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## EXISTING COLLECTION SYSTEM

### 4.1 BACKGROUND

#### 4.1.1 Existing Collection System

The existing City of Lincoln wastewater collection system has grown from a network of approximately 650 miles of piping in 1980 to over 970 miles in 2005. This represents an average yearly growth rate to the collection system of 1.6 percent. This increase in the collection system piping correlates well with the 1.5 percent growth rate used by the City-County Planning Department to estimate growth in the City as discussed in Chapter 3.

Table 4.1 presents historical length of sanitary sewer pipe in the City system for the years 1980 through 2004. For the purposes of estimating sewer system piping prior to 1980 it was assumed that the percentage change in population for a given year directly corresponds to the percentage change in total miles of sanitary pipe. As shown in Table 4.1, there are approximately 400 miles of pipe potentially over 50 years old, and approximately 201 miles of pipe potentially over 100 years old.

The sewer system is comprised of several sizes of sewers; the largest sewers, which collect and convey the wastewater from the tributary areas to the WWTF facilities are called trunk sewers. The trunk sewer system for the City is shown in Figure 4.1. The wastewater collection system is a separate system and not a combined sanitary/storm sewer system.

In addition to the wastewater collection piping, there are also 14 wastewater lift stations located throughout the system. These lift stations are strategically located to either serve a low-lying area, or to pump the collected wastewater across one of the many streams or creeks located throughout the City.

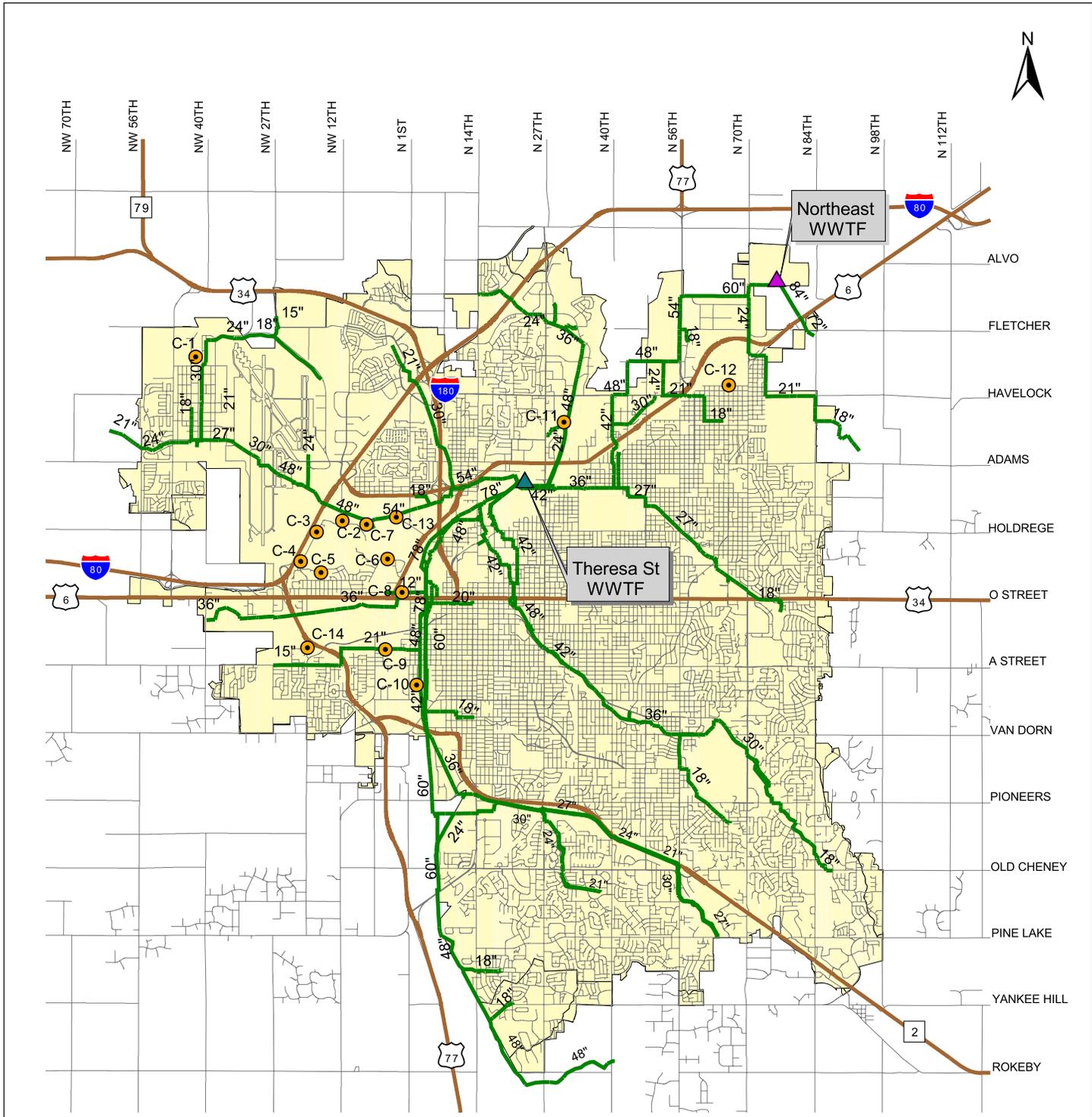
The 'current' or 'existing' acreages and acreages from the 2002 Wastewater Facilities Master Plan Update for each drainage basin served by the collection system are shown in Table 4.2. Based on these values, the average annual acreage increase in the 'modeled' area served by the Theresa Street WWTF was 3.9% from 2002 to 2007. Likewise, the average annual acreage increase in the modeled area served by the Northeast WWTF was 3.5% from 2002 to 2007.

