OAK CREEK AND LYNN CREEK BASINS

17.1 TRUNK SEWER SYSTEM

The existing Oak Creek and Lynn Creek drainage basins are shown schematically in Figures 17.1 and 17.2. Table 17.1 shows the existing and planned service areas that were used to determine the flows for the different modeling scenarios.

Table 17.1 Service Areas and Flows - Oak Creek and Lynn Creek Basins
Wastewater Facilities Master Plan Update - 2007
City of Lincoln, Nebraska

Basin	Existing		Existing and Tier I		Existing and Tiers I & II		Existing and Tiers I, II & III	
	Area (ac)	Flow (cfs)	Area (ac)	Flow (cfs)	Area (ac)	Flow (cfs)	Area (ac)	Flow (cfs)
Oak Creek	4,538	28.2	7,162	42.46	13,342	73.07	21,767	114.21
Lynn Creek	2,865	15.6	3,323	18.22	NA	NA	NA	NA

1.Based on information provided by LWWS.
2. As of July, 2006.3.

17.2 MODELING RESULTS

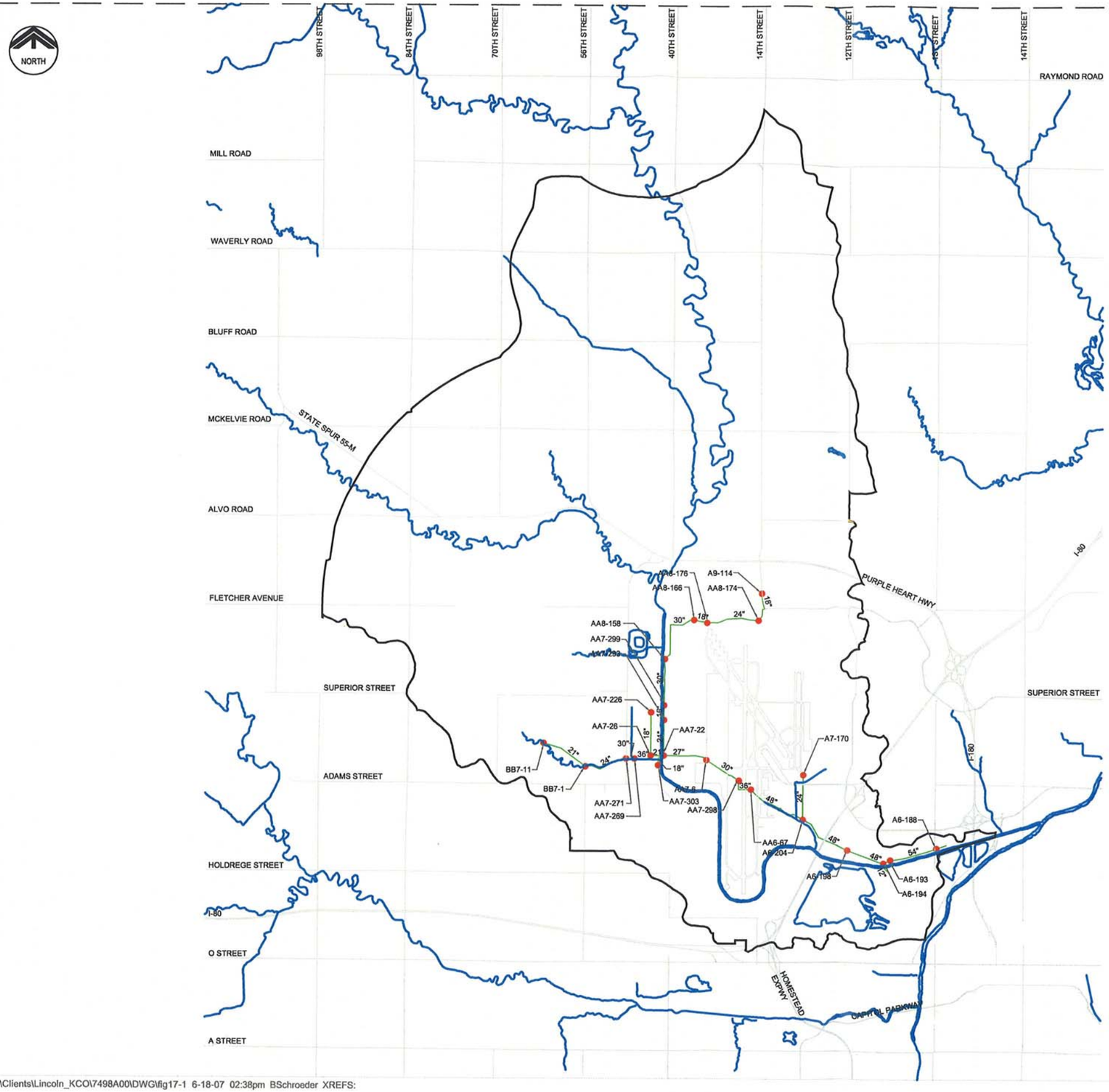
The Oak Creek and Lynn Creek identified Capital Improvement Program improvements and future proposed sewers were preliminary sized and added to the model to convey Tier III sanitary flows. The model was run at existing, Tier I, II and III conditions. The modeling results are located in Appendix D.

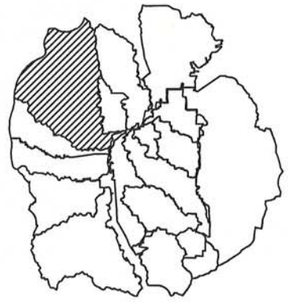
17.2.1 Existing Conditions

17.2.1.1 Oak Creek Basin

As shown in Table 17.1, the Oak Creek Basin currently contributes about 28.2 cfs of sanitary flow to Theresa Street WWTF. This corresponds to a developed service area of approximately 4,538 acres.

The existing model simulation run indicates that portions of the existing Oak Creek Trunk Sewer system do not have the capacity to adequately convey the existing peak flows.





KEY MAP

NOTES:

