexation Area (OAA) that will trigger the purchase of additional capacity in MCES Interceptor 9206.	Thank you for you comment. The City understands that additional capacity must be purchased is needed to support the development within the study area.
Met Council	21	Traffic	The TAZ allocation of the 2040 forecast was included in the City's 2040 Comprehensive Plan (Plan), finalized in 2019. The eventual development will affect the TAZ forecast allocation for the area, and potentially citywide forecast. Specifically: A) The AUAR discuses 400% more commercial, industrial, and office floorspace (9.7 mill sq. ft.) in subarea D (TAZ 2116) and subareas A and B (TAZ 2177) than has previously been discussed. The City's earlier TAZ forecast allocation assigns 2020-2040 employment growth of 2,081 jobs to these combined subareas (zones). B) The AUAR discusses 900% more housing (747 units) in subarea C (TAZ 2180) and subareas E and G (TAZ 2176) than has previously been discussed. The City's earlier TAZ forecast allocation assigns 2020-2040 household growth of 72 households to these combined subareas (zones).	Thank you for your comment. The traffic analysis studied to growth scenarios, the 2040 Comprehensive Plan and a Max Build Out scenario. The 2040 Comprehensive Plan scenario used the SE data assignments used in the 2040 plan and regional model. The max build scenario builds upon the regional model to study the full build out of the study area. It is understood that the max build will likely develop beyond the 2040 horizon.
Met Council	All	All	Metropolitan Council staff completed its review of the Jackson Township Development Area Draft Alternative Urban Areawide Review (AUAR) to determine its accuracy and completeness in addressing regional concerns. Staff concludes that the AUAR is complete and accurate with respect to regional concerns and does not raise major issues of consistency with Council policies. However, staff offers the following considerations.	Thank you for your comment. The considerations were reviewed an appropriate updates were made to the draft AUAR.

Commenter	Section		Comment	Response
MnDNR	13	Water Use	The City of Shakopee would need to construct two dedicated water level observation wells that are completed in the Jordan Aquifer due to concerns over the sustainability of the use of the Jordan Aquifer. Please plan to construct these observation wells at the same time the City of Shakopee Installation No. 24 is constructed. You may contact the DNR for advice on where to located these water level observation wells.	It is understood that water level observation wells will be needed with the construction of the well. Shakopee Public Utilities will be responsible for this construction.
MnDNR	13	Water Use	Water Use (page 16): The City of Shakopee will need to submit a "Well Construction - Preliminary Assessment" for proposed well #24 to the DNR. The application should be submitted to the DNR using the Minnesota Permitting and Reporting System (MPARS). The application should not be submitted until between six months and a year prior to actually constructing the well. DNR would use the most up to date legal and geological information available to assess the application.	Notation of the assessment added to the narrative.
MnDNR	6	Description	Water Appropriations (page 3): As a reminder, if population and commercial activity in the annexation area grow, more water would be required. If so, the City of Shakopee may need to amend DNR Water Appropriate Permit 1980-6205 to greatly increase use of water.	Thank you for the comment. The City understands that an amendment to the Water Appropriations Permit will be required. Notation added to the permits table.
MnDNR	9	Land Use	Table 4: Table 4 may shows industrial land use in Area D. Area D includes Natural Environment (NE) Lakes and areas within 1,000 feet of these lakes are considered shoreland. Industrial uses are not compatible with NE Lakes Shoreland. Please amend this by noting the issue within or below the table.	Notation added within the land use table.
MnDNR	8	Permits and Approval Required	Table 3: Please include an amendment of your shoreland ordinance, with approval by DNR. The shoreland ordinance will need to be amended because the expansion area includes two Natural Environment Lakes.	Amendment added to the narrative.
MnDNR	17	Water Quality - Stormwater Runoff	Storm Water Runoff (Page 18): A DNR Water Appropriation Permit is not required for the use of water from constructed storm water facilities for landscape irrigation, but DNR recommends that the City of Shakopee consider stormwater use as a means of protecting Gifford and Nyssen Lake from pollution.	Thank you for the comment.
MnDNR	6	Description	Dewatering (page 5): A DNR Water Appropriation Permit will be required for dewatering of groundwater, surface water and pond water in volumes that exceed 10,000 gallons per day, or one million gallons per year, for the construction of roadways and their associated storm water facilities in the AUAR.	Thank you for the comment. The City does not anticipate the need for volumes over 10,000 gallons per day, and understandings the need for a permit if volumes would exceed this level.
MnDNR	6	Description	Dewatering (page 4): Large areas of the AUAR area consist of wetlands, which are indicators of shallow ground water levels. As a reminder, a DNR Water Appropriations Permit is needed if construction of new buildings, the installation of utilities, or the grading of the sites requires dewatering of ground water and surface water in volumes that exceed 10,000 gallons per day, or one million gallons per year. This includes water diversion in the same volumes.	Thank you for the comment. The City understands the requirements for DNR Water Appropriations Permits related to dewatering activities.
MnDNR	9	Land Use	Page 10: The official name for basin 70-116 is Strunks Lake. The items are correctly addressed in Item 14, however, it should be made clear that "Nyssens" refers to Strunks Lake. Therefore, in the second paragraph beginning with "Scott County Zoning..." please correct the following: Current: "(this would include Nyssens Lake)" Should be: (this would include Nyssens/Strunks, and Gifford Lakes).	Updated as noted.
MnDOT	N/A	N/A	No comment	Thank you.
MPCA	All		Please note that the Draft AUAR was completed using an outdated version of the EAW form.	Content was updated to reflect the updated EAW form.
MPCA	17	Water Quality - Stormwater Runoff	The study area for the new development is bordered by the Minnesota River. The Draft AUAR states that the city's existing stormwater infrastructure will be extended to the new development areas and will also utilize ditches to move stormwater and use detention ponds, either new or converted existing ponds and wetlands. However, it is important to note that the existing wetlands may not be used to treat stormwater unless they have undergone mitigation. Also the National Pollutant Discharge Elimination System/State Disposal System (NPDES/SDS) General Construction Stormwater permit (CSW permit) requires volume reduction via use of infiltration or other methods, such as water harvest and reuse, to retain the required water quality volume rather than retention ponds that drain stormwater to area surface waters. Retention ponds should be used only if infiltration is prohibited from one of the reasons specified in the CSW Permit. Testing will be required to determine whether stormwater may be infiltrated.	Thank you for the comment. The City understands that the design of the stormwater infrastructure and detention/infiltration should be reviewed throughout the development process. Notation of this was added to the section and the mitigation measures table.
MPCA	18	Water Quality - Wastewater	The total number of each development type and the design flow per unit should be itemized for each sewer district. Table 6 is a good summary of the unit types. If different per unit design flows are used for the same land use type, those should also be listed.	Wastewater flow units, as defined within the wastewater analysis, were added to the narrative.