<b>Table 4.1 Historical Length of Sanitary Sewer Pipe Installed Wastewater Facilities Master Plan Update - 2007 City of Lincoln, Nebraska</b>			
<b>Year</b>	<b>Miles of Sewer Pipe in System <sup>(1, 2)</sup></b>	<b>Percentage Increase in Pipe Miles <sup>(4)</sup></b>	<b>Miles of Sewer Pipe per Population in 1000s</b>
1880	37	-	2.85
1890	201	443.2%	3.64
1900	201	0.0%	5.00
1910	201	0.0%	4.57
1920	203	1.0%	3.69
1930	284	39.9%	3.74
1940	307	8.1%	3.74
1950	372	21.2%	3.76
1960	486	30.6%	3.78
1970	567	16.7%	3.79
1980	651	14.8%	3.79
1990	697	7.1%	3.63
2000	857	23.0%	3.80
2005	970	13.2%	3.99

Notes:

1. Actual values from City used for 1980 to 2005.
2. 1880 to 1970 values are estimated and correspond to the percentage population change for that period.
3. Length was not increased due to negative population trends
4. Percentage increase from previous decade (only 5 years from 2000 to 2005).

<b>Table 4.2 Increase in Existing Wastewater Drainage Basin Areas Wastewater Facilities Master Plan Update - 2007 City of Lincoln, Nebraska</b>				
<b>Drainage Basin <sup>(1)</sup></b>	<b>Current Acres (2007) <sup>(2)</sup></b>	<b>Previous Acres <sup>(3)</sup></b>	<b>Change In Acreage <sup>(4)</sup></b>	<b>Annualized Change <sup>(4)</sup></b>
Salt Creek	5,475	4,370	1,105	4.6%
Antelope Creek	7,866	7,199	667	1.8%
Beal Slough	6,874	5,370	1,504	5.1%
Upper Southeast	0	0	0	-
Upper Southwest	0	0	0	-
Haines Creek	297	283	14	1.0%
Middle Creek	1,389	1,456	-67	-0.9%
West O St	1,042	1,042	0	0.0%
Oak Creek	4,538	3,661	877	4.4%
Lynn Creek	3,145	2,314	831	6.3%
Little Salt	3,314	2,251	1,063	8.0%
East Campus	865	865	0	-
Southeast	0	0	0	-
Theresa St. WWTF Service Area	34,805	28,811	5,994	3.9%
Deadmans Run	4,898	4,536	362	1.5%
Havelock	3,881	3,401	480	2.7%
Northeast Salt	264	0	264	-
Stevens Creek	366	0	366	-
Northeast WWTF Service Area	9,409	7,937	1,472	3.5%
Notes:				
1. Drainage Basins separated by WWTF service area.				
2. Data is from LWWS, City Planning Department, and other sources.				
3. From October 2002 Lincoln Wastewater Facilities Master Plan Update by Brown & Caldwell.				
4. Change from 2002 Master Plan Update and current 2007 acreages.				