1. ONLY 18" AND LARGER PIPES INCLUDED IN MODEL.

Figure No. 17.1
OAK CREEK BASIN TRUNK SEWER SYSTEM
WASTEWATER FACILITIES MASTER PLAN UPDATE - 2007
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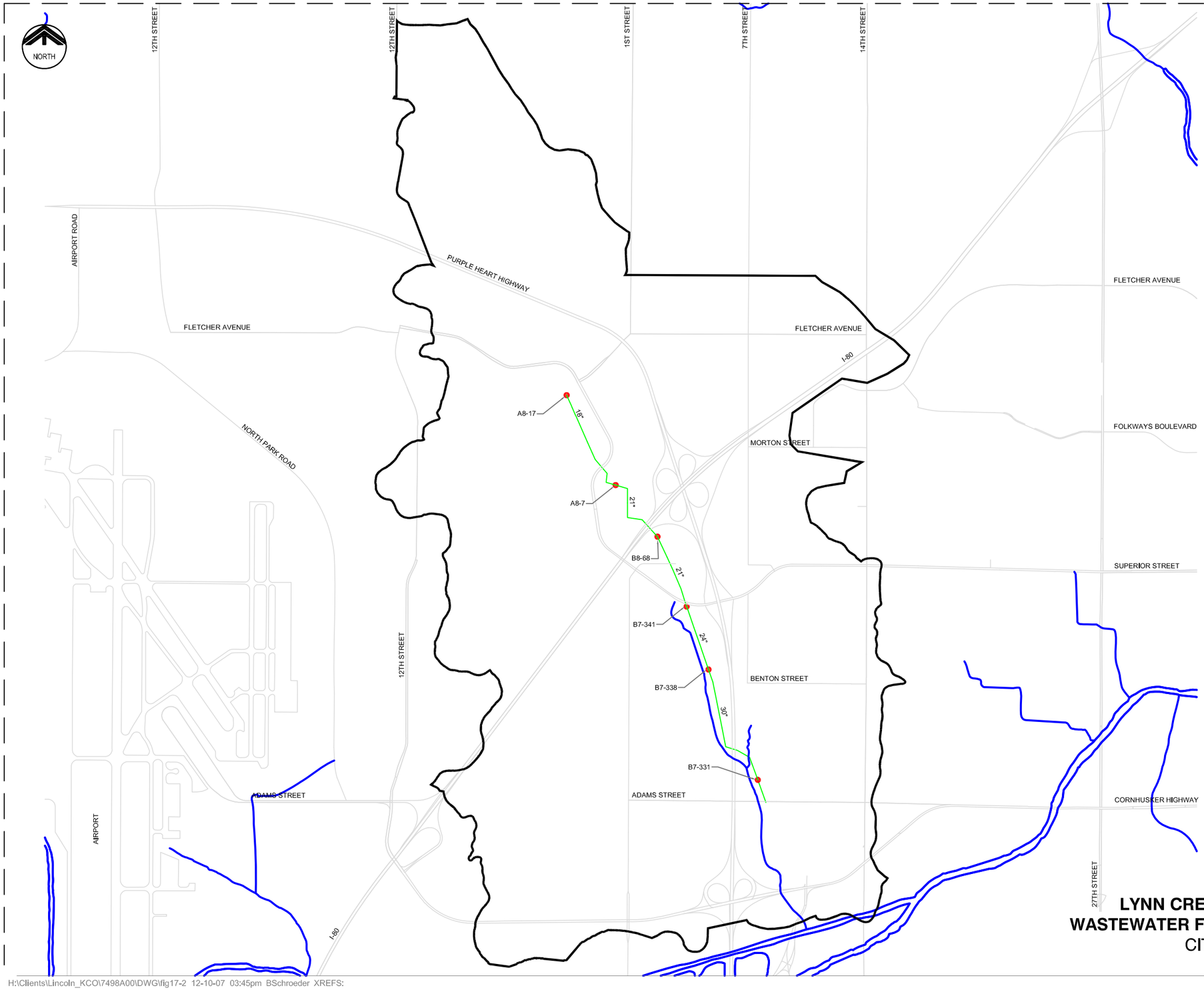

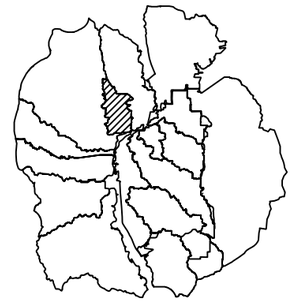

KEY MAP

NOTES:

1. ONLY 18" AND LARGER PIPES INCLUDED IN MODEL.

Figure No. 17.2
LYNN CREEK BASIN TRUNK SEWER SYSTEM
WASTEWATER FACILITIES MASTER PLAN UPDATE - 2007
CITY OF LINCOLN, NEBRASKA

According to the existing model scenario results, the occurrence of a storm equal to or greater than the magnitude of the storm used to develop the City's peak flow equation will cause overflows at nineteen locations. Table 17.2 provides a summary of capacity related modeled overflows under existing conditions. The model results show that the overflows will be of a very short duration less than fifteen minutes. The sewers that are surcharged with d/D ratios that exceed 1.0 are listed in Table 17.3. The relative locations of these pipes within the existing Oak Creek system are displayed in Figure 17.3. The limited conveyance capacity was the source of the modeled SSOs prominent in this area under existing peak flow conditions. The hydraulic profile of the capacity deficient sections in Oak Creek basin is shown schematically in Figure 17.4. Previous studies have also identified the sewers listed in Table 17.3 as capacity deficient.

Table 17.2 Oak Creek Manholes with Modeled SSO's - Existing Conditions
Wastewater Facilities Master Plan Update - 2007
City of Lincoln, Nebraska

Node ID	Ground Elev. (ft)	Invert Elev. (ft)	Water Surface Elev. (ft)	Flooded Time (min)	Location
AA7-226	1166.28	1155.84	1167.59	10.19	West of 42nd Street
AA7-225	1166.62	1155.42	1167.11	6.62	
AA7-195	1165.65	1155.32	1166.71	9.48	
AA7-194	1164.98	1155.01	1166.26	10.16	
AA7-148	1165.4	1154.76	1165.94	6.57	
AA7-137	1163.73	1154.42	1165.58	10.78	
AA7-136	1164.21	1154.25	1165.42	9.93	
AA7-135	1164.69	1154.14	1165.26	7.22	
AA7-117	1164.99	1154.26	1165.05	1.98	
AA7-116	1164.84	1153.64	1164.86	1.69	
AA7-106	1163.83	1153.07	1164.46	8.96	
AA8-160	1170.3	1159.25	1170.57	5.86	Along 42nd Street
AA8-159	1169.5	1158.75	1170.41	9.67	
AA8-157	1169.5	1158.21	1170.23	8.55	
AA8-156	1169.87	1157.86	1170.10	4.72	
AA8-155	1169.79	1157.7	1170.00	4.21	
AA8-154	1169.34	1157.06	1169.81	6.28	
AA7-301	1168.37	1156.92	1169.68	10.35	
AA7-244	1167.83	1153.94	1169.17	10.40	

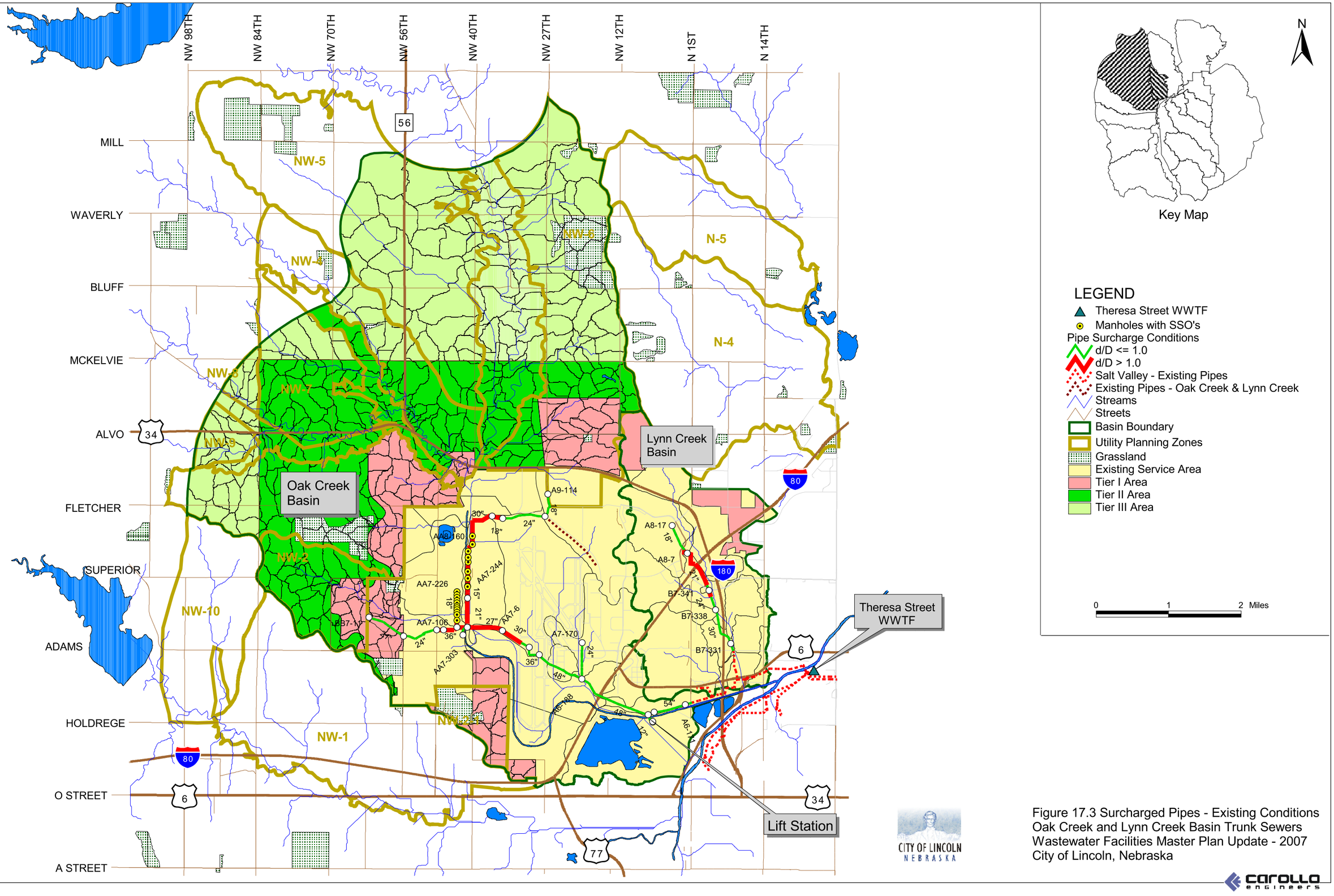

Figure 17.3 Surcharged Pipes - Existing Conditions
Oak Creek and Lynn Creek Basin Trunk Sewers
Wastewater Facilities Master Plan Update - 2007
City of Lincoln, Nebraska