Commenter	Section		Comment	Response
MPCA	18	Water Quality - Wastewater	Design water flow projections should be included for average daily flow and peak flow.	Wastewater projections including daily flow and peak flow as defined within the wastewater analysis were added to the narrative.
MPCA	18	Water Quality - Wastewater	In accordance with Minn. R. 4410.4300, subp. 18 A. an EAW may be required for sewage collection system that increase design average daily flow by 1 million gallons or more. These potential projects should be identified and the need for an EAW mentioned.	Notation of EAW requirements will be added to the section. According to Minn. R. 4410.4300, subp. 18 A, expansion, modification, or replacement of municipal sewage collection systems resulting in an increase in design average daily flow of any part of that system by 1,000,000 gallons per day. It is understood that improvements of this nature, if completed could be the result of development in this area, along with surrounding development areas.
MPCA	18	Water Quality - Wastewater	The locations, the capacity and the capability of the wastewater treatment plant that will serve the area should be discussed. Questions regarding wastewater requirements should be directed to Roberta Getman at 507-206-2629 or Roberta.Getman@state.mn.us	The wastewater generated within the City is currently conveyed to the Metropolitan Council's Blue Lake Treatment Plan, which also serves the Cities of Chaska and Prior Lake. The Blue Lake Treatment Plan has the capacity to serve household and employment growth in the region through 2040. The wastewater section is updated to reference this condition.
MPCA	13	Water Use	The table on page 301-304, under the mitigation should include mitigation for impacted wetlands. Questions regarding wetlands or the 301 Water Quality Certification process should be directed to Jim Brist at 651-757-2245 or Jim.Brist@state.mn.us	Mitigation for impacted wetlands was added to the table.
MPCA	17	Water Quality - Stormwater Runoff	The Draft AUAR does not identify that the Minnesota River is impaired for turbidity and other construction-related impairments. Because the river is listed as impaired, areas that drain to the river will require additional best management practices during construction as required in the CSW Permit.	Notation was added to the section.
MPCA	12	Physical Impacts on Water Resources	Please note that for the MPCA CWA Section 401 Water Quality Certification, the MPCA uses the definition of "Waters of the State" as defined in Minn. Stat. ch. 115.01, subd 22. to determine what waters are regulated by the MPCA. This definition is broader than the definition of "Waters of the U.S." used by the U.S. Army Corps of Engineers (USACE). Some waters that are not regulated by the USACE are regulated by the MPCA. When making an application for wetland impacts for a proposed project, the applicant needs to include all impacts to surface waters, even if those waters have been determined to be non-jurisdictional by the USACE.	References to Waters of the State was added to the section along with an update to the required permits table.
MPCA	17	Water Quality - Stormwater Runoff	The City is strongly encouraged to incorporate Better Site Design and Green Infrastructure practices into the site design to reduce runoff; such as constructing narrower streets, infiltration trenches in parking lots, pervious pavements, and other practices found in Minnesota's Stormwater Manual. Questions regarding CSW Permit requirements should be directed to Roberta Getman at 507-206-2629 or Roberta.Getman@state.mn.us	Thank you for the comment. The City supports and encourages site design and green infrastructure practices on a project by project basis. The existing landscaping code is one of the tools used to regulate site design elements.
MPCA	21	Traffic	Traffic forecasts from the 2040 Comprehensive Plan were used in the Regional Travel Demand Model for the traffic analysis. Unacceptable level of service (LOS) during peak hours were found in 8 of the 19 intersections based on the 2040 growth forecasts, and 13 of the 19 intersections based on the maximum build out scenario. Mitigation measures were defined for each of the intersections with unacceptable LOS. Intersection capacity analysis was rerun with the assumption that the improvements were made and the results indicate that all intersection were operating with an overall acceptable LOS. This City of Shakopee must ensure that the improvements planned are actually implemented to maintain acceptable LOS within the area impacted by development. Questions regarding traffic should be directed to Mehjabeen Raham at 651-757-2191 or Mehjabeen.Rahman@state.mn.us	Thank you for the comment. It is understood that the mitigation measures identified within the 2020 and max build out analysis must be completed to maintain an acceptable LOS within the study area.
Scott County	F4	Figures	Consider replacing with adopted 2040 County Land Use Plan map	Figure updated with the 2040 Comprehensive Plan land uses.
Scott County	F6	Figures	Certain parcels appear to be missing a county zoning designation.	Figure updated.
Scott County	13	Water Use	"Water Use" - Was this projected future water usage modeled to determine impacts to the aquifer? (Including the new impervious areas)?	The water usage modeling used to inform the water use section reviewed the water sources and potential challenges. The existing and proposed wells would draw water from the Prairie Du Chien-Jordan aquifer, which is noted to have capacity to serve major portions of the city now and into the future.

Commenter	Section		Comment	Response
Scott County	18	Water Quality - Wastewater	"Water Quality -Wastewater, Table 7" - There is no comment on whether or not the existing treatment plan can handle the flow projections.	The wastewater generated within the City is currently conveyed to the Metropolitan Council's Blue Lake Treatment Plan, which also serves the Cities of Chaska and Prior Lake. The Blue Lake Treatment Plan has the capacity to serve household and employment growth in the region through 2040. The wastewater section is updated to reference this condition.
Scott County	21	Traffic	Should this AUAR include a discussion on the preferred alternative C-2 Corridor in the TH 41 Minnesota River Crossing FEIS completed in 2015 and discuss how future land use decisions in the study area will need to consider how this corridor will be preserved in the long term?	The City recognizes the TH 41 Minnesota River Crossing FEIS and its preferred alternative. However, the alignment is not officially mapped or planned/programed and was not included in the traffic analysis. Notation of the alignment and FEIS was added to the end of the transportation section. The City will consider the preferred alignment for future right-of-way needs.
Scott County	F	Traffic Memo	We agree the CH 69 and Chaparral/10th Avenue full accesses are not in conformance with the County's access spacing for Arterial Roadways. However, minimum full access spacing for public streets on County arterial roads is 1/4 spacing; not 1/8 Mile spacing as mentioned.	The minimum full access spacing for public streets was updated to 1/4 spacing.
Scott County	8	Permits and Approval Required	"Permits and Approval Required" - add Scott County as a permitting unit of government for permits needed to access County roadways. Furthermore, add Scott County as a permitting unit of government (grading, subdivision, rezoning, building permit) if a major project triggering an environmental review is proposed for this AUAR study are but still remains in Jackson Township and thus under County zoning and platting authority.	Scott County will be added as a permitting unit of government for the respective permits noted within the table. Notation will be added regarding the timing of development and the appropriate approval unit.
Scott County	19	Geologic Hazards and Soil Conditions	Table 9 - "multiple activities" should not be a site type	Thank you for your comment. The data provided in Table 9 is reported directly from the MPCA database using the site type "Multiple Activities". No change was made.
Scott County	5	Project Location	"Project Location" - include Scott WMO along the Lower Minn watershed section	Updated to include the Scott WMO.
Scott County	12	Physical Impacts on Water Resources	"Physical Impacts on Water Resources" - include Scott WMO in section describing which watershed districts the study area falls within.	Updated to include the Scott WMO.
Scott County	F	Traffic Memo	CH 73 and CH 77 are potential City collector roadways by 2040.	Will include a footnote in Table 1 of the Transportation Report.
Scott County	21	Traffic	The County appreciates the City's review of a max build-out scenario and showing potential issue areas that could show up over time. However this planning tool/exercise should not be used in determining mitigation needs at the end of the AUAR document as these mitigations can be over-predicted from assumptions on a number of factors could change the results.	Will include language in the Transportation Report about the Max Build evaluation being a planning tool and the mitigation identified is considered only potential improvements if development and traffic volumes materialize.
Scott County	6	Description	"Water Infrastructure, 1st Paragraph" - consider referencing a map or providing more detail as to where 1st and 2nd high pressures zones are located.	Figure created an added to appendix. Reference added to narrative.
Scott County	I	Mitigation Plan	The future mitigation needs at the end of the AUAR for only the 2040 model scenario should be used for mitigation purposes. This 20-year forecast can always be updated when the AUAR is updated in the future to determine additional intersection mitigation needs.	Will include language in the Transportation Report about the Max Build evaluation being a planning tool and the mitigation identified is considered only potential improvements if development and traffic volumes materialize.
Scott County	I	Mitigation Plan	The proposed mitigations for intersection should be less specific on the type of intersection needs of implementation. Over time the appropriate solution will be determined on a project or development level basis. The future responsible party should also include developers and the City on road infrastructure needs as these improvements may be development-driven or City requested.	Will include language in the Transportation Report about the Max Build evaluation being a planning tool and the mitigation identified is considered only potential improvements if development and traffic volumes materialize.
Scott County	F	Traffic Memo	The intersection of CH 15 and CH 16 is currently constructed for future signalization. The proposed AUAR mitigation has a signal or roundabout. A roundabout solution would not be supported at this intersection.	Will reference the on-going Marystown Road Corridor Study in the Transportation Report, and how further discussion with area stakeholders will occur as part of that study to determine the appropriate traffic control.