- LEGEND**
- Wastewater Lift Stations
  - Northeast WWTF
  - Theresa Street WWTF
  - Existing Trunk Sewers
  - Highways
  - Streets
  - Existing Service Area



Figure 4.1 Existing Trunk Sewer System  
Wastewater Facilities Master Plan Update - 2007  
City of Lincoln, Nebraska

### 4.1.2 Collection System Operation and Maintenance

The City currently operates and maintains the collection system. This work includes sewer cleaning, videoing, and construction. The responsibilities and personnel requirements for each of the operations and maintenance components are described in Table 4.3.

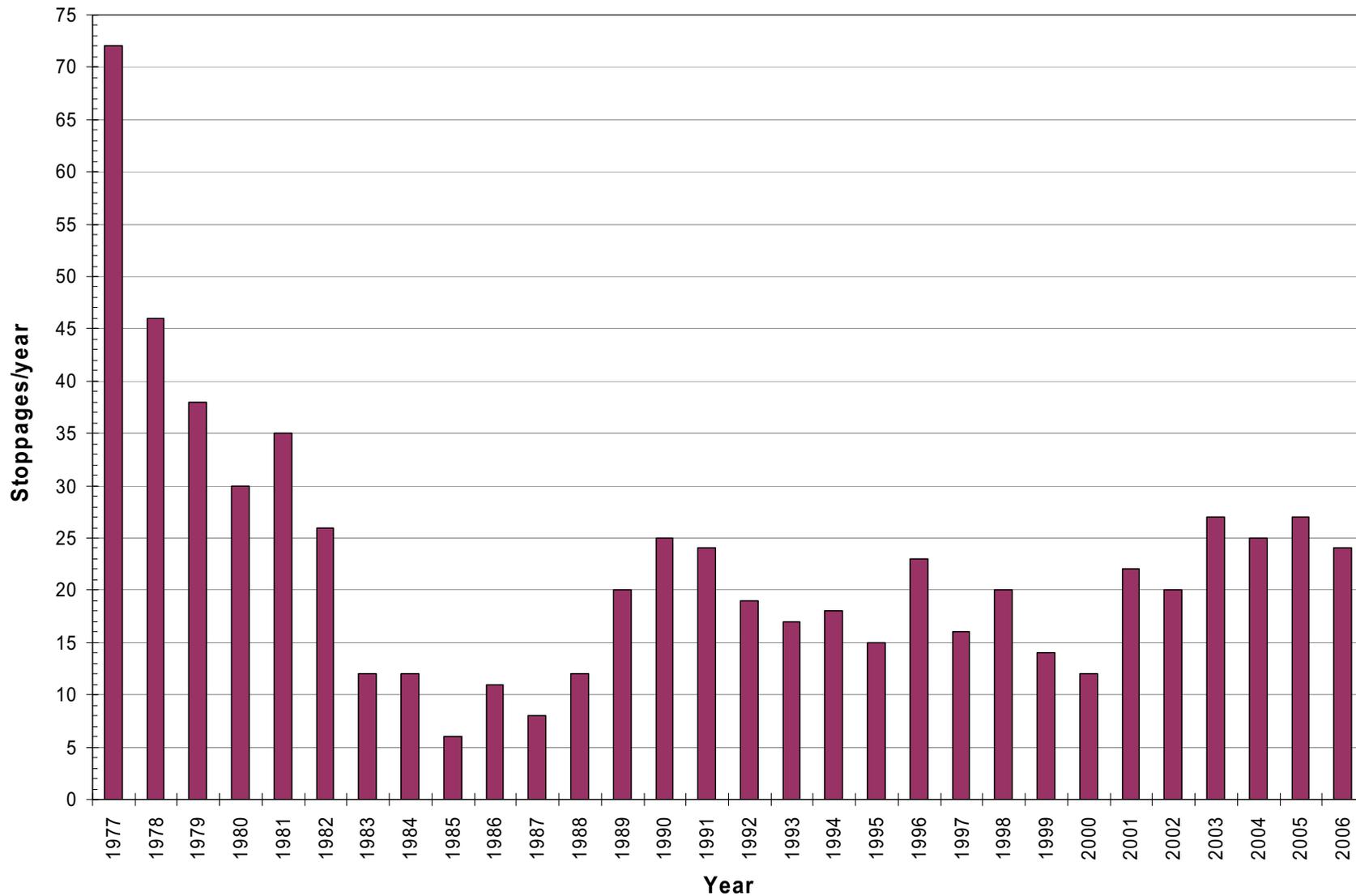
At this time, the City performs cleaning of all sewer pipes on a 12-year cycle. Cleaning includes jetting (pressure cleaning) to remove debris, scale, roots, and other blockages in the pipe. Cleaning crews also provide root treatment at identified sections to reduce the occurrence of root growth in pipes. This effort has been successful as indicated by the number of sewer stoppages noted in the collection system which is shown graphically in Figure 4.2. The data reveals that the number of stoppages has generally decrease, while the miles of installed sewer pipe has increased.