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Table 17.3 Surcharged Pipes - Oak Creek Basin - Existing Conditions
Wastewater Facilities Master Plan Update - 2007
City of Lincoln, Nebraska

Pipe ID	US Manhole	DS Manhole	Diameter (ft)	Length (ft)	Flow (cfs)	d/D
LIN71	AA7-271	AA7-270	2.50	240	2.22	2.48
LIN68	AA7-270	AA7-269	2.50	240	2.22	3.24
LIN69	AA7-269	AA7-268	3.00	400	2.22	3.01
LIN70	AA7-268	AA7-267	3.00	386	2.22	3.31
LIN72	AA7-267	AA7-26	1.75	274	2.22	6.68
LIN73	AA7-226	AA7-225	1.50	205	5.61	7.84
LIN74	AA7-225	AA7-195	1.50	189	5.39	7.80
LIN75	AA7-195	AA7-194	1.50	226	5.12	7.60
LIN76	AA7-194	AA7-148	1.50	178	5.01	7.50
LIN77	AA7-148	AA7-137	1.50	217	5.00	7.46
LIN78	AA7-137	AA7-136	1.50	125	3.94	7.45
LIN79	AA7-136	AA7-135	1.50	143	3.94	7.45
LIN80	AA7-135	AA7-117	1.50	202	3.93	7.34
LIN81	AA7-117	AA7-116	1.50	177	3.91	7.49
LIN82	AA7-116	AA7-107	1.50	235	3.87	7.55
LIN83	AA7-107	AA7-106	1.50	192	3.82	7.59
LIN85	AA7-106	AA7-91	1.50	201	3.74	7.68
LIN84	AA7-91	AA7-26	1.50	285	3.63	7.80
LIN86	AA7-26	AA7-25	1.75	277	5.88	6.68
LIN87	AA7-25	AA7-24	1.75	316	5.88	6.65
LIN127	AA8-175	AA8-167	1.50	336	4.82	1.83
LIN126	AA8-167	AA8-166	1.50	422	4.82	6.62
LIN125	AA8-166	AA8-165	2.50	198	4.82	4.02
LIN124	AA8-165	AA8-164	2.50	590	5.25	4.18
LIN123	AA8-164	AA8-163	2.50	355	7.50	4.24
LIN136	AA8-163	AA8-162	2.50	369	7.50	4.29
LIN122	AA8-162	AA8-161	2.50	593	7.47	4.43
LIN121	AA8-161	AA8-160	2.50	579	7.47	4.53
LIN120	AA8-160	AA8-159	2.50	595	7.43	4.67
LIN118	AA8-159	AA8-158	2.50	422	7.03	4.69
LIN119	AA8-158	AA8-157	2.50	241	8.20	4.81
LIN117	AA8-157	AA8-156	2.50	439	8.10	4.90
LIN116	AA8-156	AA8-155	2.50	351	8.10	4.92
LIN115	AA8-155	AA8-154	2.50	679	8.10	5.10
LIN114	AA8-154	AA7-301	2.50	468	8.10	5.11
LIN97	AA7-301	AA7-300	2.50	570	7.85	5.13
LIN96	AA7-300	AA7-299	1.50	20	7.64	10.25
LIN106	AA7-299	AA7-244	1.25	40	5.99	12.30
LIN107	AA7-244	AA7-224	1.25	386	6.47	12.18

Table 17.3 Surcharged Pipes - Oak Creek Basin - Existing Conditions Wastewater Facilities Master Plan Update - 2007 City of Lincoln, Nebraska						
Pipe ID	**US Manhole**	**DS Manhole**	**Diameter (ft)**	**Length (ft)**	**Flow (cfs)**	**d/D**
LIN95	AA7-224	AA7-193	1.25	433	6.47	9.70
LIN94	AA7-193	AA7-146	1.75	369	6.47	5.21
LIN93	AA7-146	AA7-139	1.75	344	6.47	5.10
LIN92	AA7-139	AA7-115	1.75	336	6.47	4.99
LIN91	AA7-115	AA7-104	1.75	400	6.47	4.89
LIN90	AA7-104	AA7-93	1.75	400	6.47	4.84
LIN89	AA7-93	AA7-21	1.75	309	6.47	4.71
LIN88	AA7-21	AA7-16	2.25	260	15.17	3.66
LIN10	AA7-16	AA7-15	2.25	852	15.17	3.54
LIN11	AA7-15	AA7-14	2.25	242	15.17	2.98
LIN4	AA7-14	AA7-13	2.25	577	15.17	2.73
LIN12	AA7-13	AA7-10	2.25	265	15.17	2.21
LIN13	AA7-10	AA7-9	2.25	179	15.17	1.93
LIN14	AA7-9	AA7-7	2.25	118	15.17	1.78
LIN15	AA7-7	AA7-6	2.25	155	15.17	1.50
LIN5	AA7-6	AA7-5	2.50	850	15.17	1.12
LIN7	AA7-5	AA7-4	2.50	850	15.17	1.05