Commenter	Section		Comment	Response
Scott County	19	Geologic Hazards and Soil Conditions	Last paragraph of Section 19 - Were other agencies contacted for environmental concern questions? It looks as though only MPCA's "what's in my neighborhood" was utilized.	Multiple resources were used to identify geologic and soil resources within this section. Notation of the sources was added as an introduction to the section.
Scott County	F	Traffic Memo	CH 78 is considered a future principle arterial. Roundabouts are not considered a long term solution for principle arterials.	Will include more language in the Transportation report.
SHPO	25	Sensitive Resources	Please note that this comment letter does not address the requirements of Section 106 of the National Historic Preservation Act of 1966 arid 36tFR § 800. If this project is considered for federal financial assistance, or requires a federal permit or license, then review and consultation with our office will need to be initiated by the lead federal agency. Be advised that comments and recommendations provided by our office for this state-level review may differ from findings and determinations made by the federal agency as part of review and consultation under Section 106.	Thank you for the comment. At this time there are no funding sources identified for development within the study area. It is understood that a Section 106 review would be required should federal funding be used for all or a portion of the study area.
SHPO	25	Sensitive Resources	As stated in the AUAR, the Strunk-Nyssen House, which is listed in the National Register of Historic Places (NRHP) and the Strunk-Nyssen Brewery Complex Ruins, which has previously been determined eligible for listing in the NRHP are also located within the development area. Impacts to these historic properties should be avoided by development activities.	At this time, there are no specific plans identified that would impact these historic properties. Notation added to identify activities that would minimize or avoid impact the sites.
SHPO	25	Sensitive Resources	There are several known archaeological sites in the development area, therefore, due to the nature and location of the proposed project, we recommend that a Phase I archaeological survey be completed prior to development activities. The survey must meet the requirements of the Secretary of the Interior's Standards for Identification and Evaluation, and should include an evaluation of National Register eligibility for any properties that are identified. For a list of consultants who have expressed an interest in undertaking such surveys, please visit the website preservationdirectory.mnhs.org, and select "Archaeologists" in the "Search by Specialties" box. We will reconsider the need for survey if the project area can be documented as previously surveyed or disturbed. Any previous survey work must meet contemporary standards. Note: plowed areas and right-of-way are not automatically considered disturbed. Archaeological sites can remain intact beneath the plow zone and in undisturbed portions of the right-of-way.	Thank you for the comment. Notation of the need of Phase 1 archaeological survey is identified within the document. The study area is not anticipated to be developed in one development period.

December 5, 2019

City of Shakopee
Mark Noble, Senior Planner
485 Gorman Street
Shakopee, MN 55379

RE: Jackson Township AUAR

Dear Mr. Noble,

The Minnesota Department of Natural Resources (DNR) has reviewed the Draft Alternative Urban Areawide Review (AUAR) for Jackson Township. DNR recognizes that the comment period has passed and apologizes for the late response. DNR appreciates your consideration regarding matters for which the DNR has regulatory responsibility or other interests and offers the following comments.

1. **Water Appropriations (page 3):** As a reminder, if population and commercial activity in the annexation area grow, more water would be required. If so, the City of Shakopee may need to amend DNR Water Appropriation Permit 1980-6205 to authorize greatly increased use of water.
2. **Dewatering (page 4):** Large areas of the AUAR area consist of wetlands, which are indicators of shallow ground water levels. As a reminder, a DNR Water Appropriations Permit is needed if construction of new buildings, the installation of utilities, or the grading of the sites requires dewatering of ground water and surface water in volumes that exceed 10,000 gallons per day, or one million gallons per year. This includes water diversion in the same volumes.

(page 5) A DNR Water Appropriation Permit will be required for dewatering of groundwater, surface water, and pond water in volumes that exceed 10,000 gallons per day, or one million gallons per year, for the construction of roadways and their associated storm water facilities in the AUAR.
3. **Water Use (page 16):** The City of Shakopee will need to submit a "Well Construction – Preliminary Assessment" for proposed well #24 to the DNR. The application should be submitted to the DNR using the Minnesota Permitting and Reporting System (MPARS). The application should not be submitted until between six months and a year prior to actually constructing the well. DNR would use the most up to date legal and geologic information available to assess the application.
4. **Storm Water Runoff (page 18):** A DNR Water Appropriation Permit is **not** required for the use of water from constructed storm water facilities for landscape irrigation, but DNR recommends that the City of Shakopee consider storm water use as a means of protecting Gifford and Nyssen Lake from pollution.
5. **Water Supply:** The City of Shakopee would need to construct two dedicated water level observation wells that are completed in the Jordan Aquifer due to concerns over the sustainability of the use of the Jordan Aquifer. Please plan to construct these observation wells at the same time the City of Shakopee Installation No. 24 is constructed. You may contact the DNR for advice on where to locate these water level observation wells.
6. **Table 3:** Please include an amendment of your shoreland ordinance, with approval by DNR. The shoreland ordinance will need to be amended because the expansion area includes two Natural Environment Lakes.
7. **Table 4:** Table 4 may show industrial land use in area D. Area D includes Natural Environment (NE) Lakes and areas within 1,000 feet of these lakes are considered shoreland. Industrial Uses are not compatible with NE Lakes Shoreland. Please amend this by noting the issue within or below the table.

8. **Page 10:** The official name for basin 70-116 is Strunks Lake. The items are correctly addressed in Item 14, however, it should be made clear that "Nyssens" refers to Strunks Lake. Therefore, in the second paragraph beginning with "Scott County zoning...", please correct the following:

Current: "(this would include Nyssens Lake)"

Should be: (this would include Nyssens/Strunks, and Gifford Lakes).

For questions regarding comments 1-5 or when an appropriations permit would be needed for this project, please contact Joe Richter (DNR appropriations hydrologist, joe.richter@state.mn.us).

During permitting review, the DNR may offer additional comments for minimizing impacts. On behalf of the DNR, thank you for consideration of these comments.

Sincerely,



Cynthia Novak-Krebs
Environmental Review Planner

From: [Mark Noble](#)
To: [Stephanie Falkers](#); [Joseph Widing](#)
Subject: FW: MnDOT Review #AUAR19-006 Jackson Township Draft AUAR
Date: Thursday, November 14, 2019 9:10:47 AM
Attachments: [image001.png](#)
[image002.png](#)

Fyi. I did send a short email response to Cameron.

Mark Noble

Senior Planner, Planning Division
485 Gorman St., Shakopee MN 55379
(952) 233-9348 | mnoble@ShakopeeMN.gov | www.ShakopeeMN.gov

APA



From: Muhic, P Cameron (DOT) <cameron.muhic@state.mn.us>
Sent: Wednesday, November 13, 2019 4:45 PM
To: Mark Noble <MNoble@ShakopeeMN.gov>
Cc: Shekur, Hailu (DOT) <hailu.shekur@state.mn.us>; Craig, E (DOT) <buck.craig@state.mn.us>; Parzyck, Rebecca (DOT) <rebecca.parzyck@state.mn.us>; Ramic, Almin (DOT) <almin.ramic@state.mn.us>; Langenbach, Diane (DOT) <diane.langenbach@state.mn.us>; Schowalter, Lance (DOT) <lance.schowalter@state.mn.us>; Tompkins, John (DOT) <john.tompkins@state.mn.us>; Dierberger, Jeffrey (DOT) <jeffrey.dierberger@state.mn.us>; Sherman, Tod (DOT) <tod.sherman@state.mn.us>; Kratz, David (DOT) <David.Kratz@state.mn.us>; Elvin, David (DOT) <David.Elvin@state.mn.us>; Wiltgen, Jennifer (DOT) <jennifer.wiltgen@state.mn.us>; russell.owen@metc.state.mn.us
Subject: MnDOT Review #AUAR19-006 Jackson Township Draft AUAR

Dear Mr. Noble,

MnDOT has reviewed AUAR 19-006 Jackson Township Draft AUAR. After reviewing the document MnDOT has no comments.