Internal TV inspection of existing and new sanitary sewer lines also follows a 12-year cycle for the entire system. During the routine videoing of the sanitary sewer system, crews operating the video equipment look for leaking pipe joints, obstructions or excessive deposits, as well as other pipe defects. In addition, when a leaking service lateral is identified, the service address is determined and verified. A letter is sent to the property owner describing the problem and requiring that the service lateral be fixed within 180 days.

<b>Table 4.3 Existing Collection System Operations and Maintenance Requirements Wastewater Facilities Master Plan Update - 2007 City of Lincoln, Nebraska</b>		
<b>Component</b>	<b>Current Staffing</b>	<b>Responsibilities <sup>(1)</sup></b>
Sewer Cleaning	5 crews of 2 people and 1 truck crew	95% line jetting/cleaning 5% root treatment
Videoing	2 crews of 2 people and 2 internal TV inspection vans	80% videoing older/existing system 20% reviewing newer system
Construction	2 crews of 3 people and 2 backhoes	100% repair/replacement of existing pipe, manholes, spot repairs
Notes:		
1. Approximate percentage of time spent on each task.		

At the end of the 180-day period, the service lateral is re-inspected to determine if the repairs have been made.

The current level of funding for the collection system operation and maintenance activities is approximately \$2,300,000 per year. This budget includes the cost for equipment and staffing. The actual cost of the repair and rehabilitation projects is funded from the CIP.



**Figure 4.2**  
 Historical Collection System Stoppages  
 Wastewater Facilities Master Plan Update - 2007  
 City of Lincoln, Nebraska



## **4.2 WASTEWATER COLLECTION SYSTEM BASINS TRIBUTARY TO THE THERESA STREET WWTF**

There are currently ten (10) drainage basins that flow to the Theresa Street WWTF as discussed below.

### **4.2.1 Salt Valley (Salt Creek)**

The existing Salt Valley Trunk Sewer system has 5,475 developed acres and serves the area generally to the south and west of the Theresa Street WWTF. This trunk sewer system extends from the Theresa Street WWTF located near the intersection of Theresa Street and 27th Street and proceeds south to manhole B3S-8 near Rokeby Road and 27th Street. The southerly portions of this basin serve an area known as the upper Southeast Basin. The Upper Southeast Basin extends south to near Whittstruck Road bounded on the west by Salt Creek and roughly 70th Street on the east. The majority of this system is served by parallel sewers. The new larger relief sewer ranges in size from 78-inches just upstream from the Theresa Street WWTF to 48-inches at the upper end. The older original Salt Valley Sewer discharges into the new relief sewer at manhole B6-373 which is near 14th Street and Salt Creek, and extends south to manhole B2-37 which is near Nebraska Highway No. 2 and 14th Street. This sewer ranges in size from 54-inches at the lower reach to 30 inches at the upper end at the Beals Slough drainage basin connection.