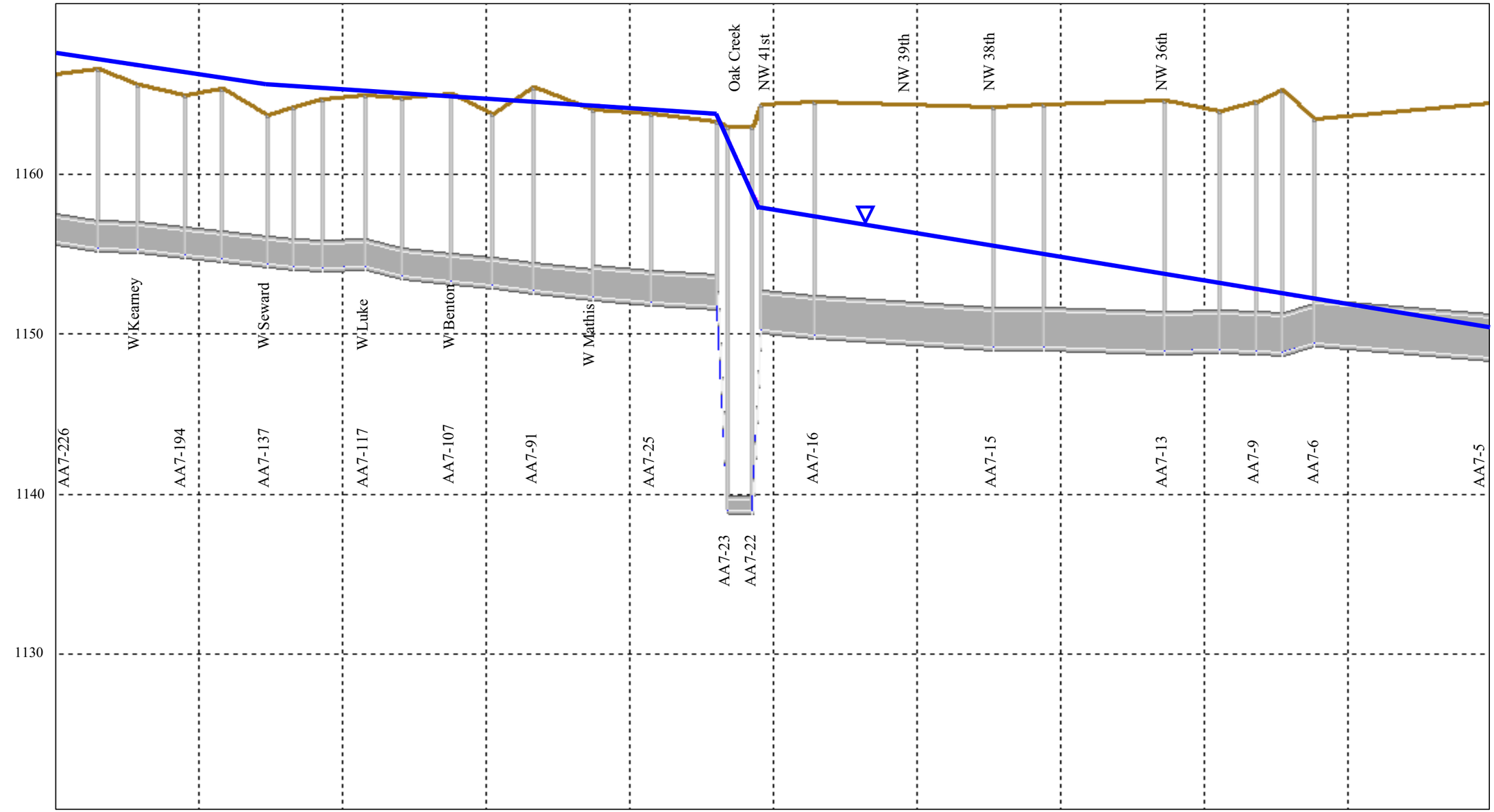

Figure 17.4A Hydraulic Profile of Existing System – Existing Conditions
Oak Creek Basin Trunk Sewer
Wastewater Facilities Master Plan Update - 2007
City of Lincoln, Nebraska

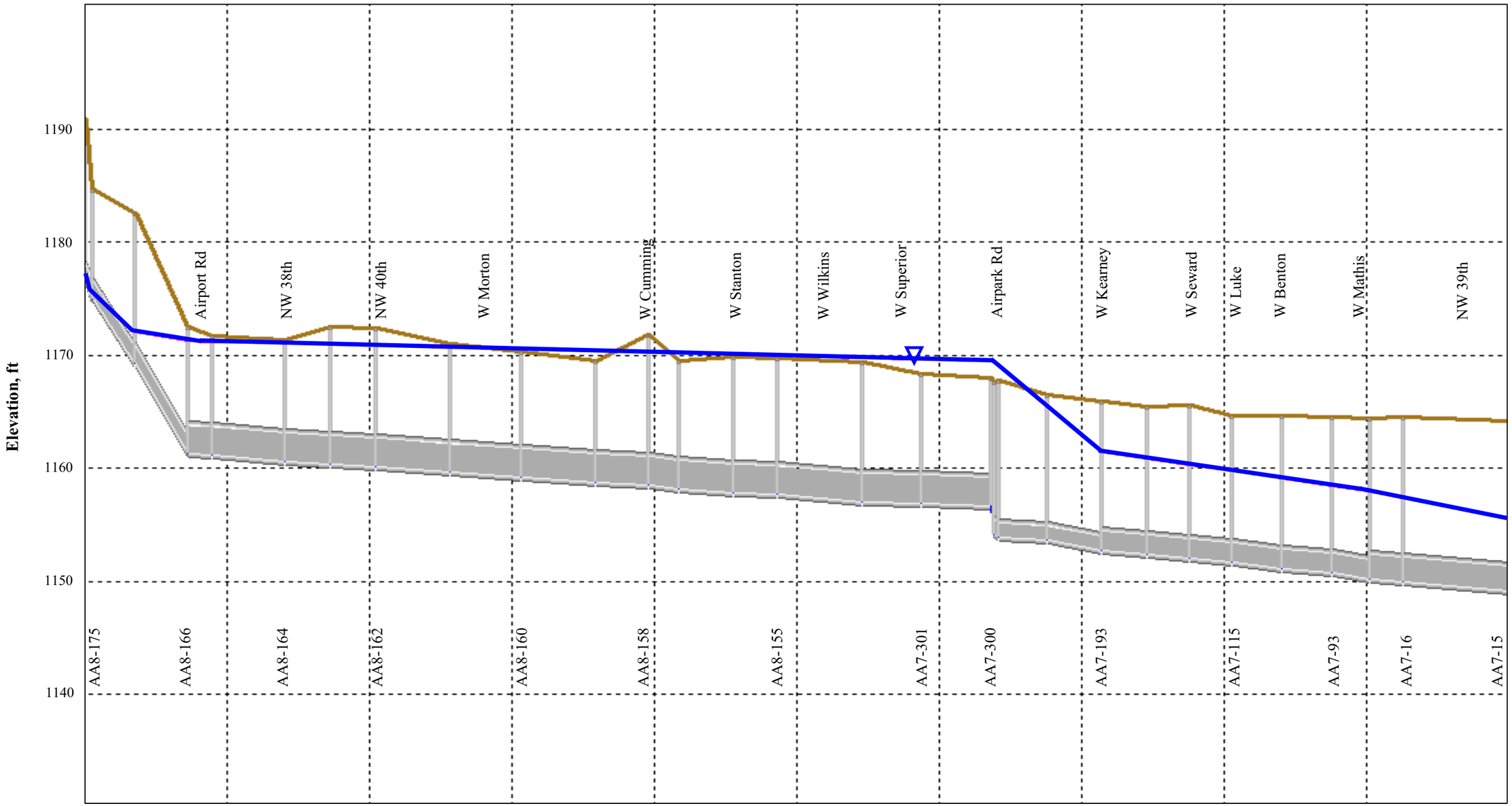

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Figure 17.4B Hydraulic Profile of Existing System – Existing Conditions
Oak Creek Basin Trunk Sewer
Wastewater Facilities Master Plan Update - 2007
City of Lincoln, Nebraska

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17.2.1.2 Lynn Creek Basin

As shown in Table 17.1, the Lynn Creek basin currently contributes about 15.6 cfs of sanitary flow to Theresa Street WWTF. This corresponds to a developed service area of approximately 2,885 acres.

The model simulations of the existing conditions indicated that no SSOs occur in the Lynn Creek trunk sewer system. However, portions of the existing system are surcharged at peak model flows. The surcharged pipes are presented in Table 17.4. The d/D ratios of the surcharged pipes varied between of 1.09 to 2.51. The location of the surcharged pipes is shown in Figure 17.3 and the hydraulic profile of these capacity deficient pipes is shown graphically in Figure 17.5.