Cordially,

Cameron Muhic
Senior Planner - Multimodal Planning
MnDOT Metro District
651-234-7797
Cameron.Muhic@state.mn.us

November 25, 2019

Mark Noble
Senior Planner
City of Shakopee
485 Gorman Street
Shakopee, MN 55379

Re: Jackson Township Draft Alternative Urban Areawide Review

Dear Mark Noble:

Thank you for the opportunity to review and comment on the Draft Alternative Urban Areawide Review (AUAR) for the Jackson Township project (Project) in the city of Shakopee, Scott County, Minnesota. The Project consists of a mixed-use development as planned in the city's 2030-2040 Comprehensive Plans. Regarding matters for which the Minnesota Pollution Control Agency (MPCA) has regulatory responsibility or other interests, the MPCA staff has the following comments for your consideration.

General Comment

Please note that the Draft AUAR was completed using an outdated version of the EAW form.

Physical Impacts on Water Resources (Item 13)

- Please note that for the MPCA CWA Section 401 Water Quality Certification, the MPCA uses the definition of "Waters of the State" as defined in Minn. Stat. ch. 115.01, subd 22. to determine what waters are regulated by the MPCA. This definition is broader than the definition of "Waters of the U.S." used by the U.S. Army Corps of Engineers (USACE). Some waters that are not regulated by the USACE are regulated by the MPCA. When making an application for wetland impacts for a proposed project, the applicant needs to include all impacts to all surface waters, even if those waters have been determined to be non-jurisdictional by the USACE.
- The table on page 301-304, under the mitigation should include mitigation for impacted wetlands. Questions regarding wetlands or the 401 Water Quality Certification process should be directed to Jim Brist at 651-757-2245 or Jim.Brist@state.mn.us.

Water Quality – Stormwater Runoff (Item 17)

- The study area for the new development is bordered by the Minnesota River. The Draft AUAR states that the City's existing stormwater infrastructure will be extended to the new development areas and will also utilize ditches to move stormwater and use detention ponds, either new or converted existing ponds and wetlands. However, it is important to note that the existing wetlands may not be used to treat stormwater unless they have undergone mitigation. Also, the National Pollutant Discharge Elimination System/State Disposal System (NPDES/SDS) General Construction Stormwater permit (CSW Permit) requires volume reduction via use of infiltration or other methods, such as water harvest and reuse, to retain the required water quality volume rather than retention ponds that drain stormwater to area surface waters. Retention ponds should be used only if infiltration is prohibited for one of the reasons specified in the CSW Permit. Testing will be required to determine whether stormwater may be infiltrated.
- The Draft AUAR does not identify that the Minnesota River is impaired for turbidity and other construction-related impairments. Because the river is listed as impaired, areas that drain to the river will require additional best management practices (BMPs) during construction as required in the CSW Permit.
- The City is strongly encouraged to incorporate [Better Site Design](#) and [Green Infrastructure](#) practices into the site design to reduce runoff; such as constructing narrower streets, infiltration trenches in

parking lots, pervious pavements, and other practices found in Minnesota's Stormwater Manual. Questions regarding CSW Permit requirements should be directed to Roberta Getman at 507-206-2629 or Roberta.Getman@state.mn.us.

Water Quality – Wastewater (Item 18)

- Design wastewater flow projects should be included for average daily flow and peak flow.
- The total number of each development type and the design flow per unit should be itemized for each sewer district. Table 6 is a good summary of the unit types. If different per unit design flows are used for the same land use type, those should also be listed.
- In accordance with Minn. R. 4410.4300, subp. 18 A. an EAW may be required for sewage collection systems that increase design average daily flow by 1 million gallons or more. These potential projects should be identified and the need for an EAW mentioned.
- The locations, the capacity, and capability of the wastewater treatment plant that will serve the area should be discussed. Questions regarding wastewater requirements should be directed to Roberta Getman at 507-206-2629 or Roberta.Getman@state.mn.us.

Traffic (Item 21)

Traffic forecasts from the 2040 Comprehensive Plan were used in the Regional Travel Demand Model for the traffic analysis. Unacceptable level of service (LOS) during peak hours were found in 8 of the 19 intersections based on 2040 growth forecasts, and 13 of the 19 intersections based on the maximum build out scenario. Mitigation measures were defined for each of the intersections with an unacceptable LOS. Intersection capacity analysis was rerun with the assumption that the improvements were made and the results indicate that all intersections were operating with an overall acceptable LOS. The city of Shakopee must ensure that the improvements planned are actually implemented to maintain acceptable LOS within the area impacted by development. Questions regarding traffic should be directed to Mehjabeen Raham at 651-757-2191 or Mehjabeen.Rahman@state.mn.us.

We appreciate the opportunity to review this Project. Please provide your specific responses to our comments and notice of decision on the need for an Environmental Impact Statement. Please be aware that this letter does not constitute approval by the MPCA of any or all elements of the Project for the purpose of pending or future permit action(s) by the MPCA. Ultimately, it is the responsibility of the Project proposer to secure any required permits and to comply with any requisite permit conditions. If you have any questions concerning our review of this Draft AUAR, please contact me by email at Karen.kromar@state.mn.us or by telephone at 651-757-2508.

Sincerely,



Karen Kromar
Project Manager
Environmental Review Unit
Resource Management and Assistance Division

KK:bt

cc: Dan Card, MPCA, St. Paul
Jim Brist, MPCA, St. Paul
Roberta Getman, MPCA, Rochester
Dave Sahli, MPCA, St. Paul
Mehjabeen Rahman, MPCA, St. Paul
Suzanne Hanson, MPCA, St. Paul

December 6, 2019

Michael Kerski
Planning Director
City of Shakopee
485 Gorman Street
Shakopee, MN 55379

Re: City of Shakopee Alternative Urban Area Review (AUAR)
Jackson Township Comments

Dear Michael:

This letter is to serve as the response of Jackson Township (the Township) to the City of Shakopee Alternative Urban Area Review (AUAR). Thank you for meeting with Township officials on November 15 and for extending the 30-day comment period to December 6, 2019.

The City of Shakopee as the responsible governmental unit (RGU) has prepared the Jackson Township Development Area Draft AUAR for an area within Jackson Township. The Jackson Township AUAR was prepared by the City of Shakopee as an alternative environmental review to consider the impacts for future development in the Jackson Township Study Area. The AUAR is governed by the rules of the Minnesota Environmental Quality Board (EQB) and Minnesota Rules Part 4410.3610. The draft AUAR considers two development scenarios. The first contemplates a development consistent with the previously adopted 2030 Comprehensive Plan for Scott County. The second is a full build scenario as proposed by the City of Shakopee 2040 Comprehensive Plan Update. This letter is the response to the draft AUAR and official comments on behalf of the Township.

Minnesota Rules Part 4410.3610 Subp. 5.B provides guidance for the subject of comments:

Comments may address the accuracy and completeness of the information provided in the draft analysis and draft mitigation plan, potential impacts that warrant further analysis, further information that may be required in order to secure permits for specific projects in the future, mitigation measures or procedures necessary to prevent significant environmental impacts within the area when actual development occurs, and the need to analyze additional development scenarios as required by this part.