The newer relief sewer and older trunk line are interconnected at three locations. The upstream location is just south of 'M' Street between manhole B4-742 on the smaller 48-inch sewer and manhole B4-743 on the larger 60-inch sewer. These two manholes are connected with a 42-inch sewer. Located in the junction structure on the 48-inch sewer (Manhole B4-742) are two sluice gates. One sluice gate is located on the downstream 48-inch sewer, and the second is located on the 42-inch interconnection sewer. These sluice gates provide operational flexibility to allow LWWS staff to direct the wastewater flow into the larger sewer or let it continue downstream through the 48-inch sewer.

The second interconnection is located north of 'U' Street between manhole B5-601 on the 48-inch sewer and manhole B5-602 on the 78-inch sewer. These two manholes are interconnected with a 42-inch sewer. Stop logs are located on the two outlets in manhole B5-601. These stop logs provide operator flexibility to direct the wastewater flow from the 48-inch sewer into the larger 78-inch sewer, or let it continue downstream through the 48-inch sewer.

The third interconnection conveys the wastewater from the 48-inch Salt Valley Trunk and the 36-inch western Antelope Valley Trunk Sewer at manhole B6-371 through a 54-inch sewer to manhole B6-373 on the 78-inch Salt Valley Trunk Sewer. From this location, the

wastewater flows under Antelope Creek through a siphon consisting of three pipes and to the Theresa Street WWTF.

#### **4.2.2 Antelope Creek**

The Antelope Creek Basin has 7,866 developed acres and is centrally located in the City and generally south of the Theresa Street WWTF. This basin is almost completely built out with only a small amount of land remaining for new development. The Antelope Creek trunk sewer extends from the Theresa Street WWTF to near Pine Lake Road and 91st Street. The main trunk sewer ranges in size from 60-inches in diameter at the lower end to 15 inches at the upper reaches. Located near R Street and 21st Street a secondary trunk sewer branches to the West. This westerly branch terminates at the original Salt Valley Trunk Sewer at Manhole B6-371 near 14th Street and Antelope Creek as discussed above. This western trunk sewer is 36-inches in diameter. Realignment and improvements to the lower portion of the system are currently underway.

#### **4.2.3 West 'O' Street**

The West 'O' Street Basin has 1,042 developed acres and is located on the west side of Salt Creek. Following the Salt Valley Trunk Sewer to the south, the flow from the West 'O' Drainage basin enters the Salt Valley Trunk Sewer. The wastewater from this basin is collected in two primary sewer lines that feed the 'P' Street or 'C-8' Lift Station, which is located in the West 'O' St Basin. In 2006, projects were completed that extended 36", 30", and 15" trunk lines to meet new growth and development needs along West 'O' St from SW 40th St and the Burlington Northern Santa Fe railroad roads to near SW 27th St and Interstate 180. The oldest is a 15-inch diameter sewer that is located in 'P' street. The newer line is a 36-inch diameter trunk that is located just south of 'O' Street. This 36-inch diameter trunk discharges to a 12-inch that just south of the 'P' Street lift station. The lift station pumps wastewater into an 8-inch diameter force main that extends across Salt Creek. Once on the east side of Salt Creek, the force main discharges into a 12-inch diameter gravity sewer that carries the flow east where it discharges into the Salt Valley Sewer at manhole B5-616 near the intersection of 4th and 'P' Streets.

#### **4.2.4 Middle Creek**

The Middle Creek Basin has 1,389 developed acres and is generally located to the south of the West 'O' St Basin. This basin is also located on the west side of Salt Creek. The existing Middle Creek Trunk Sewer System is comprised of 12 to 21-inch diameter lines. These lines feed Lift Station C-9, which is located in the Middle Creek Basin. The C-9 lift station discharges through a 12-inch diameter force main to the east side of Salt Creek where it discharges into an 18-inch diameter gravity sewer. This 18-inch diameter gravity sewer flows east where it discharges to the Salt Valley Trunk Sewer at Manhole B4-179 near the intersection of 3rd and 'D' Streets.