Table 17.4 Surcharged Pipes - Lynn Creek Basin - Existing Conditions
Wastewater Facilities Master Plan Update - 2007
City of Lincoln, Nebraska

Pipe ID	US Manhole	DS Manhole	Diameter (ft)	Length (ft)	Flow (cfs)	d/D
LH25	A8-140	A8-8	1.50	200	8.39	1.09
LH24	A8-8	A8-7	1.50	222	8.39	1.60
LH23	A8-7	A8-6	1.75	276	8.39	1.63
LH22	A8-6	A8-5	1.75	319	8.39	1.91
LH20	A8-5	A8-2	1.75	330	8.39	2.51
LH21	A8-2	B8-69	1.75	320	8.39	2.51
LH29	B8-69	B8-68	1.75	504	8.39	2.46
LH28	B8-68	B8-67	1.75	506	8.39	2.32
LH30	B8-67	B7-343	1.75	330	8.39	2.16
LH11	B7-343	B7-342	1.75	450	11.78	1.88
LH14	B7-435	B7-341	1.75	103	11.78	1.31
LH12	B7-341	B7-340	2.00	503	11.78	1.15

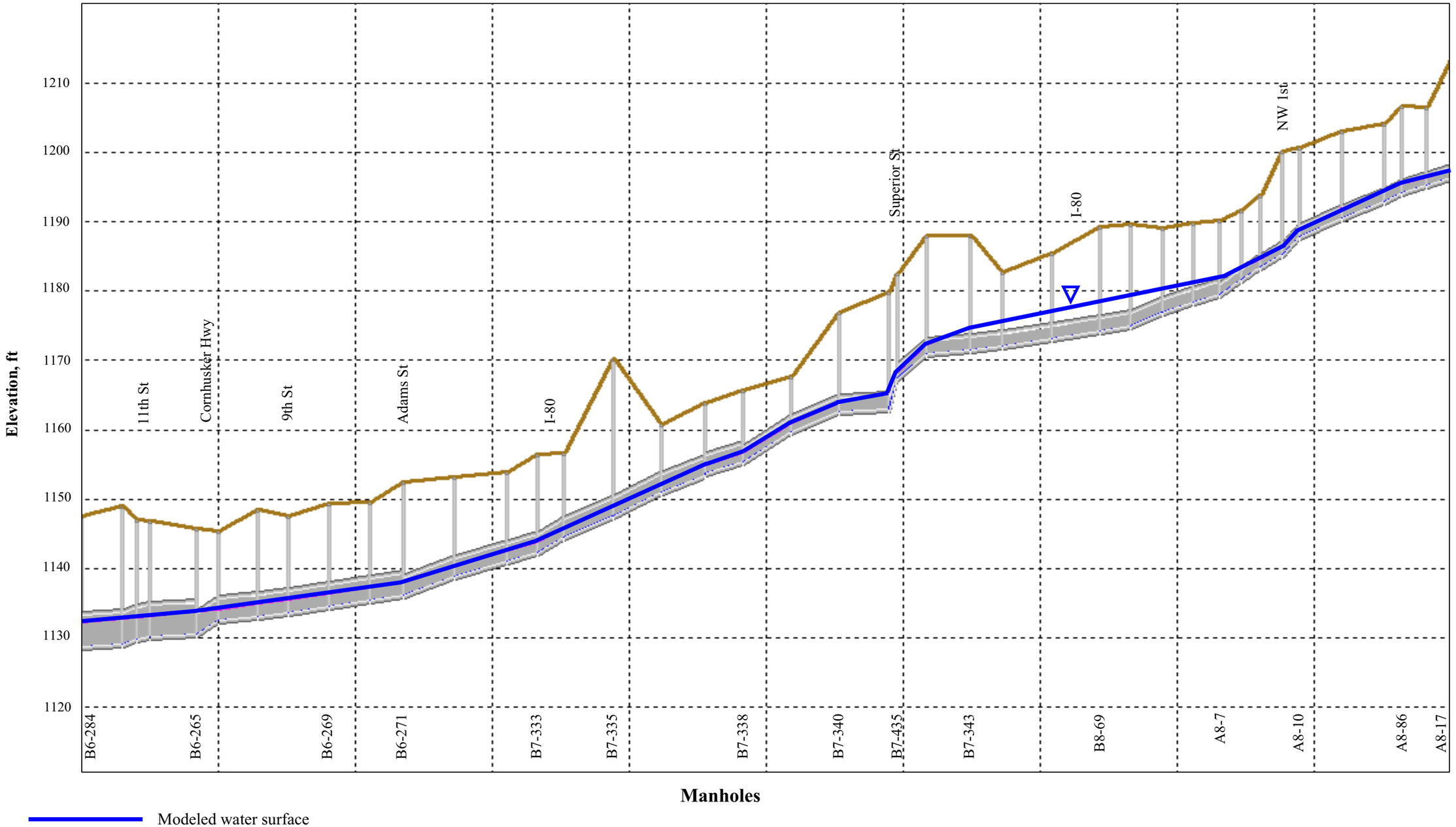


Figure 17.5 Hydraulic Profile of Existing System – Existing Conditions
Lynn Creek Basin Trunk Sewer
Wastewater Facilities Master Plan Update - 2007
City of Lincoln, Nebraska

17.2.2 TIER I CONDITIONS

17.2.2.1 Oak Creek Basin

Under the Tier I planning conditions, the Oak Creek Basin is anticipated to contribute about 42.46 cfs of sanitary flow to Theresa Street WWTF. This corresponds to a developed service area of approximately 7,162 acres. The Tier I flows were routed through the existing Oak Creek sewer system with all improvements identified in the City's current CIP under the existing design flow conditions. The model simulation run indicates the existing sewer system with the proposed CIP improvement has sufficient capacity to convey the Tier I design flows.

17.2.2.2 Lynn Creek Basin

Under Tier I conditions, it is anticipated that the Lynn Creek Basin will generate 18.22 cfs of sanitary flow. This represents a total Tier I service area of 3,313 acres.

17.2.3 Tier II Conditions

17.2.3.1 Oak Creek Basin

The Oak Creek Basin is anticipated to contribute about 73.07 cfs of sanitary flow to Theresa Street WWTF under Tier II conditions. This corresponds to a projected developed service area of approximately 13,342 acres. The Tier II flows were routed through the existing Oak Creek sewer system including the previously identified CIP improvements and the additional pipes proposed under Tier I conditions.

17.2.3.2 Lynn Creek Basin

Currently, there are no service areas planned for Tiers II and III conditions in the Lynn Creek Basin.

17.2.4 Tier III Conditions

17.2.4.1 Oak Creek Basin

The Tier III system was modeled using a total area of 21,767 acres, which resulted in a peak flow of 114.21 cfs. The Tier III flows were routed through the existing Oak Creek sewer system with all system including the previously identified CIP improvements and additional pipes proposed under Tier II conditions. The model simulation run indicates the existing sewer system with the proposed Tier I and II improvements lack the capacity to convey the Tier III design flows.

17.3 IMPROVEMENTS

The improvements for the Oak Creek and Lynn Creek Basins are shown graphically in Figure 17.6 and summarized in Tables 17.5 and 17.6.

17.3.1 Existing Improvements

17.3.1.1 Oak Creek Basin

Recommendations were evaluated to eliminate problems identified under existing flow conditions. The recommendations are mainly increased conveyance capacity through sewer replacement and siphon replacement.

The proposed improvements are essentially the same as recommended in the Oak Creek Trunk Sewer Preliminary Design Report and identified in the City's current CIP. The proposed sewers were modeled to evaluate the effectiveness of the proposed sewers in eliminating SSOs and surcharging. The simulation results indicate the proposed system will eliminate SSOs and surcharged conditions identified under existing conditions.

17.3.1.2 Lynn Creek Basin

Recommendations were evaluated to eliminate the surcharge conditions identified under existing flow conditions. The surcharging can be eliminated by constructing 2,440 feet of parallel 18-inch diameter pipe between manholes A8-5 and B7-324. However, since the surcharging is minimal and does not cause any environmental concerns, it is recommended that the surcharging be monitored at this time and improvements, if required, be implemented in the future.

17.3.2 Tier I Improvements

17.3.2.1 Oak Creek Basin

Based on the Tier I flows, and the proposed CIP Improvements additional improvements were identified as shown in Table 17.5 and Figure 17.6. Approximately 35,000 ft of 15-inch to 42-inch diameter pipelines were identified for Tier I flows. As shown in the table, the d/D at Tier I conditions ranges from 0.13 to 0.86.

17.3.2.2 Lynn Creek Basin

The small service areas planned for Tier I conditions in the Lynn Creek basin has minimal impact to the flows in the existing pipes. Improvements for Tier I conditions are the same as those recommended for existing conditions.