1. LAND USE ASSUMPTIONS AND IMPLICATIONS.

Figure 5 of the AUAR provides the general plan for designated land uses within the Jackson development area. The document shows high intensity development in the TH 169 mixed use corridor and mixed use center designations in planning areas A and D. Higher intensity residential uses are identified in planning areas B and C in and around the intersection of County Roads 69 and 78. The document explains that densities in this area could be as high as 6 to 30 dwelling units per acre. Jackson is previously on record with the city of Shakopee that the Jackson Supervisors strongly disfavor the previously developed medium density residential projects in the TH169 corridor within the City of Shakopee. The Township has previously made clear that the monotonous, cookie cutter, uninspired design of these projects within Shakopee are not acceptable within the Jackson development area. This subject must be addressed.

2. STORM WATER

Section 17 of the AUAR contains the discussion of stormwater management. This critical element of the AUAR is wholly inadequate. This section fails to provide any analysis of a stormwater management system, fails to consider the potential impacts of urbanization that warrant further analysis, and fails to adhere mitigation measures necessary to prevent significant environmental impacts in the Study Area. The stormwater analysis of the Study Area should be based upon the latest NOAA Atlas 14 precipitation frequency estimates. The stormwater element of the AUAR is not complete and further information/analysis is required.

3. TRANSPORTATION

Table 15 identifies the Intersection Capacity Analysis at critical intersections and locations in the Jackson Development Area along corridors TH141, CR78, CR69 and CR15. Most of these critical intersections are forecast to operate at levels of service D, E and F under the “maximum build” assumptions. These designations identify congested conditions.

Table 16. The traffic analysis identifies mitigation measures for recommended roadway improvements to support the development of the AUAR Study Area. Critically absent to these identified mitigation efforts are timing and sources of funding for the identified mitigation measures.

The AUAR also fails to analyze additional development scenarios as required under the Rules to prevent significant adverse environmental impacts.

4. ENVIORNMENTAL REVIEW/ANALYSIS

The purpose of an AUAR document is to provide an analysis of the environmental impacts in a proposed development scenario. The level of effort of an AUAR is in between an EAW and EIS.

City of Shakopee
December 6, 2019
Page 3

The prepared document appears to have less information than an EAW. Areas that are specifically identified as insufficient include:

- There is inconsistency within the text portion of the document in providing mitigation strategies for each of the items. Some items receive a full discussion including mitigation while others are identification only.
 - The transportation section goes into detail on the LOS of intersections for no-build, 2040 & max build, however, other items do not discuss mitigation strategies.
 - Some items only identify the resources within the study area, similar to an environmental screening document. Items that are only identified include: geologic hazard & soil conditions (bedrock, geologic hazards, soil conditions, contaminated properties), sensitive resources (cultural resources, farmland, parkland)
 - Item 30, Summary of Issues: this section needs to discuss Sensitive Resources in particular the cultural resources. There are a number of resources identified within the study area including a burial mound site that will need further coordination.
 - The document provides a table in the appendices that provides the resource type, summary of impacts, mitigation, and responsible party. This table needs to be updated to minimally include physical impacts to water resources, erosion & sedimentation, and sensitive resources.
 - Any potential resources identified within the study area need to have a discussion of those resources and how the impacts will be resolved or mitigated. The applicant also needs to include if the mitigation will include coordination with any agencies and how they will review the plans.

Jackson Township has a strong desire to maintain compatible land uses and minimize the adverse environmental impacts within the Study Area. Consistent with Minnesota Rules 4410.3610 Subp. 5.b, the Township states that they wish to be notified in a timely manner by the RGU upon receipt of applications for specific development projects within the Study Area.

Sincerely,



Timothy J. Keane

cc: Andrew Budde, PE, Jackson Town Engineer
Rose Menke, Jackson City Clerk
Tom Weckman, Jackson Board Chair
Jackson Town Board Supervisors

November 26, 2019

Mark Noble, Senior Planner
City of Shakopee
485 Gorman St.
Shakopee MN 55379

RE: Shakopee Jackson Township Development Area Draft Alternative Urban Areawide Review (AUAR)

Metropolitan Council Review File No. 22373-1
Metropolitan Council District No. 4, Deb Barber

Dear Mr. Noble:

Metropolitan Council staff completed its review of the Jackson Township Development Area Draft Alternative Urban Areawide Review (AUAR) to determine its accuracy and completeness in addressing regional concerns. Staff concludes that the AUAR is complete and accurate with respect to regional concerns and does not raise major issues of consistency with Council policies. However, staff offers the following comments for your consideration:

Wastewater (*Roger Janzig, roger.janzig@metc.state.mn.us*)

When Interceptor (9206) was constructed in 1995, a cost sharing agreement was entered into between the Metropolitan Council and the City covering additional trunk sewer capacity costs for the City. In accordance with the agreement, the City must purchase additional capacity in the interceptor, after flows within the interceptor, at Townline Avenue, reach 3 cubic feet per second peak flow, or 571,000 gallons per day (gpd) averaged. The AUAR reflects the proposed development of an Orderly Annexation Area (OAA) that will trigger the purchase of additional capacity in MCES Interceptor 9206.

Forecasts (*Todd Graham, 651-602-1322*)

- The AUAR describes 1,753 housing units and 9.9 Million sq. ft. of commercial, industrial, and office floorspace added on a subtotal of 1,364 acres. These results far exceed Metropolitan Council's 2040 forecast for this area. The City explains: "For the purposes of the AUAR, the analysis assumed the full build of each development scenario. Therefore, the resulting socio-economic totals utilized within the AUAR are higher than those assumed within the 2030 and 2040 Comprehensive Plans."
- A TAZ allocation of the 2040 forecast was included in the City's 2040 Comprehensive Plan (Plan), finalized in 2019. The eventual development will affect the TAZ forecast allocation for this area, and potentially the citywide forecast. Specifically:
 - The AUAR discusses 400% more commercial, industrial, and office floorspace (9.7 million sq. ft.) in subarea D (TAZ 2116) and subareas A and B (TAZ 2177) than has previously been discussed. The City's earlier TAZ forecast allocation assigns 2020-2040 employment growth of 2,081 jobs to these combined subareas (zones).
 - The AUAR discusses 900% more housing (747 units) in subarea C (TAZ 2180) and subareas E and G (TAZ 2176) than has previously been discussed. The

City's earlier TAZ forecast allocation assigns 2020-2040 households growth of 72 households to these combined subareas (zones).

- For development within the 2040 planning period, the City expects to prepare a comprehensive plan amendment. That amendment should explicitly discuss revision of the communitywide forecast and TAZ forecast allocations, and the Council can consider the request.

Land Use (*Raya Esmaeili, 651-602-1616*)

- The City of Shakopee's 2040 Plan was authorized by the Metropolitan Council on October 23, 2019 and is awaiting final adoption by the City Council. As the Draft AUAR mentions, the build-out scenario is consistent with the direction of the 2040 Plan. However, if the City decides to move forward with the No Build scenario, as noted under item 26, a comprehensive plan amendment to the 2040 Plan will be necessary to reflect the change in land use guiding based on the AUAR.
- The AUAR describes the proposed land uses of each subdistrict on page 9. It should be noted that subdistrict A also includes a Mixed-Use Center area in the City's 2040 Planned Land Use. Moreover, subdistrict E is described as having a thin strip of open space, which is not included in the 2040 Planned Land Use; and it also includes a small Mixed Residential area in the middle. A comprehensive plan amendment to the 2040 Plan may be necessary to reflect changes in land use guiding based on the AUAR.

The Council will not take formal action on the AUAR. If you have any questions or need further information, please contact Raya Esmaeili, Principal Reviewer, at 651-602-1616.