#### **4.2.5 Haines Branch**

The Haines Branch Basin has 297 developed acres and is located immediately south of the Middle Creek Basin and discharges into the Salt Valley Trunk Sewer System. Like the West 'O' St and Middle Creek Basins, this basin is located on the west side of Salt Creek.

Currently this basin only serves approximately developed 280 acres. The flows generated in this basin are conveyed through a 12-inch gravity line to Manhole B3-472 near Van Dorn Street and Speedway Circle where it discharges into the Salt Valley Trunk Sewer.

#### **4.2.6 Beal Slough**

The Beal Slough Basin has 6,874 developed acres and is located on the east side of Salt Creek and just to the south of Antelope Creek Basin. Like the Antelope Creek Basin, this basin is nearing full development build-out conditions. The basin is served by two trunk sewer systems. The original system discharges into the Salt Valley Trunk Sewer at Manhole B2-217. The size of this trunk sewer ranges from 30-inches at the lower end to 15 inches at the upper end near Pine Lake Road and 70th Street.

A new parallel relief line is currently being constructed from Manhole B1-310 where it discharges into the Salt Valley Trunk sewer. Phase 1 of this new relief line extends southeasterly along Nebraska Highway 2 and ends at 27th Street. The Phase 2 plan is to extend this relief line southeasterly to 56th St and Yankee Hill Road. This basin is nearing complete build-out and with the construction of the new relief line will be able to convey the wastewater from this basin.

#### **4.2.7 Oak Creek**

The Oak Creek Basin has 8,324 developed acres and is located north of Salt Creek and to the west and northwest of the Theresa Street WWTF. The flows from this basin combine with the flows from Lynn Creek Basin and are conveyed by the trunk system under Salt Creek through a siphon to the Theresa Street WWTF. The Oak Creek trunk sewer generally proceeds west and north from Theresa St WWTF towards the Lincoln airport where it terminates on the north side of the airport north of US Highway 34. This system ranges in size from 54 inches at the lower end just prior to the siphon that crosses Salt Creek to 15-inches where it splits and terminates near Highway 34 and NW 27<sup>th</sup> Street and also at the end of the West Highlands Interceptor near the northeast end of the airport near North Park Rd.

The West Highland Interceptor serves the West Highlands sub-basin located primarily northeast of the airport and discharges to the Oak Creek trunk sewer near NW 27th St and North Park Rd.

The Capital Beach Lake area, located on the south side of Salt Creek near between Interstate 80 and Sun Valley Blvd. is served by the Oak Creek Trunk Sewer System. The Capital Beach Lake sewer is comprised of a series of lift stations that eventually discharge

to the Oak Creek System through a 12-inch pipeline. The Capital Beach Lake flow enters the Oak Creek Trunk Sewer at Manhole A6-194.

#### **4.2.8 Lynn Creek.**

The Lynn Creek Basin has 3,145 developed acres and is bounded by the Oak Creek Basin and West Highlands sub-basin on the west, Salt Creek on the south, and the Little Salt Creek Basin on the east. The flows from this basin and trunk sewer system are discharged into the Oak Creek Trunk Sewer at Manhole B6-265. The trunk sewer generally proceeds northerly along Interstate Highway I-180. The Lynn Creek Basin trunk lines range in size from 36-inches at the lower end to 15-inches near Highway 34 and North 1st Street.

#### **4.2.9 Little Salt Creek**

The Little Salt Creek Basin has 3,314 developed acres and is located just to the east of the Lynn Creek Basin and north of Theresa Street WWTF. Proceeding uphill to the east from the WWTF to the intersection of 27th Street, Kimco Court, and State Fair Park Drive are a 30 inch and 42 inch parallel trunk sewer system. At this intersection, the flows from both the Little Salt Creek and the East Campus drainage basins combine and flow to the WWTF.