17.3.3 Tier II Improvements

17.3.3.1 Oak Creek Basin

17.3.3.1.1 Pipelines

Based on the Tier II flows, and the CIP and Tier I improvements previously discussed new pipelines were identified as shown in Table 17.5 and Figure 17.6. Approximately 37,000 ft of 15-inch to 48-inch diameter pipelines were identified for Tier II flows. As shown in the table, the d/D at Tier II conditions ranges from 0.10 to 1.10.

17.3.3.1.2 Storage

To eliminate the surcharged condition identified under Tier II flow conditions, a storage facility located near the airport is proposed.

To model this improvement, a flow diversion curve was developed to divert approximately 16 cfs of the peak flow to the storage facility. This analysis revealed that a storage volume of about 2.5 MG will be needed to store the flow for about six hours. A storage facility will incorporate a pump station to deliver the stored wastewater back to the system. The results indicate that this alternative will eliminate all the surcharging identified under Tier II flow conditions. The location of the proposed storage facility is near manhole AO-6 (near NW 40th St and Purple Heart Highway) and is shown in Figure 17.6.

17.3.3.2 Lynn Creek Basin

Currently, there are no service areas planned for Tier II conditions in the Lynn Creek basin.

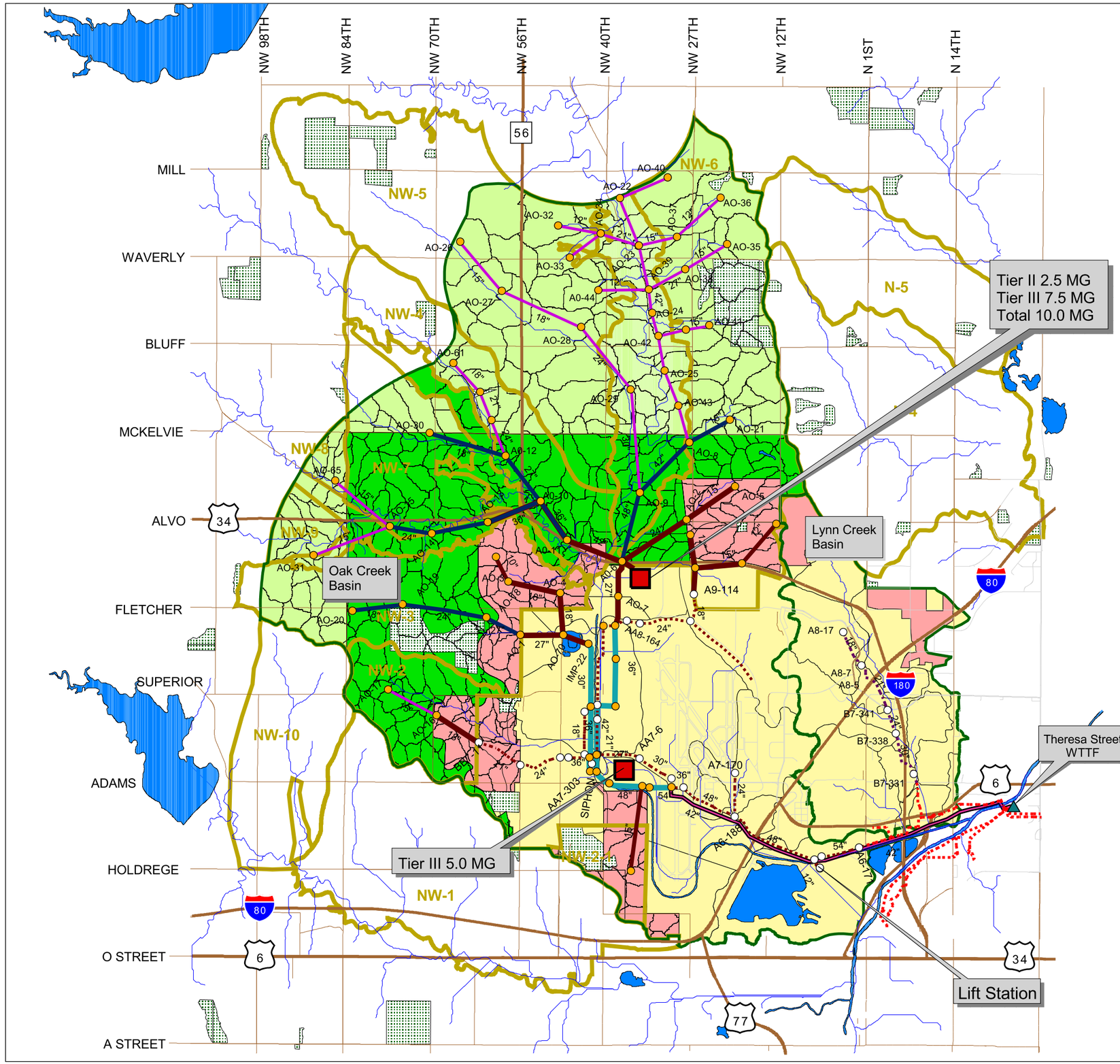
17.3.4 Tier III Improvements

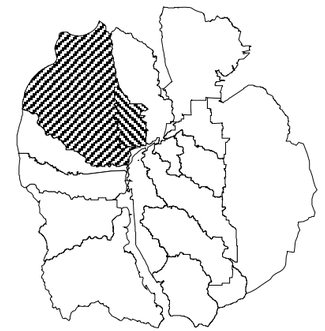
17.3.4.1.1 New Pipelines

Based on the Tier III flows, and the CIP and Tier I improvements previously discussed, new pipelines were identified as shown in Table 17.5 and Figure 17.6. Approximately 80,000 ft of 12-inch to 42-inch diameter pipelines were identified for Tier III flows. The proposed sewers have adequate capacity to convey Tier III flows.

17.3.4.1.2 Storage

The 2.5 MG storage facility proposed for Tier II conditions near the airport would be expanded to 10.0 MG of offline storage designed to temporarily hold wet weather flows that exceed the capacity of the sewer system. After flow subsides, the stored wastewater can be conveyed back the system. The modeling results indicate that this alternative will eliminate all surcharging identified under Tier III flow conditions. Alternatively, the City may consider the option of a new wastewater treatment facility located in the Oak Creek Basin during the Tier III planning period. A suggested location for this new WWTF would be at the same site as the storage facility.





Key Map

LEGEND

- Theresa Street WWTF
- Salt Valley - Existing Pipes
- Existing Pipes - Oak Creek & Lynn Creek
- Planned Pipes - Existing Design
- Tier I Pipes
- Tier II Pipes
- Tier III Pipes
- Streams
- Streets
- Basin Boundary
- Utility Planning Zones
- Grassland
- Storage Basins - Tier II & III
- Existing Service Area
- Tier I Area
- Tier II Area
- Tier III Area

0 1 2 Miles

Notes:
Pipes less than 15-in are shown for planning purposes. Additional 10-in, 12-in, or 15-in pipes may be required depending on the actual land use and development.

Figure 17.6 Proposed Sewer Improvements
Oak Creek and Lynn Creek Basin Trunk Sewers
Wastewater Facilities Master Plan Update - 2007
City of Lincoln, Nebraska