Sincerely,



Angela R. Torres, AICP, Manager
Local Planning Assistance

CC: Tod Sherman, Development Reviews Coordinator, MnDOT - Metro Division
Deb Barber, Metropolitan Council District No. 4
Judy Sventek, Water Resources Manager
Raya Esmaeili, Sector Representative/Principal Reviewer/Reviews Coordinator

N:\shared\CommDev\LPA\Communities\Shakopee\Letters\Shakopee 2019 Jackson Twp Draft AUAR 22373-1.docx



SCOTT COUNTY PLANNING & RESOURCE MANAGEMENT Planning Department

GOVERNMENT CENTER 114 · 200 FOURTH AVENUE WEST · SHAKOPEE, MN 55379-1220
(952) 496-8475 · Fax (952) 496-8496 · Web www.co.scott.mn.us

December 4, 2019

Mark Noble
Senior Planner
City of Shakopee
485 Gorman Street
Shakopee, MN 55379

RE: DRAFT Jackson Township Development Area AUAR

Dear Mr. Noble,

Thank you for the opportunity to review and comment on the draft *Jackson Township Development Area Alternative Urban Areawide Review (AUAR)*. Staff from Scott County's planning, zoning, highway, environmental health, and parks departments have completed a review of the draft AUAR and provide the following comments:

- Page 2, "Project Location" – include Scott WMO along with Lower Minn in watershed section
- Page 4, "Water Infrastructure, 1st paragraph" – consider referencing a map or providing more detail as to where 1st and 2nd high pressure zones are located.
- Page 7, "Permits and Approval Required" – add Scott County as a permitting unit of government for permits needed to access County roadways. Furthermore, add Scott County as a permitting unit of government (grading, subdivision, rezoning, building permit) if a major project triggering an environmental review is proposed for this AUAR study area but still remains in Jackson Township and thus under County zoning and platting authority.
- Page 15, "Physical Impacts on Water Resources" – include Scott WMO in section describing which watershed districts the study area falls within.
- Page 16, "Water Use" - Was this projected future water usage modeled to determine impacts to the aquifer? (Including the new impervious areas)?
- Page 19, "Water Quality-Wastewater, Table 7" - There is no comment on whether or not the existing treatment plant can handle the flow projections.
- Page 24, Table 9 – "multiple activities" should not be a site type
- Page 27, last paragraph of Section 19 – Were other agencies contacted for environmental concern questions? It looks as though only MPCA's "what's in my neighborhood" was utilized.
- Page 28, "Traffic" – should this AUAR include a discussion on the preferred alternative C-2 Corridor in the TH 41 Minnesota River Crossing FEIS completed in 2015 and discuss how future land use decisions in this study area will need to consider how this corridor will be preserved in the long-term?
- Figure 4a, consider replacing with adopted 2040 county land use plan map
- Figure 6, certain parcels appear to be missing a county zoning designation
- Page 7 of Transportation Analysis – We agree the CH 69 and Chaparral/10th Avenue full accesses are not in conformance with the County's access spacing for Arterial Roadways. However, minimum full access spacing for public streets on County arterial roads is 1/4 Mile spacing; not 1/8 Mile spacing as mentioned.



SCOTT COUNTY PLANNING & RESOURCE MANAGEMENT Planning Department

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- The County appreciates the City's review of a max build-out scenario and showing potential issue areas that could show up over time. However, this planning tool/exercise should not be used in determining mitigation needs at the end of the AUAR document as these mitigations can be over-predicted from assumptions and a number of factors could change the results.
- The future mitigation needs at the end of the AUAR for only the 2040 model scenario should be used for mitigation purposes. This 20-year forecast can always be updated when the AUAR is updated in the future to determine additional intersection mitigation needs.
- The proposed mitigations for intersection should be less specific on the type of intersection needs for implementation. Over time the appropriate solution will be determined on a project or development level basis. The future responsible party should also include developers and the City on road infrastructure needs as these improvements may be development-driven or City requested.
- CH 73 and CH 77 are potential City collector roadways by 2040.
- CH 78 is considered a future principal arterial. Roundabouts are not considered a long term solution for principal arterials.
- The intersection of CH 15 and CH 16 is currently constructed for future signalization. The proposed AUAR mitigation has a signal or roundabout. A roundabout solution would not be supported at this intersection.

If you have any questions about the County's review, please contact me at 952-496-8654 or bdavis@co.scott.mn.us.

Sincerely,

Brad Davis, AICP
Planning Manager

Cc: Jackson Town Clerk and Board Members (via email)



DEPARTMENT OF ADMINISTRATION

STATE HISTORIC PRESERVATION OFFICE

December 3, 2019

Mark Noble
City of Shakopee
485 Gorman Street
Shakopee, MN 55379

RE: Jackson Township Draft Alternative Urban Area Review and Mitigation Plan
Shakopee, Scott County
SHPO Number: 2020-0287

Dear Mr. Noble:

Thank you for providing this office with a copy of the Draft AUAR for the Jackson Township Development/Annexation Area.

There are several known archaeological sites in the development area, therefore, due to the nature and location of the proposed project, we recommend that a Phase I archaeological survey be completed prior to development activities. The survey must meet the requirements of the Secretary of the Interior's Standards for Identification and Evaluation, and should include an evaluation of National Register eligibility for any properties that are identified. For a list of consultants who have expressed an interest in undertaking such surveys, please visit the website preservationdirectory.mnhs.org, and select "Archaeologists" in the "Search by Specialties" box.

We will reconsider the need for survey if the project area can be documented as previously surveyed or disturbed. Any previous survey work must meet contemporary standards. **Note:** plowed areas and right-of-way are not automatically considered disturbed. Archaeological sites can remain intact beneath the plow zone and in undisturbed portions of the right-of-way.

As stated in the AUAR, the Strunk-Nyssen House, which is listed in the National Register of Historic Places (NRHP) and the Strunk-Nyssen Brewery Complex Ruins, which has previously been determined eligible for listing in the NRHP are also located within the development area. Impacts to these historic properties should be avoided by development activities.

Please note that this comment letter does not address the requirements of Section 106 of the National Historic Preservation Act of 1966 and 36 CFR § 800. If this project is considered for federal financial assistance, or requires a federal permit or license, then review and consultation with our office will need to be initiated by the lead federal agency. Be advised that comments and recommendations provided by our office for this state-level review may differ from findings and determinations made by the federal agency as part of review and consultation under Section 106.

If you have any questions regarding our review of this project, please contact our Environmental Review Program at (651) 201-3285.

Sincerely,

Sarah J. Beimers
Environmental Review Program Manager

MINNESOTA STATE HISTORIC PRESERVATION OFFICE

50 Sherburne Avenue ■ Administration Building 203 ■ Saint Paul, Minnesota 55155 ■ 651-201-3287

mn.gov/admin/shpo/ ■ mnshpo@state.mn.us

AN EQUAL OPPORTUNITY AND SERVICE PROVIDER

Attachment I

Mitigation Plan

JACKSON TOWNSHIP AUAR

MITIGATION PLAN

Introduction

This Mitigation Plan has been prepared as part of the AUAR for the Jackson Township completed for the City of Shakopee to review the potential comprehensive impacts from the development of the City's Orderly Annexation Area in Jackson Township. The AUAR identified the impacts anticipated to result from the development planned within the Envision Shakopee 2040 Comprehensive Plan. The mitigation plan identifies the steps to be taken by the City and/or other responsible parties to avoid or minimize environmental impacts and to mitigate for unavoidable impacts.

This mitigation plan was prepared in accordance with the Minnesota Environmental Quality Board's Environmental Review Program, Minnesota Rules 4410.3610. This plan addresses the mitigation methods to be implemented for impacts that could result from the study area development scenario examined in the AUAR.

The AUAR determined that impacts related to traffic, surface water, ecologically sensitive resources, utility infrastructure, and potential environmental hazards could result from the proposed development. The section below summarizes the impacts and the specific mitigation measures to be implemented to avoid, minimize or compensate for these impacts. A table is included that identifies the potential impacts, proposed mitigation efforts, and responsible parties.