The majority of the flows from the Little Salt Creek Basin flow through a parallel trunk line system from the north along State Fair Park Drive. Located on the west side of State Fair Park Drive and east of SW 27th St is a 30-inch gravity sewer that discharges into the 42-inch sewer, which flows to the WWTF. Also located on the east side of State Fair Park Drive is a new 36-inch diameter line that can be operated as either a gravity sewer or a force main in the future. This line discharges into the 30-inch diameter line that flows west to the WWTF. At this location, there is also a 24-inch diameter cross-over line that will allow excess flows greater than the capacity of the 30-inch line to be re-directed to the 42-inch diameter line if needed.

The majority of the flows from this basin flow by gravity to lift station C-11 which is located just north of Salt Creek and east of 27th Street (behind the Menard's). The trunk Sewer that drains to lift station C-11 ranges in size from 48-inches at the lower end to 18-inches at the upper reaches where it terminates near N 14th Street and Humphrey Avenue. Pump Station C-11 discharges through a 24-inch force main to a recently constructed splitter structure. At this location, the flows can be directed into one, or both gravity sewers that flow to the south along State Fair Park Drive.

#### **4.2.10 East Campus**

The East Campus Basin has 1,800 developed acres and is located to the east of the Theresa Street WWTF and just south of the Little Salt Creek Basin. This basin is considered to be built out with little opportunity for new development. The flows from this basin enter the Theresa Street WWTF through a 36-inch diameter sewer that discharges into the 42-inch diameter sewer at the intersection of 27th Street, Kimco Court, and State

Fair Park Drive. The 36-inch diameter sewer proceeds easterly along Huntington Avenue to a diversion structure located in Manhole C6-194. At this location flows from Deadmans Run can be directed west to the Theresa Street WWTF, or northerly to the Northeast WWTF. Under normal operating conditions, the flows at this point are directed to the Northeast WWTF. This is accomplished by the use of sluice gates. Under normal operating conditions the sluice gates are arranged such that all of the flow in the Deadmans Run Trunk Sewer is directed to the Northeast WWTF. Based on current flow rates, approximately 4 mgd can be diverted using this interconnection.

### **4.3 WASTEWATER COLLECTION SYSTEM BASINS TRIBUTARY TO THE NORTHEAST WWTF**

There are currently three collection system drainage basins that discharge to the Northeast WWTF as discussed below.

#### **4.3.1 Deadmans Run**

The Deadmans Run Basin has 4,898 developed acres and is generally located to the east of the Antelope Creek and East Campus Basins, south of the Havelock Basin, and west of the Stevens Creek Basin. This basin is almost completely built-out, with little opportunity for new development. The Deadmans Run trunk system ranges in size from 60 inches at the Northeast WWTF to 18 inches at its upper reaches. The trunk sewer proceeds uphill to the southwest to the diversion structure located in Manhole C6-194. At this location, it continues uphill to the southeast where it terminates near "O" Street and Skyway Road.

#### **4.3.2 Havelock**

The Havelock Basin has 3,881 developed acres and is located to the north of Deadmans Run Basin, south of the Northeast WWTF, and just west of Stevens Creek Basin. This basin is almost completely built-out, with little opportunity for new development. The basin is served by a trunk system that discharges into the Deadmans Run Trunk Sewer at Manhole C8-28. The trunk system lines range from 24-inches at this location to 15-inches at its upper reaches located west of 84th Street and Adams Street.

#### **4.3.3 Stevens Creek**

The Stevens Creek Basin has 366 developed acres and is located to the east of Havelock, Deadmans Run, and Antelope Drainage Basins. Currently there are no connections to this system. However, the first phase of the Stevens Creek Trunk sewer has been installed from the Northeast WWTF just south and west of the intersection of Fletcher St and Stevens Creek. This trunk line ranges in size from 84-inches at the Northeast WWTF to 72-inches at its termination. Development in the area is being planned and phased extensions of the trunk lines to serve future development in the basin are identified in the City's six year capital improvement program.