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Table 17.5 Design Characteristics of Proposed Sewers - Oak Creek Basin Wastewater Facilities Master Plan Update - 2007 City of Lincoln, Nebraska							
Pipe ID	**US Manhole**	**DS Manhole**	**Diameter (ft)**	**Length (ft)**	**Slope (%)**	**Design Cap. (cfs)**	**Tier**
LOK-50	AO-1	AO-70	2.25	2,564	0.30	16.96	I
LOK-79	AO-3	AO-4	1.50	3,231	0.30	5.75	
LOK-82	AO-4	AO-70	1.50	2,526	0.30	5.75	
L1580	AO-70	IMP-22	2.50	1,762	0.14	22.77	
LOK-81	AO-16	BB7-11	1.50	2,933	0.30	5.75	
LOK-40	AO-5	AO-2	1.25	3,643	0.25	3.23	
LOK-41	AO-2	AO-6	2.00	5,253	0.25	9.32	
LOK-71	AO-11	AO-6	3.50	2,616	0.14	37.49	
LOK42	AO-6	AO-7	2.25	2,340	0.15	12.17	
L1579	AO-7	AA8-164	2.25	1,867	0.13	10.99	
LOK-63	AO-13	AO-10	2.50	3,317	0.30	22.47	II
LOK-70	AO-10	AO-11	3.00	2,787	0.18	28.16	
LOK-60	AO-12	AO-10	2.25	3,507	0.15	11.99	
LOK-78	AO-14	AO-13	2.00	3,465	0.30	12.39	
LOK-72	AO-15	AO-14	2.00	2,633	0.20	10.12	
LOK-53	AO-18	AO-1	2.25	3,446	0.30	16.96	
LOK-80	AO-17	AO-16	1.25	3,347	0.30	3.54	
LOK-52	AO-19	AO-18	2.00	3,620	0.30	12.39	
LOK-51	AO-20	AO-19	1.50	3,359	0.30	5.75	
LOK-48	AO-21	AO-8	1.50	2,834	0.25	5.25	
LOK-61	AO-30	AO-12	1.50	4,820	0.30	5.75	
LOK-44	AO-8	AO-9	3.50	4,305	0.15	38.97	
LOK-45	AO-9	AO-6	4.00	4,517	0.11	48.62	
LOK-46	AO-22	AO-23	1.50	3,095	0.21	4.99	III
LOK-47	AO-23	AO-39	2.50	2,729	0.10	16.15	
LOK-67	AO-24	AO-42	3.50	1,407	0.10	31.81	
LOK-65	AO-25	AO-43	3.50	2,171	0.10	31.81	
LOK-90	AO-26	AO-27	1.25	3,914	0.30	3.54	
LOK-91	AO-27	AO-28	1.50	5,302	0.30	5.75	
LOK-92	AO-28	AO-29	2.00	4,833	0.30	12.39	
LOK-93	AO-29	AO-9	2.50	6,232	0.12	14.08	
LOK-62	AO-31	AO-15	1.25	4,933	0.30	3.54	
LOK-54	AO-32	AO-34	1.00	2,630	0.30	1.95	
LOK-56	AO-33	AO-34	1.00	2,396	0.30	1.95	
LOK-55	AO-34	AO-23	1.75	2,440	0.10	5.50	
LOK-59	AO-35	AO-38	1.25	2,971	0.30	3.54	
LOK-57	AO-36	AO-37	1.00	3,585	0.30	1.95	
LOK-58	AO-37	AO-23	1.25	2,348	0.25	3.37	
LOK-64	AO-38	AO-39	2.25	2,467	0.10	9.79	
LOK-97	AO-39	AO-24	3.50	1,428	0.10	31.82	
LOK-49	AO-40	AO-22	1.25	3,160	0.30	4.30	
LOK-73	AO-41	AO-45	1.25	1,435	0.30	3.54	
LOK-68	AO-42	AO-25	3.50	2,174	0.10	31.82	
LOK-66	AO-43	AO-8	3.50	2,363	0.10	31.82	

Table 17.5 Design Characteristics of Proposed Sewers - Oak Creek Basin Wastewater Facilities Master Plan Update - 2007 City of Lincoln, Nebraska

Pipe ID	US Manhole	DS Manhole	Diameter (ft)	Length (ft)	Slope (%)	Design Cap. (cfs)	Tier
LOK-69	AO-44	AO-39	1.00	3,052	0.25	1.78	
LOK-74	AO-45	AO-42	1.75	1,725	0.15	6.14	
LOK-75	AO-61	AO-62	1.50	2,409	0.20	4.70	
LOK-76	AO-62	AO-63	1.75	1,836	0.15	6.14	
LOK-77	AO-63	AO-12	2.00	2,324	0.15	8.76	
LOK-88	AO-65	AO-15	1.25	4,207	0.30	3.54	

Table 17.6 Modeling Results of Proposed Sewers - Oak Creek Basin Wastewater Facilities Master Plan Update - 2007 City of Lincoln, Nebraska

Pipe ID	US Manhole	DS Manhole	Capacity cfs	Tier I Conditions		Tier I & II Conditions		Tier I, II, III Conditions		Tier
				Q, cfs	d/D	Q, cfs	d/D	Q, cfs	d/D	
LOK-50	AO-1	AO-70	16.96	2.42	0.38	10.30	0.62	13.36	0.73	I
LOK-79	AO-3	AO-4	5.75	1.40	0.54	1.40	0.54	1.40	0.54	
LOK-82	AO-4	AO-70	5.75	3.26	0.57	3.26	0.92	3.37	0.76	
L1580	AO-70	IMP-22	22.77	5.68	0.34	13.59	0.91	16.60	0.66	
LOK-81	AO-16	BB7-11	5.75	0.20	0.23	4.92	0.73	4.92	0.73	
LOK-40	AO-5	AO-2	3.23	0.74	0.86	2.68	1.10	2.70	0.84	
LOK-41	AO-2	AO-6	9.32	5.27	0.57	7.66	0.72	7.68	0.78	
LOK-71	AO-11	AO-6	37.49	1.05	0.33	16.74	0.49	28.61	0.71	
LOK42	AO-6	AO-7	12.17	6.31	0.54	8.97	0.70	9.88	0.76	
L1579	AO-7	AA8-164	10.99	6.31	0.55	9.05	0.87	9.86	0.76	
LOK-63	AO-13	AO-10	22.47	NA	NA	10.61	0.61	14.70	0.96	II
LOK-70	AO-10	AO-11	28.16			14.38	0.57	26.36	0.80	
LOK-60	AO-12	AO-10	11.99			1.51	0.67	10.73	0.89	
LOK-78	AO-14	AO-13	12.39			7.44	0.60	11.58	0.78	
LOK-72	AO-15	AO-14	10.12			4.89	0.56	9.17	0.78	
LOK-53	AO-18	AO-1	16.96			7.71	0.56	10.81	0.67	
LOK-80	AO-17	AO-16	3.54			3.54	0.88	2.07	0.88	
LOK-52	AO-19	AO-18	12.39			4.72	0.53	7.96	0.64	
LOK-51	AO-20	AO-19	5.75			1.05	0.56	4.75	0.77	
LOK-48	AO-21	AO-8	5.25			0.70	0.26	3.99	0.91	
LOK-61	AO-30	AO-12	5.75			1.52	0.36	3.83	0.72	
LOK-44	AO-8	AO-9	38.97			0.70	0.10	30.03	0.96	
LOK-45	AO-9	AO-6	48.62			0.69	0.36	43.33	0.84	
LOK-46	AO-22	AO-23	4.99	NA	NA	NA	NA	3.19	0.95	III
LOK-47	AO-23	AO-39	16.15					9.90	0.78	
LOK-67	AO-24	AO-42	31.81					19.22	0.63	

Table 17.6 Modeling Results of Proposed Sewers - Oak Creek Basin Wastewater Facilities Master Plan Update - 2007 City of Lincoln, Nebraska										
Pipe ID	US Manhole	DS Manhole	Capacity cfs	Tier I Conditions		Tier I & II Conditions		Tier I, II, III Conditions		Tier
				Q, cfs	d/D	Q, cfs	d/D	Q, cfs	d/D	
LOK-65	AO-25	AO-43	31.81					24.37	0.69	
LOK-90	AO-26	AO-27	3.54					3.18	0.84	
LOK-91	AO-27	AO-28	5.75					5.39	0.90	
LOK-92	AO-28	AO-29	12.39					9.43	0.97	
LOK-93	AO-29	AO-9	14.08					13.45	0.86	
LOK-62	AO-31	AO-15	3.54					3.18	0.90	
LOK-54	AO-32	AO-34	1.95					1.76	0.85	
LOK-56	AO-33	AO-34	1.95					1.56	0.72	
LOK-55	AO-34	AO-23	5.50					3.65	0.81	
LOK-59	AO-35	AO-38	3.54					3.19	0.81	
LOK-57	AO-36	AO-37	1.95					1.67	0.85	
LOK-58	AO-37	AO-23	3.37					2.71	0.73	
LOK-64	AO-38	AO-39	9.79					7.38	0.87	
LOK-97	AO-39	AO-24	31.82					18.81	0.58	
LOK-49	AO-40	AO-22	4.30					3.12	0.68	
LOK-73	AO-41	AO-45	3.54					2.43	0.80	
LOK-68	AO-42	AO-25	31.82					22.88	0.66	
LOK-66	AO-43	AO-8	31.82					26.12	0.69	
LOK-69	AO-44	AO-39	1.78					1.56	0.76	
LOK-74	AO-45	AO-42	6.14					3.68	0.87	
LOK-75	AO-61	AO-62	4.70					2.94	0.73	
LOK-76	AO-62	AO-63	6.14					4.32	0.82	
LOK-77	AO-63	AO-12	8.76					6.99	0.84	
LOK-88	AO-65	AO-15	3.54					2.40	0.66	