Responsible Parties

The responsibility for ensuring the implementation of many of the mitigation methods identified in this plan will lie with the City of Shakopee. In these cases, the City's review and approval of developer's preliminary and final subdivision plans and preliminary and final planned development amendments; land disturbance and erosion control plan and permit reviews; and other approvals required for each phase and component of development will serve as the step where measures to avoid impacts and/or specific mitigation plans and requirements are identified and reviewed. City approval of development plans will be dependent upon reaching agreements with the developer(s) regarding plan elements to reduce environmental impacts, mitigation to be preformed for unavoidable impacts, and financial and regulatory assurances that the mitigation plans will be implemented. In addition, the City will inspect the development as it is constructed, or will, through other means ascertain that the prescribed measures are implemented. However, developers are ultimately responsible for implementing mitigation measures in accordance with plan review and permit requirements.

Agencies other than the City of Shakopee also have authority for determining compliance with the regulations within their jurisdiction as part of the approval and permitting requirements. These agencies include, among others: Scott County; Metropolitan Council; Lower Minnesota River Watershed District, Scott Watershed Management Organization; the Minnesota Pollution Control Agency (MPCA); the Minnesota Department of Transportation (MnDOT) and the Minnesota Department of Health. The AUAR

and this mitigation plan list permits and approvals required by these and other governmental regulatory agencies. Responsibility for obtaining all required permits and approvals and for providing mitigation required as part of those approvals lies with the developer(s).

Identified Impacts and Proposed Mitigation Plan

The following italicized text is from the Environmental Quality Board document, Recommended Content and Format Alternative Urban Areawide Review Documents.

Mitigation Plan. The draft and final AUAR documents must include an explicit mitigation plan. It must be understood that the mitigation plan is a commitment by the RGU to prevent potentially significant impacts from occurring from specific projects. It is more than just a list of ways to reduce impacts—it must include information about how the mitigation will be applied and assurance that it will. Otherwise, the AUAR may not be adequate and/or specific projects may lose their exemption from the individual review.

The RGU’s final action on the AUAR must specifically adopt the mitigation plan; therefore, the plan has a “political” as well as a technical dimension.

Based upon the mitigation plan guidelines summarized above, the following table identifies the resource area, anticipated impact, mitigation action, and responsible party.

Resource Area		Summary of Impact	Mitigation	Responsible Party
Land Use	Development Review	Proposed development may require additional changes, approvals or amendments to policy and regulatory items, such as the Comprehensive Plan, Annexation, and Zoning changes.	Build (Shakopee 2040 Plan) Scenario will require: • Comprehensive Plan Update (Adoption of draft 2040 Plan) • Annexation of township land into city limits • Zoning amendments	Developer in coordination with the City of Shakopee
Fish, Wildlife and Ecologically Sensitive Resources	DNR public waters	Impacts to public waters may result from proposed development including the fill or modification of the wetland.	• DNR public waters permits will be obtained if impacted by future development.	Developer
Fish, Wildlife and Ecologically Sensitive Resources	Wetlands	Impacts to wetlands may results from proposed development including the fill or modification of the wetland.	• Mitigation of the wetland impact must occur per the 301 Water Quality Certification process with the MPCA	Developer
Fish, Wildlife and Ecologically Sensitive Resources	Minnesota River	Runoff into the Minnesota River during construction must be regulated, as the river is impaired for turbidity and other construction-related impairment.	• Best management practices will be deployed during construction for areas that drain to the Minnesota River.	Developer
Fish, Wildlife and Ecologically Sensitive Resources	Bluff Area	The build scenario includes potential development near existing bluff areas.	• Bluff areas within Subdistrict A should be preserved in accordance with local long-range plans.	City of Shakopee
Fish, Wildlife and Ecologically Sensitive Resources	Minnesota Valley State Recreation Area	The build scenario preserves the land within the Minnesota Valley State Recreation Area as a natural/recreational resource area. Potential noise, visual, etc. impacts may from development in close proximity.	• Future development in close proximity to the Minnesota Valley State Recreation Area must not interfere with enjoyment of the natural resources/ recreational uses (e.g. noise issues). • Future development should avoid/minimize impacts to native plant communities and wetlands within and in the vicinity of the Minnesota Valley State Recreation Area.	City of Shakopee, Developer
Fish, Wildlife and Ecologically Sensitive Resources	Native Plant Communities	Proposed development within close proximity of sensitive resources may occur.	• At the time that development is proceeding, consult with the DNR regarding potential botanical survey requirements.	Developer
Fish, Wildlife and Ecologically Sensitive Resources	Minnesota Biological Survey (MBS) Sites	Proposed development within close proximity to MBS sites may occur.	The following minimization measures are recommended for work within MBS sites: • Minimize vehicular disturbance in the area (allow only vehicles/equipment necessary for construction activities) • Do not park equipment or stockpile supplies in the area • Do not place spoil within MBS Sites or other sensitive areas • If possible, conduct the work under frozen ground conditions • Use effective erosion prevention and sediment control measures • Inspect and clean all equipment prior to bringing it to the site to prevent the introduction and spread of invasive species • As much as possible, operate within already-disturbed areas • Revegetate disturbed soil with native species suitable to the local habitat as soon after construction as possible • Use only weed-free mulches, topsoils, and seed mixes. Of particular concern are birdsfoot trefoil (<i>Lotus corniculatus</i>) and crown vetch (<i>Coronilla varia</i>), two invasive species that are sold commercially and area problematic in prairies and disturbed open areas.	Developer

Resource Area		Summary of Impact	Mitigation	Responsible Party
Fish, Wildlife and Ecologically Sensitive Resources	Calcareous Fens	Proposed development within close proximity to Calcareous Fens sites may occur.	- Calcareous fens may not be filled, drained, or otherwise degraded, wholly or partially, by any activity, except as provided for in a management plan approved by the commission of the DNR per the Minnesota Wetlands Conservation Act. - Any activities that might affect groundwater flows, including groundwater pumping or discharge should be avoided. - Any adverse affects to calcareous fens, including indirect impacts through the alteration of hydrological conditions, must be reported to the DNR.	Developer, City of Shakopee
Fish, Wildlife and Ecologically Sensitive Resources	Butternut	Proposed development within or near the Cottonwood Terrace Forest.	- Tree removal must be avoided within Silver Maple - Green Ash - Cottonwood Terrace Forest native plant community (T 115N, R 23W, Sec. 9). - Consult with the DNR at the time that future development is proceeding to determine if a rare species survey is required.	Developer, City of Shakopee
Fish, Wildlife and Ecologically Sensitive Resources	Little Brown Bat and Big Brown Bat	Required tree removal for infrastructure and development.	Tree removal must avoid the bat pupping season (approximately June - July).	Developer, City of Shakopee
Fish, Wildlife and Ecologically Sensitive Resources	Lake Sparrow and Purple Martin	Required tree removal and ground disturbance for infrastructure and development.	- Future development should avoid disturbance to undisturbed grassland areas. - Tree and shrub removal from May 15th through August 15th should be avoided.	Developer, City of Shakopee
Fish, Wildlife and Ecologically Sensitive Resources	Northern Long-Eared Bat	Required tree removal for infrastructure and development.	Tree removal must avoid the bat pupping season (approximately June 1 - August 15). Commitment to winter clearing (November 1 - March 31) is recommended.	Developer, City of Shakopee
Fish, Wildlife and Ecologically Sensitive Resources	Rusty Patched Bumble Bee	Required tree removal and ground disturbance for infrastructure and development.	- Consult with the U.S. Fish and Wildlife Service to identify potential impacts to rusty patched bumble bee high potential zone. - Bee surveys may be required based on the proposed improvements and regulations in place at the time of any future development.	Developer, City of Shakopee
Traffic	MN 41 and Rail Frontage	As a result of the planning development within the AUAR study area, and forecasted increases in background traffic levels, traffic volumes will increase on roadways in and adjacent to the study area. These increasing volumes will result in operational problems at area intersections if no improvements are implemented.	Construct a 4-Lane Divided Roadway with turn lanes along MN Highway 41 ⁽¹⁾	MnDOT
			Construct left-turn lanes at the side-street approaches, with potential for future signalization ⁽¹⁾	Shakopee
			Construct a traffic signal ⁽¹⁾	Shakopee
Traffic	CR 78 and Emery Way		Construct a traffic signal or roundabout ⁽¹⁾	Shakopee, Scott County
			Construct a southbound left-turn lane at the Emery Way intersection ⁽¹⁾	Shakopee, Developer
Traffic	CR 78 and CR 69		Construct a traffic signal or roundabout ⁽¹⁾	Scott County
			Construct a westbound right-turn lane to accommodate to the heavy westbound movement ⁽¹⁾	Scott County
			Construct left-turn lanes at the side-street approaches ⁽¹⁾	Scott County, Developer
Traffic	CR 78 and CR 79		Construct a traffic signal or roundabout ⁽¹⁾	Scott County
			Construct a westbound right-turn lane to accommodate to the heavy westbound movement ⁽¹⁾	Scott County
			Construct left-turn lanes on all approaches ⁽¹⁾	Scott County, Developer