## 4.4 WASTEWATER LIFT STATIONS

### 4.4.1 General Summary

There are currently fourteen collection system lift (pumping) stations, C-1 through C-14, that serve the collection system in Lincoln. The need for a lift stations is generally dependent on site specific topographic criteria such as serving a low lying area, or transporting the wastewater across a river or such as the salt Creek. The lift stations are all maintained by LWWS staff. A summary of the lift stations is presented in Table 4.4 below. The locations of the lift stations are shown in Figure 4.1. Of the fourteen wastewater lift stations, there are only five stations (C-6, C-7, C-8, C-9, C-11) that serve 300 or more acres. These pump stations are discussed in further detail hereinafter. The remaining stations are quite small and serve very small areas. A detailed summary of each lift station is located in Appendix C. In addition to the fourteen wastewater lift stations, LWWS operates and maintains four storm water pump stations

<b>Lift Station</b>	<b>Location</b>	<b>Service Area (ac)</b>	<b>Basin Served</b>
C-1	NW 44th & West Cuming	7	Oak Creek
C-2	952 N. Lakeshore Drive	4	Oak Creek
C-3	412 W. Lakeshore Drive	20	Oak Creek
C-4	52 W. Lakeshore Drive	54	Oak Creek
C-5	1721 Surfside Drive	70	Oak Creek
C-6	550 W. Industrial Lake Dr.	300	Oak Creek
C-7	1598 East Lakeshore Dr.	300	Oak Creek
C-8	West P & Salt Creek	1,042	West "O"
C-9	West "E" & SW 6th Street	1,389	Middle Creek
C-10	3rd & Rose Street	43	Salt Creek
C-11	3700 N 31st Street & Salt Creek	2,000	Little Salt
C-12	66th & Burlington Ave.	10	Havelock
C-13	NW 3rd & W. Charleston	10	Oak Creek
C-14	South Coddington & West Millstone Rd.	37	Middle Creek

Notes:  
 1. Lift stations as of July 1, 2006  
 2. Based on information provided by LWWS.

#### **4.4.1.1 Capital Beach and Lift Stations C-6 and C-7**

These two lift stations serve the residential area around Capital Beach. They are similar in design and were both constructed in the same time period (early 1970's). Lift stations C-2 through C-7 operate in series, one station pumping to a gravity main that feeds the next station until all wastewater from the Capital Beach service area is pumped to station C-6. Lift Station C-6 pumps directly to station C-7, which in turn pumps all flows across Oak Creek and into a receiving interceptor.

#### **4.4.1.2 Lift Stations C-8 and C-9**

Lift stations C-8 and C-9 serve the West "O" Street and Middle Creek drainage basins. Both lift stations were built in the 1960's and each is in need of replacement due to the physical size of the drywells and wetwells (especially C-9) and limited room for increasing pump capacity. There have been some preliminary analyses on the feasibility of constructing one new lift station, which would serve both the Middle Creek and West "O" Street drainage basins, thus allowing abandonment of the existing stations (C-8 & C-9). This project is identified in the current Capital Improvements Program for the Lincoln Wastewater System.

#### **4.4.1.3 Lift Station C-11**

Lift Station C-11 is currently the largest remote pumping station serving approximately 2,900 acres. A new outlet sewer, with higher carrying capacity, has been recently constructed and work is currently proceeding to install two new dry-pit submersible pumps, which will increase the pumping capacity of the station. Following construction, this station will be prepared to serve the Little Salt Creek basin for some time.

#### **4.4.2 Wastewater Lift Station Telemetry**

At the present time, all of the stations communicate with the Lincoln Wastewater SCADA system via dedicated data grade phone lines. The telemetry provides alarms to SCADA for power loss, pump overloads, high wetwell level, and in some cases, seal failure, high sump pump pit levels, and alternate power activation. The LWWS is currently involved in a project to replace the current phone line communication system with a radio telemetry communication system. This project will ensure reliability of communications and reduce costs associated with leasing data-grade phone lines. Eventually, flow measuring instrumentation will be added to the pumping stations so that remote monitoring can occur (through SCADA) along with logging of historical flow data in the SCADA file server.

#### **4.4.3 Lift Station Operation and Maintenance**

According to LWWS staff, all of the stations have been well maintained and are currently in good mechanical condition. The routine maintenance and inspection of the lift stations is accomplished by LWWS maintenance personnel. Current funding levels for lift station maintenance and equipment replacement ranges from \$150,000 to \$200,000 per year.