17.3.4.1.3 Parallel Relief Pipeline

For Tier III flows, a parallel relief sewer will be required from manhole AA-68 to the Theresa Street WWTF. In lieu of a parallel pipeline through this area, 5 MG of storage could be constructed near manhole AA-68. For planning purposes, the estimated costs for the parallel pipeline have been used. This assumption should be confirmed.

17.4 SUMMARY OF RECOMMENDED IMPROVEMENTS

Recommendations for maintenance and improvements of the Oak Creek and Lynn Creek Basin Sewer Systems include:

- Existing Flows:
    - Increased capacity by sewer line and siphon replacement.

    - Monitor surcharging in sewer lines in Lynn Creek Basin.

- Tier I Flows:
    - Construct new sewer lines to service the Tier I area.
- Tier II Flows:
    - Construct new sewer lines to service the Tier II area.
    - Add 2.5 MG of storage at NW 40th St and Purple Heart Highway.
- Tier III Flows
    - Construct new sewer lines to service the Tier III area.
    - Expand 2.5 MG storage facility by 7.5 MG (total 10.0 MG) to handle additional Tier III flow.
    - Construct parallel relief sewer from manhole AA-68 to Theresa St WWTF or add 5.0 MG of storage near manhole AA-68.

The proposed alignments of the sanitary sewers are preliminary and developed for planning purposes. It is recommended that a detailed study be performed prior to designing the improvements to make certain conformance with existing and proposed development and to determine project phasing. In most cases, the alignments shown closely follow natural drainage ways. Until full development of the system, some pipes will be oversized with regard to interim flows. These sewers should be periodically inspected to determine if deposition is occurring.

To maximize the use of the recommended storage facilities it is recommended that they also be designed, constructed and operated to dampen the diurnal peaks throughout the trunk sewer system. Dampening the diurnal peaks will result in maximizing the trunk infrastructure and deliver a more constant flow to the WWTF's.

A summary of the improvement projects identified with planning costs is outlined in Table 17.7.

Table 17.7 Recommended Improvements - Oak Creek and Lynn Creek Basins
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Tier	ID	Description	Location [1]	Parameters	Unit Price	Planning Cost [2]
I	OC-1	Trunk and siphon improvements (CIP 6.a)	NW 41st & W. Mathis to Air Park Rd			$1,064,000 [3]
I	OC-2	Relief trunk (CIP 6.b)	S. Runway to NW 41st& W. Mathis			$2,750,000 [3]
I	OC-3	Sub-basin sewer (CIP 6.c)	NE of NW 27th & Hwy 34			$200,000 [3]
I	OC-4	Relief trunk (CIP 6.d)	NW 44th & W. Mathis to Cummings			$300,000 [3]
I	OC-5	Sub-basin sewer (CIP 6.e)	W of NW 48th, N of Cummings			$350,000 [3]
I	OC-6	Extend trunk sewer (CIP 6.f)	57th N of W. Adams to 70th & Superior			$450,000 [3]
I	OC-7	Extend trunk Sewer (CIP 6.g)	N of Highway 34 to Arbor Rd.			$400,000
I	LC-1	Relief trunk sewer (CIP 9.b)	NW 1st & Superior to NW 10th & W. Fletcher			$1,140,000 [3]
I	OL-1	42-inch	AO-11 to AO-6	2,616 lf	$420.00	$1,099,000
I	OL-2	36-inch	AO-10 to AO-11	2,787 lf	$360.00	$1,003,000
I	OL-3	30-inch	AO-13 to AO-10, AO-70 to IMP-22	5,079 lf	$300.00	$1,524,000
I	OL-4	27-inch	AO-1 to AO-70, AO-6 to AA8-164	6,772 lf	$270.00	$1,829,000
I	OL-5	24-inch	AO-2 to AO-6	5,253 lf	$240.00	$1,261,000
I	OL-6	18-inch	AO-16 to BB7-11, AO-3 to AO-70	8,690 lf	$180.00	$1,564,000
I	OL-7	15-inch	AO-5 to AO-2. See Figure 17.6.	8,893 lf	$150.00	$1,334,000
I	OL-8	12-inch	See Figure 17.6.	3,202 lf	$120.00	$384,000
I	OL-9	10-inch	See Figure 17.6.	1,644 lf	$100.00	$164,000

Table 17.7 Recommended Improvements - Oak and Lynn Creek Basins
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Tier	ID	Description	Location [1]	Parameters	Unit Price	Planning Cost [2]
II	OL-10	48-inch	AO-9 to AO-6	4,517 lf	$480.00	$2,168,000
II	OL-11	42-inch	AO-8 to AO-9	4,305 lf	$420.00	$1,808,000
II	OL-12	27-inch	AO-12 to AO-10, AO-18 to AO-1	6,953 lf	$270.00	$1,877,000
II	OL-13	24-inch	AO-15 to AO-13, AO-19 to AO-18	9,717 lf	$240.00	$2,332,000
II	OL-14	18-inch	AO-30 to AO-12, AO-21 to AO-8, AO-20 to AO-19	11,013 lf	$180.00	$1,982,000
II	OL-15	15-inch	AO-17 to AO-16	3,347 lf	$150.00	$502,000
II	OL-16	Storage Basin	East of AO-7	2,500,000 gal	$4.00/gal	$10,000,000
III	OL-17	42-inch	AO-39 to AO-8	9,543 lf	$420.00	$4,008,000
III	OL-18	30-inch	AO-29 to AO-9, AO-23 to AO-39	8,961 lf	$300.00	$2,688,000
III	OL-19	27-inch	AO-38 to AO-39	2,467 lf	$270.00	$666,000
III	OL-20	24-inch	AO-28 to AO-29, AO-63 to AO-12	7,156 lf	$240.00	$1,718,000
III	OL-21	21-inch	AO-34 to AO-23, AO-45 to AO-42, AO-62 to AO-63	6,001 lf	$210.00	$1,260,000
III	OL-22	18-inch	AO-61 to AO-62, AO-27 to AO-28	7,711 lf	$180.00	$1,388,000

Table 17.7 Recommended Improvements - Oak and Lynn Creek Basins
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Tier	ID	Description	Location [1]	Parameters	Unit Price	Planning Cost [2]
III	OL-23	15-inch	AO-31 to AO-15, AO-65 to AO-15, AO-26 to AO-27, AO-40 to AO-23, AO-37 to AO-23, AO-35 to AO-38, AO-41 to AO-45	26,063 lf	$150.00	$3,909,000
III	OL-24	12-inch	AO-36 to AO-37, AO-32 to AO-34, AO-33 to AO-34, AO-44 to AO-39	11,663 lf	$120.00	$1,400,000
III	OL-25	Additional Storage	East of MH AO-7	7,500,000 gal	$4.00/gal	$30,000,000
III	OL-26	42-inch parallel relief pipe	MH AA-668 to Theresa Street WWTF	24,500 lf	$420.00	$10,290,000

Notes:
1. Upstream and downstream nodes for each pipe section.
2. ENR CCI for Kansas City = 8512 (July 2006).
3. Costs from current City CIP.