Resource Area		Summary of Impact	Mitigation	Responsible Party
Traffic	CR 78 and CR 15		Construct a traffic signal or roundabout ⁽¹⁾	Scott County
			Construct a southbound right-turn lane and a westbound right-turn lane ⁽¹⁾	Scott County
			Construct left-turn lanes on all approaches ⁽¹⁾	Scott County
Traffic	CR 78 and CR 73		Construct eastbound and westbound left-turn lanes ⁽¹⁾	Scott County, Developer
Traffic	CR 78 and CR 77		Construct a southbound right-turn lane and eastbound left-turn lane ⁽¹⁾	Scott County, Developer
Traffic	CR 69 and 10th Avenue/Chaparral Avenue	As a result of the planning development within the AUAR study area, and forecasted increases in background traffic levels, traffic volumes will increase on roadways in and adjacent to the study area. These increasing volumes will result in operational problems at area intersections if no improvements are implemented.	Reconstruct Chaparral Avenue to align with 10th Avenue to create a 4-leg intersection ⁽¹⁾	Shakopee, Scott County
			Construct a traffic signal or roundabout ⁽¹⁾	Shakopee, Scott County
Traffic	CR 69 and Vierling Drive		Construct a traffic signal or roundabout ⁽¹⁾	Shakopee, Scott County
Traffic	CR 69 and US 169 North Ramp		Construct a traffic signal or roundabout ^(1)	Shakopee, Scott County, MnDOT
Traffic	CR 69 and US 169 South Ramp		Construct a traffic signal or roundabout ⁽¹⁾	Shakopee, Scott County, MnDOT
Traffic	CR 69 and Subdistrict A/B North Access		Construct a northbound and southbound left-turn lane on CR 69 ⁽¹⁾	Shakopee, Scott County, Developer
			Construct a traffic signal or roundabout ⁽¹⁾	Shakopee, Scott County, Developer
Traffic	CR 69 and Subdistrict A/B South Access (CR 16)		Construct a northbound and southbound left-turn lane on CR 69 ⁽¹⁾	Shakopee, Scott County, Developer
			Construct a traffic signal or roundabout ⁽¹⁾	Shakopee, Scott County, Developer
Traffic	CR 15 and 128th Street		Construct a northbound and southbound left-turn lane on CR 15 ⁽¹⁾	Shakopee, Scott County, Developer, Township
Traffic	Marystown Road and US 169 North Ramp		Construct a traffic signal or roundabout ⁽¹⁾	Shakopee, MnDOT
Traffic	Marystown Road and US 169 South Ramp		Construct a traffic signal or roundabout ⁽¹⁾	Shakopee, MnDOT
Traffic	CR 15 and CR 16		Construct a traffic signal or roundabout ⁽¹⁾	Scott County
Construction Odors, Noise and Dust	Construction Activities	Various construction activities will be required to achieve the development proposed within the Build Alternative. The range of activities are unknown at this time, though there is a potential for noise and dust from activities.	• Implement dust control measures (e.g. apply water to exposed soil and limit the extent and duration of exposed soil conditions). • Limit construction noise to daytime hours in accordance with the City's noise ordinance per City Code 130.45. • Construction equipment house be fitted with mufflers and properly maintained.	Developer
Traffic-Related Noise	Traffic Noise	As a result of the planning development within the AUAR study area, and forecasted increases in background traffic levels, traffic volumes will increase on roadways in and	• Noise mitigation measures should be identified as future development occurs (e.g. installation of noise barriers).	Developer

Resource Area		Summary of Impact	Mitigation	Responsible Party
		adjacent to the study area. This increase in traffic may result in increased volumes in the study area.		
Infrastructure and Public Services	Water Supply	As a result of future development, the existing water supply system will need to be extended to provide service to new areas.	Extend trunk water main and other water distribution features to accommodate expansion	Developer in coordination with Shakopee Public Utilities (SPU)
Infrastructure and Public Services	Water Supply	New development areas will increase the water supply need, along with increased needs from surrounding development areas.	Construction of additional supply well #23 (Well #23 needed to support development outside of study area)	SPU
Infrastructure and Public Services	Water Supply	New development areas will increase the water supply need, along with increased needs from surrounding development areas.	Construction of a 500,000-gallon elevated storage tank	SPU
Infrastructure and Public Services	Water Supply	As a result of future development, the existing water supply system will need to be extended to provide service to new areas.	Extend city water service as development occurs.	Developer in coordination with SPU
Infrastructure and Public Services	Sanitary Sewer	As a result of future development, the existing sanitary system will need to be extended to provide service to new areas.	Extend sanitary sewer service as development occurs.	Developer in coordination with the City of Shakopee
Infrastructure and Public Services	Sanitary Sewer	As a result of future development, the existing sanitary system will need to be extended to provide service to new areas.	Construct forcemain and gravity mains throughout study area to provide sanitary service to development areas and allow for future extension	Developer in coordination with the City of Shakopee
Infrastructure and Public Services	Sanitary Sewer	As a result of future development, the existing sanitary system will need to be extended to provide service to new areas.	Construct lift stations to service study area and future development areas. Two lift stations are identified within study area. Two additional lift stations will be needed beyond the study area to service adjacent growth.	City of Shakopee
Infrastructure and Public Services	Water Quality - Stormwater Runoff	As a result of potential development, stormwater water runoff rates may increase with increased impervious surface in the study area. Increased volumes may impact existing facilities.	Expansion and water quality improvements of the Upper Valley Drainage Ditch (regional facility).	City of Shakopee
Infrastructure and Public Services	Water Quality - Stormwater Runoff	As a result of potential development, stormwater water runoff rates may increase with increased impervious surface in the study area.	Continue to employ City policies and regulations for onsite surface water management.	Developer in coordination with the City of Shakopee

(1) It should be noted that the Max Build evaluation is meant to be a planning tool and the improvements identified in this section are to be considered potential improvements if current development plans and traffic volumes materialize. The mitigation actions identified throughout this plan should be reviewed as development is purused and conditions are updated.

Future Environmental Concerns or Impacts Not Anticipated in this AUAR and Mitigation Plan

Although steps have been taken to identify potential future conditions based on the best information currently available, as development plans are completed and more information becomes available, or as regulatory requirements change, environmental concerns or issues that differ from those addressed in the AUAR or Mitigation Plan may be identified. Also, new information or mitigation methods may be developed after the approval of this Plan. In these instances, the development plans would be reviewed to identified measures to avoid, minimize and mitigate for impact consistent with the new information, while maintaining the basic intent and process identified in this Plan.

Actions Beyond the Scope of this AUAR and Mitigation Plan

The City is responsible for permits/approvals and related mitigation for regulatory issues and impacts under its local jurisdiction (e.g., traffic improvements). Private developers are responsible for obtaining all permits necessary from all governmental agencies having jurisdiction over their development.